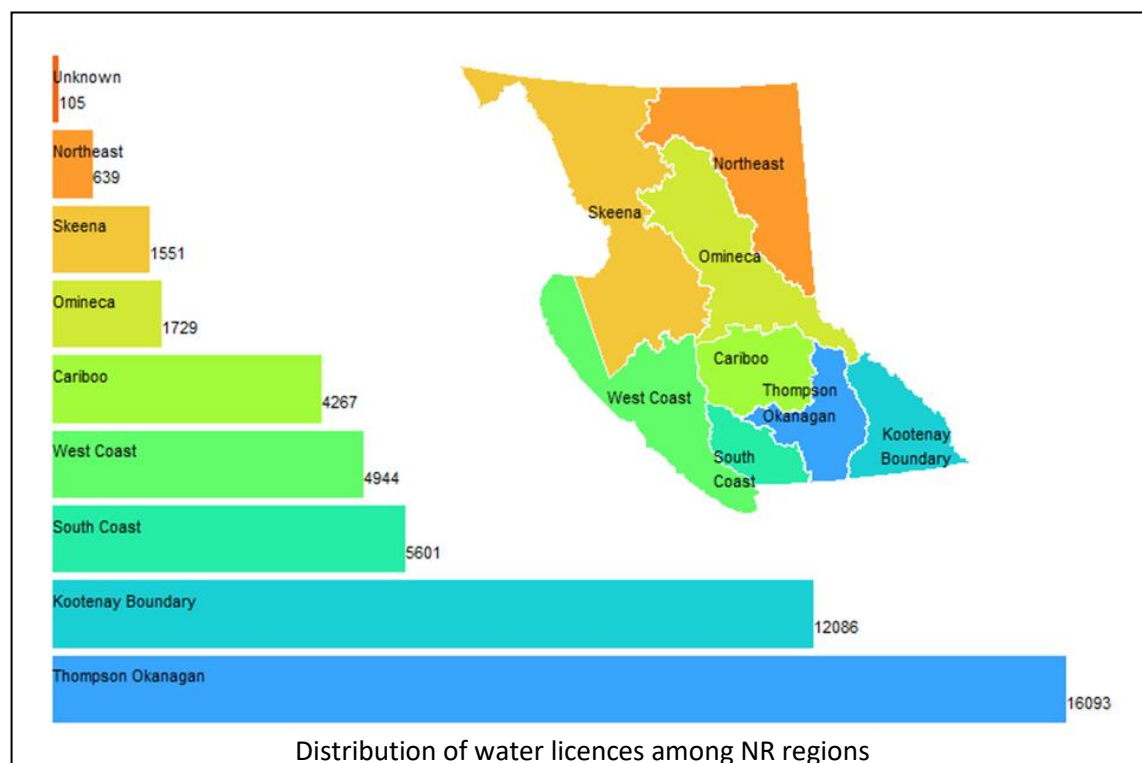


Analysis of Licensed Water Use in British Columbia

Christine Bieber



July 2024

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Author's Affiliation:

Christine Bieber, P.Geol.
Water Stewardship and Security Branch
Ministry of Water, Land, and Resource Stewardship, Province of BC
525 Superior St
Victoria, BC
Mailing: PO Box 9362 STN Provincial Govt Victoria, V8W 9M2

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EXECUTIVE SUMMARY

In British Columbia, water licences and short term use approvals allow individuals and businesses to divert, use or store surface water or groundwater. Licences and approvals can be issued for many water use purposes ranging from household use, municipal or other local water supply, agriculture, power production, habitat conservation, industry or water storage. Water licences and approvals are issued by the Province under the *Water Sustainability Act* (WSA) and the *Water Sustainability Regulation* (WSR).

Understanding how licenced water use, groundwater wells, and short term use approvals are distributed throughout British Columbia and among sectors is important for informing the direction of the provincial water science program. Furthermore, analysis of information available through the provincial data catalogue can be used to identify gaps and limitations that can be addressed through future data management improvement projects. The analysis presented in this report is intended to inform Provincial science priority setting.

The majority of the water licences issued in the Province of B.C. are for domestic (household) use and agricultural uses. Both of these licence sectors are generally composed of smaller quantity licences; however, the largest agricultural licences have allocated volumes that are several orders of magnitude larger than the smaller users. This result indicates that the scale of water used by agricultural operations varies significantly among licensees within this sector with the largest agricultural licences issued for irrigation. Approaches to water management within the agricultural sector should take into account the magnitude of this scale variation to optimize results.

Licensed water use for power generation has the greatest allocated volumes of any sector. Power generation is generally not consumptive. Acknowledging there are some losses of water and changes to the water conditions through hydropower production, water used or held in storage for this use is expected to generally be released back to the environment. Water users for power generation are required to report their actual water use to the Province, but this information is not currently available in a format that can be efficiently analyzed on a provincial scale. Some licences for conservation purposes are also very large relative to other licences. Water licensed for conservation uses is not expected to be consumptive and licensed water is generally expected to be diverted for ecosystem purposes.

This report contains an analysis of provincial databases that store information related to water use. Analysis of this information provides context for provincial water resource stewardship and priority setting, for understanding limitations of the water databases and potential areas for improvement, and provides an understanding of how water use data sources can be used to support watershed specific analyses.

Recommendations following from this work include:

- Periodically update and refine this analysis of provincial water use as the Province continues to collect and improve water use information stored in GWELLS and eLicensing.
- Analysis of provincial water use, including analyses on the sector and spatial distribution of water use, should be used to inform prioritization of resources related to water management and to develop targeted approaches to outreach.
- Compare licensed water use to the predictions of the Ministry of Agriculture, Food and Fisheries Agricultural Water Demand model (Province of B.C., 2015) or other water demand modelling (Bennett et al., 2021).

- Explore how water allocation and use varies at a smaller scale such as a watershed scale for watershed level governance and management projects. This information could inform project selection, the policies considered, and engagement/outreach.
- Further analyses to investigate how water use has changed over time within sectors and spatially could be used to better understand why conditions have changed in some watersheds. For a more fulsome analysis, this data could also be coupled with land use changes.

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ACRONYMS

BCER	British Columbia Energy Regulator
GWELLS	The Provincial Groundwater and Wells database
eLicensing	The Provincial license database which include water licences.
STUA	Short Term Use Approval
WLRS	Ministry of Water, Land and Resource Stewardship
WSA	Water Sustainability Act
WSS	Water Science Series

1. INTRODUCTION

Surface water licensing in B.C. dates back to the year 1859 and began under the Provincial *Water Act*. This act was modernized February 29, 2016 with enactment of the B.C. *Water Sustainability Act* (WSA). Licences issued under the original *Water Act* have been grandfathered in under the WSA. Prior to the WSA, groundwater use did not require a water licence or registration. Under the WSA, domestic groundwater water users are required to register their well with the Province, while all surface water users and non-domestic groundwater users are required to apply for water licences.

The Province of B.C. introduced an Open Information and Open Data Policy in 2011 (Province of BC, 2011). This commitment to open data has been reaffirmed with the recently released Provincial Data Plan (Province of BC, 2023). Over 1,000 datasets are available in the B.C. Data Catalogue for access by the public, businesses or institutions. Information on water licences and applications are available through the catalogue while information on domestic groundwater wells can be found in the provincial groundwater and wells (GWELLS) application.

Analysis of water use information held in provincial data systems was conducted to understand how licensed, permitted or registered water use is distributed throughout the Province and among different sectors. Comprehensive information on unauthorized water use is not readily available within Provincial information systems and, although measured water use is recorded and reported to the Province for several sectors (e.g. pulp mills, oil and gas operators), this information is difficult to access on a provincial scale. As such, unauthorized and measured water use are not considered in the following analysis. These limitations, as well as others, are discussed in the later sections of this report, particularly Section 5.

2. METHODS

2.1 Data Sources

The data analyzed for this report was derived from publicly available provincial data sources in the B.C. Data Catalogue. The majority of these data layers are curated and published by the Ministry of Water, Land and Resource Stewardship (WLRS). The primary data layers used in this analysis are as follows:

- Water Rights Licences – Pubic (Province of B.C., 2024a)
- Water Rights Applications – Public (Province of B.C., 2024b)
- Natural Resource (NR) Regions (Province of B.C., 2024c)
- Province of B.C. GWELLS (Province of B.C., 2024d)
- Short Term Water Use Permits (B.C. Energy Regulator, 2024)
- Water Approval Points (Province of B.C., 2024e)

All analysis presented in this report was created from data downloaded from the provincial sources in March 2024. Provincial water databases are continually being updated; however, overall on a provincial or regional scale, the changes over small periods of time are expected to be minimal.

To better understand water rights applications, the Water Rights Applications data in the BC Data Catalogue was supplemented with information directly downloaded from the provincial eLicensing system. This directly downloaded information allowed for differentiation between new surface water and groundwater applications and existing use groundwater applications.

2.2 Data Tools and Analysis

Water use information was processed using scripts written in R Studio. Key R packages used in this study included the *bcddata* package for data downloading, the *dplyr* package (Wickham et al., 2023) for data manipulation, the *sf* package (Pebesma, 2018) for spatial processing, and the *ggplot2* package (Wickham, 2016) for graphics.

The provincial water rights information contains a multitude of water use purposes (approximately 100 different unique descriptions). In some cases, the variation in the categorization of uses in the water rights layer reflects variation between an older classification system used under the original B.C. *Water Act* and the current water use purposes defined under the WSA (Province of B.C., 2016). For the purposes of this study, the water use purposes in the water rights layer were simplified into a smaller number of sector categories that could be displayed graphically. For example, water use purposes associated with irrigation, livestock, greenhouses, nurseries, and other crop related uses were grouped within the larger sector category of agriculture. These grouped sectors largely align with the purposes and categories of the current WSA, with a few exceptions. In particular, the industrial purpose category defined in the WSA was overly broad for the purposes of this analysis. Several of the uses within the industrial category have been broken into separate categories, and industrial uses associated with agriculture have been grouped within the agricultural category. Similarly, the analysis below breaks storage uses into those for power generation and those for non-power applications. Sector groupings and definitions are summarized in Table 1, and the full details of the grouping of water use purposes are documented in Appendix A.

No attempt has been made within this report to distinguish between consumptive and non-consumptive water use; however, different types of water usage may have differing environmental impacts even for equivalent authorized water usages. Most water uses are not fully consumptive as some proportion of the water used is often returned to aquifers or streams within the province through wastewater infrastructure or irrigation returns although often with impacted water quality. Assessment of the relative degree of environmental impacts associated with different types of water use is beyond the scope of this analysis.

Water licences are issued from surface water and groundwater sources. Water licences in the DataBC water rights layer that are identified as a point of well diversion or a point of groundwater diversion are assumed to be issued on groundwater sources. All other water licences are assumed to be issued on surface water sources in the following analysis.

The quantity and units fields of the provincial water rights layer contain information on the allocated rate of diversion associated with a water licence. The quantity field generally contains the allowed rates of diversion in units of cubic metres per year, cubic metres per day or cubic metres per second. For the purposes of this analysis, all units were converted to common units of cubic metres per day with the assumption that the maximum quantity would be utilized at all times. This assumption was necessary as actual water use data associated with authorizations is not available for the majority of authorization types, and the limited water use provided to the Province is not practical to access for an analysis of this scale under the current provincial data systems. This limitation is further discussed in Section 5. As has been stated in Barroso and Wainwright (2020), “Licences are typically issued based on a maximum potential demand, while actual water usage is likely to vary seasonally and inter-annually.” It should be noted that seasonal licences such as irrigation licences are typically only issued to be valid for part of the year. As an example, with irrigation licences this is during the irrigation season from April 1 to September 30. Therefore, the licenced water use rates in this report can be interpreted as potential authorized water takings and are expected to be higher than the actual water takings associated with the authorizations in many cases.

Table 1: Summary of sector groupings and definitions.

Sector (Purpose)	Definition
Waterworks	Movement or supply of water by one person or entity for the use in British Columbia of another person or entity. Most commonly this is expected to be for household uses.
Domestic	Household purposes by the occupants of a single parcel.
Industrial, Manufacturing, Transportation or Waste Management	Waste management, processing and manufacturing, construction and transportation, and vehicles or other equipment.
Mining	Water for (a) recovering minerals from the ground or from ore (including the use of water under pressure) or (b) the use of water under pressure to move earth, sand, gravel, or rock.
Land Improvement	Diversion or impounding of water to conduct activities such as land reclamation or improvement.
Power	Use of water in production of electricity or other power.
Storage - Power	Impounding and retention of water for so that it can be used for power production.
Storage - Non-power	Impounding and retention of water for a reason other than power production.
Pulp Mills	Use of water in the production of pulp and paper products or in the operation and maintenance of a pulp mill.
Conservation	Diversion, retention or use of water for conserving fish or wildlife
Recreation, Public Facilities, Lawn/Garden	Water used for lawns, gardens, public facilities such as hospitals, snowmaking, swimming pools and recreational camps.
Commercial Enterprise	Use of water for the operation of a variety of businesses which could include apartment buildings, hotels, motels, restaurants, mobile home parks, campgrounds or a food processing plant.
Aquaculture and Hatcheries	Fish hatcheries or other aquaculture.
Heat Exchange	Industrial and commercial operations to extract or dissipate heat by passing water through an open loop system.
Water Bottling or Sales	Water is sold to customers by the authorization holder.
Oil & Gas	Use of water in the development of petroleum or natural gas wells or the production of petroleum or natural gas resources.
Agriculture	Water use for agricultural production. This grouping is a combination irrigation crop harvesting and protection, livestock and animal water use, greenhouses, and nurseries.

Water licence data in the BC Data Catalogue has data for each point of diversion associated with the licence. To arrive at a total allocated quantity for each licence, the data in the quantity field was interpreted according to the Quantity Flag field which indicates if the quantity associated with the point of diversion corresponds to the total for the licence or the quantity for the individual point of diversion. If the quantity corresponded to the individual point of diversion, quantities for each point of diversion were summed. Where licences were associated with multiple purposes, the total allocated diversion was calculated by summing the water use associated with each purpose. The allocated diversions associated with each individual water use purpose were used in sectorial analysis.

A limited number of licences (approximately 500) have total flow rather than a quantity assigned in the quantity units field. These licences are often associated with land improvement so the total flow corresponds to the amount of water diversion necessary for the land use. In these cases, a quantity could not be assigned to the licence and quantitative accounting of the licenced diversion volume was

not performed. This is a relatively small number of licences so this limitation is not expected to have a substantial impact on the results of analysis.

Some licences contain information about the maximum instantaneous rate of diversion in cubic metres per second in addition to the allocated volume. The maximum instantaneous rate of diversion information has not been used in the following analysis as the information was found to be available for only a limited number of licences and in some licences unit errors were identified in this field. Further quality control on this field may be needed if data analysis of this field is required for future projects.

3. DATA CHARACTERISTICS

3.1 Water Licences

The Provincial Water Rights Licences layer contains information on nearly 47,000 licences that are classified as current within the water licencing database and have points of diversion classified as active. It is likely that some licences that are classified as current within the database may have fallen out of use and may actually be inactive; however, this is a limitation of the data that is not possible to resolve for the current analysis. In the following analysis, all licences classified as current and points of diversion classified as active are assumed to be current and active. The Water Rights Licences layer also contains information about licences that have been discontinued which could be useful for historical studies, but this information has not been considered or analyzed with this report.

Licences issued by the province range from straightforward domestic licences issued for a small quantity at a single point of diversion to complex licences for much larger quantities with multiple potential uses and points of diversion. Approximately 15% (nearly 7,000) of active licences have been authorized for more than one use. In the simplest multi-use cases, a licence authorized for multiple uses may be a small farm operation also authorized for domestic use; however, some complex licences may have several uses associated with site operations, such as industrial uses associated with major projects (well drilling, work camps, vehicle and other industrial uses) or agricultural uses associated with large ranches (livestock, irrigation, greenhouse, and storage).

