# YUKON SNOW SURVEY BULLETIN & WATER SUPPLY FORECAST

March 1, 2022



Prepared and issued by: Water Resources Branch Department of Environment



#### **PREFACE**

The Department of Environment's Water Resources Branch issues the *Yukon Snow Survey Bulletin and Water Supply Forecast* three times annually – early March, April and May. The bulletin provides a summary of winter meteorological and streamflow conditions for the Yukon, as well as current snow depth and snow water equivalent observations for 57 locations. This information is used to evaluate the potential for spring flooding caused by both breakup ice jams and large spring snowmelt (freshet) flows. It is important to note that other processes such as summer rain and glacier melt can significantly influence maximum annual water levels in specific Yukon basins.

The Snow Bulletin is continuing to improve using new technologies and comments provided by users and partners. The fall and winter average weather conditions (temperatures and precipitation) are spatially presented for the entire territory in two figures showing October 1 to February 28 anomalies. The spatial distribution of snow water content (or Snow Water Equivalent, SWE) is presented for 11 watersheds (or river basins) in a separate figure. Complementary meteorological and hydrological data are presented for each basin through a series of five graphs, depending on data availability:

- **Figure A**: Daily Snow Water Equivalent (SWE) data starting in September at one specific location in the watershed, showing an overview of winter snowpack evolution.
- **Figure B**: Current, basin-averaged, estimated Snow Water Equivalent (SWE) from snow survey data, compared with historical data, serving as an indicator of potential runoff volumes in the spring (acknowledging that snow sublimation, evapotranspiration, rain and glacier melt also significantly affect runoff).
- **Figure C**: Monthly winter precipitation (rain and/or snow) compared with historical data (1980-2021 period of record), complementing the information presented in Figure B.
- **Figure D**: Cumulated degree-days of freezing (CDDF, sum of negative daily temperatures) compared with historical data, functioning as an indicator of winter coldness and overall river ice thickness; variables that influence river ice breakup scenarios in the spring.
- **Figure E**: Current, estimated daily discharge or measured water level, compared with historical data, representing an overview of the watershed hydrological conditions.

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- Parks Canada, Kluane National Park and Reserve
- Yukon Department of Highways and Public Works
- Yukon Department of Energy Mines and Resources, Compliance Monitoring and Inspections Branch
- Yukon Department of Environment, Information Management and Technology Branch
- Vuntut Gwitchin First Nation

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#### YUKON TERRITORY WEATHER AND SNOWPACK CONDITIONS

After a dry start to the winter in October, the pattern shifted to above-normal precipitation across most of the territory through February. Watson Lake stands out, having exceeded record monthly totals in November, January and February. February was significant in many communities, setting new monthly total records in Watson Lake, Dawson City, and Mayo while challenging the record in all other communities except Old Crow. While the overall temperature anomaly was close to or slightly above normal<sup>1</sup> across the territory, there were periods of extreme cold in December and January that saw lows rarely experienced in recent years.

#### October

October brought mild temperatures across the territory, with all long-term weather stations recording slightly warmer than normal values. Precipitation was more varied and exhibited a clear north-south divide: northern and central Yukon recorded near or slightly above normal rain and snow for the month, while southern Yukon was closer to 50% of normal, and Watson Lake recorded only 20% of normal. Notable weather events included significant freezing rain mid-month in Dawson City that resulted in a multi-hour highway closure.

#### November

November brought generally stormy weather to central and southern Yukon as the storm track moved northwards after a relatively calm October. While most storms were relatively weak, bringing near-normal precipitation, Watson Lake recorded just over 90 mm for the month, which is 330% of normal. Temperatures were generally within 2 to 3 degrees above or below normal with no regional trends.

#### December

The story for December was snowfall: all stations with reliable long-term records reported above to well above normal precipitation. While multiple days with 5 to 10 cm of snow is not a notable event in southern Canada, in the Yukon it can challenge or break monthly records. The second half of the month brought such days to much of central and southern Yukon and the month ended with Burwash reporting 380% of normal and Whitehorse at 290%. Temperatures, while not as notable as snowfall, were also colder than normal throughout most of the territory thanks to frequent and persistent bouts of cold arctic air. This cold air was the cause of much of the snowfall as it clashed with the warmer, humid air coming from the Gulf of Alaska.

#### January

The most-reported weather of January was the frigid arctic air that blanketed the territory to start the month, however it did not last long and the majority of stations ended up with a monthly mean temperature that was very close to the long-term normal. Above-normal snowfall continued throughout southern and central Yukon, aided by warm Pacific air overrunning the frigid arctic air early in the second week of the month. Watson Lake was once again notable, reporting 99 mm, or 320% of normal January precipitation.

#### **February**

The territory's February weather can be characterized as "wet and warm" as a predominantly stormy westerly pattern yielded to even warmer air from southern Canada later in the month. With the exception of

<sup>&</sup>lt;sup>1</sup> Historical temperature, precipitation, snow water equivalent and discharge or water level records are not always long enough to establish a state-of-the-art "normal", which implies 30 years of data. Therefore, this document refers to historical average, or more simply, average. Historical records considered in this bulletin are always long enough to be representative of recent hydro-meteorological conditions.

