Oil Sands Monitoring Program:

Summary of 2024 Hydrologic Conditions in the Alberta Oil Sands Area

Oil Sands Monitoring Program
Technical Report Series

OIL SANDS MONITORING PROGRAM

Canada

Alberta

Summary of 2024 Hydrologic Conditions in the Alberta Oil Sands Area

(Based on hydrometric data collected by Environment and Climate Change Canada, National Hydrological Service)

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2024 Overview

This annual report presents a summary of hydrometric data collected by the Water Survey of Canada (WSC) in the Alberta oil sands area in 2024. This report is the seventh annual publication intended to provide the public with an understanding of the hydrologic conditions that were present in the oil sands area during each year and how they compared with historical conditions. This report is a deliverable produced by Environment and Climate Change Canada (ECCC) as part of the surface water quantity monitoring services provided by ECCC to support the Alberta Oil Sands Monitoring (OSM) Program.

The ongoing collection of high-quality surface water quantity data by the WSC, as part of the national surface water monitoring network, supports scientific efforts to address several of the Oil Sands Monitoring Program key questions, including those regarding establishment of baseline data, monitoring for change, and integration of environmental monitoring data to support scientific investigation into other themes (e.g., water quality, benthos, fish, etc.). Detailed hydrometric data collected by the WSC in the oil sands area are publicly available on the ECCC Water Office website in near real time for both viewing and download (https://wateroffice.ec.gc.ca/). In addition to users accessing data online, there were 34 data requests received by WSC for data from OSM funded hydrometric stations between January 1st and December 31st of 2024; this was less than half the requests received in 2023. Of the requests for data from the OSM gauges in 2024, 1 request came from academia, 15 came from government/utility corporations, 10 came from consultants, none from industry, and the remaining 8 had unknown affiliation. Data from the oil sands Athabasca region are often used for scientific studies, the following are two examples of studies published in 2024 using such data. Aryal et al. (2024) assessed indicators of hydrologic alteration in the Athabasca River basin, and hydrometric data from the Athabasca River at Embarras Airport (07DD001) was used to inform when open-water floods occurred that could impact surrounding lakes as part of a larger study on monitoring the Peace-Athabasca Delta (Neary et al. 2024).

There were 48 hydrometric gauging stations operated by WSC in the oil sands area in 2024 (shown on Figure A1 in Appendix A). Conditions at four key stations are discussed in the main body of this report and are presented from upstream to downstream as follows: Athabasca River at Athabasca, Clearwater River above Christina River (a major tributary to the Athabasca River), Athabasca River below Fort McMurray, and Athabasca River at Embarras Airport. The local contributions from the western and eastern tributaries to the Athabasca River main stem are also discussed. A summary table of all active WSC hydrometric stations within the oil sands area in 2024 is provided in Appendix B, and annual hydrographs are provided for all active hydrometric stations in Appendix C.

Key stations summary

Based on the historical record, the 3 stations on the Athabasca River main stem recorded below average spring flow in late April following ice break-up, with average, to below average flow throughout the remainder of the year. The fourth key station, Clearwater River above Christina River, had average flow around ice break-up with average to above average from mid-May to early July with below average flows for the remainder of the year.

The eastern and western tributaries downstream of Fort McMurray experienced average to above average flow following precipitation mid-May to early-June, and low flow through the remainder of the year. Precipitation in mid to late July also contributed to average to above average flows in late July and August within the western tributaries. Overall, the 2024 mean discharge in the eastern and western tributaries was lower than the mean annual discharge over the period of record.

Mean precipitation, presented in the figures in Appendix C was retrieved from the Regional Deterministic Precipitation Analysis (RDPA). More information about the RDPA is available from the Meteorological Services of Canada Open Data documentation at https://eccc-msc.github.io/open-data/msc-data/nwp_rdpa/readme_rdpa_en/.

Athabasca River at Athabasca (07BE001)

The hydrometric data for this station (Figure 1) shows that ice breakup occurred in late April which was followed by a decrease in flow, from average to below 25th percentile. The basin mean areal precipitation for 2024, calculated using precipitation data available from the RDPA, was shown to be 89% of the historical mean based on records from 2002 to 2024. The measured flow has a few peaks higher than the interquartile range (25th-75th percentiles) of flows for this station for the year; however, most flows were below the interquartile range throughout the year. The 2024 mean flow of 304 m^3/s was approximately 28% lower than the historical mean annual flow of 423 m^3/s over the station's period of record.