The Province of B.C. issues water rights with a priority date. The priority date generally corresponds to the date that the licence application was accepted, or in the case of existing use groundwater users, the date of first water use. Priority dates for active licences in the water licencing database range from as early as 1859 (Figure 1). Issuance of water licences in B.C. that are still active peaked in the 1970's with over 9,000 licences issued in that decade. Since that time the number of active water licences issued in each decade has declined with only approximately 2,400 licences issued in the 2010's. Thus far only approximately 500 licences have been issued with priority dates from 2020 onward. It should be noted that as the Province works through the backlog of water licence applications (both those that have been processed by FrontCounter BC and those that have not yet been processed) this figure could be updated for an improved picture of historical water use.

The majority of licences issued are on surface water sources with only 6% of active licences (approximately 2,500) issued for groundwater uses. Groundwater licence priority dates begin in the 1870's; however, the distribution of priority dates indicates that groundwater use in B.C. began to increase in the 1960's and continued to increase thereafter with over 500 groundwater licences dated to the 2010's. Groundwater licences include groundwater use from wells (described further in Section 3.3) and may also include ditches or dugouts where groundwater is determined to be the source of water.

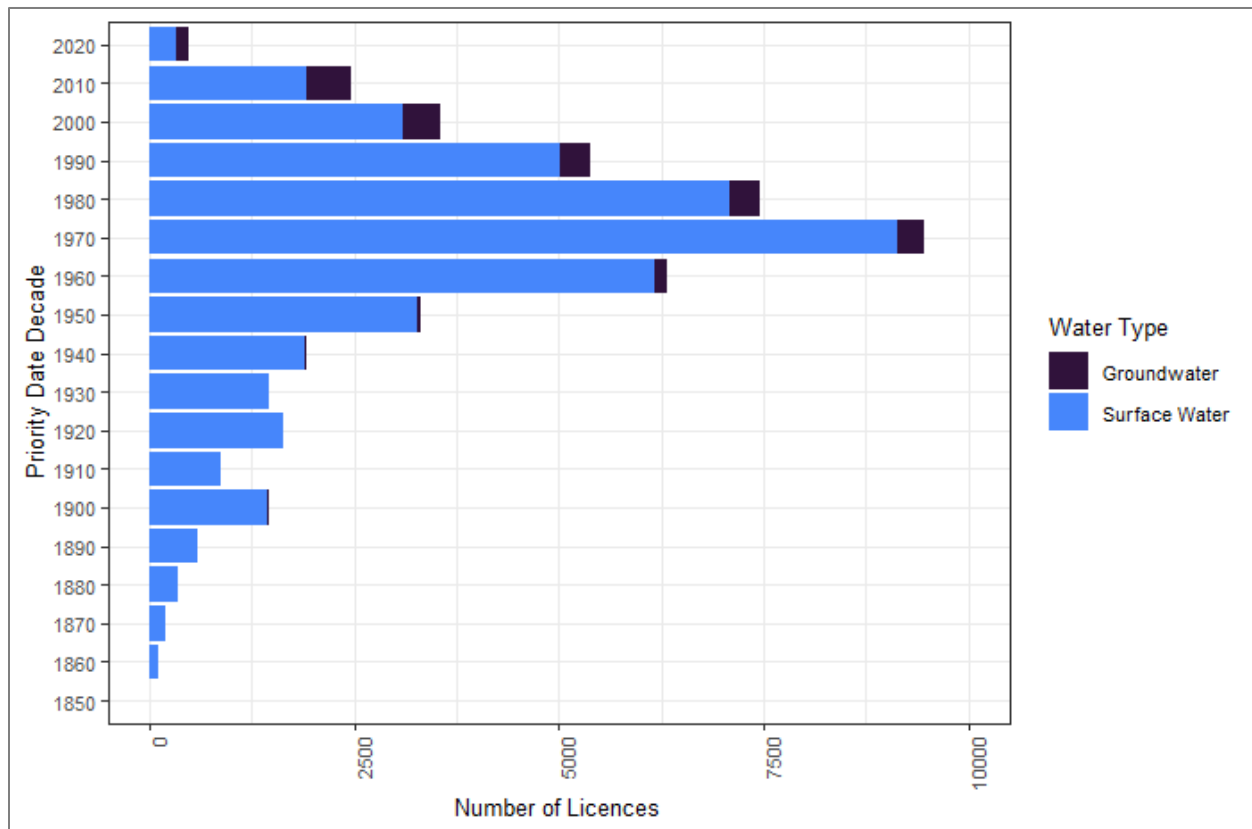


Figure 1: Histogram of water licence priority date.

3.2 Water Licence Applications

The Provincial Water Rights Applications layer and eLicensing contain information that has been processed by FrontCounter BC on both active applications that are awaiting decision and applications that have been refused. There are over 6,000 files included in this layer with approximately 2,000 applications that have been refused and over 4,000 active files. The majority of active applications are for new surface water use (over 1,400) or existing groundwater use (over 1,600) with a lesser number for new groundwater (nearly 600) (Figure 2). The remainder of active applications have not yet been classified (approximately 600).

It is known that at the time of this report additional applications have been submitted to the Province, but have not yet been processed by FrontCounter BC. Work is presently underway to address this backlog, but because these applications have not been processed, they are not included in the Water Rights Applications layer or in the work presented here. Therefore, the actual number of groundwater applications is expected to be larger than presented in Figure 2.

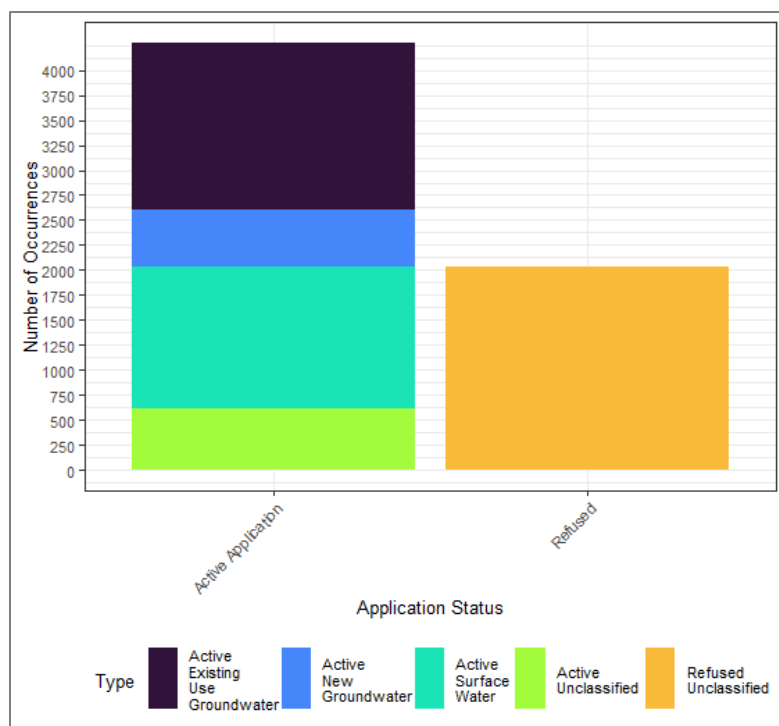


Figure 2: Histogram of water licence application status (April 2024).

3.3 Groundwater Wells

The provincial GWELLS database contains hydrogeologic information on over 120,000 wells throughout B.C. The database contains information on both active and closed (abandoned or decommissioned) wells dating back to the year 1889. The database was created in the 1990's by the Province to house groundwater information collected during water well construction by both public and private entities. The creation of this public data resource vastly improved the knowledge basis for provincial groundwater management and this information can provide substantial cost savings for property owners through more successful water well construction. However, because the database was partially created from historical records, the information can be variable in quality. The database is also generally acknowledged to be incomplete as well registration was voluntary in B.C. for all water supply wells drilled prior to February 29, 2016. Similarly, wells for monitoring, temporary dewatering operations or for remediation of contamination are not required to be submitted to the GWELLS database and therefore are often missing from this data resource.

Similar to the Water Rights licensing data, the GWELLS database information indicates that the rate of water resource development in B.C. peaked in the 1970's (Figure 3) and has generally declined in each subsequent decade since. The majority of the wells (53%) in GWELLS are domestic wells, which are not required to be licenced under the WSA.

The next largest group of wells (33%) are unlicensed with unknown intended use. These wells could be currently utilized for domestic purposes; therefore, a licence may not be required. Wells with unknown use tend to be a larger proportion of older wells than newer wells which likely reflects improvements in data management and reporting over time through work with the water well drilling community and staff training.

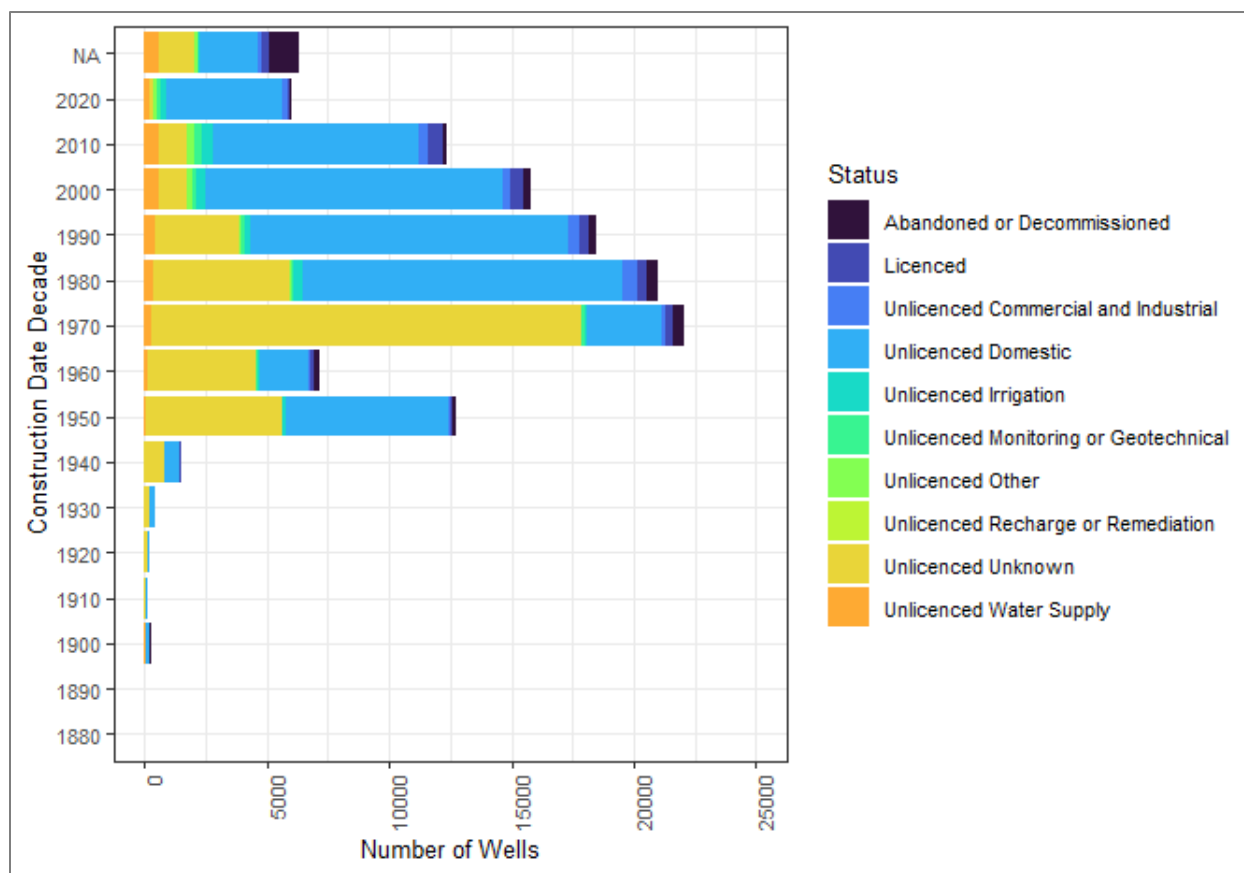


Figure 3: Histogram of groundwater well construction dates by decade.

Many wells are unlicensed with intended purposes that include commercial/industrial (over 2,000, 2%), irrigation (over 2,000, 2%), water supply system (over 3,000, 3%), and other (over 1,000). If these wells are still in use for these purposes, a licence is required and they would be out of compliance with the WSA if an application for licensing has not been submitted to the Province. It is also possible that these wells have been put out of service or decommissioned but have not reported the closure. Out of service wells are required to be decommissioned within 10 years and submission of a decommissioning report is a requirement of the WSA. Approximately 3% of wells within the GWELLS database are recorded as abandoned or decommissioned.

Licensed wells compose a relatively small fraction of wells in the GWELLS database (2%). This proportion is expected to increase as groundwater licence applications are processed. There were over 2,200 active applications for groundwater use that had been processed by FrontCounter BC (Figure 2) and approximately 5,000 other applications had been submitted to the Province, but not yet processed at the time of writing.

3.4 Short Term Use

In addition to issuing long term water licences, the Province issues permits for short term water use for water usage up to 24 months in duration. Although a short term water use approval (STUA) cannot be extended, applicants can submit a new application for short term water use if they require water use beyond the 24 month period.

As with water licences, short term use approvals may be issued by the BC Energy Regulator (BCER), which was formerly known as the BC Oil and Gas Commission, for energy related approvals or by WLRS for all other licences. Unlike water licencing information for which BCER and WLRS are accessed in the same data resource, STUAs issued by the two agencies are accessed in two separate datasets from the BC data catalogue and there are some differences in the information that the two agencies release in the publicly accessible datasets.

Figure 4 presents the characteristics of STUAs in B.C. issued by BCER and WLRS. Most STUAs are issued for the maximum limit of 24 months with very few STUAs issued for less than 12 months. BCER issues nearly 60% of all STUAs, while WLRS issues the remaining 40%. WLRS and BCER issue similar numbers of small and medium size authorizations of less than 5,000 m³/day; however, BCER issues a much larger number of authorizations greater than 5,000 m³/day with 86% of all large STUA issued by BCER.

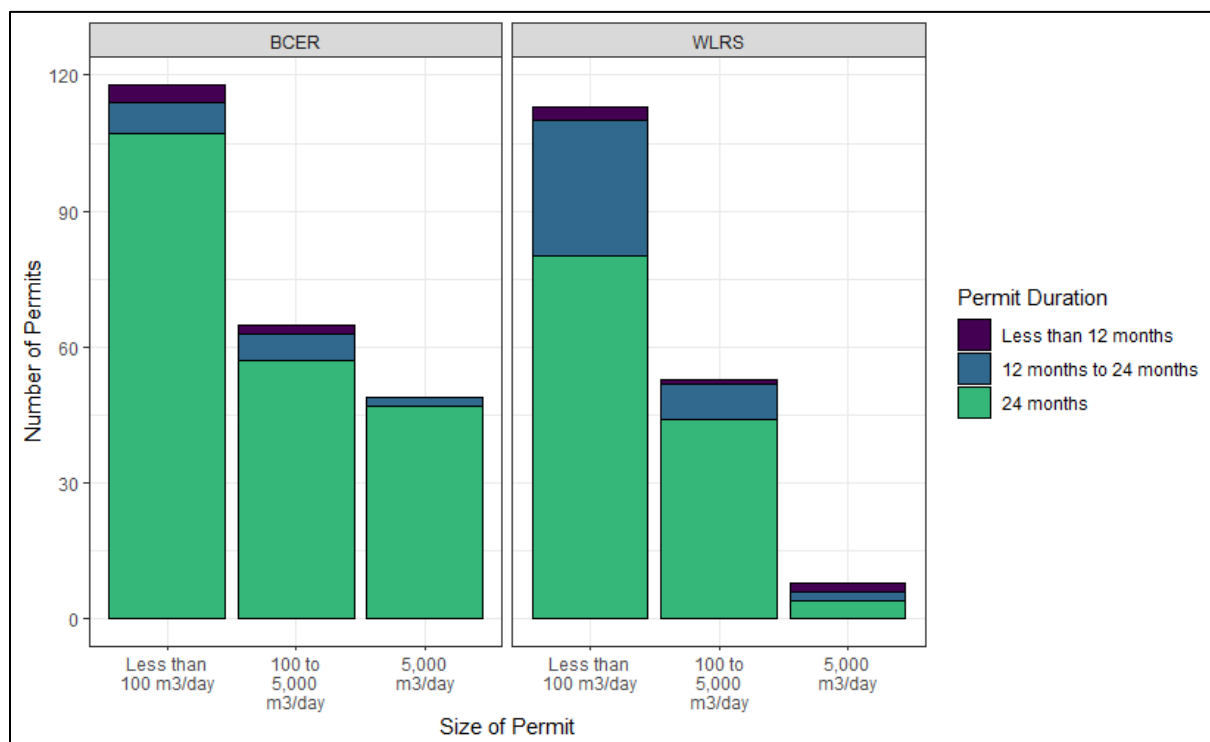


Figure 4: Characteristics of short term water use approvals issued in B.C.