Old Crow and Mayo areas, the territory was 3 to 7 degrees warmer than normal and precipitation was 250% to 430% of normal with the exceptions of Old Crow (110%) and Carcross (90%). The precipitation anomalies do deserve a caveat, as normal February precipitation ranges from 10 to 20mm.

#### Snowpack

The March 1, 2022 snowpack throughout the Yukon is above to well above normal. Individual snow courses in many regions reported record snowpack – 26 of the 57 stations met or exceeded their historical monthly records, and of those, 9 stations set new all-time records, while 5 stations challenged the all-time record.

Basin-averaged snowpack estimates range from a low of 130% of median in the Alsek River Basin to 201% in the Central Yukon River Basin (Carmacks region). The Central Yukon River Basin, the Lower Yukon River Basin (Dawson Area) (185%) and the Pelly River Basin (177%) had the highest basin snowpack estimates ever recorded. The highest snowpack for this time of year was observed in the White (171%), Teslin (164%), Peel (155%), and Stewart (148%) river basins, while the Liard River Basin (173%) was near the historical maximum for this time of year. The Upper Yukon River Basin (Southern Lakes / Whitehorse) (147%), Porcupine River Basin (140%), and Alsek River Basin (130%) were above the historical median.

By early March, approximately 85% of the annual snowpack has typically accumulated.

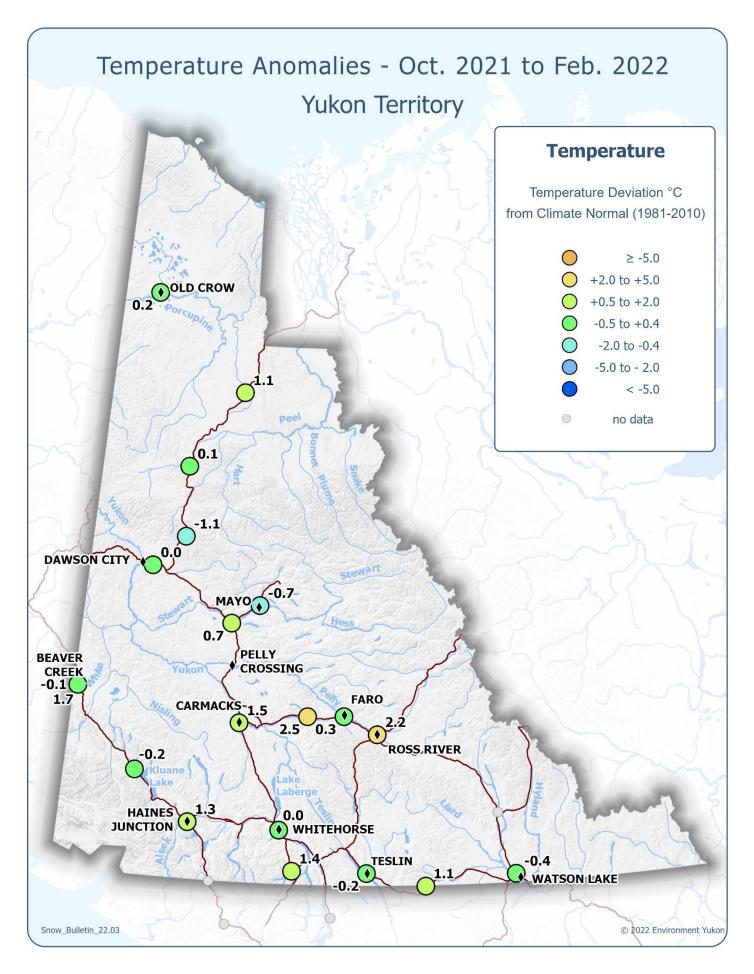
## YUKON TERRITORY FLOW CONDITIONS AND OUTLOOK

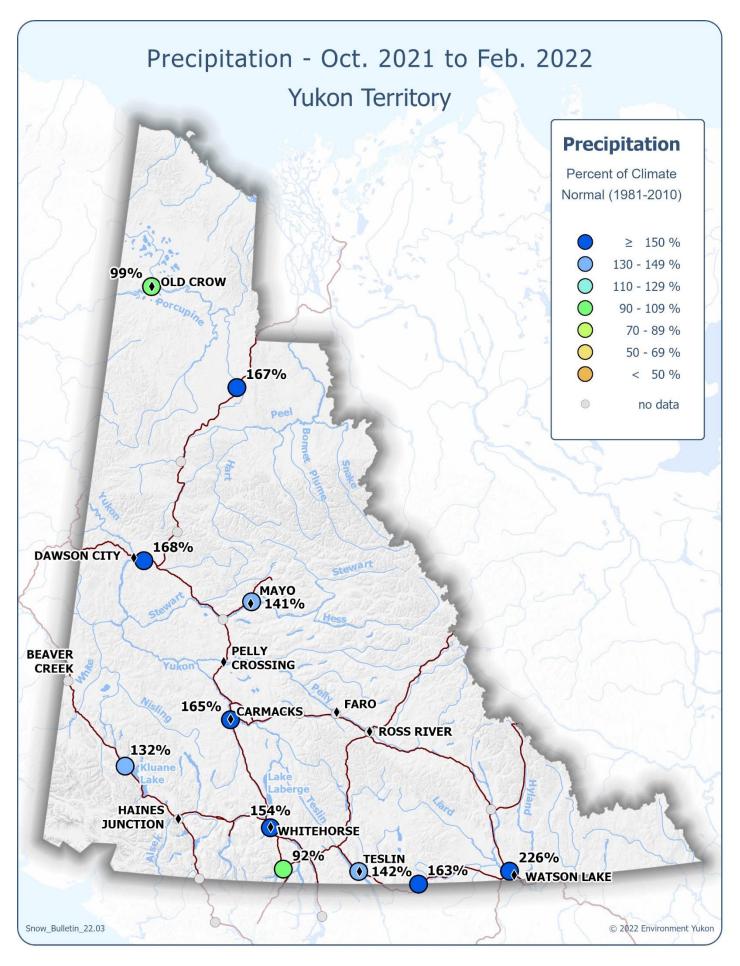
Winter discharge is estimated based on a combination of periodic winter measurements as well as historic data and regional trends. However, not all sites have been visited recently and it should be noted that discharge estimates are provisional at all stations.

