Northwest Water Tool Report

Feb 10 2020

Tyhee Lake

Bulkley River

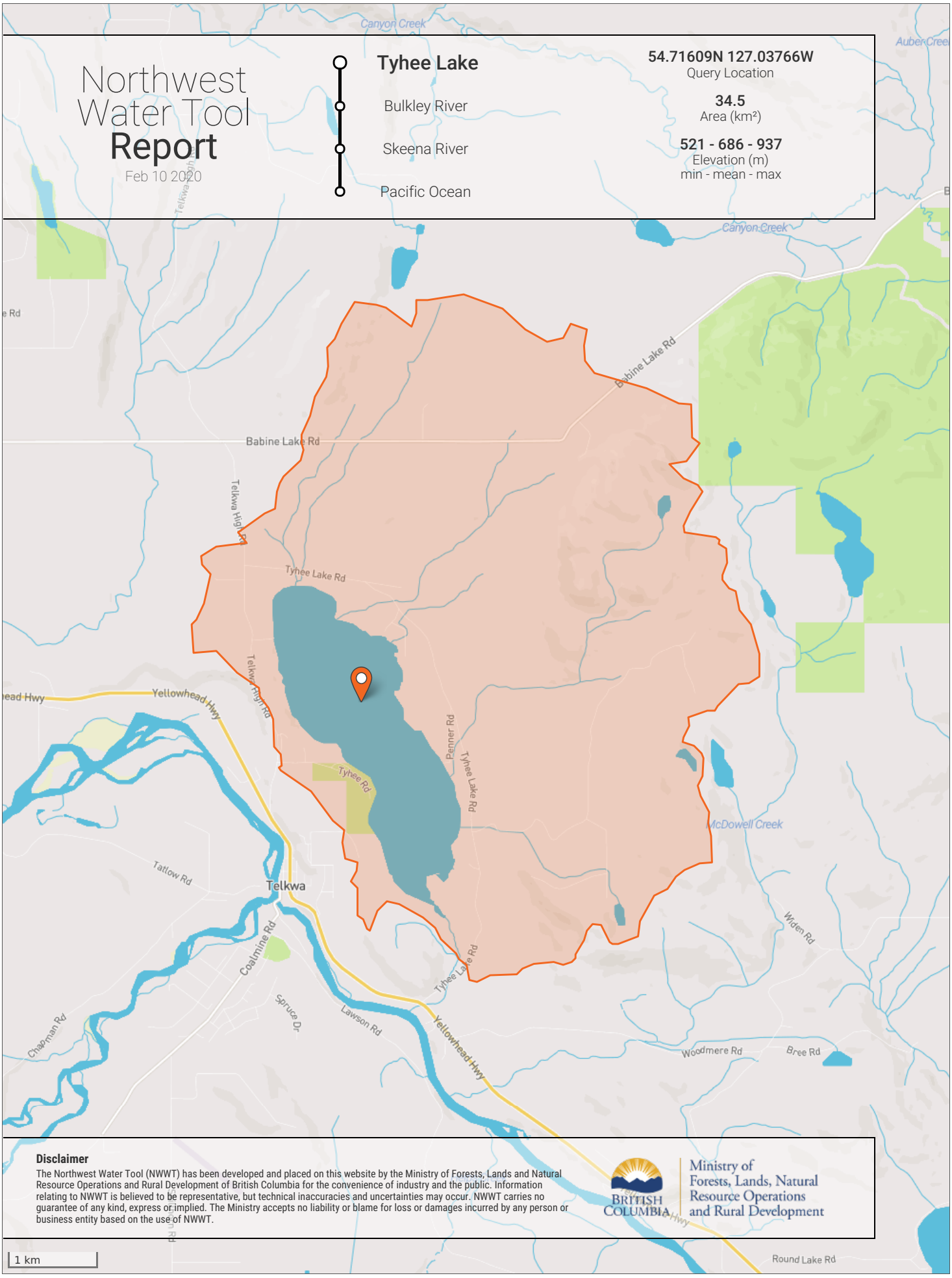
Skeena River

Pacific Ocean

54.71609N 127.03766W
Query Location

34.5
Area (km²)

521 - 686 - 937
Elevation (m)
min - mean - max



Disclaimer

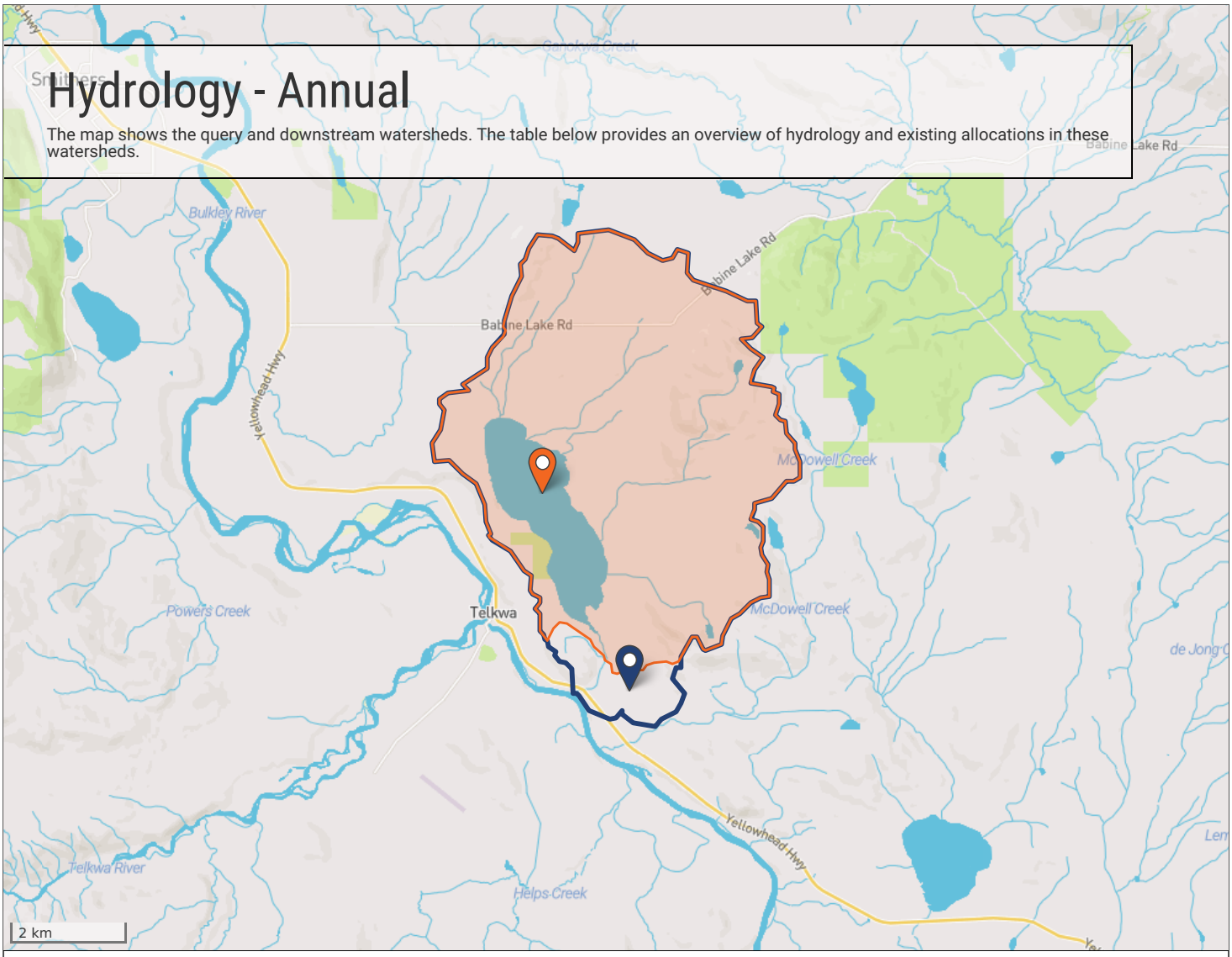
The Northwest Water Tool (NWWT) has been developed and placed on this website by the Ministry of Forests, Lands and Natural Resource Operations and Rural Development of British Columbia for the convenience of industry and the public. Information relating to NWWT is believed to be representative, but technical inaccuracies and uncertainties may occur. NWWT carries no guarantee of any kind, express or implied. The Ministry accepts no liability or blame for loss or damages incurred by any person or business entity based on the use of NWWT.

BRITISH COLUMBIA

Ministry of Forests, Lands, Natural Resource Operations and Rural Development

Hydrology - Annual

The map shows the query and downstream watersheds. The table below provides an overview of hydrology and existing allocations in these watersheds.



Query Watershed		Downstream Watershed
34.5	Area (km²)	36.7
0.052	Mean Annual Discharge (m³/s)	0.055
0.003	Allocations (m³/s)	0.003
5.2	Allocations (%)	4.9
None	Reserves & Restrictions	None
1,638,383	Volume Runoff (m³/yr)	1,739,085
85,008	Volume Allocations (m³/yr)	85,008
Winter, Summer	Seasonal Flow Sensitivity**	Winter, Summer

The downstream watershed is defined at the location where the queried drainage meets with another drainage of comparable size. For information further downstream, please generate an additional report at a location of interest. Predictions for small watersheds (generally smaller than 50 sq. km.) may be less accurate due to the lack of hydrometric data available for watersheds of this size.

* For more information on water reserves or restrictions present in the watershed, please visit the links below or contact FrontCounter BC.

FrontCounter BC: www.frontcounterbc.ca **Email:** FrontCounterBC@gov.bc.ca **Toll Free:** 1-877-855-3222 **Outside North America:** ++1-778-372-0729

Water Reservations: https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/water-reservations

Water Restrictions: https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/water-allocation-restrictions