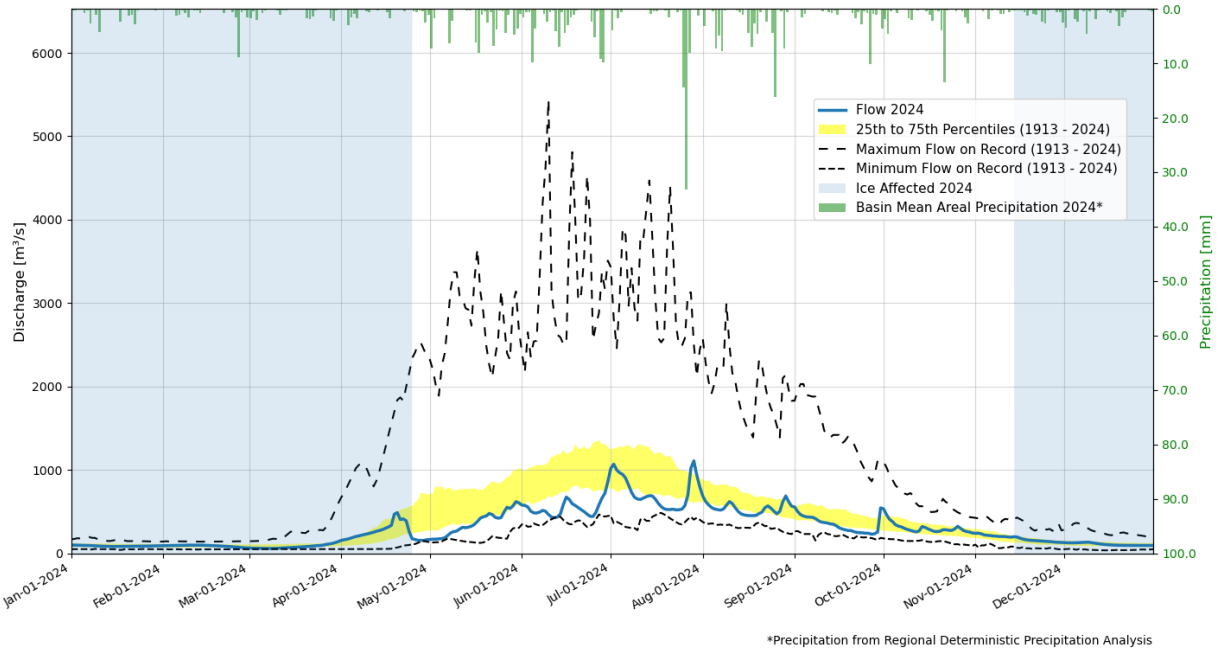

Figure 1: Annual Hydrograph for Station 07BE001 Athabasca River at Athabasca

Clearwater River above Christina River (07CD005)

Hydrometric data from this station is presented as an indicator of tributary contributions to the Athabasca River upstream of Fort McMurray. The hydrometric data for 2024 from this station (Figure 2) shows that ice break-up occurred in late April. Flow peaked mid-April, mid-May, and mid-June, and was otherwise below the inter-quartile range throughout. The 2024 mean flow of 68 m^3/s was approximately 10% lower than the historical mean annual flow of 76 m^3/s over the station's period of record. The calculated basin mean areal precipitation for 2024, using precipitation data available from the RDPA, was shown to be 86% of the historical mean based on records from 2002 to 2024.