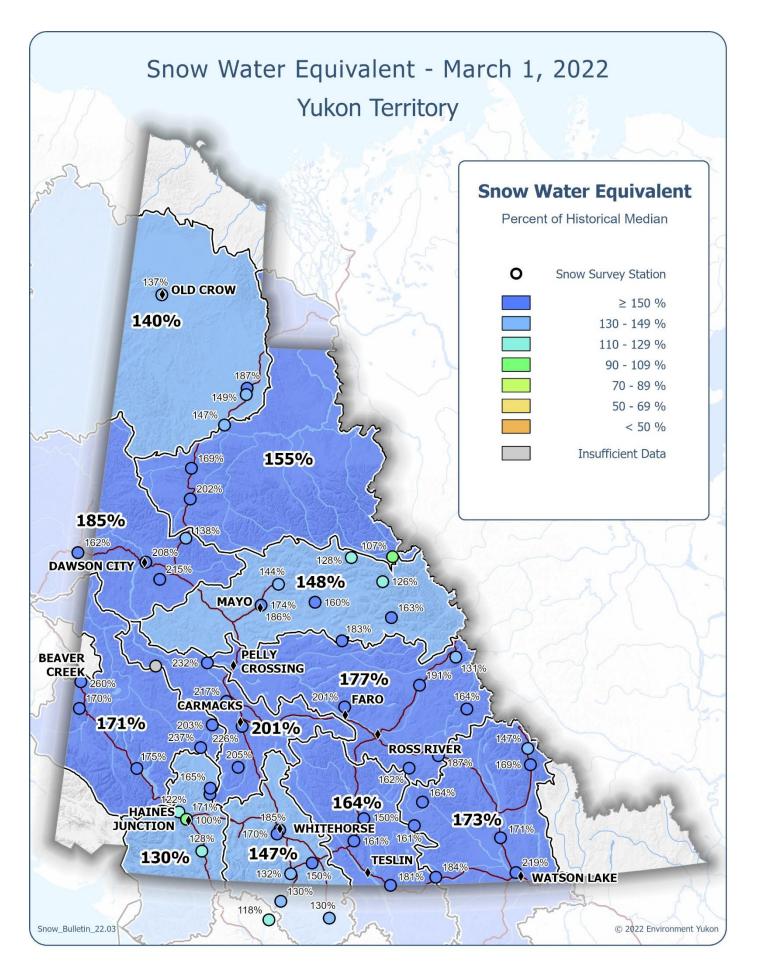
Estimated discharge and water level at the below presented basin indicator stations range from near average to above average. The Alsek and White Rivers are estimated to be near historical maximums while the Pelly, Stewart, and Yukon River at White River are all above average. A notable exception is Marsh Lake tracking below average, which is the result of Yukon Energy's management strategy going into freshet.

The higher than median snowpack in many watersheds in the territory makes high spring freshet flows likely. Higher than average lake levels are also expected this summer.

Peak spring freshet flows will depend on spring weather patterns, while weather conditions over the spring and summer will influence peak flows and lake levels in watersheds influenced by glacial melt.

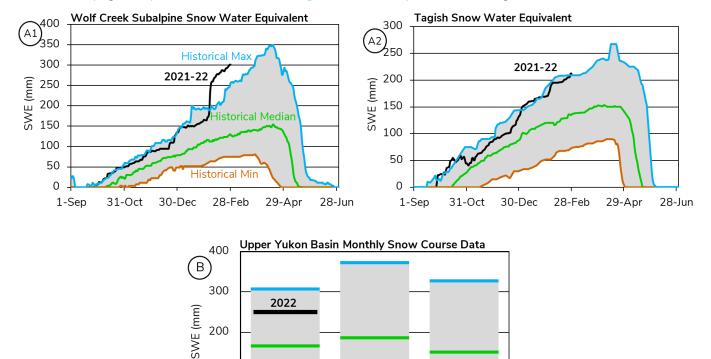






# UPPER YUKON RIVER BASIN (SOUTHERN LAKES / WHITEHORSE)

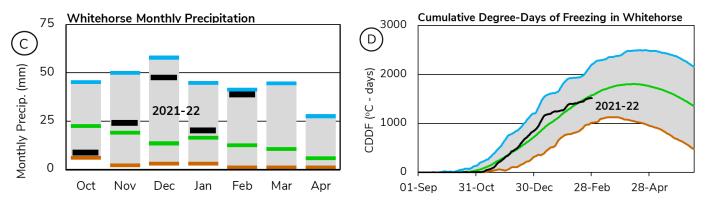
At Wolf Creek Subalpine Station, Snow Water Equivalent (SWE) is estimated to be **232%** of the **historical median** (Figure A1), while at Tagish Station, SWE is estimated to be **156%** of the **historical median** (Figure A2). The Upper Yukon basin-averaged SWE is estimated to be **147%** of the **historical median**, with **250 mm** as of March 1 (Figure B). This is considered a **significant snowpack** for the region.