**Ptolemy, R. Environmental Flow Protection in British Columbia. Presentation to 2015 IFC Panel, April 29, 2015.

Hydrology - Monthly Tyhee Lake

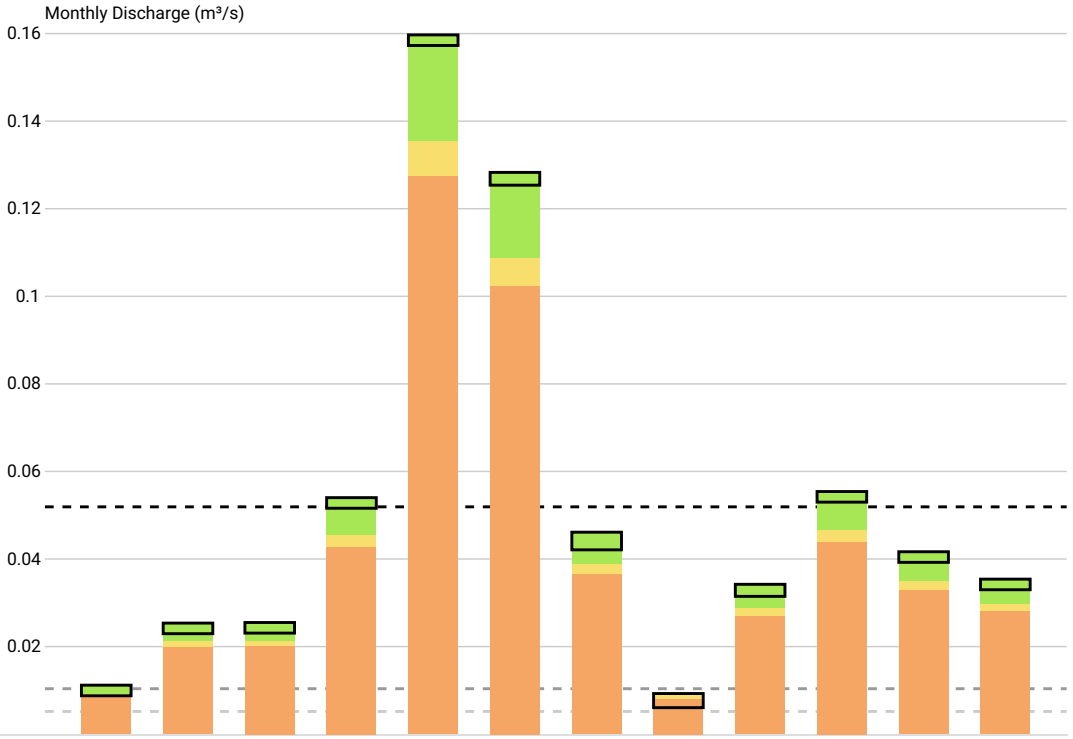
The chart and table show information on modeled hydrology and existing allocations in the query watershed. Notes are provided at the bottom on data sources, methods, and interpretation. Environmental flow needs risk levels are as defined in the Province of BC *Environmental Flow Needs Policy.*

Legend

Risk Management Level 1
Risk Management Level 2
Risk Management Level 3
Existing Allocations

Mean Annual Discharge (MAD)

MAD	0.052 m³/s
20% MAD	0.010 m³/s
10% MAD	0.005 m³/s



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Monthly Discharge (m³/s)	0.011	0.025	0.025	0.054	0.159	0.128	0.046	0.009	0.034	0.055	0.041	0.035
% of MAD	20.9%	48.2%	48.5%	103.4%	307.0%	246.5%	88.2%	17.2%	65.3%	106.1%	79.6%	67.6%
Flow Sensitivity	Low	Low	Low	Low	Low	Low	Low	Mod	Low	Low	Low	Low
Existing Allocations (m³/s)	0.002	0.002	0.002	0.002	0.002	0.003	0.004	0.003	0.003	0.002	0.002	0.002
Potential Allocation (m³/s, Risk Mgmt 1)	0.000	0.001	0.001	0.006	0.021	0.016	0.003	0.000	0.002	0.006	0.004	0.003
Potential Allocation (m³/s, Risk Mgmt 2)	0.000	0.003	0.003	0.008	0.029	0.023	0.005	0.000	0.004	0.009	0.006	0.005
Potential Allocation (m³/s, Risk Mgmt 3)	>0.000	>0.003	>0.003	>0.008	>0.029	>0.023	>0.005	>0.000	>0.004	>0.009	>0.006	>0.005

Methods: Monthly discharge estimates have been generated from a hydrologic model. Existing allocation volumes have been summarized from government water licence and short term approval databases. Potential allocations are determined using criteria established in the Province of BC *Environmental Flow Needs* (EFN) Policy. Risk management levels have been calculated assuming the presence of fish. If the source can be classified as non-fish bearing, this may affect risk management levels. For more information on the EFN policy: *https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/water-policies/environmental-flow-needs*

Risk Management Levels: The Province of BC Environmental Flow Needs Policy establishes risk management levels to be used in the evaluation of applications for water rights. Risk Management Levels and associated Risk Management Measures are discussed on page 5 of this report.

Error: The query watershed is within the Skeena Region. The hydrologic modeling study conducted in this region employed a water balance approach to estimate runoff in ungauged basins. The model was calibrated using stream flow measurements from the Water Survey of Canada, and validated using a leave-one-out cross validation. The model used 123 watersheds with hydrometric gauges, and included detailed information on watershed climate, evapotranspiration, topography, vegetation and land cover. Error metrics calculated for the entire model domain are: Mean error = -2.8%, Median Error = -4.2%, Mean Absolute Error = 13.9%, Watersheds within +/- 20% = 80.5%.

Allocations: Existing allocation volumes are determined from digital databases and include *BC Water Sustainability Act* licences and short term approvals. These represent a maximum amount of water authorized, not actual use. In many cases, licences may have additional terms and conditions to those represented in the digital version which are not represented. This may result in existing allocation volumes being presented as larger than are actually approved, either in total (on an annual basis) or for individual months. On subsequent pages of this report, information on each licence occurring in the watershed is provided, along with links to scanned copies of complete water licence information. For more information on specific areas of concern, please contact Water Stewardship Staff via FrontCounter BC. Contact information for FrontCounter BC is provided on page 2 of this report.