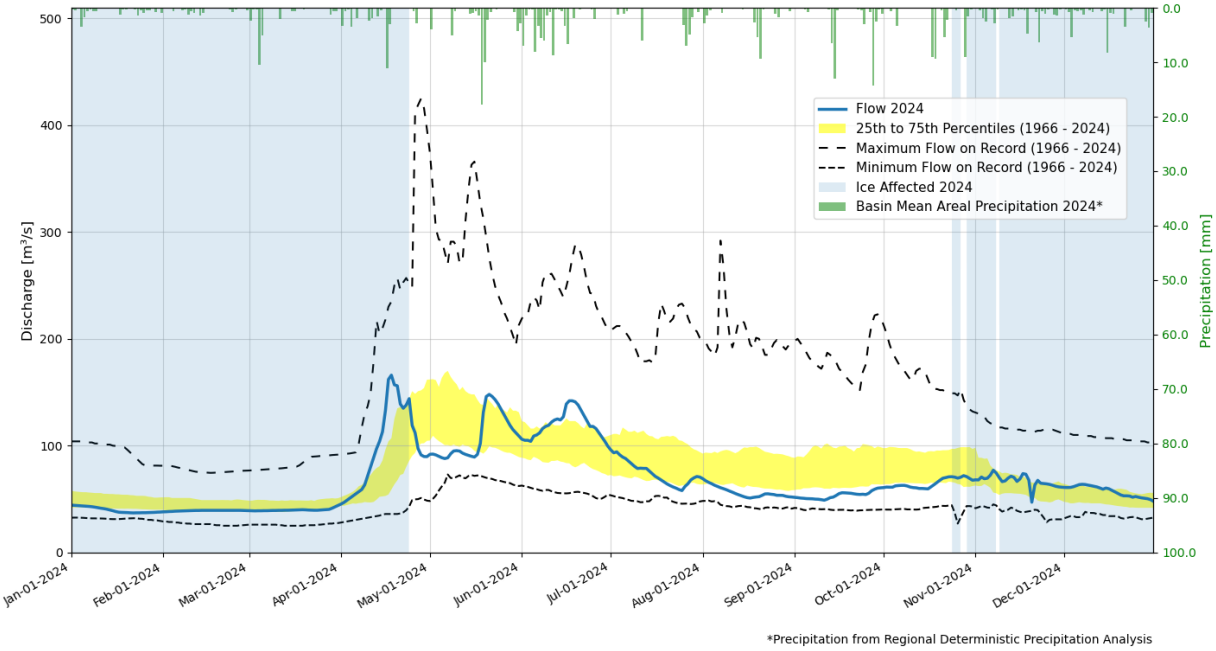

Figure 2: Annual Hydrograph for Station 07CD005 Clearwater River above Christina River

Athabasca River below Fort McMurray (07DA001)

The hydrometric data for this station (Figure 3) indicates that ice break-up occurred in late April. The measured flow was within or below the interquartile range (25th-75th percentiles) of flows for this station throughout the year. The 2024 mean flow of 466 m^3/s was approximately 25% lower than the historical mean annual flow of 615 m^3/s over the station's period of record. Basin mean areal precipitation for 2024, calculated using precipitation data available from the RDPA, was also found to be 89% of the historical mean based on records from 2002 to 2024.

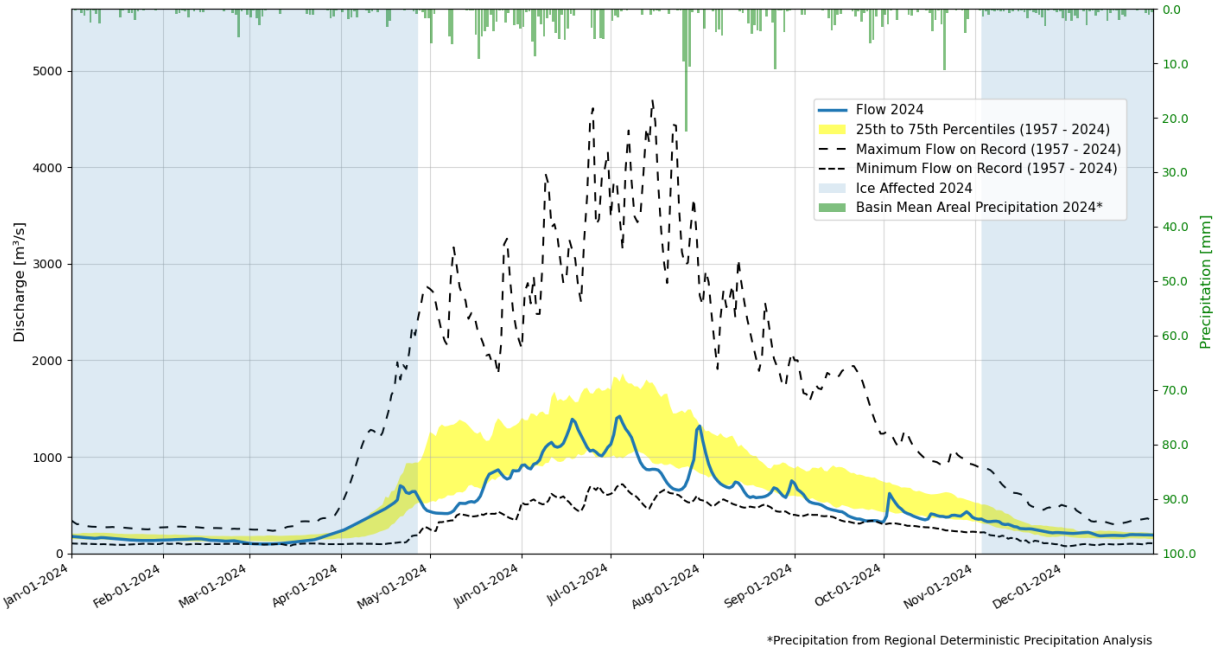

Figure 3: Annual Hydrograph for Station 07DA001 Athabasca River below Fort McMurray

Athabasca River at Embarras Airport (07DD001)

The hydrometric data for this station (Figure 4) indicates that the period of ice-affected data ended in late April. The peak flow for 2024 occurred in mid-June and was within the interquartile range of historical flow rates. The majority of flow throughout the year was average to below average with 28 new daily low flow records being set. The 2024 mean flow of 511 m^3/s was approximately 25% lower than the historical mean annual flow of 678 m^3/s over this station's period of record. Basin mean areal precipitation for 2024, calculated using precipitation available from the RDPA, was found to be 90% of the historical mean based on records from 2002 to 2024.