Following a **dry** October, monthly precipitation at Whitehorse Airport has been **above median** all winter (Figure C) with the cumulative precipitation being **well above median** on March 1. Cumulated degree-days of freezing (CDDF) are **close to average**, with 1520 °C-Days (Figure D), which suggests that the thickness of the ice cover on rivers and lakes of the region is likely **close to normal**.

April-1

May-1

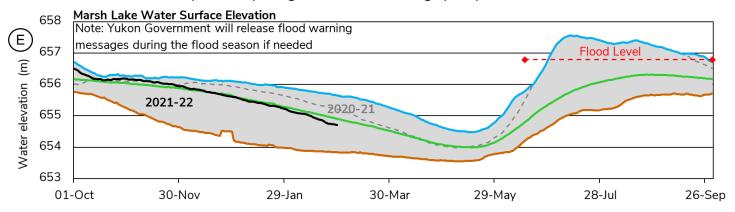


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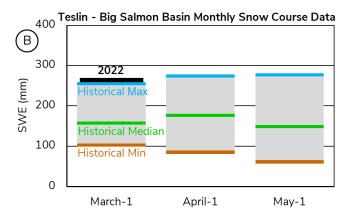
March-1

The measured water surface elevation (relative to sea level) in Marsh Lake is currently below average (Figure E), which is the result of Yukon Energy's management strategy going into freshet. Water levels in the Southern Lakes are driven by a combination of snowmelt, summer precipitation and glacier melt. Current snow conditions suggest that water levels will be well above average this summer. However, weather conditions over the spring and summer will determine the peak water level in Marsh Lake, which typically occurs in late summer in response to peak glacial runoff and large precipitation events.

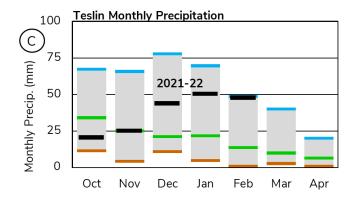


#### **TESLIN RIVER BASIN**

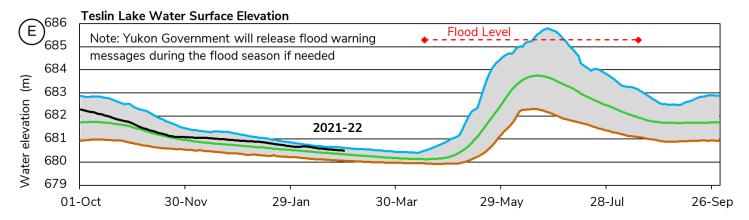
The Teslin River basin-averaged SWE is estimated at **164%** of the **historical median**, with **265 mm** as of March 1 (Figure B). This is the **highest recorded basin snowpack estimate** for this time of year.



Teslin monthly precipitation has been above median since December (Figure C), with cumulative precipitation being well above median on March 1.

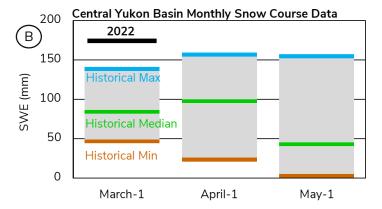


The measured water surface elevation (relative to sea level) in Teslin Lake is currently above average (Figure E). The record high snowpack and the above average water level suggest that summer water levels will be well above average. Weather conditions in March and April will determine the most probable spring scenario.

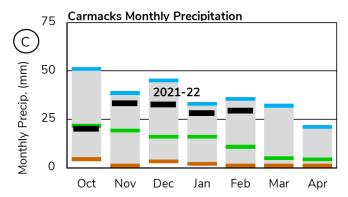


## CENTRAL YUKON RIVER BASIN (CARMACKS AREA)

The Central Yukon basin-averaged SWE is estimated to be **201%** of the **historical median**, with **174 mm** as of March 1 (Figure B). This is the **highest basin snowpack estimate on record** (record extends back to 1980).



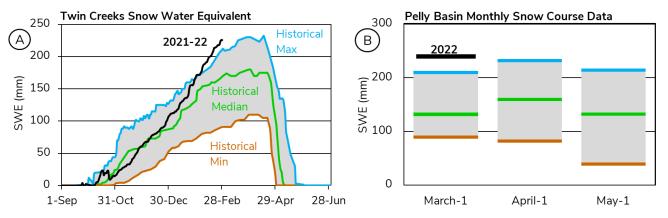
Carmacks monthly precipitation has been above median since November (Figure C), with cumulative precipitation being well above median on March 1.