4. DATA ANALYSIS

4.1 Water Use Quantity

The Water Rights layer contains information about licenced water quantity. Quantity information in this layer was converted to consistent units for all water licences as described in Section 2.2 in preparation for analysis. A histogram of water licenced quantity provided in Figure 5 demonstrates that a substantial proportion of water licences (58%) are for quantities of less than 10 m³/day with nearly 80% of licences for amounts of less than 100 m³/day. While larger licences represent a minority of licences, because the licenced quantities are many orders of magnitude larger than smaller users (e.g. domestic or small farms), provincially and potentially in some watersheds, the majority of licenced water use may be attributed to a minority of licences. This result suggests that focusing water efficiency efforts on larger users would result in disproportionately large return for effort.

The histogram provided in Figure 6 presents cumulative quantities allocated within each bin. This result demonstrates that although a minority of licences are for large quantities, these larger licences represent the vast majority of all authorized water use with more than 99.9% of all water authorized accounted for in licences authorized for volumes greater than 100,000,000 m³/day.

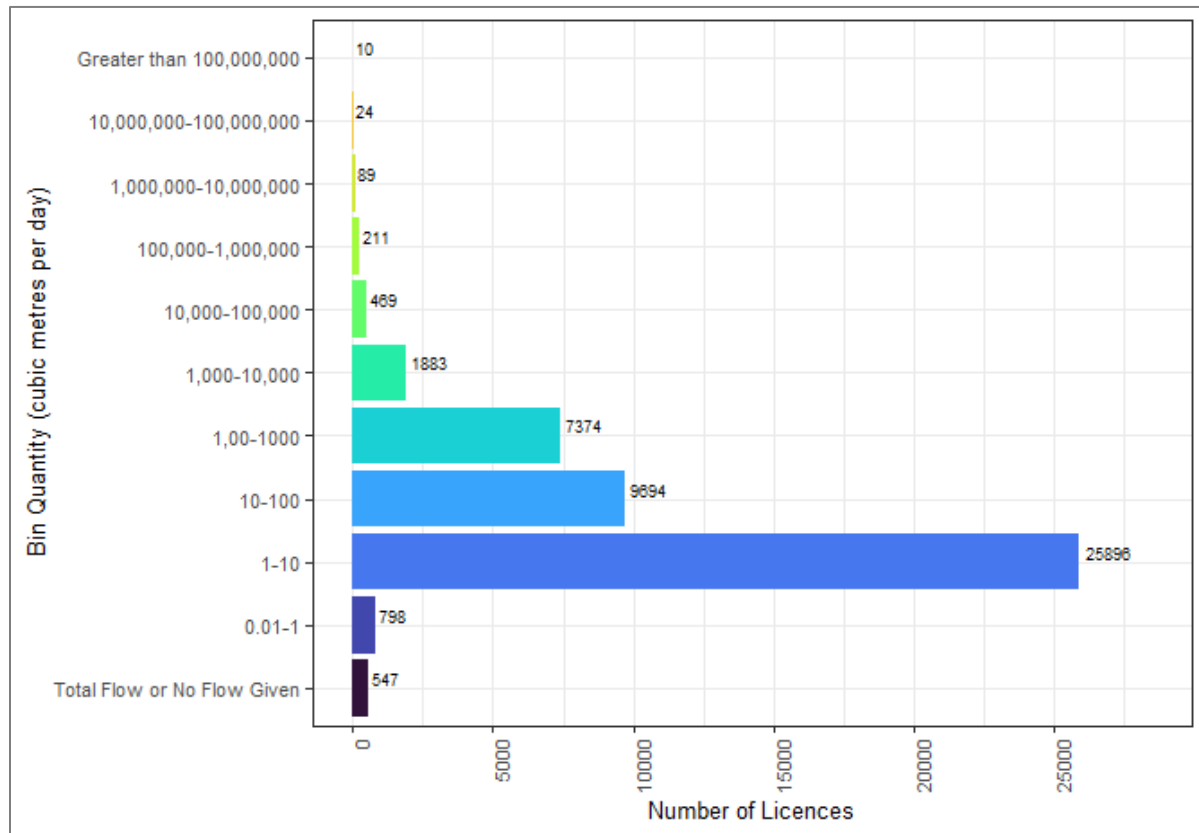


Figure 5: Histogram of water licence quantities.

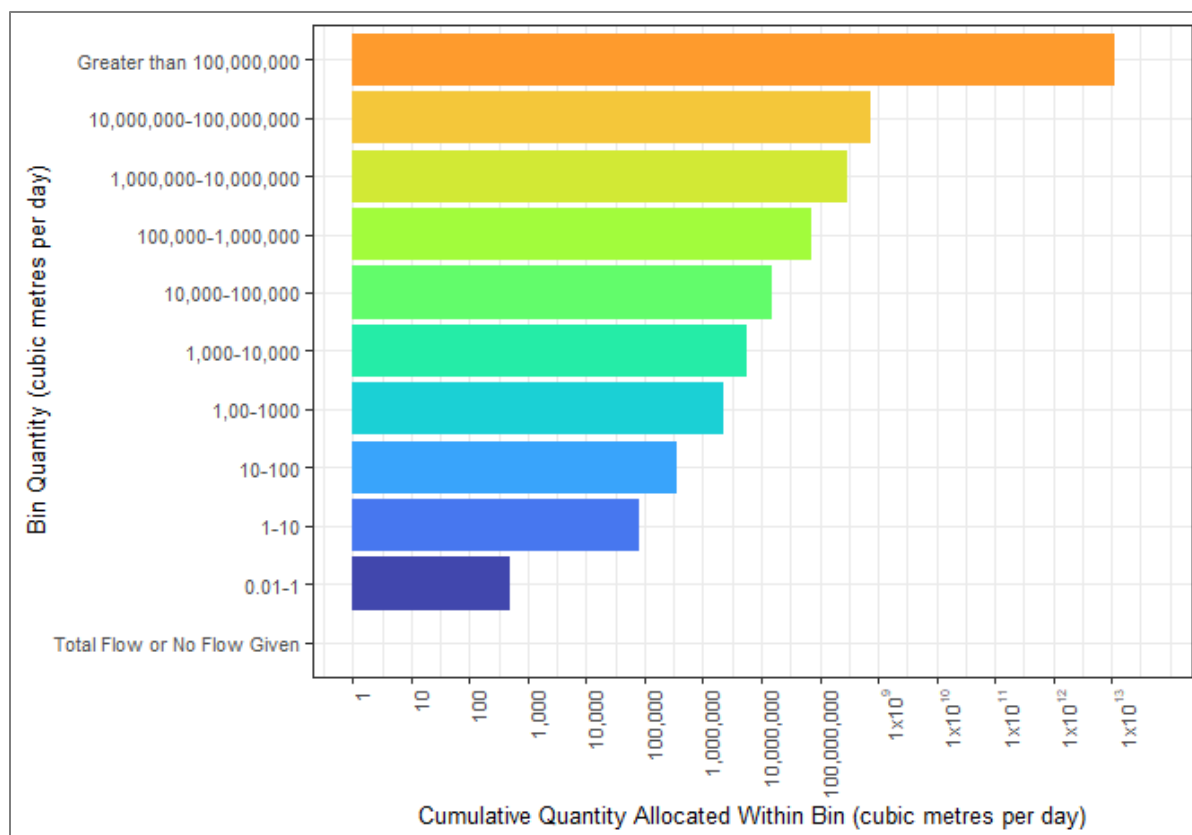


Figure 6: Histogram of cumulative water licence quantities within bins. Note that quantity is shown on a semi-log scale due to the large range in values.

The Water Rights Applications layer does not have reported quantity information in the publicly available layer; therefore, a similar histogram of quantities associated with water licence applications cannot be produced. Similarly, the GWELLS database does not collect water quantity information. Well yield information is collected and stored in GWELLS; however, this is an indication of the amount of water that the well can physically provide rather than an indication of the water required.

A significant proportion of the wells in the GWELLS database are for domestic purposes and the usages associated with these wells can generally be expected to be relatively low. The Province allows domestic groundwater usage for household and related uses by the occupants of a private dwelling without requiring a water licence. Average residential water usage in B.C. has been estimated to be approximately 0.3 m³/day per capita based on municipal water use information (Honey-Rosés et al., 2016). Assuming a household size of four people this would correspond to a household usage of 1.2 m³/day. Water use by rural domestic water users is generally expected to be higher than these estimates as the users are located outside of municipal service areas where exclusive domestic water use occurs, irrigation for growing food for household use or keeping animals such as chickens for household consumption are more common. For this reason, historically the Province has assumed domestic usage to be approximately 2 m³/day for surface water licencing purposes, although a larger or smaller amount could be licenced at the discretion of the decision maker. However, domestic licences may not be used for irrigation of an area greater than 1,000 m² or for rearing livestock or growing crops for sale.

Assuming that the just over 66,000 unlicensed domestic wells in GWELLS are diverting approximately 2 m³/day, this would correspond to a total usage of approximately 130,000 m³/day. When compared with total use by larger users, this is a relatively small percentage of water use provincially; however, domestic water use by groundwater users could be significant in some watersheds. Further watershed specific analysis would be needed to determine this.

4.2 Sectoral Analysis

Water licences are issued for specific water use purposes. For example, if the Province issues a licence for irrigation, the use will be specified within the licence documents and provincial data system. The licensed quantity will correspond with the required quantity for that purpose. During initial data exploration, it was identified that water licences in B.C. had been issued with nearly one hundred different water use categories. Therefore, the water use categories within the water rights database were simplified in the following analysis to enable graphical display and understanding of sectoral analysis. Appendix A has complete information of this categorization. Approximately 15% of water licences have more than one licensed water use purpose. In the following analysis, the use associated with these licences will be distributed within two or more categories.

Understanding how licensed water use is distributed among different economic or social sectors is important in determining how policies related to water licensing could affect individual sectors. It can also be used to design targeted outreach or incentives for conservation. A count of the number of water licences among different sectors is presented in Figure 7. These results demonstrate that the majority of water licences have been issued for domestic (46%) or agricultural purposes (33%) with far fewer licences issued for all other purposes. The third and fourth largest number of licences issued within a sector are for storage non-power (5%) and waterworks (3%).

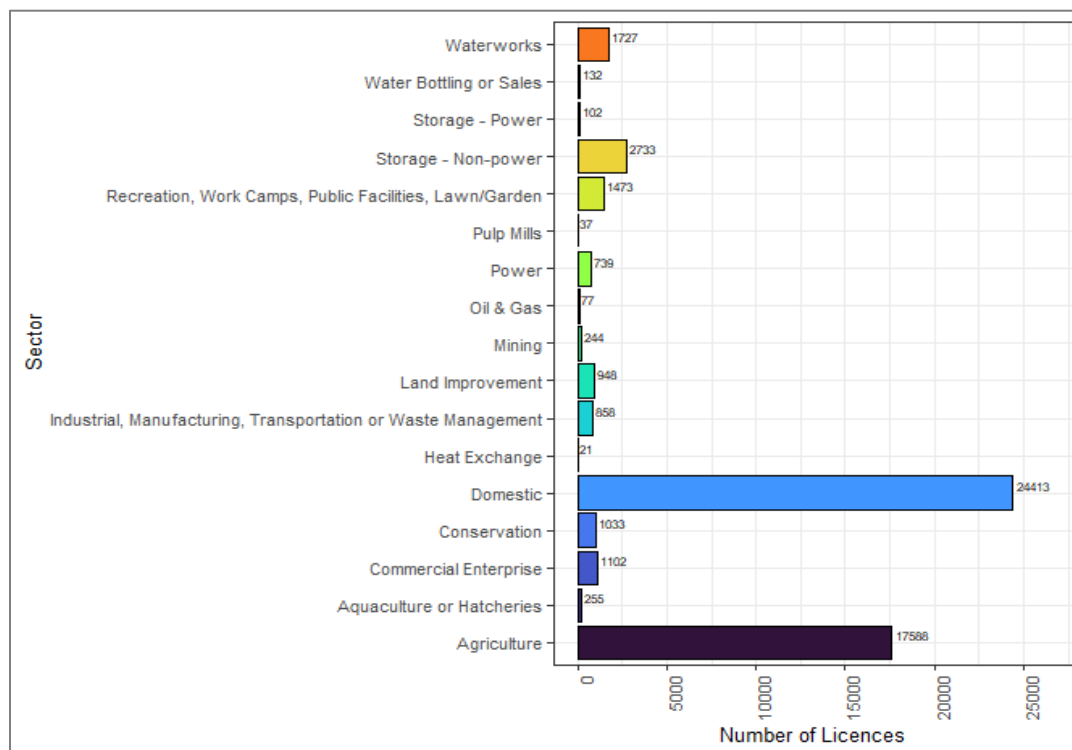


Figure 7: Sectoral distribution of licenced water use. Note that groundwater domestic users are not shown.

Additional analysis was performed to understand how water use quantity is distributed among sectors. As demonstrated in Section 4.1 (Figure 6) the magnitude of water quantity authorized for water licences varies by more than 10 orders of magnitude with the smallest licences generally associated with domestic uses. The majority of water licences issued by the Province are for smaller quantities of less than 10 m³/day while cumulatively these licences represent less than 0.1% of all authorized water use. The largest licences authorized in B.C. are for power or conservation uses with all except one of the licences authorized to use more than 1 million m³/day authorized for power, conservation, or storage for power uses. Because these licences are so much larger than the smallest licences, graphical representation of all uses on one plot is challenging to present. To address this challenge, water licences have been binned into three classes:

- Smaller Allocations (Less than 10 m³/day),
- Medium Allocations (10 to 1 million m³/day), and
- Large Allocations (Greater than 1 million m³/day).

These categories are used to present the sectorial analysis of licence numbers and licence quantities presented in Figures 8 and 9. As presented in Figure 8, most of the small allocation users are domestic (75%) and agricultural users (16%). Similarly, the majority of water use quantity (Figure 9) allocated within the small class of users is domestic (67%) and agriculture (23%). Among medium allocations users, agricultural users are the majority (60%) of licences. However, agricultural users compose only 4% of the total quantity allocated within this category while power (47%) and conservation (18%) are major users within the medium allocation category. Within the large allocation class, most licences (99%) are for power, conservation or storage for power uses and correspondingly all of the water use quantity is allocated within these categories.