Hydrology - Monthly Tyhee Creek

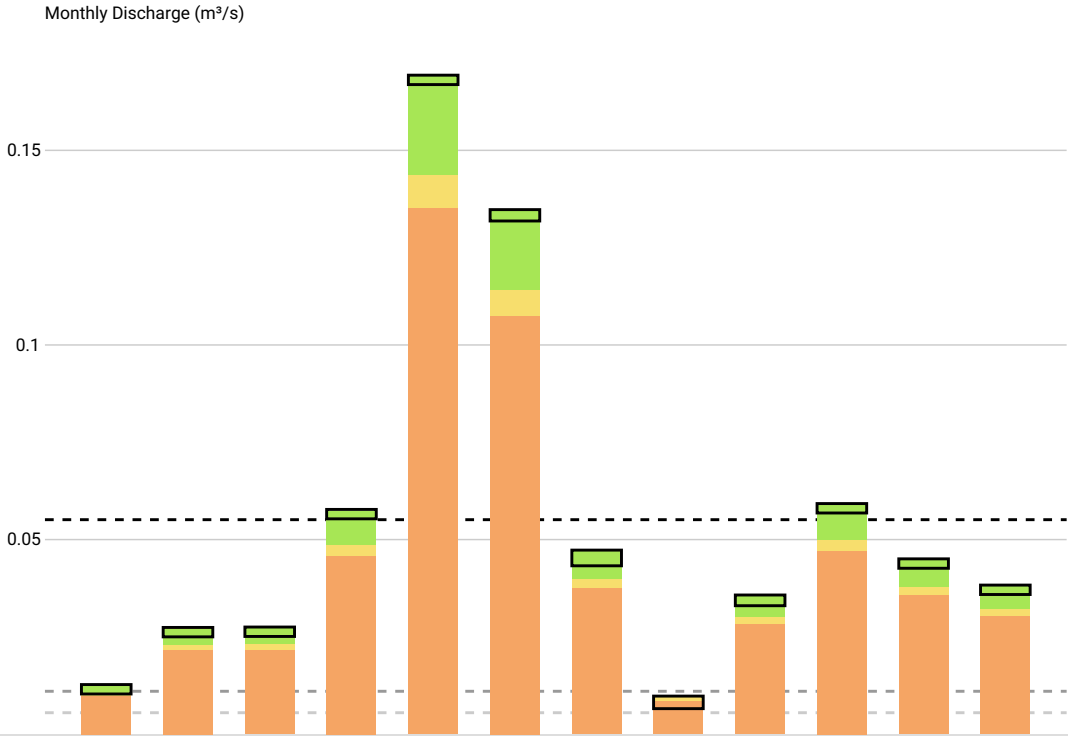
The chart and table show information on modeled hydrology and existing allocations in the downstream watershed, where the subject drainage meets with another drainage of comparable size. Notes are provided at the bottom on data sources, methods, and interpretation. Environmental flow needs risk levels are as defined in the Province of BC *Environmental Flow Needs Policy*.

Legend

- Risk Management Level 1
- Risk Management Level 2
- Risk Management Level 3
- Existing Allocations

Mean Annual Discharge (MAD)

MAD	0.055 m³/s
20% MAD	0.011 m³/s
10% MAD	0.006 m³/s



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Monthly Discharge (m³/s)	0.012	0.027	0.027	0.057	0.169	0.134	0.047	0.009	0.035	0.059	0.045	0.038
% of MAD	22.5%	49.1%	49.3%	104.1%	306.6%	243.9%	85.1%	17.1%	64.2%	106.8%	81.1%	68.8%
Flow Sensitivity	Low	Low	Low	Low	Low	Low	Low	Mod	Low	Low	Low	Low
Existing Allocations (m³/s)	0.002	0.002	0.002	0.002	0.002	0.003	0.004	0.003	0.003	0.002	0.002	0.002
Potential Allocation (m³/s, Risk Mgmt 1)	0.000	0.002	0.002	0.006	0.023	0.017	0.003	0.000	0.003	0.006	0.004	0.003
Potential Allocation (m³/s, Risk Mgmt 2)	0.000	0.003	0.003	0.009	0.031	0.024	0.005	0.000	0.004	0.009	0.007	0.005
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Risk Management Levels and Measures

Guide to interpreting potential allocation amounts in each environmental flow needs risk level as defined in the Province of BC *Environmental Flow Needs Policy*.

Water volumes presented as "Potential Allocations" within this report are determined in consideration of the Province of BC *Environmental Flow Needs Policy*. Within the Policy, risk management measures are suggested to assess or mitigate potential effects of withdrawals from a stream, and provide an ecosystem perspective on environmental flow needs. The measures are associated with risk levels 1, 2, and 3 and are intended to guide where more caution may be needed in reviewing an application or making a decision.

Where there are known species or habitat sensitivities, more detailed, site-specific studies may be required. Where detailed assessments or studies exist, they will supersede policy recommendations.

Risk management levels, for assessing new applications to withdraw water, are determined for each month using the relationship of mean monthly flows to the mean annual discharge, and also using a stream size threshold based on mean annual flows. The calculations presented within this report assume all streams are fish-bearing. Where no water is indicated as available under a risk level, the stream may be very flow sensitive during that time, or the stream may have existing allocations in excess of the relevant threshold.