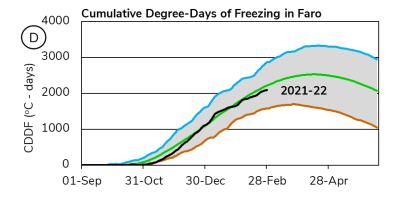
Water levels in Carmacks area rivers are likely to be **well above average** this spring and summer with a **high potential for significant spring freshet flows**. Weather conditions in March and April will determine the most probable spring scenario.

#### PELLY RIVER BASIN

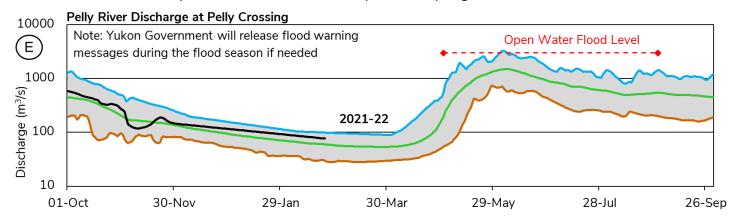
At Twin Creeks weather station, Snow Water Equivalent (SWE) is estimated to be **134%** of the **historical median** (Figure A). The Pelly River basin-averaged SWE is estimated to be **177%** of the **historical** median, with **239 mm** as of March 1 (Figure B). This is the **highest basin** snowpack estimate on record (record extends back to 1980).



Precipitation at Faro has not been recorded, but snowpack observations indicate values are **above** the **climate normals**. Cumulated degree-days of freezing (CDDF) at Faro are **slightly below average** at 2090 °C-Days (Figure D), which suggests that the thickness of the ice cover on rivers and lakes of the region is likely **close to normal**.

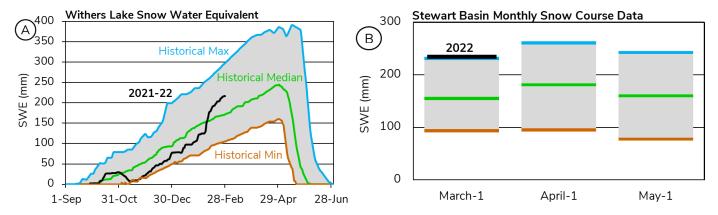


The estimated Pelly River discharge at Pelly Crossing is currently above average (Figure E). The historically high snowpack in the watershed suggests a high potential for significant spring freshet flows. Weather conditions in March and April will determine the most probable spring scenario.

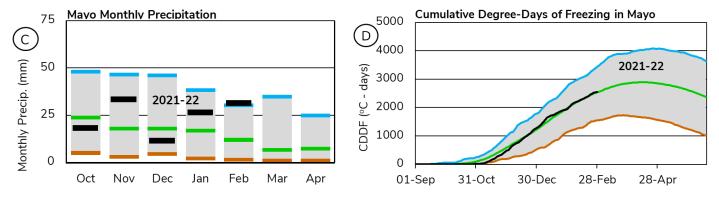


#### STEWART RIVER BASIN

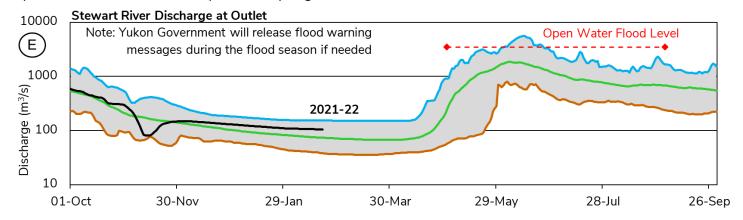
At Withers Lake Meteorological station, Snow Water Equivalent (SWE) is estimated to be **122%** of the **historical median** (Figure A). The Stewart River basin-averaged SWE is estimated to be **148%** of **historical median**, with **234 mm** as of March 1 (Figure B). This is the **highest recorded basin snowpack estimate** for this time of year.



Precipitation at Mayo Airport was **slightly below median** in October and December, but the **above median** precipitation for subsequent months, including a record wet February, has resulted in the cumulative precipitation being **above median** on March 1 (Figure C). Cumulated degree-days of freezing (CDDF) are **close to average**, with 2550 °C-Days (Figure D), which suggests that the thickness of the ice cover on rivers and lakes of the region is likely **close to normal**.

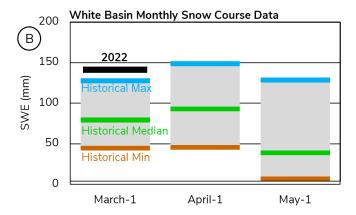


The estimated Stewart River discharge at the outlet is currently above average (Figure E). The record high snowpack suggests a high potential for significant spring freshet flows. Weather conditions in March and April will determine the most probable spring scenario.

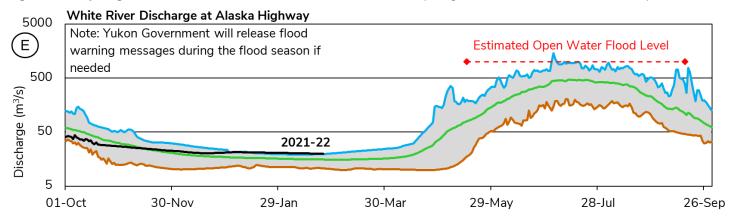


## WHITE RIVER BASIN

The White River basin-averaged SWE is estimated to be **171%** of the **historical median**, with **140 mm** as of March 1 (Figure B). This is the **highest recorded basin snowpack estimate** for this time of year.