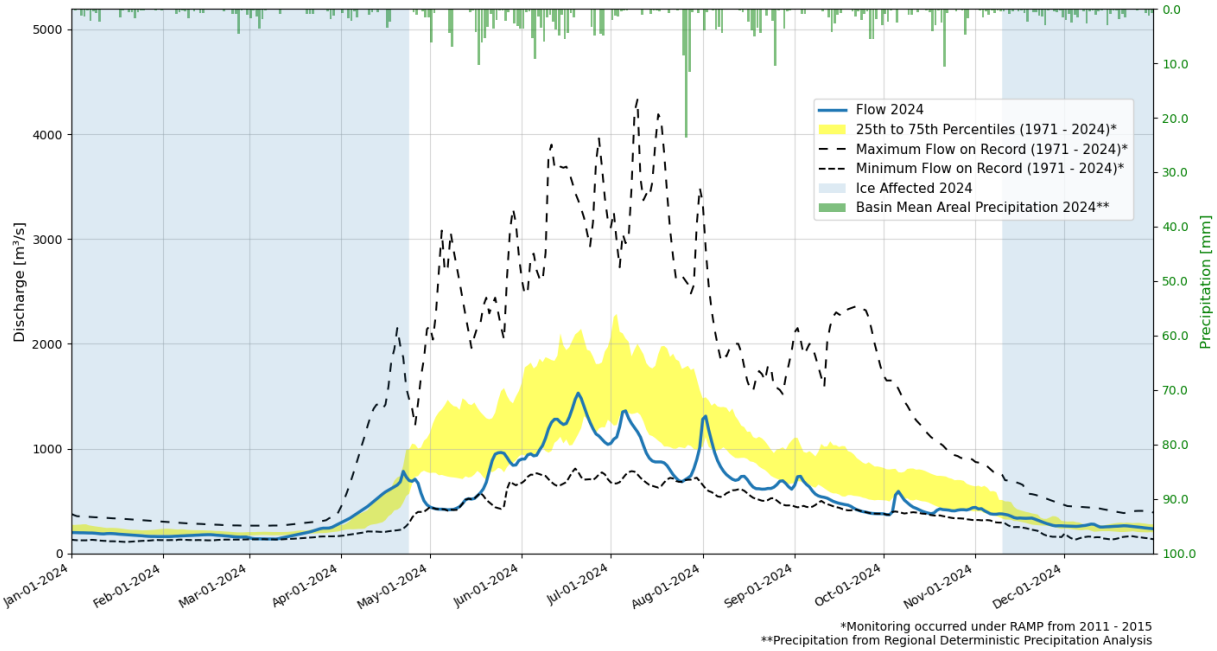

Figure 4: Annual Hydrograph for Station 07DD001 Athabasca River at Embarras Airport

Tributary Contributions to the Athabasca Main Stem

A subset of tributary hydrometric stations located downstream of Fort McMurray (listed in Table 1) were assessed to determine the significance of contributions of sub basins lying to the east and west of the Athabasca River main stem in 2024. Annual hydrographs for these individual gauging stations for 2024 are included in Appendix C.

Table 1: Hydrometric Stations Used to Assess Contributions From Eastern and Western Sides of the Athabasca River Downstream of Fort McMurray

Eastern Tributaries	Clearwater River at Draper (07CD001)
	Hangingstone River at Fort McMurray (07CD004)
	Steepbank River near Fort McMurray (07DA006)
	Muskeg River near Fort MacKay (07DA008)
	Firebag River near the Mouth (07DC001)
Western Tributaries	Poplar Creek near Fort McMurray (07DA007)
	Beaver River above Syncrude (07DA018)
	MacKay River near Fort MacKay (07DB001)
	Ells River at Canadian Natural Resources Limited Bridge (07DA032)
	Tar River near the Mouth (07DA045)
	Calumet River near the Mouth (07DA033)
	Eymundson Creek near the Mouth (07DA041)
	Big Creek near the Mouth (07DA040)

The eastern tributaries in the oil sands area experienced lower quartile flows following ice break-up, then saw upper quartile discharge values following precipitation in mid-May and mid-June. The discharge stayed low, below the 25th percentiles (1965-2024), for the remainder of the year following the recession from the June peaks. The eastern tributaries collectively set 61 record daily low discharge values in 2024. Overall, the 2024 mean discharge in the eastern tributaries downstream of Fort McMurray was 65% of the historical mean annual discharge (79% when averaged by basin area).

The western tributary indicator stations had late April ice break-up and experienced precipitation induced peaks in mid to late May, early to mid-June, and late July to early August, collectively setting 38 new daily high flow records. For the remainder of the year discharge was average (in interquartile range) to below average (lower quartile) in the western tributaries. These stations then went on to collectively set 128 record daily low discharge values for the remainder of the year. Overall, the 2024 mean discharge in the western tributaries was 91% of the historical mean annual discharge (90% when averaged by basin area).