Inter-annual hydrologic variability may affect the amount of water available in a given year. The impact of this variability on water allocations should be considered separately from the information presented in this report.

The following risk management measures may be appropriate for consideration before a decision is made, could be completed by regional staff to inform a decision, or could be a condition of the licence or approval.

Risk management measures may differ for short-term approvals vs. licences and may vary in relation to withdrawal amounts.

Risk Management Level: 1

Measures to assess or mitigate potential effects on low sensitivity flow periods:

1. Assess veracity of information and ensure appropriate methods are used, (e.g., RISC)
2. Consider downstream users and species/habitats

Risk Management Level: 2

Measures to assess or mitigate potential effects on moderate sensitivity flow periods:

In addition to Level 1 measures:

1. Establish adequate baseline hydrological data before withdrawals
2. Prepare reconnaissance-level fish and fish habitat impact assessment (e.g., Section 4.1.10.1 in Lewis et al. 2004)
3. Issue seasonal licence, or restrictions during low flow periods
4. Development of off-stream storage
5. Inclusion of a daily maximum or inst. withdrawal e.g., greater consideration of instantaneous demand over averages
6. Limit pump intake size
7. Monitor and report water use during higher risk flow periods, e.g., install flow gauge
8. Monitor low flows and limit withdrawals when flows drop below a certain level
9. Ministry staff to conduct audit of basin use/beneficial use review
10. Refuse application to withdraw water

Risk Management Level: 3

Measures to assess or mitigate potential effects on high sensitivity flow periods:

In addition to Level 2 measures:

1. Issue limited licence term, allowing for review and potential adjustment (e.g., 5 years)
2. Prepare detailed habitat assessment (e.g., Lewis et al. 2004; Hatfield et al. 2007)

References

Hatfield, T., A. Lewis, and S. Babakaiff. 2007. Guidelines for the collection and analysis of fish and fish habitat data for the purpose of assessing impacts from small hydropower projects in British Columbia.

Lewis, A., T. Hatfield, B. Chilibeck, and C. Roberts. 2004. Assessment methods for aquatic habitat and instream flow characteristics in support of applications to dam, divert, or extract water from streams in British Columbia. Prepared for Ministry of Water, Land & Air Protection and Ministry of Sustainable Resource Management.

A. Lewis. 2002. Rationale for Multiple British Columbia Instream Flow Standards to Maintain Ecosystem Function and Biodiversity. Draft for Agency Review. Prepared for Ministry of Water, Land and Air Protection and Ministry of Sustainable Resource Management.

Resources Information Standards Committee: https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/natural-resource-standards-and-guidance/inventory-standards

Water Policies, including Environmental Flow Needs: https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/water-policies

Existing Allocations Water Licences

Current approved and active applications for term water licences.

BC Water Sustainability Act - Water Licences - 59 Licences, 85,008.29 m³ Total Annual Volume

Licensee	Number	POD	Priority Date	Quantity (m³/year)	Flag
Private Individual Name Domestic from Bitterlich Springs	C039559	PD35445	1971-12-29	1,660.46	T
Private Individual Name Domestic from Tyhee Lake	C039855	PD35373	1972-03-25	830.23	T
Private Individual Name Domestic from Trio Spring	C039995	PD35381	1972-05-03	830.23	T
Private Individual Name Domestic from Tyhee Lake	C043095	PD35372	1973-11-05	830.23	T
Private Individual Name Domestic from Bitterlich Springs	C044199	PD35445	1974-03-01	830.23	T
Private Individual Name Domestic from Tyhee Lake	C045178	PD35378	1974-06-28	830.23	T
Private Individual Name Domestic from Granlin Spring	C047687	PD35450	1976-03-05	830.23	T
Private Individual Name Domestic from Beaufort Spring	C047691	PD35460	1974-09-23	1,660.46	T
Private Individual Name Waterworks: Local Provider from Tyhee Lake	C051653	PD35379	1972-05-03	9,955.94	T
Private Individual Name Domestic from Nelson Spring	C054812	PD35447	1979-06-04	830.23	T
Multiple Licence Holders Domestic from Tyhee Lake	C057742	PD35369	1981-06-15	830.23	T
Private Individual Name Domestic from Tyhee Lake	C057743	PD35377	1981-04-30	830.23	T
Private Individual Name Domestic from Bergen Spring	C058118	PD35456	1981-06-19	830.23	T
Private Individual Name Irrigation: Private from Bede Creek	C058269	PD35452	1981-03-30	2,466.96	T
Private Individual Name Domestic from Nelson Spring	C058549	PD35448	1981-10-07	830.23	T
Private Individual Name Domestic from Tyhee Lake	C060201	PD35374	1983-07-06	830.23	T
Private Individual Name Domestic from Tyhee Lake	C060202	PD35376	1983-07-06	830.23	T

Water Licence Flag Description

D : Multiple PODs for PUC/qty at each are known/PODs on different sources
M : Max licenced demand for purpose/multiple PODs/qty at each POD unknown
P : Multiple PODs for PUC/qty at each are known/PODs on same source
T : Total demand one POD

Other

A : Active application status
N : Licence volumes not used in calculations
R : Rediversion

For more information on water licences:

Water Licence Query Tool: http://a100.gov.bc.ca/pub/wtrwhse/water_licences.input
Water Rights Databases: https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/water-licences-approvals/water-rights-databases