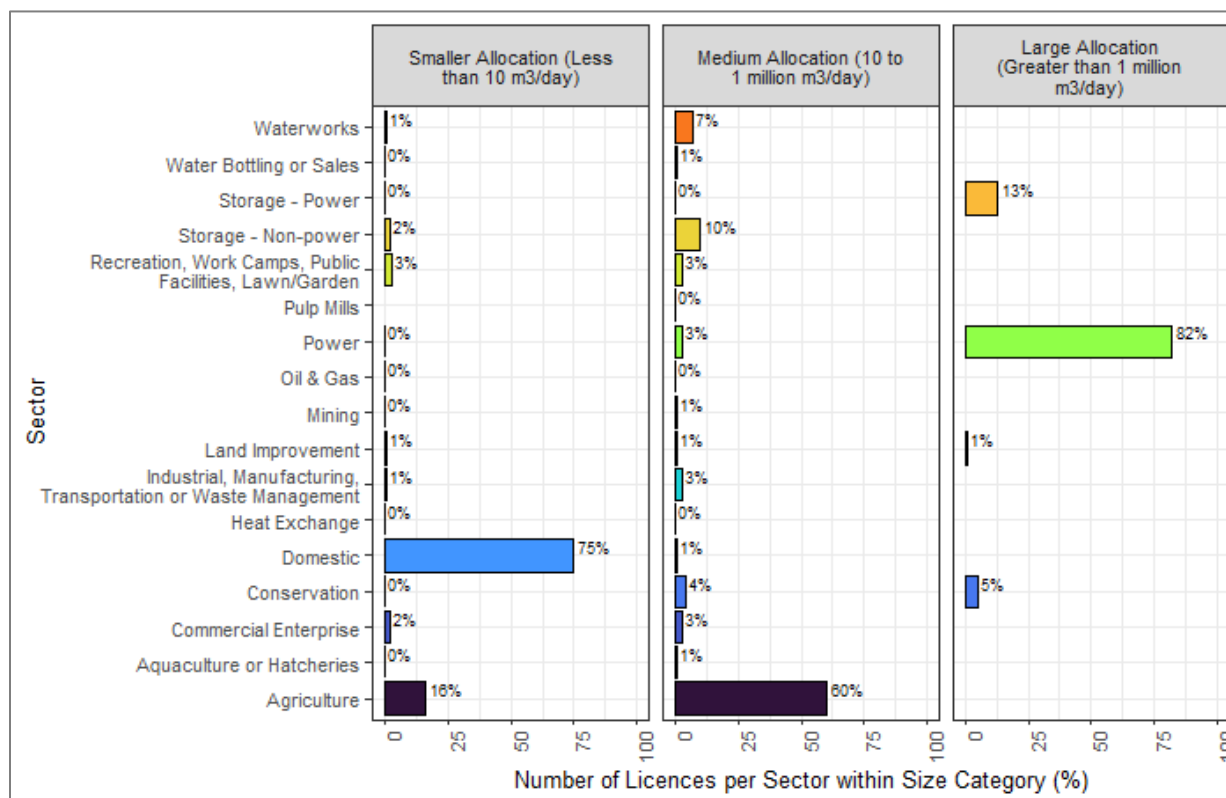


Figure 8: Analysis of sectorial licence distribution with allocation categories.

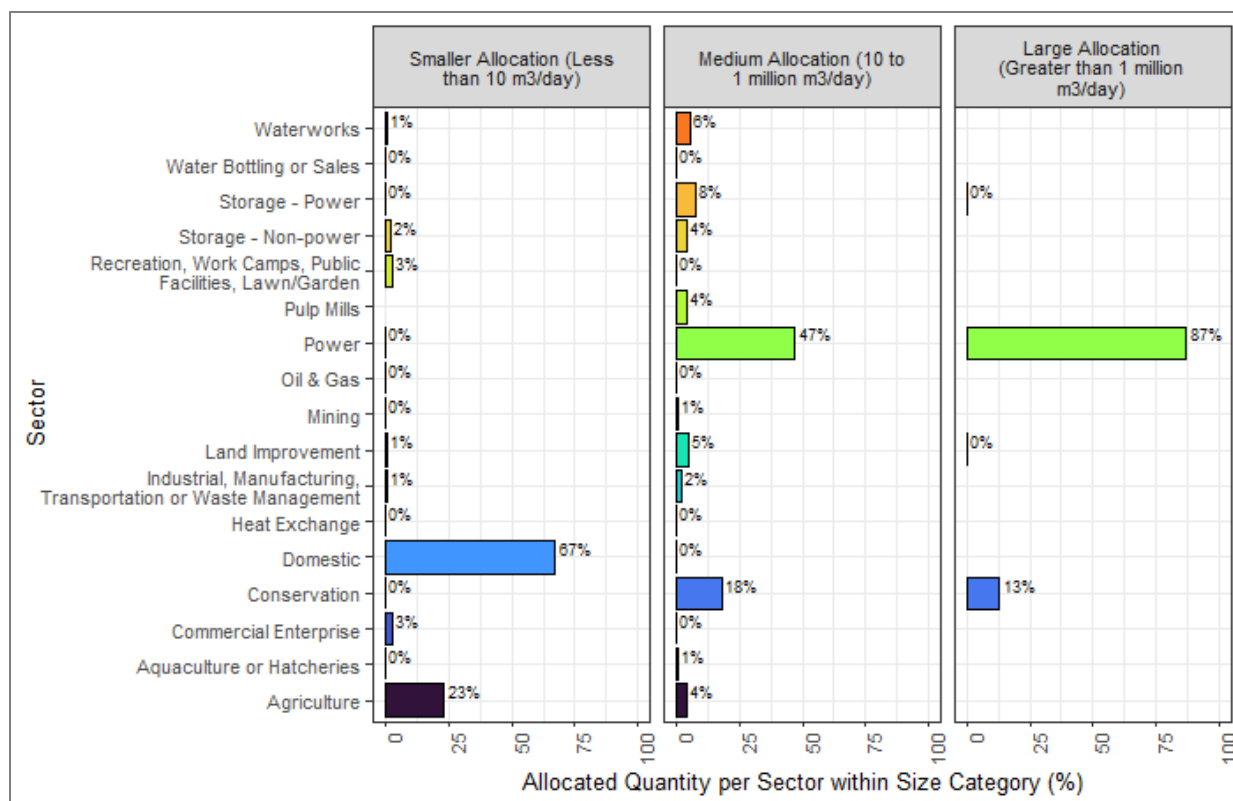


Figure 9: Analysis of sectorial quantity distribution with allocation categories.

4.3 Spatial Analysis

Provincial water management is administrated through eight Natural Resource (NR) regions that together span the Province. These regions are referred to as Skeena, Northeast, Thompson-Okanagan, Cariboo, West Coast, South Coast, Omineca and Kootenay-Boundary. WSA authorizations are granted through regional teams that focus on each of these areas. Examining the distribution of licences among these regions and the types of water uses within each region is useful for understanding how water management challenges vary among the NR regions (Figure 10). In this Figure and the following figure, some licences are identified as region unknown. In these cases, the licence did not have a spatial location associated with it within the BC Data Catalogue so the region could not be included in the data analysis. The actual licence locations are known by the province, but not recorded in the BC Data Catalogue.

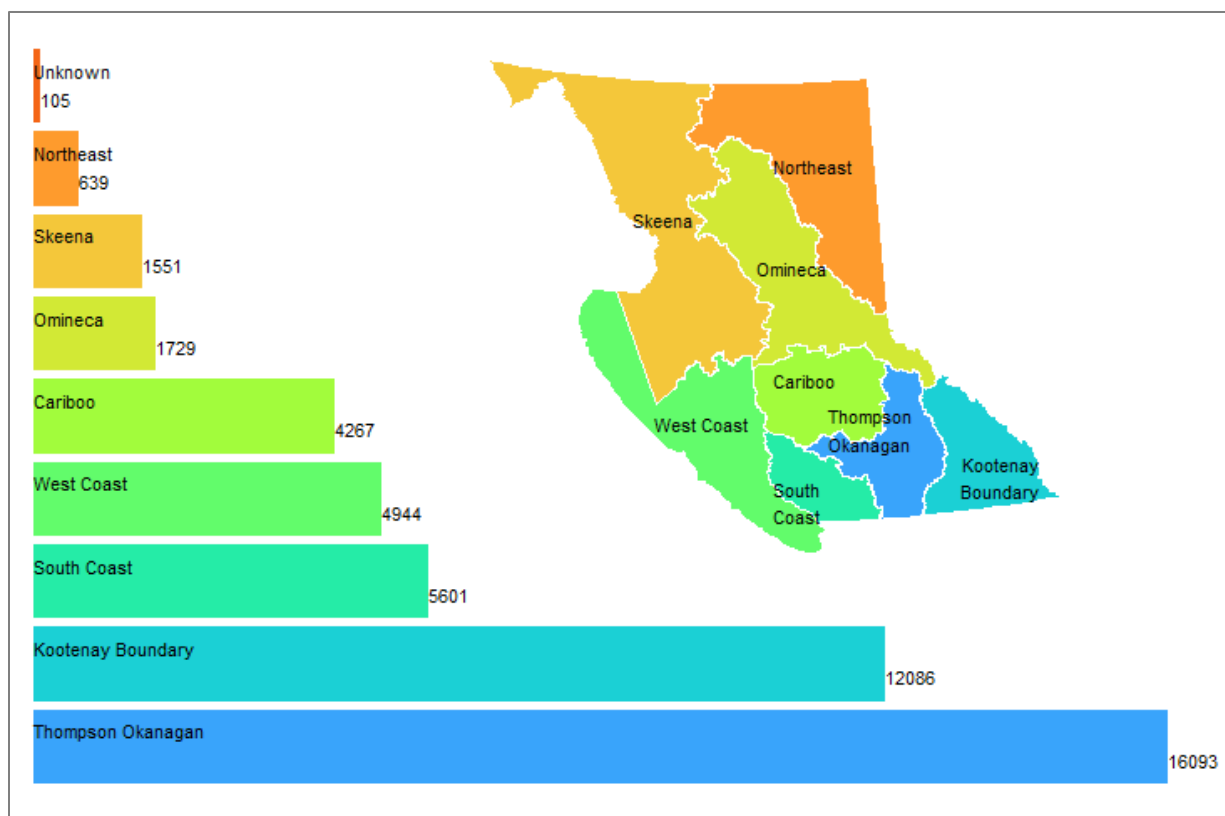


Figure 10: Distribution of water licences among NR regions.

The distribution of the number of water licences for each of the NR regions are presented in Figure 10 and Figure 11. Figure 10 demonstrates that the largest numbers of licences are within the Thompson-Okanagan (over 16,000) and Kootenay-Boundary regions (over 12,000). In comparison, the West Coast, South Coast and Cariboo regions have moderate numbers of licences (approximately 4,300 to 5,600) while the Skeena, Omineca and Northeast regions have lesser numbers (less than 2,000). In each region, agricultural and domestic licences are a significant proportion of all licences (Figure 11). The regional share of licences for agricultural water use varies from approximately 20% in the West Coast and South Coast to 42% in the Thompson-Okanagan. The regional share of licences that are for domestic use varies from 16% in the Northeast to 57% in the Kootenay-Boundary. Licences for storage for non-power uses are also a substantial proportion of the total in some regions with 18% of licences in the Northeast and 10% of licences on the West Coast within this category. Within the Northeast, industrial, manufacturing, transportation and waste management water uses is also approximately 11% of the total for the region.

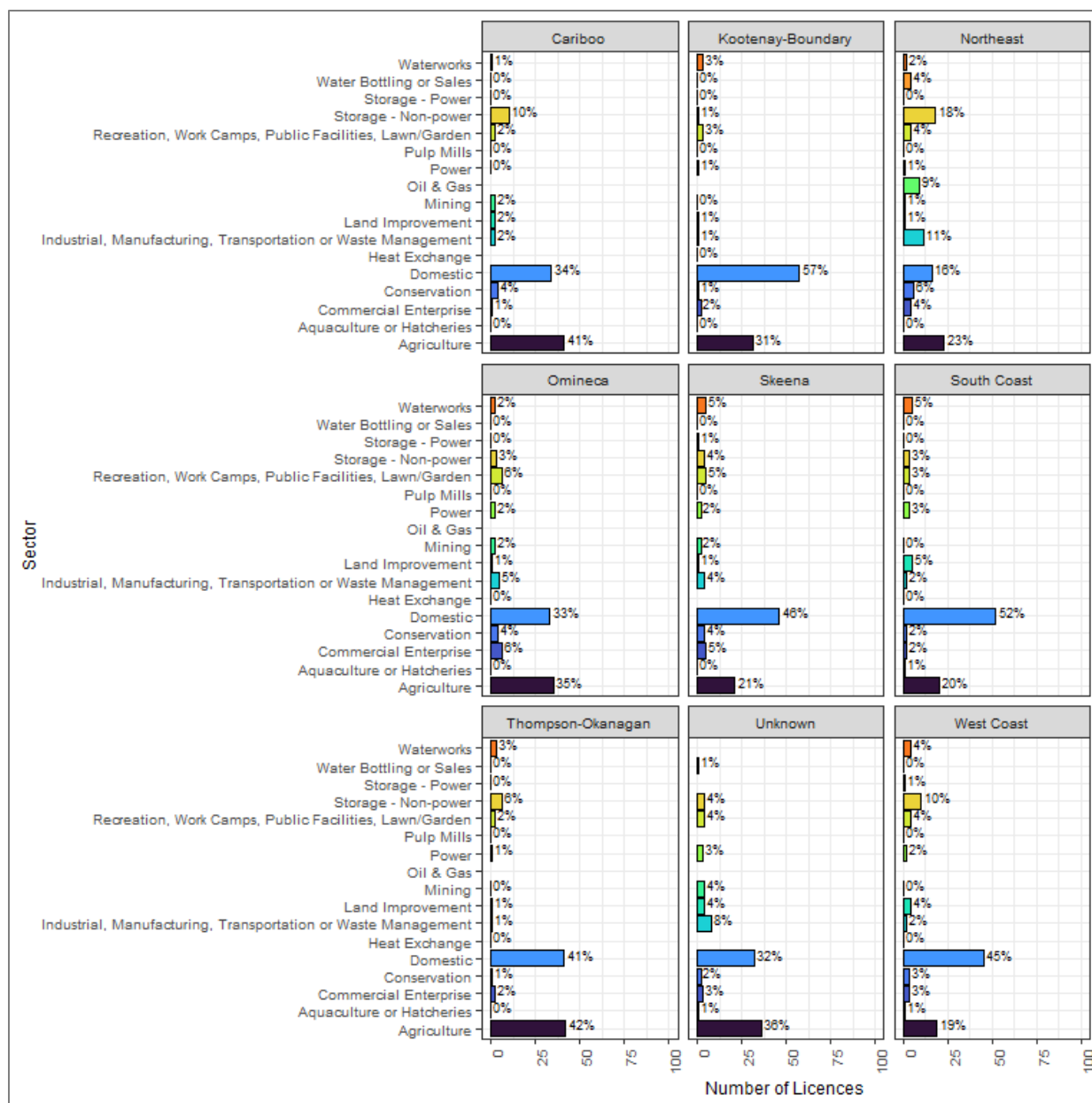


Figure 11: Distribution of water licences in NR Regions and water use sectors.

Water allocations can be further analyzed by looking at total allocated water volumes for each NR region. Figure 12 and Figure 13 present cumulative licenced volumes within each region and sector. All sectors except power and conservation are shown in Figure 12. This figure demonstrates that each region varies in the mix of water allocated in different sectors.

In the South Coast region, waterworks is the largest non-power/non-conservation water user. Waterworks are also significant users in the Kootenay-Boundary, Skeena, Thompson-Okanagan and West Coast regions. Water storage for non-power uses is also substantial in the Skeena, South Coast, Thompson-Okanagan and West Coast regions.



Figure 12: Regional and sector summary of licensed water use (excludes power and conservation uses).