References

Aryal, S., Babel, M.S., Gupta, A., Farjad, B., Khadka, D., and Hassan, Q.K. (2024). Assessment of hydrological baseline condition and its alteration in Athabasca River Basin, Canada. *Journal of Hydrology: Regional Studies.* 53: 101805. doi: https://doi.org/10.1016/j.ejrh.2024.101805

Neary, L.K., Remmer, C.R., Owca, T.J, Girard, C.A.M., Kay, M.L., Wiklund, J.A., Imran, A., Hall, R.I., and Wolfe, B.B. (2024). Synthesis of a hydrological, water chemistry, and contaminants research program in the Peace-Athabasca Delta (Canada) to inform long-term monitoring of shallow lakes. *Environmental Reviews*. 32(4): 688-706. doi: https://doi.org/10.1139/er-2024-0041

Appendix A:
Overview Maps – Alberta Oil Sands Area

Figure A1 shows all active hydrometric monitoring stations operated by WSC in 2024. Figure A2 shows all the RDPA grids within the Athabasca River at Embarras Airport (07DD001) contributing area and their 2024 annual precipitation. The daily precipitation at each of these grid points was spatially averaged over each monitoring station's contributing area and used to represent the basin mean areal precipitation on the annual hydrographs included in the main body of this report and in Appendix C. Daily RDPA data can be accessed through Meteorological Services of Canada Datamart (https://dd.weather.gc.ca/).