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BC Water Sustainability Act - Water Licences - 59 Licences, 85,008.29 m³ Total Annual Volume

Licensee	Number	POD	Priority Date	Quantity (m³/year)	Flag
Private Individual Name Domestic from Tyhee Lake	C062004	PD35339	1985-05-13	1,660.46	T
Private Individual Name Comm. Enterprise: Enterprise from Tyhee Lake	C062308	PD35375	1972-07-11	9,962.76	T
Private Individual Name Domestic from Kirby Lake	C068096	PD35210	1989-08-16	830.23	T
Kirby Lake Wuc (53349) Domestic from Kirby Lake	C068097	PD35210	1989-08-16	830.23	T
Private Individual Name Domestic from Kirby Lake	C068098	PD35210	1989-08-16	830.23	T
Private Individual Name Domestic from Kirby Lake	C068099	PD35210	1989-08-16	830.23	T
Private Individual Name Domestic from Kirby Lake	C072040	PD35210	1989-08-16	830.23	T
Private Individual Name Domestic from Tyhee Lake	C072046	PD35370	1989-01-24	830.23	T
Private Individual Name Domestic from Tyhee Lake	C072079	PD61822	1990-07-06	830.23	T
Tyee Farms Ltd. (42635) Livestock & Animal: Stockwatering from Victor Lake	C104551	PD35458	1985-02-01	8,302.30	T
Tyee Farms Ltd. (42635) Domestic from Victor Lake	C104551	PD35458	1985-02-01	1,660.46	T
Private Individual Name Domestic from Kirby Lake	C106681	PD35210	1993-05-21	830.23	T
Private Individual Name Domestic from Kirby Lake	C108749	PD35210	1994-09-28	830.23	T
Private Individual Name Domestic from Kirby Lake	C109055	PD35210	1994-11-25	830.23	T
Private Individual Name Domestic from Kirby Lake	C109880	PD35210	1993-05-21	830.23	T
Private Individual Name Domestic from Kirby Lake	C109881	PD35210	1993-05-21	830.23	T
Private Individual Name Domestic from Kirby Lake	C109882	PD35210	1993-05-21	830.23	T

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Existing Allocations Water Licences

Current approved and active applications for term water licences.

BC Water Sustainability Act - Water Licences - 59 Licences, 85,008.29 m³ Total Annual Volume

Licensee	Number	POD	Priority Date	Quantity (m³/year)	Flag
Private Individual Name Domestic from Kirby Lake	C109883	PD35210	1993-05-21	830.23	T
Private Individual Name Domestic from Kirby Lake	C109884	PD35210	1993-05-21	830.23	T
Private Individual Name Domestic from Kirby Lake	C109885	PD35210	1993-05-21	830.23	T
Private Individual Name Domestic from Kirby Lake	C109886	PD35210	1993-05-21	830.23	T
Private Individual Name Domestic from Kirby Lake	C109887	PD35210	1993-05-21	830.23	T
Private Individual Name Domestic from Kirby Lake	C109888	PD35210	1993-05-21	830.23	T
Private Individual Name Domestic from Kirby Lake	C109889	PD35210	1993-05-21	830.23	T
Private Individual Name Domestic from Kirby Lake	C109890	PD35210	1993-05-21	830.23	T
Private Individual Name Domestic from Kirby Lake	C109891	PD35210	1993-05-21	830.23	T
Private Individual Name Domestic from Kirby Lake	C109892	PD35210	1993-05-21	830.23	T
Private Individual Name Domestic from Kirby Lake	C109893	PD35210	1993-05-21	830.23	T
Private Individual Name Domestic from Kirby Lake	C109894	PD35210	1993-05-21	830.23	T
Private Individual Name Domestic from Kirby Lake	C114352	PD35210	1999-04-30	830.23	T
Private Individual Name Domestic from Barlow Creek	C116299	PD76135	2001-06-07	830.23	T
Private Individual Name Stream Storage: Non-Power from Barlow Creek	C116299	PD76135	2001-06-07	308.37	T, N
Private Individual Name Domestic from Tyhee Lake	C120349	PD79061	2005-01-10	830.23	T
Private Individual Name Domestic from Kirby Lake	C120791	PD35210	2005-05-18	830.23	T

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Licensee	Number	POD	Priority Date	Quantity (m³/year)	Flag
Private Individual Name Domestic from Tyhee Lake	C122255	PD80245	2006-09-20	830.23	T
Private Individual Name Domestic from Kirby Lake	C123548	PD35210	1993-01-22	830.23	T
Private Individual Name Domestic from Cronin Spring	C125648	PD35337	1945-12-10	830.23	T
Private Individual Name Irrigation: Private from Victor Lake	C131043	PD35458	1977-04-29	6,167.00	M
Private Individual Name Domestic from Victor Lake	C131043	PD35458	1977-04-29	2,490.64	M
Private Individual Name Stream Storage: Non-Power from Victor Lake	C131043	PD35458	1977-04-29	12,335.00	M, N
Private Individual Name Domestic from Kirby Lake	C131926	PD35210	2014-10-01	830.21	T
Private Individual Name Domestic from Heal Spring	F060238	PD35368	1972-07-04	830.23	T

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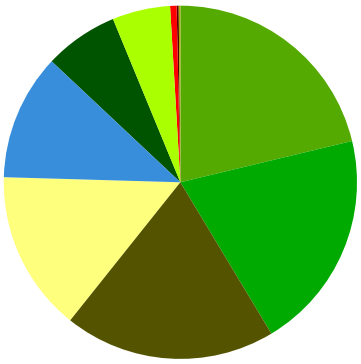
Land Cover and Topography

Characteristics of the query watershed. For more information on watershed characterization in British Columbia please refer to Pike and Wilford (2013).