Land improvement is a prominent water use in some regions, in particular in the West Coast, South Coast and Thompson-Okanagan regions. These licences are generally expected to be related to the drainage of land to enable development. Further investigation of these licences on a watershed scale could be of interest for future studies as drainage of land has been linked to lower water storage within watersheds and could result in a magnification of seasonal variations in flows (higher winter flows and lower summer flows).

Agriculture water use comprises a substantial proportion of water licences in the Thompson-Okanagan, Cariboo and Kootenay Boundary regions. The relatively modest amount of water allocated to agriculture

in the South Coast region is somewhat surprising considering that the Fraser Valley and Metro Vancouver generated the largest share of gross farm income in B.C., generating more in farm incomes in 2015 than the remainder of B.C. (Fraser Valley Regional District 2017). This result could be indicative of several factors including the wetter climate in the Fraser Valley requiring less irrigation, the mix of livestock and crops grown in the Fraser Valley being less water intensive or unauthorized use may be more prevalent in this region. The West Coast region is the only region in B.C. in which water allocated to aquaculture and hatcheries exceeds water allocated to agriculture. In the West Coast region, this use is substantial.

There are a variety of industrial uses that are significant within the regions. Pulp mills are substantial users in every region except the Northeast. Water allocated to pulp mills is the largest non-power/non-conservation use in the Omineca region and the second largest such use in the West Coast region.

Water allocated to the mining sector appears to be relatively modest in Figure 12; however, it should be noted that mining water use summarized in Figure 12 only includes water allocated for the direct use of water for mining purposes (Table 1). Not all water usage associated with the mining sector is allocated for mineral processing related usages as water usage associated with mine operations may fall into a number of other categories. To better understand the range of water use purposes associated with the mining sector, water use purposes that have been allocated to mining companies were reviewed. Results of review suggest that power; storage for power or non-power uses; waterworks; land improvement, industrial, manufacturing, transportation or waste management; domestic; agriculture (irrigation); conservation; commercial enterprise and recreation, public facilities and lawn/garden categories all contain some water use associated with the mining sector.

The large sector category of industrial, manufacturing, transportation or waste management has substantial water allocation in several regions most notably in the Kootenay-Boundary, Northeast, Skeena, and South Coast. Oil and gas production holds a relatively small amount of licenced water use; however, short term use approvals are common in this sector due to the shorter term nature of operations. Short term use approvals are further discussed in Section 4.6. Also, similar to the mining sector, water usage associated with the oil and gas sector may be assigned to a range of other water use purposes. A review of water use purposes held by oil and gas companies suggests that water use purposes associated with licences held by oil and gas companies include storage for non-power uses; recreation, public facilities and lawn/garden; industrial, manufacturing, transportation or waste management; agriculture (irrigation); commercial enterprise; domestic; waterworks, and water bottling or sales.

Domestic water use is a small percentage of overall water use within every region despite the large number of domestic licences. This result suggests that water efficiency campaigns aimed at individual domestic surface water users would result in only minor changes to the overall water balance within regions assuming that these users are not exceeding their allocated volumes. Similarly on a regional scale, water bottling or sales are generally allocated lower cumulative volumes than other commercial or industrial uses. Although individual water bottling licences may be large relative to other enterprises and could have local or watershed scale impacts, on a regional scale this use is much lower than what is allocated to other commercial interests.

Water licences for power, storage for power, and conservation uses are shown on Figure 13. These uses are presented separately from others due to the large quantity of water allocated to these sectors. Because the magnitude of water allocated to these sectors also varies greatly between regions, this figure shows total regional use within order of magnitude bins. It should also be noted that there are some water licences with very high volumes (Figure 5); therefore, a single license can have a large effect on the regional total and the regional total can be strongly influenced by only a small number of these

licences. Further, large licences may have limiting conditions that restrict water usage to provide for environmental flow needs, may not require the maximum diversion rate all year or works may be in the process of decommissioning or upgrading works so they often will not actually use the amount allocated. For example, licence C023265 issued on the Heber River on Vancouver Island in 1957 has the largest allocated rate in the water licensing database. From the date of issue, this licence had a limiting clause that stipulated that flow of water in the Heber River must be maintained. In 2012, B.C. Hydro developed a Water Use Plan for the Campbell River area, and as a result of this plan decided to decommission the Heber Dam with restoration work following the decommissioning (Polster, 2017). This licence is no longer in use but is still active. This result demonstrates the limitation of using total allocated use as opposed to actual use.

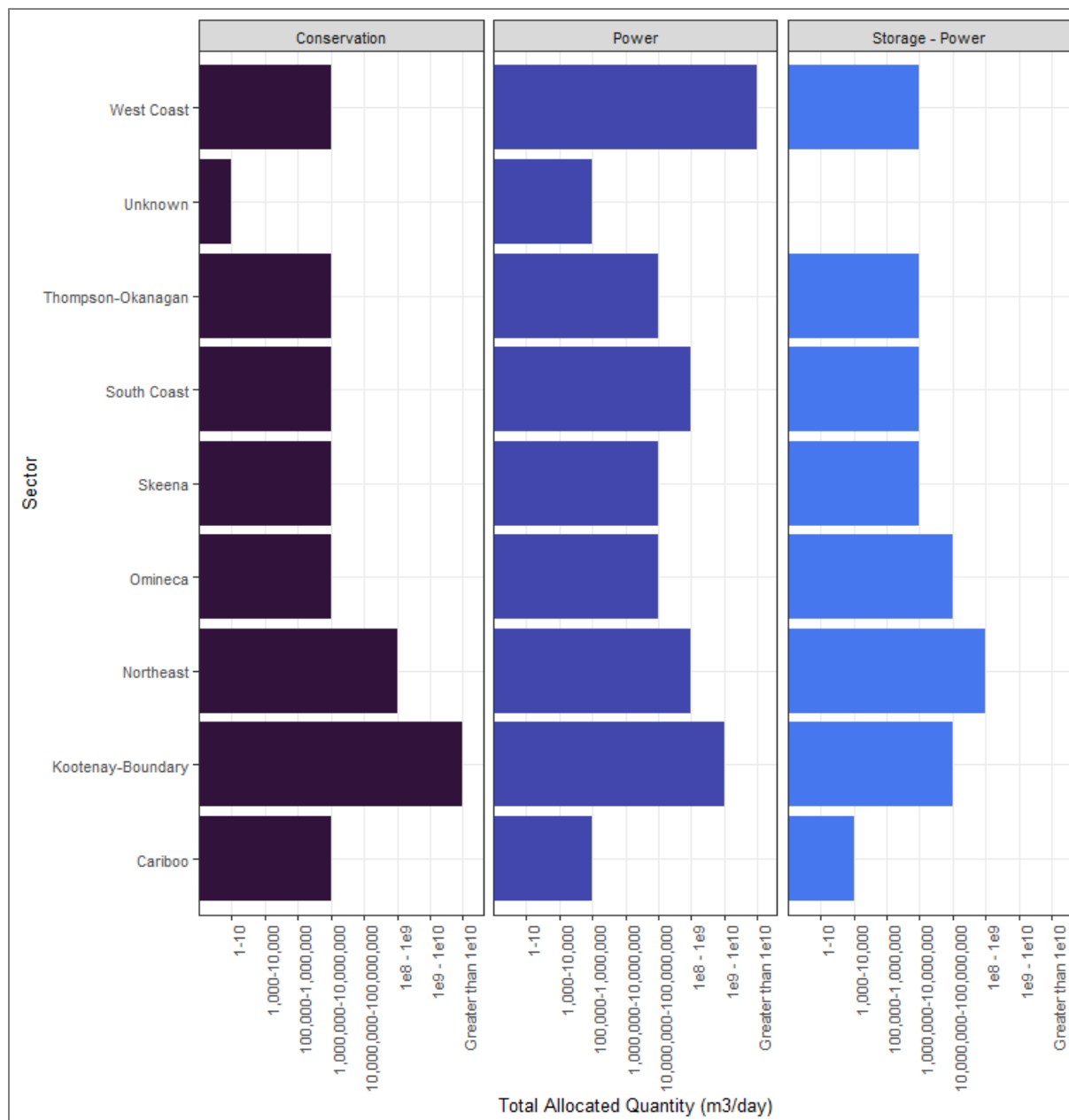


Figure 13: Regional and sector summary of licensed water use for power and conservation uses.

4.4 Power Generation Licences

Licences issued for the power generation sector may have uses specified in the licence ranging from power for general, commercial or residential purposes. Stream storage licences issued for power purposes are also included in this category. There are over 800 active water licences for power generation purposes spanning over 250 watersheds in B.C. The magnitude of water allocated to individual power licences varies greatly with the smallest licences issued for less than ten m³/day and the largest licences greater than ten million m³/day. Although the magnitude of power licences varies over this large range, the majority of power licences are substantial allocations (greater than 1,000 m³/day) (Figure 14).

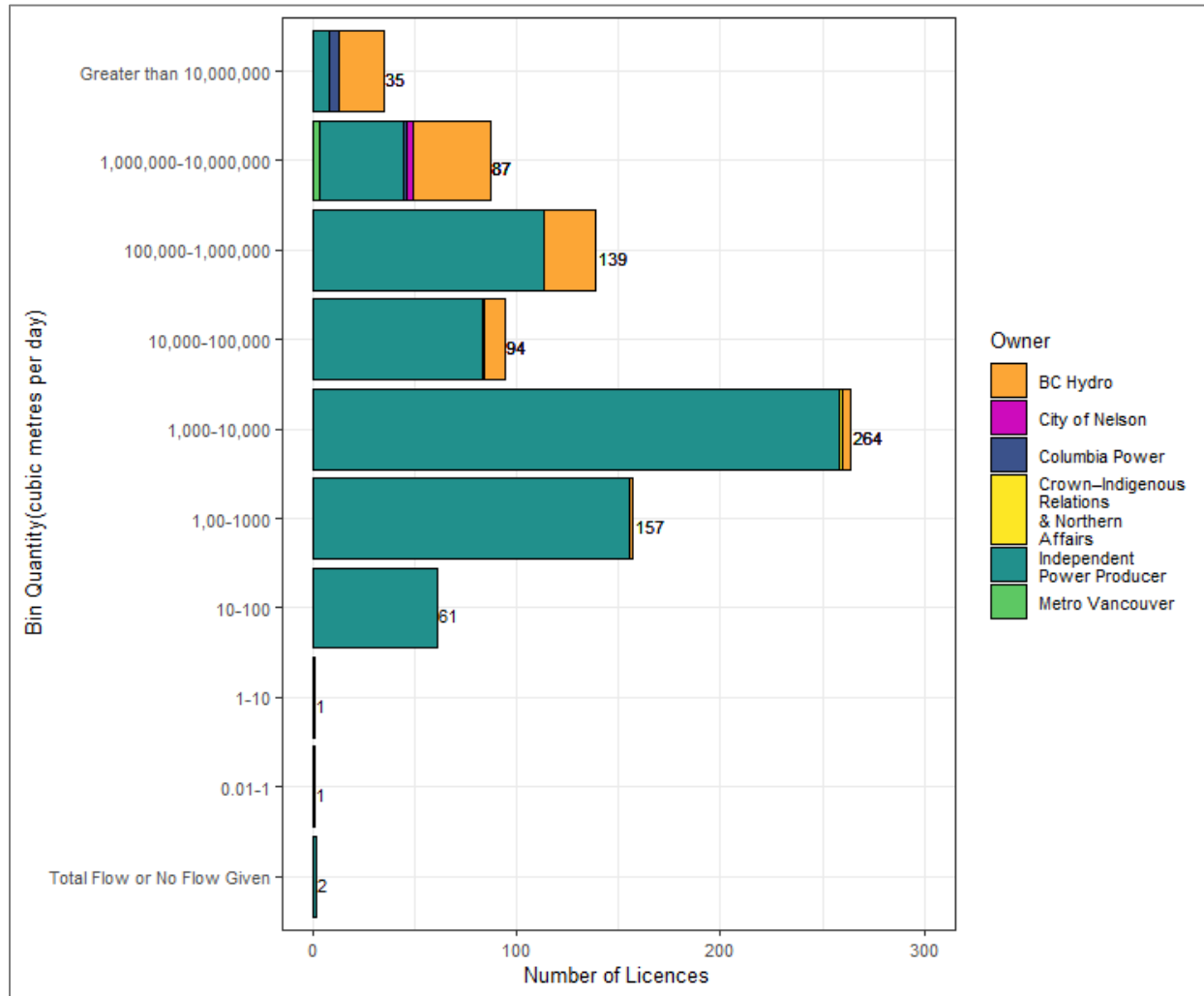


Figure 14: Histogram of power generation water licences,

Active power licences are held by a variety of entities. BC Hydro is the largest single holder of water licences with approximately 100 licences; however, the majority of power licences (approximately 700) are held privately by independent power producers (Figure 15). BC Hydro operations span only approximately 30 of the more than 250 water licencing watersheds that host water for power licences. BC Hydro holds a large proportion of the larger licences; however, independent power producers also hold a proportion of the large licences.

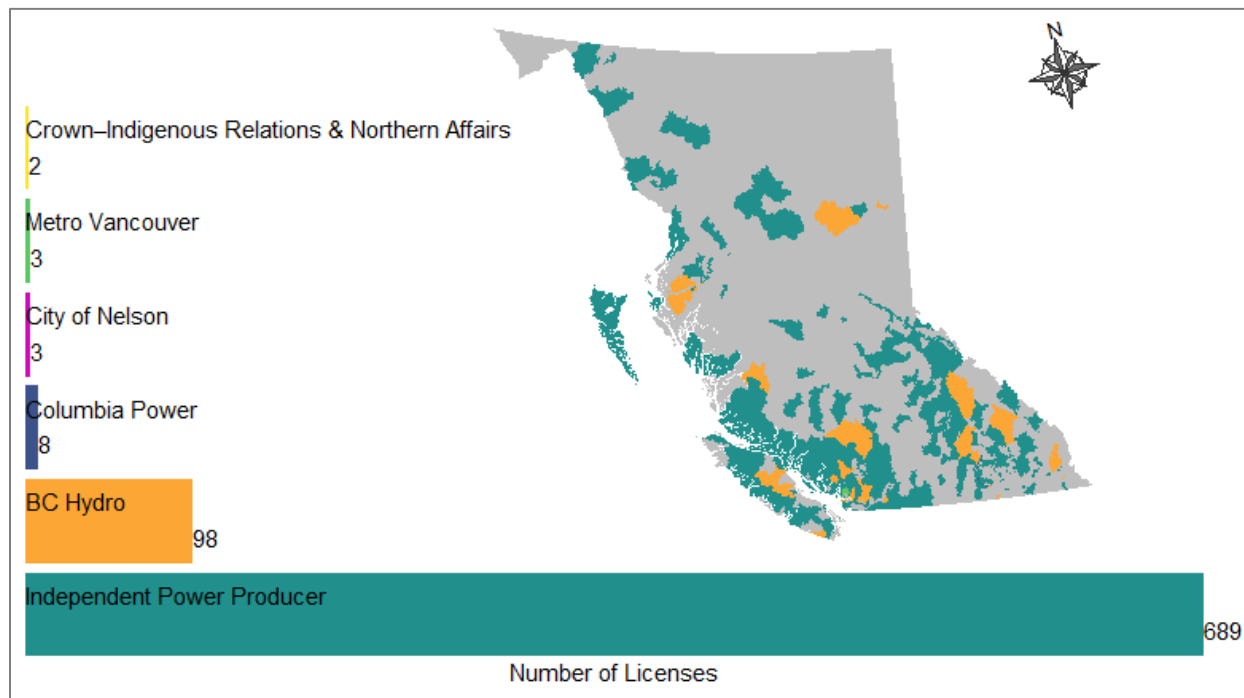


Figure 15: Power water licence ownership and watershed distribution. Note that numbers shown are licence counts for each owner.