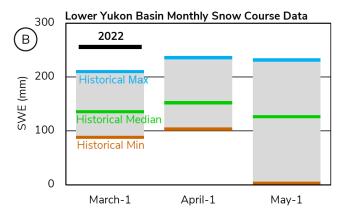


The estimated White River discharge at the Alaska Highway is currently well above average (Figure E). In this watershed, high flows are dominated by mountain snowmelt and glacial melt that are largely influenced by summer temperatures and precipitation. The record high snowpack suggests a high potential for significant spring freshet flows. Weather conditions over the spring and summer will determine peak flows.

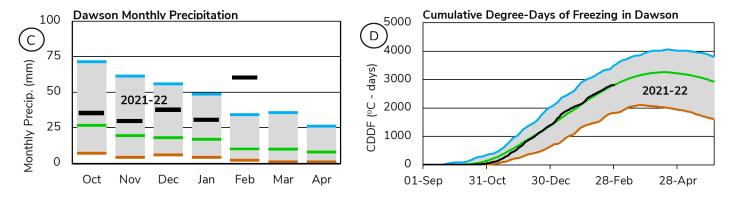


# LOWER YUKON RIVER BASIN (DAWSON AREA)

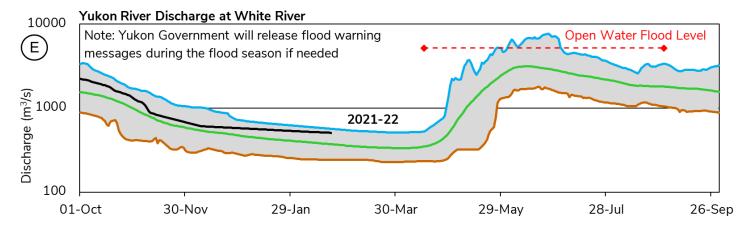
The Lower Yukon basin-averaged SWE is estimated to be **185%** of the **historical median**, with **256 mm** as of March 1 (Figure B). This is the **highest basin snowpack estimate on record** (record extends back to 1980).



Monthly precipitation at Dawson Airport has been above median all winter and set a new wet record for February (Figure C). Cumulated degree-days of freezing (CDDF) are close to average, with 2810 °C-Days (Figure D), which suggests that the thickness of the ice cover on rivers and lakes of the region is likely close to normal.

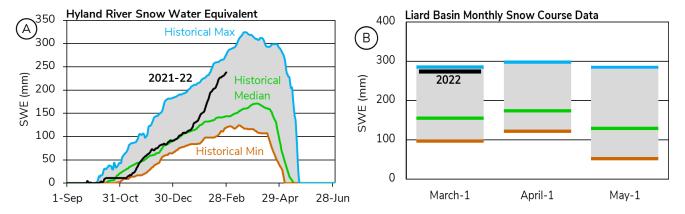


The estimated Yukon River discharge at the White River is **well above average** (Figure E). The **historically high** snowpack suggests a **high potential for significant spring freshet flows**. These statements also apply to the Klondike River. Weather conditions in March and April will determine the most probable spring scenario.

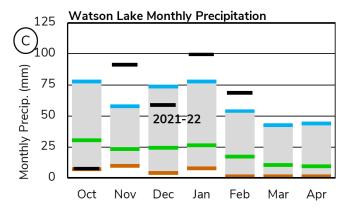


#### LIARD RIVER BASIN

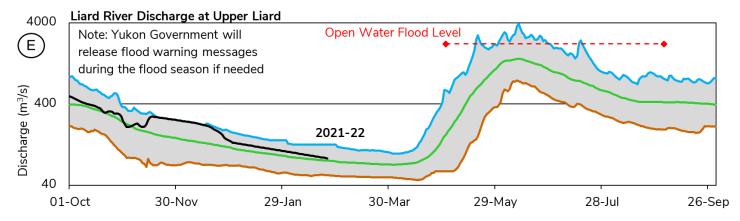
At Hyland meteorological station, Snow Water Equivalent (SWE) is estimated to be **165%** of the **historical** median (Figure A). The Liard River basin-averaged SWE is estimated to be **173%** of the **historical** median, with **274 mm** as of March 1 (Figure B). This is considered a significant snowpack for the region.



Cumulative precipitation at Watson Lake Airport has been well above average (Figure C). Following a record dry October, new wet records were set in November, January and February.

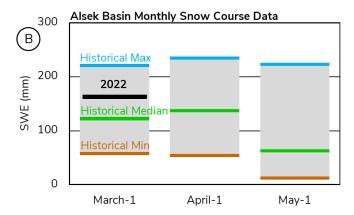


The estimated Liard River discharge at Upper Liard is currently slightly above average (Figure E). The very high snowpack in the watershed suggests a high potential for significant spring freshet flows. Weather conditions in March and April will determine the most probable spring scenario.