Land Cover

The land cover characteristics chart illustrates the composition of vegetation and land cover types in the query watershed. These land cover components are incorporated in the hydrologic model, to represent the variations in evapotranspiration rates amongst the classes.

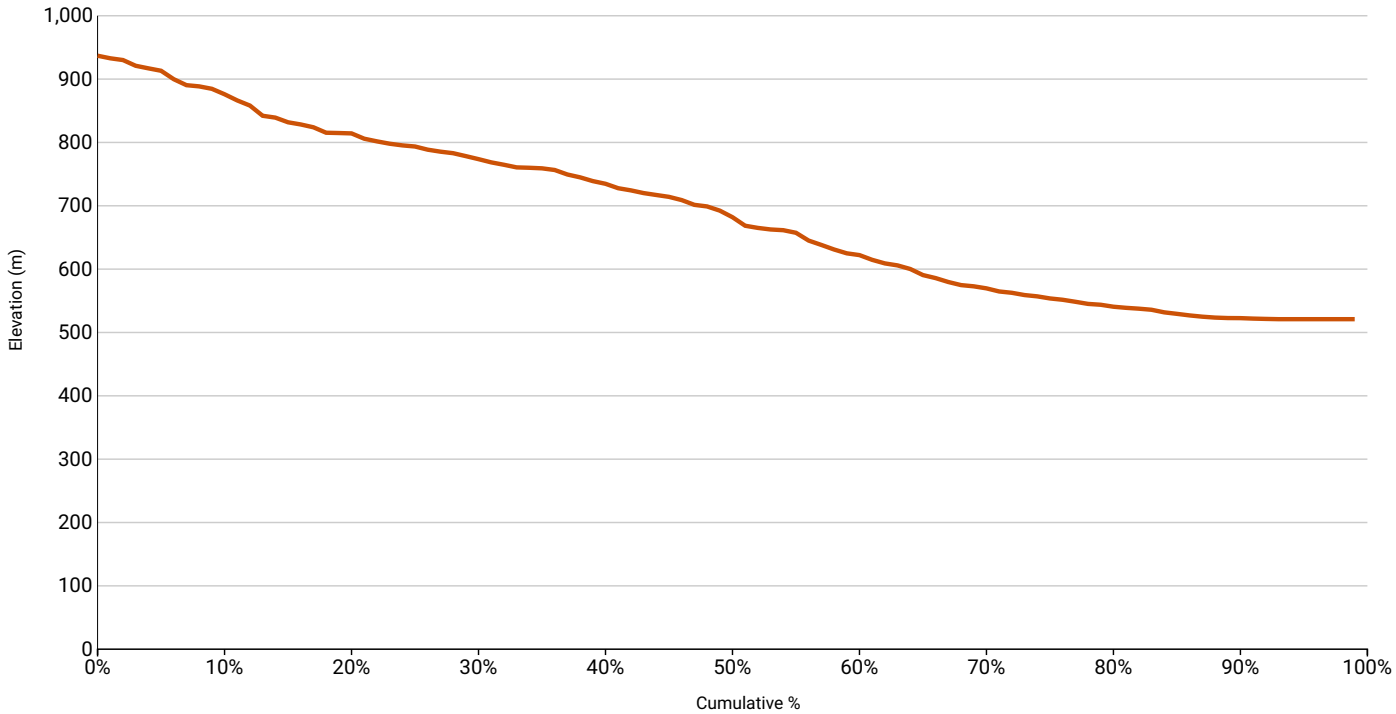


Type	Area (km²)	% of Query Watershed (%)
Barren	0.1	0.2
Coniferous	2.3	6.8
Deciduous	7.3	21.2
Developed	0.2	0.6
Grassland	5.1	14.7
Herb	6.9	20.1
Mixed	6.7	19.3
Shrub	1.8	5.3
Snow / Glacier	0.0	0.0
Water	4.0	11.5
Wetland	0.1	0.2

The land cover characteristics chart illustrates the composition of vegetation and land cover types in the query watershed. These land cover components are incorporated in the hydrologic model, to represent the variations in evapotranspiration rates amongst the classes.

Topography

Elevation of the query watershed influences hydrology in a number of ways. The amount, and state of precipitation (as rain or snow) is influenced by elevation substantially. Likewise, temperatures will vary by elevation in value and also direction of temperature gradient throughout the course of the year.



The elevation characteristics of the query watershed are shown using a hypsometric curve, which shows the cumulative distribution of elevation by area in the watershed. Percent values can be used to identify the percentage of the watershed above a given elevation value.

Reference:
Pike, R.G. and D.J. Wilford. 2013. Desktop watershed characterization methods for British Columbia. Prov. B.C., Victoria, B.C. Tech. Rep. 079. www.for.gov.bc.ca/hfd/pubs/Docs/Tr/Tr079.htm.

Climate

Historic normal conditions and predicted future change.

The climate of the query watershed has been characterized using ClimateWNA (Wang 2012). In the left hand column, charts are presented for the reference time period 1961-1990. In the right hand column, three illustrative climate change scenarios have been selected to estimate a wide range of potential future change in the query watershed (Murdock and Spittlehouse 2011).