4.5 Agriculture

B.C.'s agricultural industry is important for ensuring British Columbians have food security. In public engagement British Columbians have ranked water for agriculture among the most important water values just below drinking water and water for aquatic species (Province of B.C., 2022). Water licences issued for agricultural purposes can be grouped among four main use categories: irrigation, livestock and animal, greenhouse & nursery, and other crop uses such as flood harvesting. The distribution of the number of water licences and the cumulative volumes allocated among these agricultural water use categories throughout the province are shown in Figure 16, Figure 17 and Figure 18.

Figure 16 shows the majority of agricultural water licences are in the southern portion of the province and are issued for irrigation uses. The region with the largest number of water licences issued for irrigation uses is in the Thompson-Okanagan region with over 6,000 irrigation licences in that region (Figure 17). The Kootenay and Cariboo regions also have large numbers of agricultural licences with over 4,000 in the Kootenay and over 1,500 in the Cariboo. The regions with the largest numbers of livestock and animal licences are the over 1,000 licences in the Thompson-Okanagan, and over 400 licences in Omineca and the Cariboo.

Figure 18 demonstrates that the volumes of water allocated to irrigation water licences are much higher than the volumes allocated to other agricultural uses. This result suggests that agricultural water efficiency efforts could have the greatest impact if the focus is on irrigation efficiency over other uses.

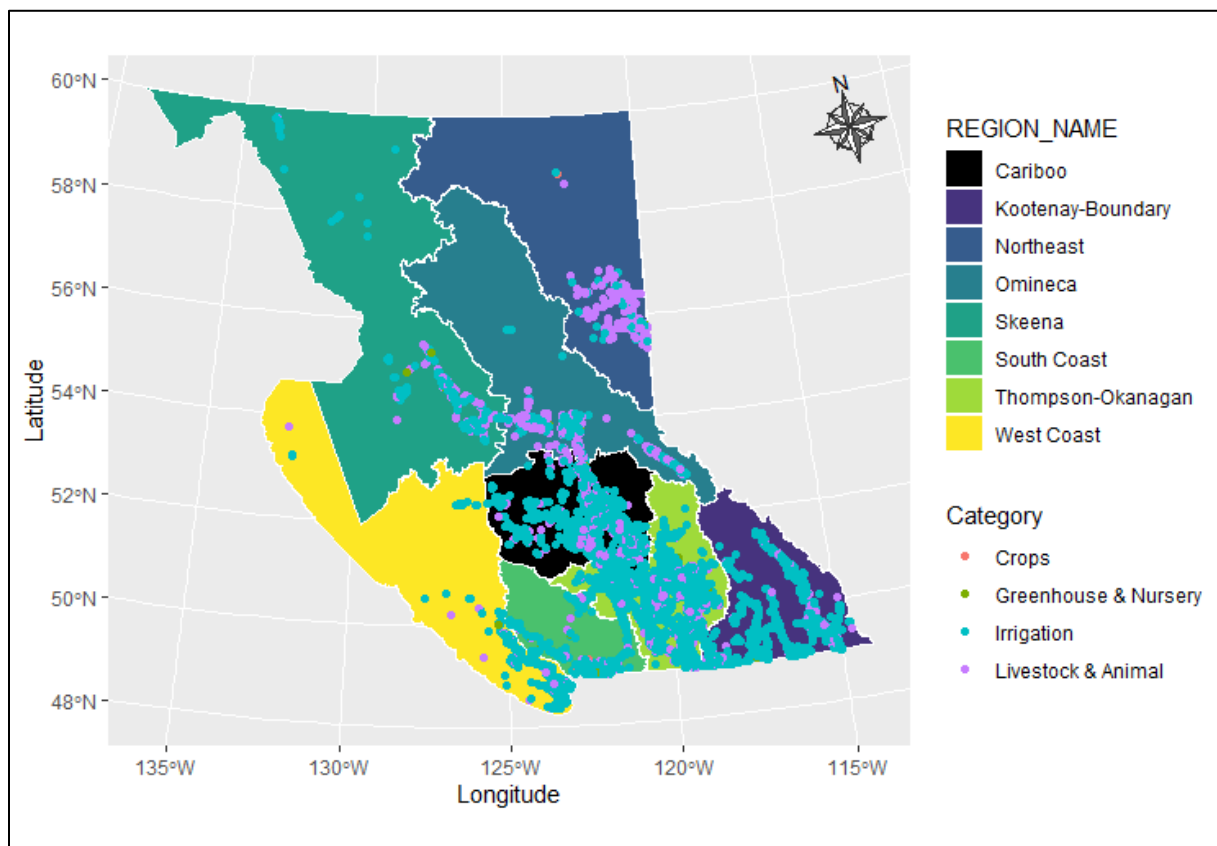


Figure 16: Distribution of agricultural water licences in B.C.

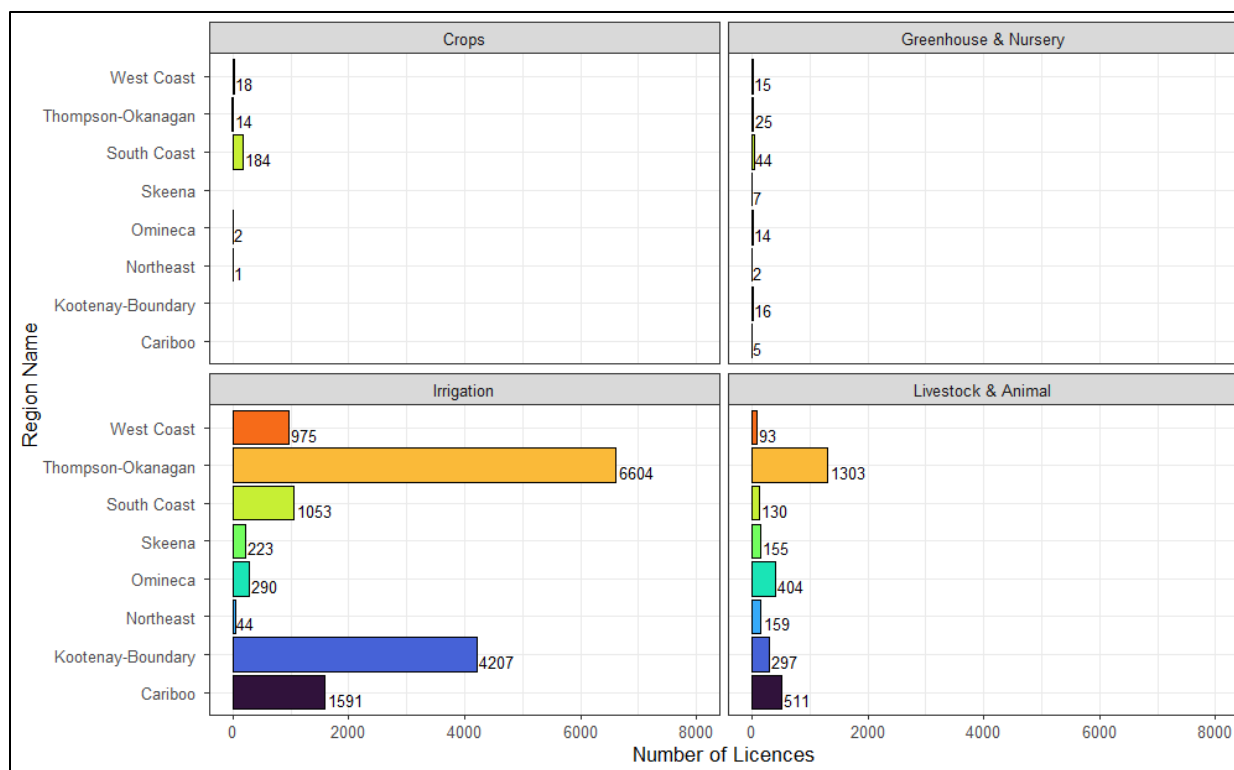


Figure 17: Count of agricultural water licences by natural resource region.

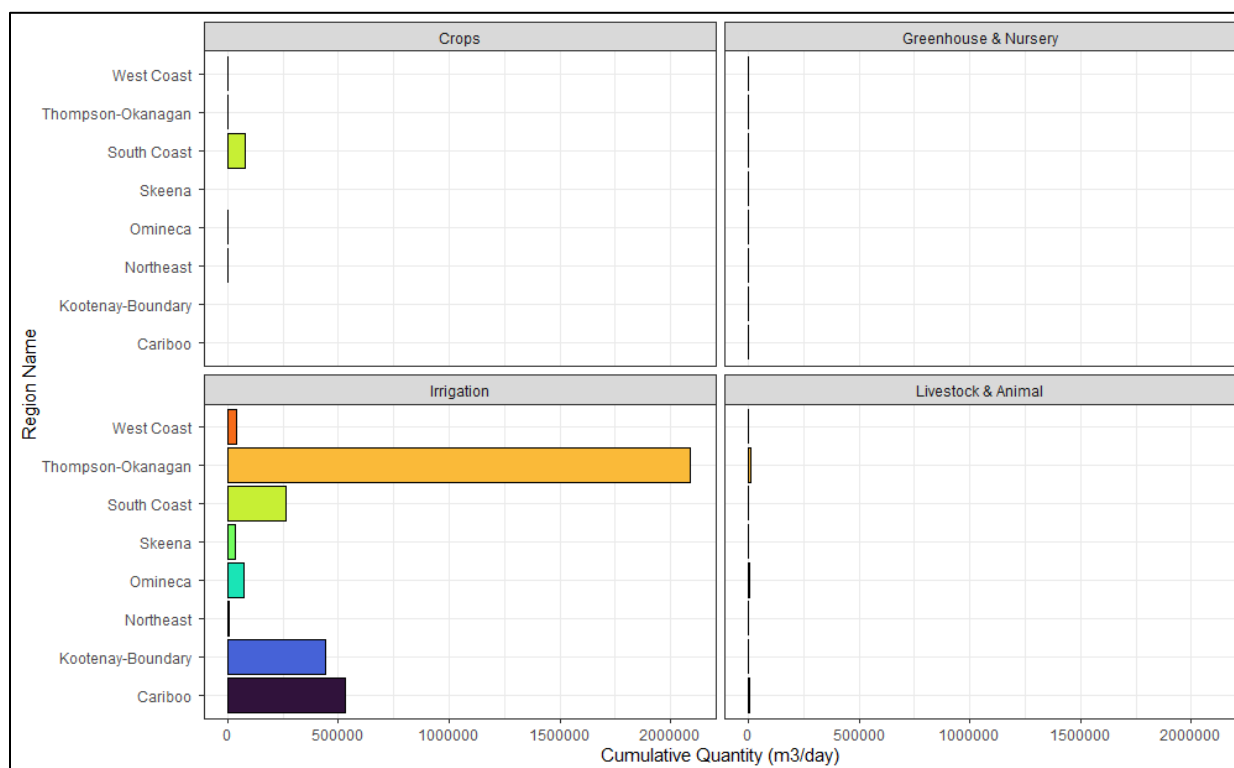


Figure 18: Cumulative water authorized for agricultural water use.

4.6 Short Term Use

The analysis presented thus far in Section 4 has been based on long term water licences held by various sectors; however, it is also known that much of the water usage by the Oil and Gas sector in B.C. is under Short Term Use approvals (WSA S. 10). Short term use approvals (STUA) authorize water use for periods less than 24 months and these are commonly used in the Oil and Gas industry. STUA for the Oil and Gas industry are generally issued by the BC Energy Regulator. STUA are also issued by WLRS for other sectors to support other temporary purposes such as mineral exploration, construction, or transportation projects.

The distribution of STUA within the B.C. natural resource regions is presented in Figure 19, Figure 20 and Figure 21. These results demonstrate that the Northeast region has the greatest number of STUA both active and terminated. Approximately 40% of active STUA are in the Northeast region. The cumulative water authorized under these approvals is more distributed with the greatest amounts of water authorized in the Skeena, Northeast, Thompson-Okanagan and Omineca regions. A number of BCER STUA follow two linear routes. These permits are generally associated with the Coastal Gaslink Pipeline which traverses the Northeast, Omineca and Skeena regions and the Transmountain Pipeline which traverses the Omineca, Thompson-Okanagan and South Coast regions.

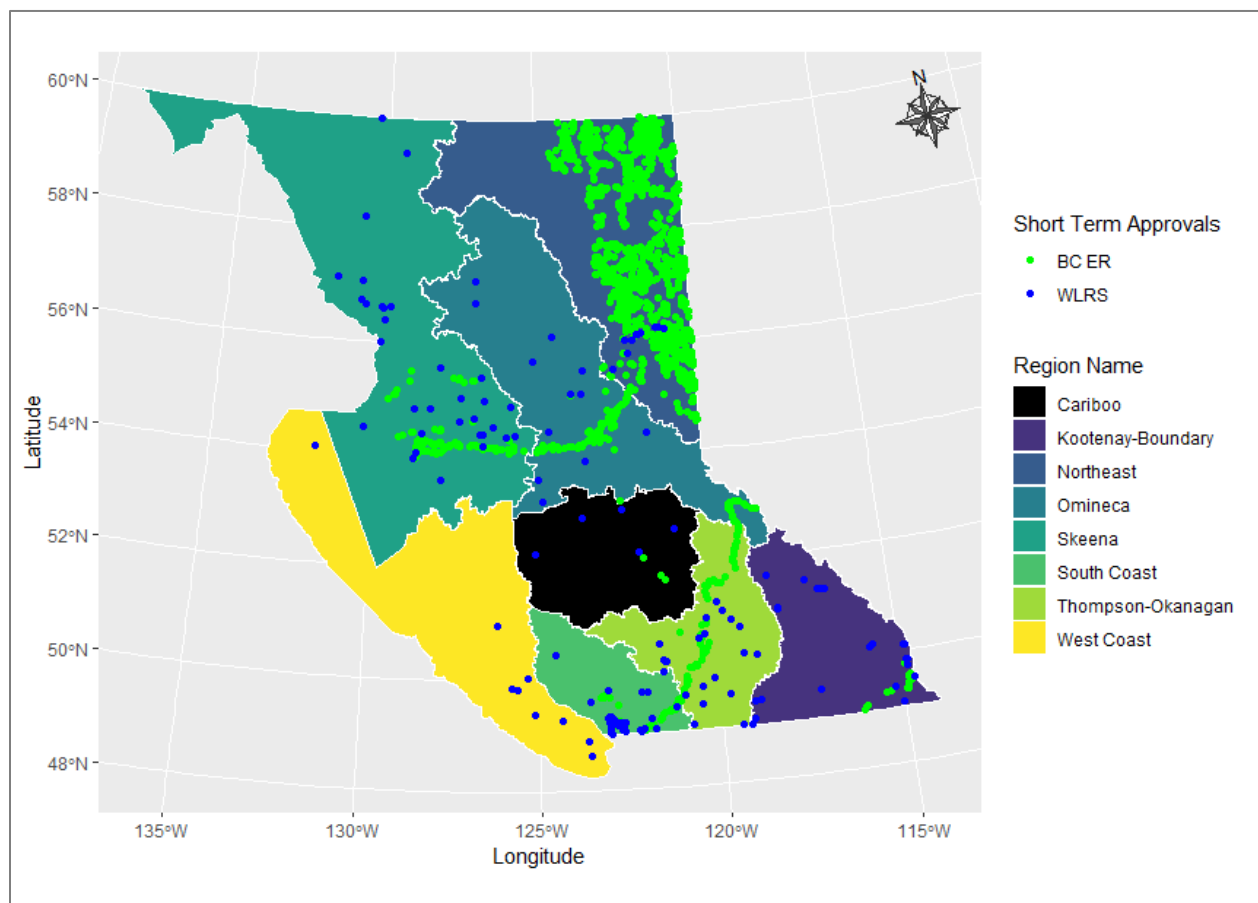


Figure 19: Short term use approvals in B.C.