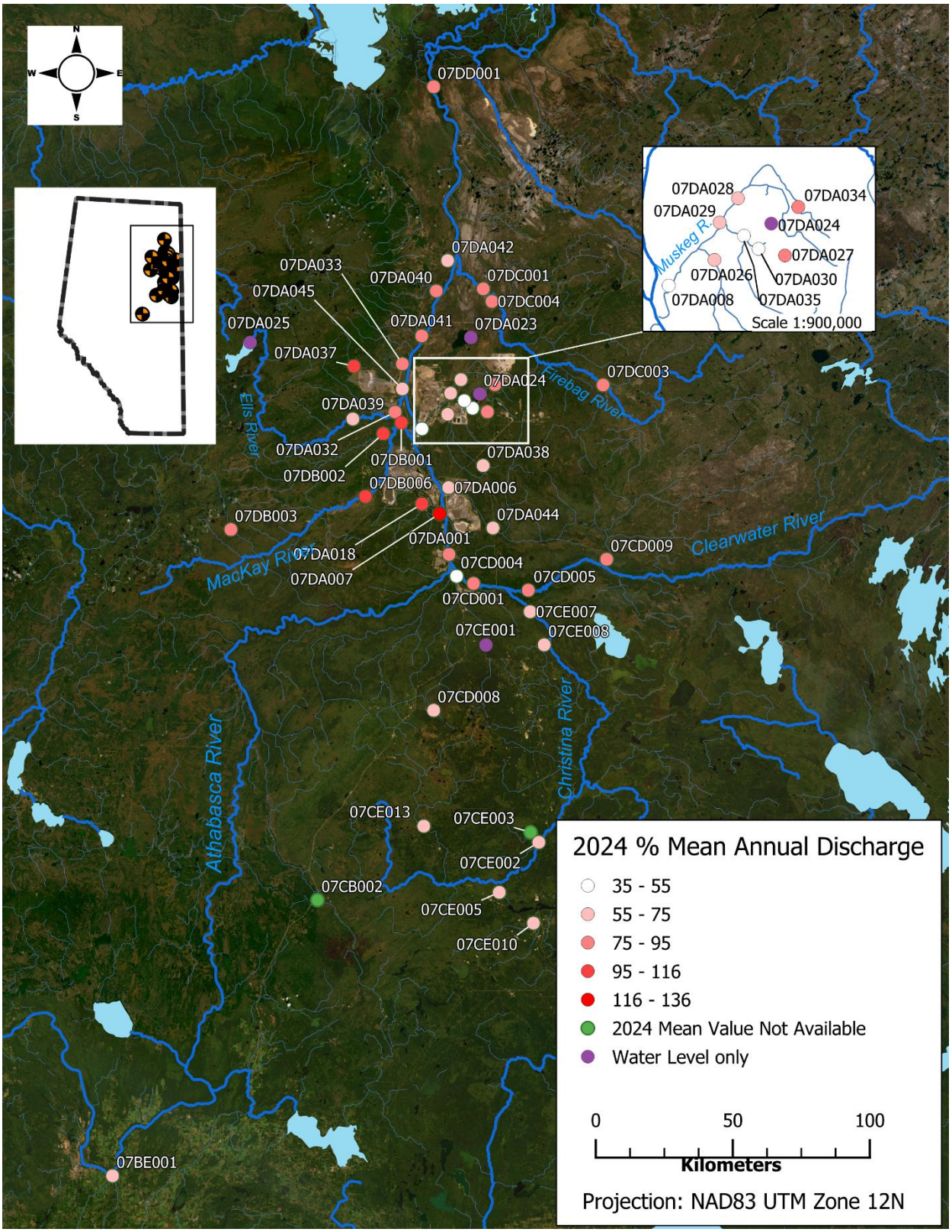

Figure A1: Active Hydrometric Stations in the Alberta Oil Sands Area in 2024

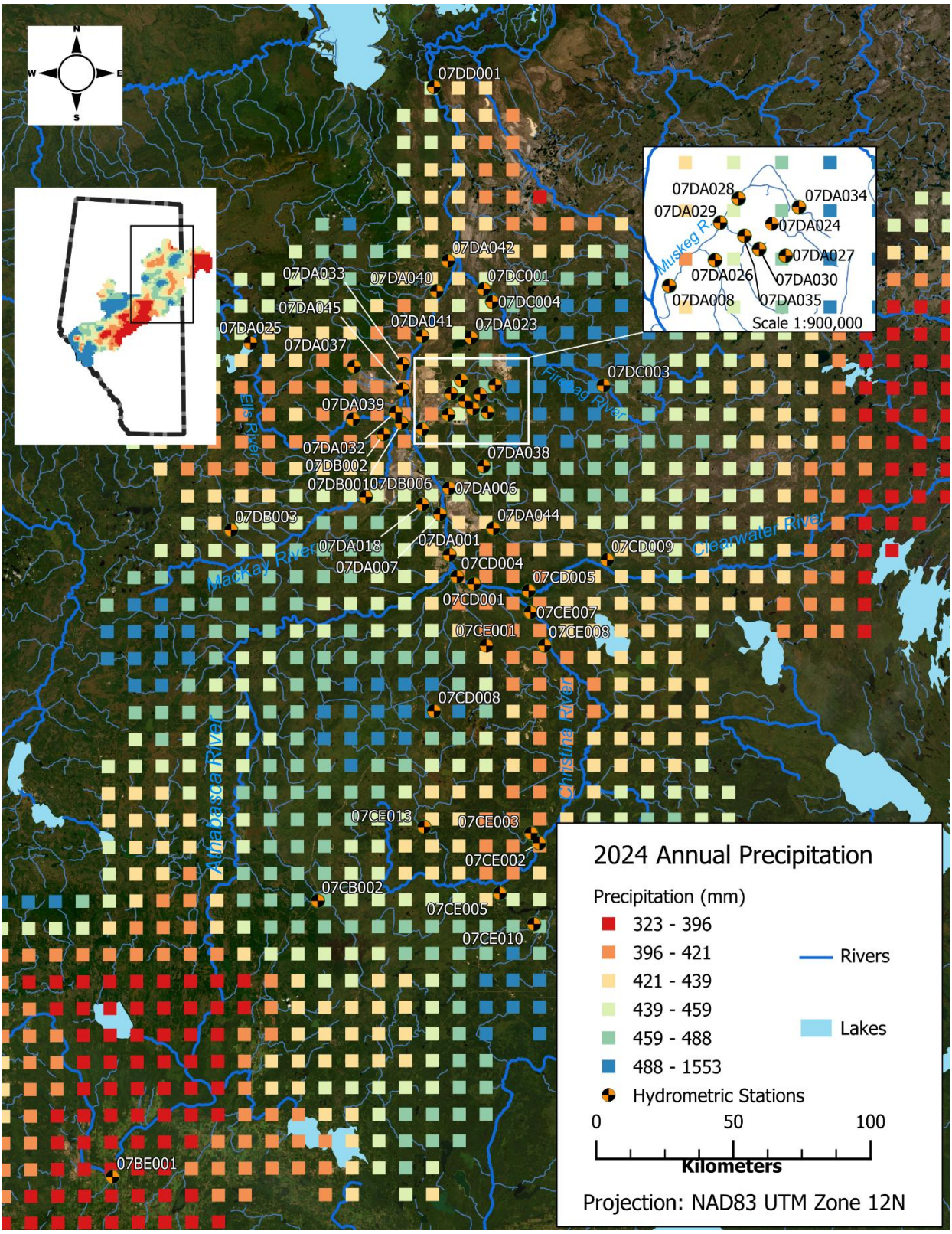

Figure A2: Regional Deterministic Precipitation Analysis (RDPA) Gridded Annual Precipitation over the Alberta Oil Sands Area (Contributing Area to Athabasca River at Embarras Airport - 07DD001) Used in Producing this Annual Report

Appendix B:
Summary – All Hydrometric Stations

The following tables summarize all active WSC hydrometric stations within the oil sands area in 2024. Table B1 provides a summary of all discharge stations, and Table B2 provides a summary of all level stations.

The provided mean annual discharge, mean annual yield, and mean annual level are calculated from historical water level or discharge at the selected hydrometric monitoring station over the entire period of record. This record includes monitoring that occurred under the Regional Aquatics Monitoring Program (RAMP), for which data is publicly available on the RAMP website at http://www.ramp-alberta.org/ramp.aspx. Data included from RAMP has not been verified by WSC.