Scenario A illustrates the UKMO HadGEM A1B run 1 global climate model (GCM), scenario B shows the CGCM3 A2 run 4 GCM and scenario C shows the UKMO HadCM3 B1 run 1 GCM. The combination of these three climate models and emissions scenarios were chosen because, over most of British Columbia, they provide a range of generally hot/dry, warm/very wet, and moderately warm/wet for HadGEM A1B, CGCM3 A2, and HadCM3 B1 respectively.

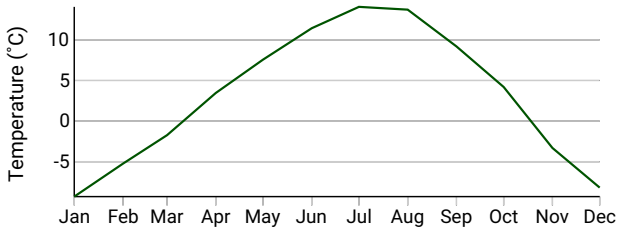
Historic and future climate change information has been provided to assist in understanding potential changes in the basin as temperature and precipitation are intricately related to stream flow. For example, snowpack levels affect many aspects of water resources, from instream flows for fish to community water supplies to soil moisture, groundwater, and aquifer recharge. Climate studies generally indicate a trend of rising air temperatures for all seasons across BC while precipitation trends vary by season and region (Pike *et al.* 2008, Rodenhuis *et al.* 2007). Local responses to changing precipitation and temperature will differ due to BC's inherent hydrological diversity as well as varying climate trends. These charts are intended as a quick glance starting point to basin climate change assessment.

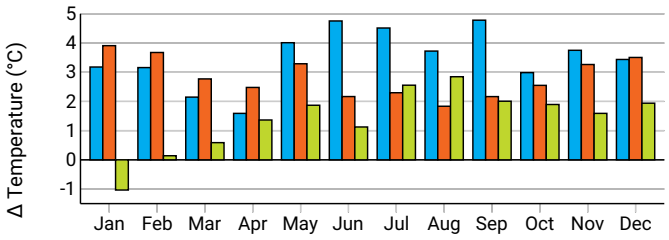
Normal (1961 - 1990)

Predicted Change (2041 - 2070)

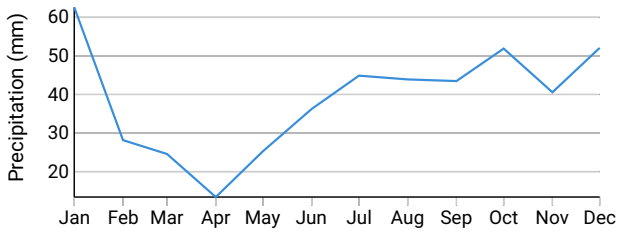
Scenario A Scenario B Scenario C

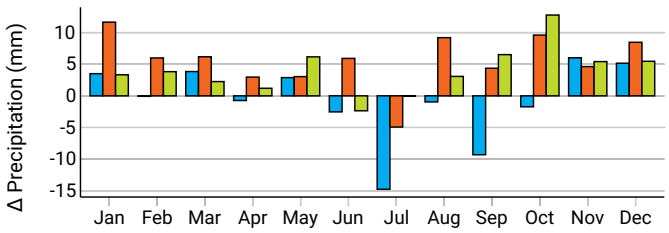
Monthly temperatures are presented as averages of the monthly mean temperature for the query basin as a whole. Projected changes in temperature may affect the hydrology in the watershed by influencing the time of freeze and thaw, evapotranspiration rates, form of precipitation, and vegetation composition, among other factors.



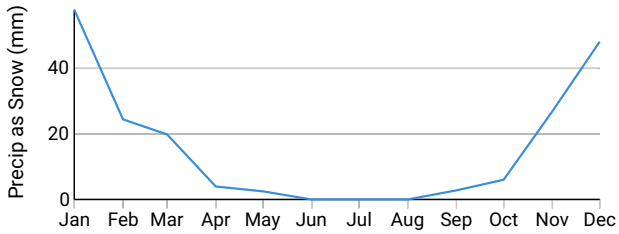


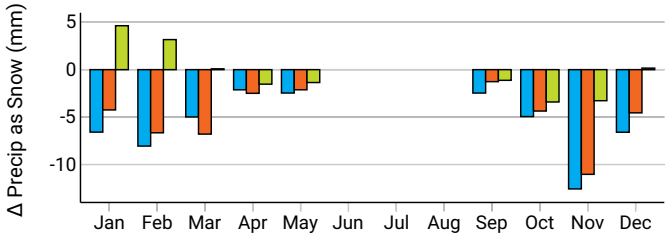
The precipitation in the query watershed is shown as an average unit precipitation for the watershed. Changes in precipitation timing and amount may affect the hydrology in the watershed by influencing the timing and magnitude of peak and low flow conditions. These changes may affect availability of water for environmental flow needs and human use, and modify the physical characteristics of river channels and associated needs for engineered structures.





Precipitation as snow in the query watershed is presented as an average unit precipitation for the query basin as a whole. Changes in the amount of precipitation as snow may affect winter snowpack volumes and associated melt related hydrology in the spring. An increase in rain-on-snow events may be associated with elevated natural hazard risk from avalanche or other slope stability failures.





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