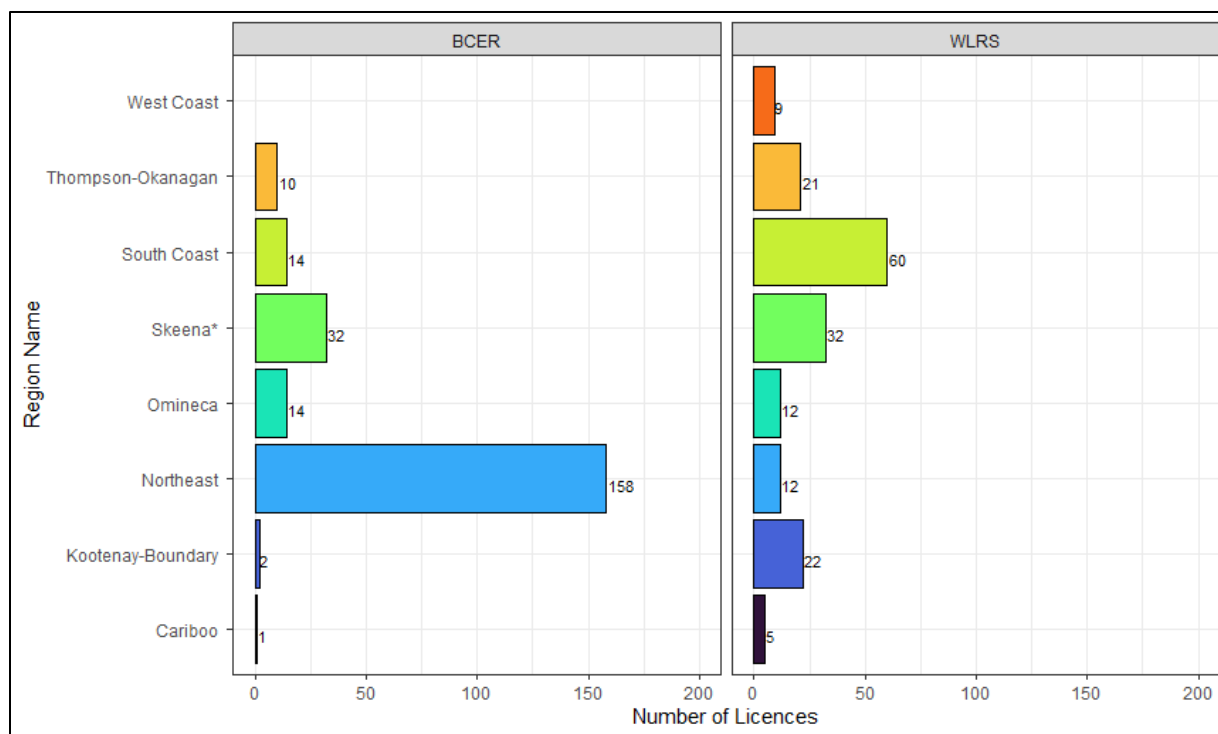


Figure 20: Count of short term use approvals by natural resource region, January, 2024.

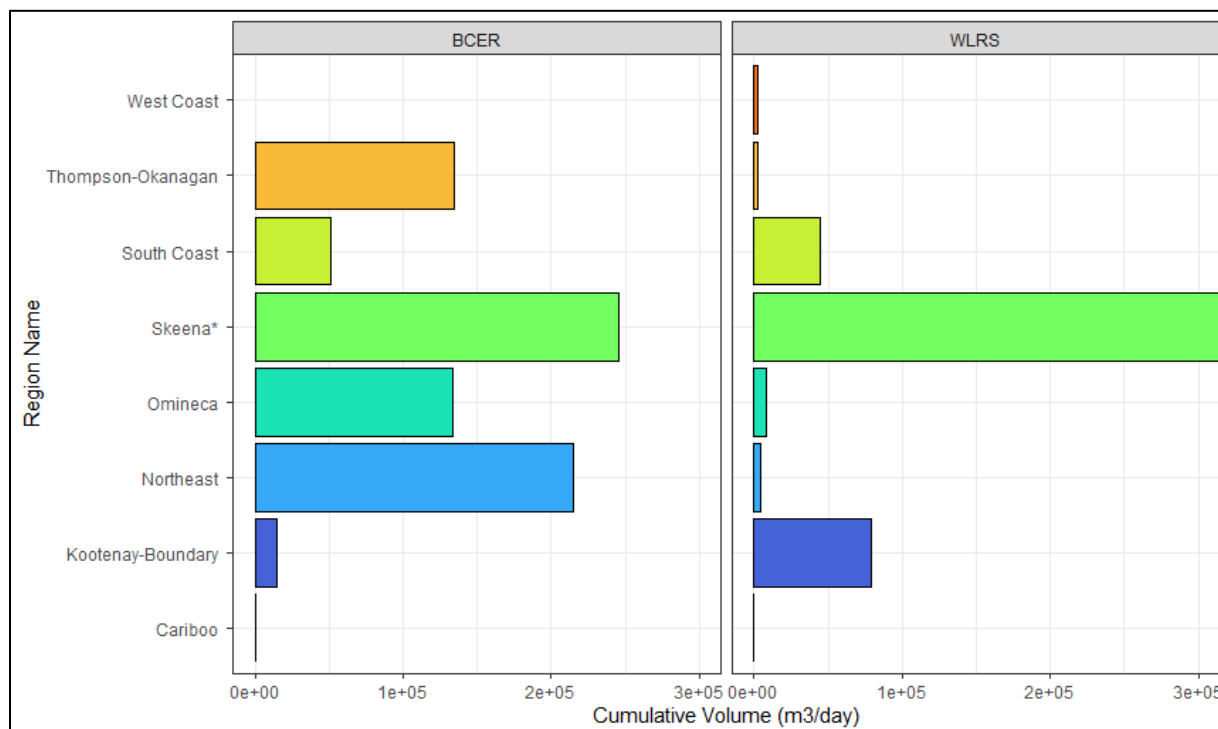


Figure 21: Cumulative water authorized under short term use approvals, January 2024. *In the Skeena region, there is one STUA issued by WLRs that is much larger than all STUAs (over 1 million m³/day); therefore the x-axis is truncated to better show relative water allocated under STUA for all regions.

4.7 Groundwater Use

Analysis of the groundwater wells database and distribution of groundwater wells within the NRS regions is presented below in Figure 22. These results demonstrate that groundwater well development is greatest in West Coast region (just over 38,000 wells) followed by the South Coast (over 25,000) and Thompson-Okanagan (over 22,000) regions.

In each region, a notable proportion are classified as having unknown water use. In all regions, the majority of wells are domestic with over 21,000 in the West Coast region; however, substantial numbers of wells are designated as water supply systems (ranging from just under 200 in the Skeena region to over 1,200 in the West Coast region). Likewise, many wells are associated with a commercial or industrial use ranging from over 200 in the Skeena region to over 700 in the South Coast region. Irrigation wells are more concentrated in the southern portions of the province, particularly in known agricultural areas with over 1,200 wells in the Thompson-Okanagan region and over 800 in the South Coast region. Irrigation wells are more concentrated in the southern portions of the province, particularly in known agricultural areas with over 1,200 wells in the Thompson-Okanagan region and over 800 in the South Coast region. Irrigation wells are more concentrated in the southern portions of the province, particularly in known agricultural areas with over 1,200 wells in the Thompson-Okanagan region and over 800 in the South Coast region.

In some cases, wells that are classified as domestic may be supporting small scale farming operations that exceed the threshold of domestic use. Identifying these wells or estimating usage associated with these wells is beyond the scope of this report, but as the province continues to licence existing water use, the water use designated in GWELLS should be updated.

Many wells in all regions are classified as water supply systems. The South Coast (over 700), Thompson-Okanagan (over 800) and the West Coast regions (over 1200) have the largest number of wells with this classification.

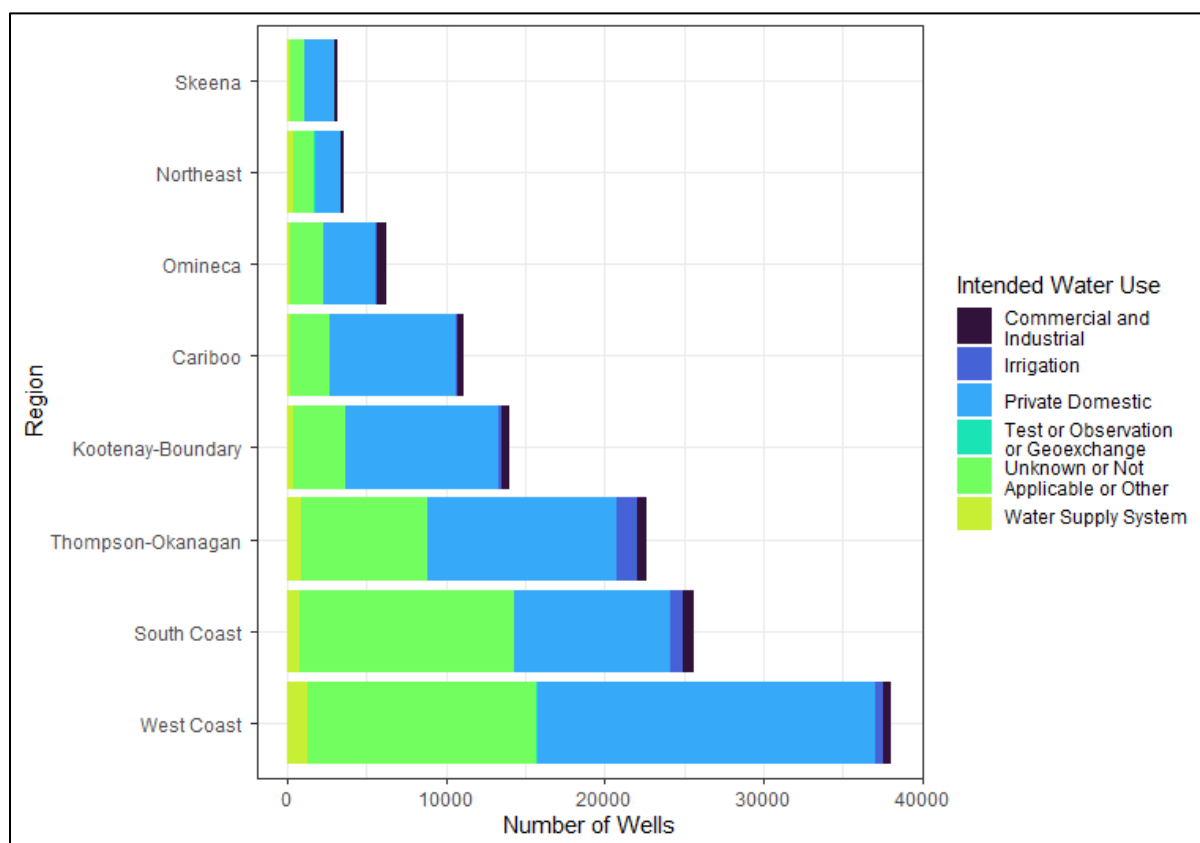


Figure 22: Distribution of Groundwater Wells in B.C.

5. LIMITATIONS

Water use volumes summarized in the preceding sections represent licensed water use only and may vary from actual water used. Oil and gas producers, local water providers, pulp mills, and power producers are required to report water use to the Province under the terms and conditions of all licences within these sectors. In other sectors such as agriculture, water use reporting is not required for all users, but may be required within the terms of a particular licence (WSA S.14). However, water use information is not stored in a common database and cannot be easily accessed to estimate cumulative water use on a provincial or regional scale. Accessing water use data held in paper files or many separate digital files is beyond the scope of this report; therefore, reported water use information has not been accessed for the analysis presented. If in the future, the Province is able to make this data more easily available, a future update to the allocated water analysis contained in this report could include a comparison of actual water used versus water licensed, particularly for the larger licences. Actual water use for many licences will be less than the total licensed as some older surface water licences may no longer be in use and licences are typically for maximum potential demand (Barroso and Wainwright, 2020). Some licences, particularly those issued for oil and gas purposes, may also have environmental flow needs requirements that restrict water takings during low flow periods. Conversely, some licence holders may use more water than allocated if operations have expanded or become more water intensive since the licence was issued.

The relationship between licensed water quantity and the potential impact on the environment is complex. Although larger diversions will generally have greater environmental impact than smaller diversions, more detailed investigation of the site and watershed specific factors in addition to the nature of the diversion are considered within the water licensing process to obtain a more complete picture of impacts and potential mitigation strategies. In general, consumptive water uses where water is transferred to another watershed, water is subject to greater loss due to evaporation, or water quality is degraded before discharge will be correlated to greater impacts. In some cases, particularly in sensitive environments such as arid areas or where water temperatures are near thresholds required for fish survival, smaller diversions or the cumulative impacts of several small diversions can have substantial environmental consequences. Watershed specific studies (Nott et al., 2023; Barroso and Wainwright, 2020; Pike et al., 2015) or monitoring of indicator parameters such as water temperature and other field investigations (Allen et al., 2020; Hall et al., 2017) would be required to assess and recommend mitigative measures in watersheds where small diversions may have an unacceptable cumulative impact.

Unlicensed water use has not been thoroughly estimated within this report. Unlicensed water use includes domestic groundwater use for household and related uses by the occupants of a private dwelling (estimated in section 4.2) but could also include existing use groundwater users who have applied, but not yet received a water licence from the Province or water users that are out of compliance with the water licensing requirement. Remediation and drainage wells are also excluded from licensing requirements under S. 35 of the Water Sustainability Regulation. A complete estimate of water use provincially would require an estimate of water demand from unlicensed household use and unauthorized use ideally complemented by actual reported water use of licensed users. Ideally, remediation and drainage wells water takings would also be included in this estimate; however, these wells are expected to be more concentrated in more developed and urban areas.

To estimate water use impacts during vulnerable periods, an understanding of the timing of water use in addition to volumes is needed (Barroso and Wainwright, 2020). This type of analysis would require the improvements to water use reporting data identified above. Previous studies that could inform future

water demand analysis include Forster et al. (2018) which estimated provincial groundwater demand, Bennett et al. (2021) which estimated groundwater demand in the West Coast region, and Fathom Scientific Ltd (2020) which estimated water use in the Northeast region of BC.

Water use is an important component to understand when assessing overall watershed health; however, land use is also an important control of watershed functioning. Forest mismanagement, storm water infrastructure, roads and increases in impervious surfaces impact watershed functioning and have the potential to decrease infiltration of precipitation to groundwater resulting in flooding, erosion and low winter or summer streamflow. Changes to water quality including physical parameters such as temperature and chemical parameters such as pH or introduction of contaminants also impact watershed health. A complete assessment of watershed health would require consideration of the impacts of both land and water use in addition to the water-related values such as drinking water protection or aquatic habitat.

The analysis presented herein is based on the available data and errors or inconsistencies in the province's data layers will result in errors in the resulting analysis. The province is continually improving data quality; therefore, rerunning this analysis is recommended in the future as the databases are improved.

6. CONCLUSIONS

This report contains an analysis of provincial databases that store information related to water use. Analysis of this information provides context for provincial water resource stewardship and priority setting, for understanding limitations of the water databases and potential areas for improvement, and provides an understanding of how water use data sources can be used to support watershed specific analyses.