For a given year in the record, the annual mean water level or discharge value is calculated by averaging all the daily water level or discharge values for that year. For consistency with data published on the ECCC Water Office website, the annual mean is not calculated when one or more daily mean values are missing, either because of operational problems, or where a seasonal operating schedule is in place. In those instances of operational problems, the data has been listed as N/A in the table, while a dash has been used for the stations with a seasonal operating schedule.

Table B1: Discharge Stations Summary

STATION NAME	STATION ID	PERIOD OF RECORD	GROSS DRAINAGE AREA [km²]	2024 WATER YIELD [mm]	HISTORICAL MEAN ANNUAL WATER YIELD [mm]	2024 MEAN DISCHARGE [m³/s]	HISTORICAL MEAN ANNUAL DISCHARGE[1] [m³/s]	2024 AS A PERCENT OF HISTORICAL MEAN ANNUAL DISCHARGE [%]
ATHABASCA RIVER AT ATHABASCA	07BE001	1913 – 2024	74600	129	179	304	423	71.9
ATHABASCA RIVER AT EMBARRAS AIRPORT	07DD001	1971 – 2024 [1]	155000	104	138	511	678	75.4
ATHABASCA RIVER BELOW FORT MCMURRAY	07DA001	1957 – 2024	133000	111	146	466	615	75.8
BEAVER RIVER ABOVE SYNCRUDE	07DA018	1975 – 2024	165	106	108	0.554	0.567	97.7
BIG CREEK NEAR THE MOUTH	07DA040	2011 – 2024 [2]	323	43.5	55.3	0.445	0.566	78.6
CALUMET RIVER NEAR THE MOUTH	07DA033	2001 – 2024 [2]	175	28.5	32.8	0.158	0.182	86.8
CHRISTINA RIVER ABOVE STATOIL LEISMER	07CE013	2013 – 2024 [2]	1030	93.4	133	3.05	4.33	70.4
CHRISTINA RIVER NEAR CHARD	07CE002	1982 – 2024	4860	76	124	11.7	19.1	61.3
CHRISTINA RIVER NEAR THE MOUTH	07CE007	2011 – 2024 [2]	13200	71	106	29.7	44.5	66.7
CLEARWATER RIVER ABOVE CHRISTINA RIVER	07CD005	1966 – 2024	17000	127	141	68.2	76	89.7
CLEARWATER RIVER AT DRAPER	07CD001	1930 – 2024	30800	99.8	124	97.4	121	80.5
DOVER RIVER NEAR THE MOUTH	07DB002	1975 – 2024 [3]	974	63.5	61.9	1.96	1.91	103
DUNKIRK RIVER NEAR FORT MACKAY	07DB003	1975 – 2024 [3]	1570	78.6	90.7	3.91	4.51	86.7
EAST JACKPINE CREEK NEAR THE 1300 FT CONTOUR	07DA038	2007 – 2024 [2]	44.8	91.6	149	0.13	0.211	61.6
ELLS RIVER ABOVE JOSLYN CREEK DIVERSION	07DA039	2009 – 2024 [2]	2260	70.4	102	5.04	7.33	68.8
ELLS RIVER AT CANADIAN NATURAL RESOURCES LIMITED BRIDGE	07DA032	2004 – 2024 [2]	2430	73.1	96.2	5.63	7.41	76
EYMUNDSON CREEK NEAR THE MOUTH	07DA041	2011 – 2024 [2]	319	63.2	70.3	0.639	0.711	89.9
FIREBAG RIVER NEAR THE MOUTH	07DC001	1971 – 2024	6390	111	130	22.5	26.4	85.2
FIREBAG RIVER UPSTREAM OF SUNCOR FIREBAG	07DC003	2009 – 2024 [2]	2420	116	134	8.9	10.3	86.4
GREGOIRE RIVER NEAR THE MOUTH	07CE008	2012 – 2024 [2]	1000	65.3	117	2.07	3.71	55.8
HANGINGSTONE RIVER AT FORT MCMURRAY	07CD004	1965 – 2024	962	62.3	124	1.9	3.78	50.3
HANGINGSTONE RIVER AT NORTH STAR ROAD	07CD008	2002 – 2024 [2]	113	101	157	0.36	0.563	63.9
HIGH HILL RIVER NEAR THE MOUTH	07CD009	2012 – 2024 [2]	1360	103	123	4.44	5.32	83.5