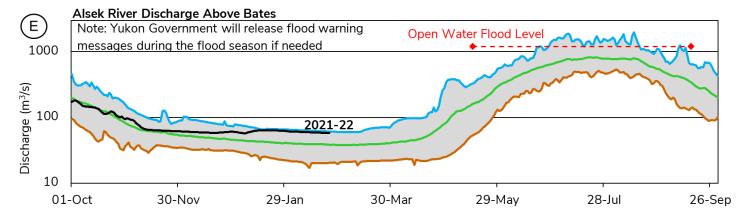


## ALSEK RIVER BASIN

The Alsek River basin-averaged SWE is estimated to be **130%** of the **historical median**, with **162 mm** as of March 1 (Figure B).

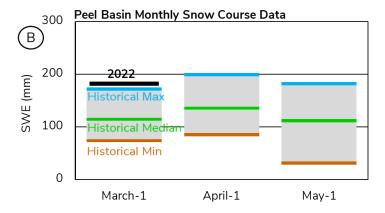


The estimated Alsek River discharge is currently well above average (Figure E). High flows in this watershed are dominated by mountain snowmelt and glacial melt that are largely influenced by summer temperatures and precipitation. The snowpack in the St. Elias Range is likely to generate higher than average freshet volumes. Weather conditions over the spring and summer will determine peak flows.

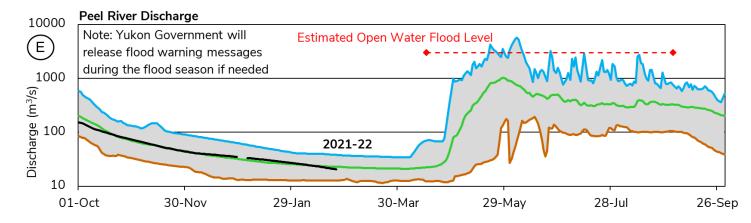


## PEEL RIVER BASIN

The Peel River basin-averaged SWE is estimated to be **155%** of the **historical median**, with **182 mm** as of March 1 (Figure B). This is the **highest recorded basin snowpack estimate** for this time of year.

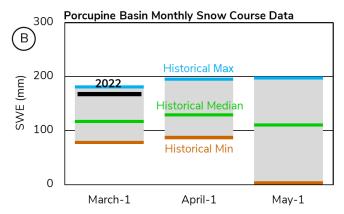


The estimated Peel River discharge is **close to average** (Figure E). The **record high** snowpack suggests a **high potential for significant spring freshet flows**. Weather conditions in March and April will determine the most probable spring scenario.

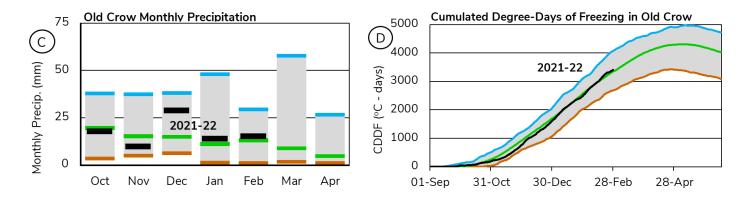


#### PORCUPINE RIVER BASIN

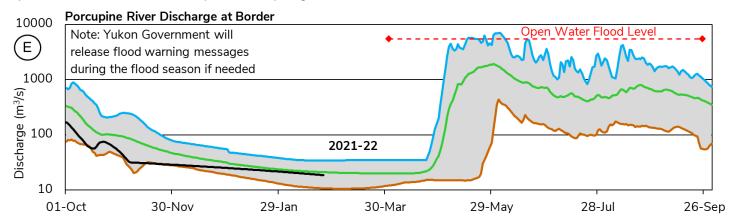
The Porcupine River basin-averaged SWE is estimated to be **140%** of the **historical median**, with **168 mm** as of March 1 (Figure B). This basin average relies heavily on the Old Crow snow survey result, which had to be estimated for March 1. Snow courses on the eastern edge of the basin adjacent to the Dempster Highway were **well above historical median**, while cumulative winter precipitation at Old Crow was **near median** (Figure C).



Cumulated degree-days of freezing (CDDF) are close to average, with 3415 °C-Days as of March 1 (Figure D), which suggests a close to average ice cover thickness on lakes and rivers in the region.



The estimated Porcupine River discharge is **close to average** (Figure E). The **above median** snowpack in the watershed increases the probability of **significant spring freshet flows.** Weather conditions in March and April will determine the most probable spring scenario.