To summarize, key conclusions of this work are as follows:

- The majority of the water licences issued in B.C. are for domestic (household) use and agricultural uses. Both of these licence sectors are generally composed of smaller quantity licences; however, the largest agricultural licences have allocated volumes that are several orders of magnitude larger than the smaller users.
- The scale of water used by agricultural operations varies significantly among licensees within the agricultural sector with the largest agricultural licences issued for irrigation. Approaches to water management within the agricultural sector should take into account the magnitude of this scale variation to optimize results.
- When compared to water use by large users, unlicensed domestic groundwater wells comprise a relatively small percentage of water use provincially; however, it is possible that domestic water use by groundwater users could be significant in some watersheds. Further watershed specific analysis would be needed to determine this.
- Licensed wells compose a relatively small fraction of known groundwater wells (approximately 2%). A substantial number of wells in the GWELLS database may be out of compliance. If these wells are still in use for non-domestic or other exempt purposes, a licence is required and they would be out of compliance with the WSA if an application for licensing has not been submitted to the Province. It is also possible that these wells have been put out of service or decommissioned, but have not reported the closure. Out of service wells are required to be decommissioned within 10 years and submission of a decommissioning report is a requirement of the WSA.

- The number of licences and mixture of water use sectors operating in different regions of the province varies considerably. Strategies enacted to improve water use efficiency or reduce environmental impacts could be tailored to the most prominent water use sectors to maximize the impacts.
- The largest water licences and overall the bulk of licensed water use in B.C. has been issued for power generation purposes. Although BC Hydro is the largest single holder of power generation licences and holds many of the largest licences, most power generation licences are held by independent power producers including a proportion of the largest allocations.
- Short term water use approvals in B.C. are issued for periods less than 24 months and commonly used in the Oil and Gas industry as well as other short term projects. For a full picture of water use in B.C., short term usage must also be considered. Short term approvals are issued by BCER and WLRS. The region with the greatest number of short term approvals is the Northeast; however, the Thompson-Okanagan, Skeena, Omineca and Northeast regions all have notable levels of short term water usage.

7. **RECOMMENDATIONS**

The provincial databases that house water use information (GWELLS and eLicensing) hold a wealth of information that supports evidence-based decision-making. As the Province continues to work on improving these databases, this analysis could be updated and improved. Specific upgrades that could support refinement of the analyses contained in this report include:

- Adding quantity, application type and additional location data to the Water Rights Applications layer.
- Updating and correcting information provided in the well class and intended water use fields within GWELLS as currently these fields are listed as unknown for many groundwater wells.
- Adding information about estimated water use to the GWELLS database could be considered if practical (as the current information is limited to well yield).
- Adding information about the business sector that the licence supports in eLicensing in addition to the water use purposes (as industries may use water under a number of different purposes, but supporting a single industrial project such as a mine).
- Improving the accessibility of the water use reporting information that the Province already collects could enable a comparison of actual water used for sectors such as pulp mills which report their usage to the Province.

The information on distribution of sector and spatial distribution of usage can be used to inform prioritization of resources related to water management and develop targeted approaches for outreach. For example, because much of the larger irrigation licences are concentrated in the Thompson-Okanagan region, it may be worth creating targeted outreach and education for irrigators within this region taking into account the geology, climate and agricultural activity within the region.

Further data analyses could compare licensed water use to the predictions of the Ministry of Agriculture, Food and Fisheries Agricultural Water Demand model (Province of B.C., 2015) or other water demand modelling (Bennett et al., 2021).

Exploring how water allocation and use varies at a smaller scale such as a watershed scale could be of value for watershed level governance and management projects. This information could inform project selection, the policies considered, and engagement/outreach.

Further analyses to investigate how water use has changed over time within sectors and spatially could be used to better understand why conditions have changed in some watersheds. This information could be coupled with monitoring data and other sources of risk mapping to understand how resources (streams and aquifers) are responding to water use pressure. For a more fulsome analysis, this data could also be coupled with land use changes.

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APPENDIX A: SECTOR USE GROUPING

PURPOSE_	PURPOSE_USE	Simplified Water Use Category	Simplified Code	Grouped Sector for Data Visualization Only
03A	03A - Irrigation: Local Provider	Irrigation	WSA03AB	Agriculture
02I31	02I31 - Livestock & Animal: Stockwatering	Livestock & Animal	WSA08	Agriculture
03B	03B - Irrigation: Private	Irrigation	WSA03AB	Agriculture
WSA08	WSA08 - Livestock & Animal	Livestock & Animal	WSA08	Agriculture
02I22	02I22 - Grnhouse & Nursery: Nursery	Greenhouse & Nursery	WSA05	Agriculture
02I15	02I15 - Livestock & Animal: Game Farm	Livestock & Animal	WSA08	Agriculture
02I13	02I13 - Crops: Flood Harvesting	Crops	WSA04	Agriculture
02I14	02I14 - Crops: Frost Protection	Crops	WSA04	Agriculture
02I17	02I17 - Grnhouse & Nursery: Grnhouse	Greenhouse & Nursery	WSA05	Agriculture
WSA04	WSA04 - Crop: Harvest/Protect/Compost	Crops	WSA04	Agriculture
WSA05	WSA05 - Greenhouse & Nursery	Greenhouse & Nursery	WSA05	Agriculture
02I41	02I41 - Livestock & Animal: Kennel	Livestock & Animal	WSA08	Agriculture
02I05	02I05 - Crops: Crop Suppression	Crops	WSA04	Agriculture
WSA04	WSA04 - Crop Harvest, Protect & Compost	Crops	WSA04	Agriculture
02E	02E - Pond & Aquaculture	Aquaculture or Hatcheries	WSA04AB	Aquaculture or Hatcheries
02I38	02I38 - Fish Hatchery	Aquaculture or Hatcheries	02I38	Aquaculture or Hatcheries
WSA03	WSA03 - Commercial Enterprise	Commercial Enterprise	WSA03	Commercial Enterprise
02D	02D - Comm. Enterprise: Enterprise	Commercial Enterprise	WSA03	Commercial Enterprise
02I40	02I40 - Comm. Enterprise: Amusement Park	Commercial Enterprise	WSA03	Commercial Enterprise
11A	11A - Conservation: Storage	Conservation	WSA11ABC	Conservation
11B	11B - Conservation: Use of Water	Conservation	WSA11ABC	Conservation
11C	11C - Conservation: Construct Works	Conservation	WSA11ABC	Conservation
01A	01A - Domestic	Domestic	WSA01	Domestic
WSA01	WSA01 - Domestic (WSA01)	Domestic	WSA01	Domestic
01A01	01A01 - Incidental - Domestic	Domestic	WSA01	Domestic
02I47	02I47 - Heat Exchanger, Residential	Heat Exchange	Other	Heat Exchange
02I18	02I18 - Heat Exchanger	Heat Exchange	Other	Heat Exchange
02HU	02HU - Marine Export - Used (Inactiv	Inactive	none	Inactive
WSA13	WSA13 - Industrial Waste Mgmt	Waste Management	WSA13	Industrial, Manufacturing, Transportation or Waste Management
02I28	02I28 - Ind'I Waste Mgmt: Sewage Disposal	Waste Management	WSA13	Industrial, Manufacturing, Transportation or Waste Management
WSA09	WSA09 - Processing & Manufacturing	Processing & Manufacturing	WSA09	Industrial, Manufacturing, Transportation or Waste Management
02I34	02I34 - Ind'I Waste Mgmt: Intake Wash	Waste Management	WSA13	Industrial, Manufacturing, Transportation or Waste Management
02I29	02I29 - Processing & Mfg: Shipyard	Processing & Manufacturing	WSA09	Industrial, Manufacturing, Transportation or Waste Management
02B	02B - Processing & Mfg: Processing	Processing & Manufacturing	WSA09	Industrial, Manufacturing, Transportation or Waste Management
02I	02I - Industrial - Misc (Inactiv	Miscellaneous Industrial	WSA07	Industrial, Manufacturing, Transportation or Waste Management

PURPOSE_	PURPOSE_USE	Simplified Water Use Category	Simplified Code	Grouped Sector for Data Visualization Only
02C	02C - Cooling	Miscellaneous Industrial	WSA07	Industrial, Manufacturing, Transportation or Waste Management
WSA10	WSA10 - Well Drill/Transprt Mgmt	Construction & Transportation	WSA10	Industrial, Manufacturing, Transportation or Waste Management
02I27	02I27 - Misc Ind'l: Sediment Control	Miscellaneous Industrial	WSA07	Industrial, Manufacturing, Transportation or Waste Management
02I08	02I08 - Transport Mgmt: Dust Control	Construction & Transportation	WSA10	Industrial, Manufacturing, Transportation or Waste Management
WSA07	WSA07 - Misc Indust	Miscellaneous Industrial	WSA07	Industrial, Manufacturing, Transportation or Waste Management
02I07	02I07 - Ind'l Waste Mgmt: Effluent	Waste Management	WSA13	Industrial, Manufacturing, Transportation or Waste Management
02I46	02I46 - Transport Mgmt: Road Maint.	Construction & Transportation	WSA10	Industrial, Manufacturing, Transportation or Waste Management
02I36	02I36 - Processing & Mfg: Wharves	Processing & Manufacturing	WSA09	Industrial, Manufacturing, Transportation or Waste Management
02I12	02I12 - Misc Ind'l: Fire Protection	Miscellaneous Industrial	WSA07	Industrial, Manufacturing, Transportation or Waste Management
02I33	02I33 - Vehicle & Eqpt: Truck & Eqp Wash	Vehicle and Equipment	WSA12	Industrial, Manufacturing, Transportation or Waste Management
02I24	02I24 - Misc Ind'l: Overburden Disposal	Miscellaneous Industrial	WSA07	Industrial, Manufacturing, Transportation or Waste Management
02I43	02I43 - Transport Mgmt: Tunnelling/Well Drilling	Construction & Transportation	WSA10	Industrial, Manufacturing, Transportation or Waste Management
02H	02H - Bulk Shipment for Marine Trans	Marine Transportation	02H	Industrial, Manufacturing, Transportation or Waste Management
02I39	02I39 - Vehicle & Eqpt: Mine & Quarry	Vehicle and Equipment	WSA12	Industrial, Manufacturing, Transportation or Waste Management
WSA12	WSA12 - Vehicle & Equipment	Vehicle and Equipment	WSA12	Industrial, Manufacturing, Transportation or Waste Management
02I01	02I01 - Vehicle & Eqpt: Brake Cooling	Vehicle and Equipment	WSA12	Industrial, Manufacturing, Transportation or Waste Management
02I06	02I06 - Misc Ind'l: Dewatering	Miscellaneous Industrial	WSA07	Industrial, Manufacturing, Transportation or Waste Management
02I11	02I11 - Processing & Mfg: Fire Prevention	Processing & Manufacturing	WSA09	Industrial, Manufacturing, Transportation or Waste Management
02I16	02I16 - Ind'l Waste Mgmt: Garbage Dump	Waste Management	WSA13	Industrial, Manufacturing, Transportation or Waste Management
04A	04A - Land Improve: General	Land Improvement	WSA04AB	Land Improvement
04B	04B - Land Improve: Ind'l for Rehab/Remed	Land Improvement	WSA04AB	Land Improvement
02I26	02I26 - River Improvement	Land Improvement	WSA04AB	Land Improvement
04B	04B - Land Improve: Rehab/Remed	Land Improvement	WSA04AB	Land Improvement
05D	05D - Mining: Placer	Mining	WSA05AtoD	Mining
05A	05A - Mining: Hydraulic	Mining	WSA05AtoD	Mining
05B	05B - Mining: Washing Coal	Mining	WSA05AtoD	Mining
05C	05C - Mining: Processing Ore	Mining	WSA05AtoD	Mining
05F	05F - O & G: Hydrlic Frctrng (deep GW)	Oil and Gas	WSA05EtoH	Oil & Gas
05E	05E - O&G: Hydrlic Frctrng non-deep GW	Oil and Gas	WSA05EtoH	Oil & Gas
02I23	02I23 - O&G: Oil Fld Inject (non-deep GW)	Oil and Gas	WSA05EtoH	Oil & Gas
02I23	02I23 - O&G: Field Inject (non-deep GW)	Oil and Gas	WSA05EtoH	Oil & Gas
05E	05E - O & G: Hydrlic Frctrng (non-deep GW)	Oil and Gas	WSA05EtoH	Oil & Gas
05H	05H - O & G: Drilling	Oil and Gas	WSA05EtoH	Oil & Gas
02I19	02I19 - Hydrauliclicking (Inactiv	Oil and Gas	WSA05EtoH	Oil & Gas
07A	07A - Power: Residential	Power Residential	WSA07A	Power
07C	07C - Power: General	Power	WSA07C	Power
07B	07B - Power: Commercial	Power	WSA07B	Power
02A	02A - Pulp Mill	Pulp Mill	02A	Pulp Mills

PURPOSE_	PURPOSE_USE	Simplified Water Use Category	Simplified Code	Grouped Sector for Data Visualization Only
02F	02F - Lwn, Fairway & Grdn: Watering	Lawn, Fairway, Garden	WSA11	Recreation, Public Facilities, Lawn/Garden
02I42	02I42 - Lwn, Fairway & Grdn: Res L/G	Lawn, Fairway, Garden	WSA11	Recreation, Public Facilities, Lawn/Garden
WSA11	WSA11 - Lawn, Fairway & Garden	Lawn, Fairway, Garden	WSA11	Recreation, Public Facilities, Lawn/Garden
WSA02	WSA02 - Camps & Public Facilities	Camps and Public Facilities	WSA02	Recreation, Public Facilities, Lawn/Garden
02I09	02I09 - Camps & Pub Facil: Exhibition Grnds	Camps and Public Facilities	WSA02	Recreation, Public Facilities, Lawn/Garden
02I21	02I21 - Camps & Pub Facil: Institutions	Camps and Public Facilities	WSA02	Recreation, Public Facilities, Lawn/Garden
02I37	02I37 - Camps & Pub Facil: Work Camps	Camps and Public Facilities	WSA02	Recreation, Public Facilities, Lawn/Garden
02I25	02I25 - Camps & Pub Facil: Public Facility	Camps and Public Facilities	WSA02	Recreation, Public Facilities, Lawn/Garden
02I02	02I02 - Camps & Pub Facil: Non-Work Camps	Camps and Public Facilities	WSA02	Recreation, Public Facilities, Lawn/Garden
02I30	02I30 - Ice & Snow Making: Snow	Ice and Snow Making	WSA06	Recreation, Public Facilities, Lawn/Garden
02I03	02I03 - Camps & Pub Facil: Church/Com Hall	Camps and Public Facilities	WSA02	Recreation, Public Facilities, Lawn/Garden
02I32	02I32 - Swimming Pool	Swimming Pool	02I32	Recreation, Public Facilities, Lawn/Garden
02I20	02I20 - Ice & Snow Making: Ice	Ice and Snow Making	WSA06	Recreation, Public Facilities, Lawn/Garden
02I09	02I09 - Camp & Pub Facil: Exhibition Grnds	Camps and Public Facilities	WSA02	Recreation, Public Facilities, Lawn/Garden
WSA06	WSA06 - Ice & Snow Making	Ice and Snow Making	WSA06	Recreation, Public Facilities, Lawn/Garden
08A	08A - Stream Storage: Non-Power	Storage - non-power	WSA08AB	Storage - Non-power
08B	08B - Aquifer Storage: NP	Storage - non-power	WSA08AB	Storage - Non-power
12A	12A - Stream Storage: Power	Storage - Power	12A	Storage - Power
02G	02G - Fresh Water Bottling	Water Bottling	02G	Water Bottling or Sales
00C	00C - Waterworks: Sales	Water sales	00C	Water Bottling or Sales
09B	09B - Mineralized Water: Comm. Pool	Water Bottling	WSA09AB	Water Bottling or Sales
09A	09A - Mineralized Water: Bottling & Dist	Water Bottling	WSA09AB	Water Bottling or Sales
00A	00A - Waterworks: Local Provider	Waterworks	WSA00	Waterworks
00B	00B - Waterworks (other than LP)	Waterworks	WSA00	Waterworks
02I35	02I35 - Waterworks: Water Delivery	Water Delivery	Other	Waterworks
NA	NA			