# DRAINAGE BASIN AND SNOW COURSE

For Sample Date: 2022-03-01

Name	Number	Eleva- tion (m)	Date of survey	This year snow depth (cm)	Water content (SWE) (mm)	Last year (mm)	Median Historical SWE (mm)	Years of record
Alsek River Basin								
Canyon Lake	08AA-SC01	1160	2022-02-23	73	137	92	80	44
Alder Creek	08AA-SC02	768	2022-02-25	89	172	194	134	41
Aishihik Lake	08AA-SC03	945	2022-02-23	67	114	88	69	28
Haines Junction Farm	08AA-SC04	610	2022-02-28	44	87	174	87	22
Summit	08AB-SC03	1000	2022-02-28	110	280	411	230	42
Yukon River Basin							•	
Tagish	09AA-SC01	1080	2022-02-28	83	191	184	127	46
Montana Mountain	09AA-SC02	1020	2022-02-24	71	174	220	132	46
Log Cabin (B.C.)	09AA-SC03	884	2022-02-23	135	419	700	324	60
Atlin (B.C)	09AA-SC04	730	2022-02-24	57	129	207	99	56
Mt McIntyre B	09AB-SC01B	1097	2022-02-28	102	228 R	189	135	46
Whitehorse Airport	09AB-SC02	700	2022-02-24	71	168	151	91	57
Meadow Creek	09AD-SC01	1235	2022-02-23	153	396	322	246	45
Jordan Lake	09AD-SC02	930	2022-02-23	90	183	172	122	31
Morley Lake	09AE-SC01	824	2022-02-24	93	230	141	127	33
Mount Berdoe	09AH-SC01	1035	2022-02-28	106	217 R	119	96	46
Satasha Lake	09AH-SC03	1106	2022-02-28	73	166 R	101	81	34
Williams Creek	09AH-SC04	914	2022-02-28	85	174 R	104	80	25
Twin Creeks B	09BA-SC02B	900	2022-02-23	114	243 R	146	127	5
Hoole River	09BA-SC03	1036	2022-02-23	95	188	201	116	43
Burns Lake	09BA-SC04	1112	2022-02-23	145	318 R	236	194	33
Finlayson Airstrip	09BA-SC05	988	2022-02-23	89	170 R	136	91	35
Fuller Lake	09BB-SC03	1126	2022-02-24	110	223	162	171	32
Russell Lake	09BB-SC04	1060	2022-02-24	148	355 R	201	194	34
Rose Creek	09BC-SC01	1080	2022-03-01	89	195 R	134	97	27
Mount Nansen	09CA-SC01	1021	2022-02-28	74	136 R	84	67	45
MacIntosh	09CA-SC02	1160	2022-02-28	81	185 R	94	78	45
Burwash Airstrip	09CA-SC03	810	2022-02-23	47	70	36	40	45
Beaver Creek	09CB-SC01	655	2022-02-23	80	165 R	109	64	46
Chair Mountain	09CB-SC02	1067	2022-02-23	66	131 R	71	77	28
Casino Creek	09CD-SC01	1065	N.S.			112	108	43
Pelly Farm	09CD-SC03	472	2022-02-27	67	176 R	100	76	35
Plata Airstrip	09DA-SC01	830	2022-02-24	122	265	185	163	40
Withers Lake	09DB-SC01	975	2022-02-24	117	236	167	188	34
Rackla Lake	09DB-SC02	1040	2022-02-24	103	202	147	158	31

Code "E" - Estimate, Code "B" - Survey date is outside of valid sampling range, "N.S." – No survey, "R" – New record.

# DRAINAGE BASIN AND SNOW COURSE

For Sample Date: 2022-03-01

Name	Number	Eleva- tion (m)	Date of survey	This year snow depth (cm)	Water content (SWE) (mm)	Last year (mm)	Median Historic al SWE (mm)	Years of record			
Yukon River Basin											
Mayo Airport A	09DC-SC01A	540	2022-02-24	78	160	98	92	51			
Mayo Airport B	09DC-SC01B	540	2022-02-24	85	172 R	90	93	32			
Edwards Lake	09DC-SC02	830	2022-02-24	104	218	167	137	32			
Calumet	09DD-SC01	1310	2022-02-23	117	246	167	171	44			
King Solomon Dome	09EA-SC01	1070	2022-02-28	132	316 R	190	147	47			
Grizzly Creek	09EA-SC02	975	2022-02-24	102	204	193	148	46			
Midnight Dome	09EB-SC01	855	2022-02-23	126	281 R	190	135	46			
Boundary (Alaska)	09EC-SC02	1005	2022-03-01	99	185 E	99	114	43			
Porcupine River Bas	Porcupine River Basin										
Riff's Ridge	09FA-SC01	650	2022-03-01	88	191	128	130	35			
Eagle Plains	09FB-SC01	710	2022-03-01	98	213	141	143	39			
Eagle River	09FB-SC02	340	2022-03-01	96	203 R	113 E	109	38			
Old Crow	09FD-SC01	299	2022-03-04	78	147 E	N.S.	107	27			
Liard River Basin											
Watson Lake Airport	10AA-SC01	685	2022-02-28	118	258 R	168	118	57			
Tintina Airstrip	10AA-SC02	1067	2022-02-23	130	301	265	184	41			
Pine Lake Airstrip	10AA-SC03	995	2022-02-24	140	344 R	275	187	45			
Ford Lake	10AA-SC04	1110	2022-02-23	118	261	236	162	32			
Frances River	10AB-SC01	730	2022-02-28	118	237 R	192	139	46			
Hyland River	10AD-SC01	855	2022-03-01	115	261	265	155	46			
Hyland River B	10AD-SC01B	880	2022-03-01	117	263	276	179	4			
Peel River Basin											
Blackstone River	10MA-SC01	920	2022-02-24	83	171 R	96	85	46			
Ogilvie River	10MA-SC02	595	2022-03-01	75	151	108	90	46			
Bonnet Plume Lake	10MB-SC01	1120	2022-02-24	87	154	153	144	31			
Alaska Snow Courses											
Eaglecrest	08AK-SC01	305	2022-03-01	173	668	551	434	39			
Moore Creek Bridge	08AK-SC02	700	2022-03-01	180	561	691	465	29			

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