Table continued on next page…

STATION NAME	STATION ID	PERIOD OF RECORD	GROSS DRAINAGE AREA [km²]	2024 WATER YIELD [mm]	HISTORICAL MEAN ANNUAL WATER YIELD [mm]	2024 MEAN DISCHARGE [m³/s]	HISTORICAL MEAN ANNUAL DISCHARGE[1] [m³/s]	2024 AS A PERCENT OF HISTORICAL MEAN ANNUAL DISCHARGE [%]
HOUSE RIVER AT HIGHWAY NO. 63	07CB002	1982 – 2024 [6]	781	N/A	N/A	N/A	N/A	N/A
IYINIMIN CREEK ABOVE KEARL LAKE	07DA027	1989 – 2024 [2]	42.9	103	135	0.14	0.184	76.1
JACKFISH RIVER BELOW CHRISTINA LAKE	07CE005	1982 – 2024 [3]	1290	59.9	108	2.45	4.41	55.6
JACKPINE CREEK AT CANTERRA ROAD	07DA026	1995 – 2024 [2]	343	66.2	111	0.72	1.21	59.5
KEARL LAKE OUTLET	07DA030	1989 – 2024 [2]	82.5	26.2	75.7	0.0684	0.198	34.5
MACKAY RIVER AT PETRO-CANADA BRIDGE	07DB006	2008 – 2024 [2]	4130	78.7	81.8	10.3	10.7	96.3
MACKAY RIVER NEAR FORT MACKAY	07DB001	1972 – 2024	5570	77.1	79.9	13.6	14.1	96.5
MCCLELLAND LAKE OUTLET ABOVE FIREBAG RIVER	07DC004	2008 – 2024 [2]	359	50.6	62.5	0.576	0.711	81
MUSKEG CREEK NEAR THE MOUTH	07DA035	1989 – 2024 [2]	322	42.2	94.9	0.431	0.968	44.5
MUSKEG RIVER ABOVE MUSKEG CREEK	07DA029	1995 – 2024 [2]	567	42.1	69	0.756	1.24	61
MUSKEG RIVER ABOVE STANLEY CREEK	07DA028	2003 – 2024 [2]	440	49.4	69.1	0.689	0.964	71.5
MUSKEG RIVER NEAR FORT MACKAY	07DA008	1974 – 2024	1460	39.1	78.7	1.81	3.64	49.7
MUSKEG RIVER UPLAND	07DA034	2001 – 2024 [2]	150	73.8	95.5	0.351	0.454	77.3
PONY CREEK NEAR CHARD	07CE003	1982 – 2024 [6]	279	N/A	N/A	N/A	N/A	N/A
POPLAR CREEK NEAR FORT MCMURRAY	07DA007	1972 – 2024 [4]	136	341	251	1.47	1.08	136
RED CLAY CREEK NEAR THE MOUTH	07DA042	2011 – 2024 [5]	176	67.2	107	0.375	0.594	63.1
STEEPBANK RIVER BELOW NORTH STEEPBANK RIVER	07DA044	2014 – 2024 [2]	1180	79.2	140	2.96	5.22	56.7
STEEPBANK RIVER NEAR FORT MCMURRAY	07DA006	1972 – 2024	1320	76.3	126	3.19	5.29	60.3
SUNDAY CREEK ABOVE CHRISTINA LAKE	07CE010	2012 – 2024 [2]	365	71.6	119	0.828	1.38	60
TAR RIVER ABOVE CANADIAN NATURAL RESOURCES LIMITED LAKE	07DA037	2005 – 2024 [2]	143	104	100	0.472	0.455	104
TAR RIVER NEAR THE MOUTH	07DA045	2007 – 2024 [2]	320	42.9	67.3	0.435	0.682	63.8

[1] Monitoring occurred under RAMP from 2011-2015.

[2] Monitoring occurred under RAMP prior to 2017.

[3] Monitoring occurred under RAMP from 2012 – 2016.

[4] Monitoring occurred under RAMP from 1996 – 2016.

[5] Monitoring occurred under RAMP prior to 2017. ECCC operation started in May 2018.

[6] Seasonally operated

Table B2: Level Stations

STATION	STATION ID	RECORD	DATUM	2024 MEAN LEVEL [m]	HISTORICAL MEAN ANNUAL LEVEL [m]	DIFFERENCE [m]
GREGOIRE LAKE NEAR FORT MCMURRAY	07CE001	1969 – 2024 [3]	Geodetic Survey of Canada	N/A	N/A	N/A
KEARL LAKE AT CANTERRA ROAD [1]	07DA024	2017 - 2024	Assumed [4]	99.297	99.436	-0.139
MCCLELLAND LAKE AT EAST END	07DA023	1997 – 2024 [2]	Assumed [4]	N/A	294.593	N/A
NAMUR LAKE NEAR THE OUTLET	07DA025	2012 – 2024 [2]	Assumed [4]	N/A	97.853	N/A

[1] Water level data collected prior to October 21, 2017 at hydrometric station KEARL LAKE AT CANTERRA ROAD is not included in this assessment due to a shift in the assumed datum used for monitoring.

[2] Monitoring occurred under RAMP prior to 2017.

[3] Seasonally operated

[4] Conversion to CGVD 2013 Datum available on Wateroffice.

Appendix C:
Annual Hydrographs – All Hydrometric Stations

The following figures show the annual hydrographs for all active stations within the oil sands area in 2024. Each hydrograph includes the measured discharge/level for 2024, the maximum and minimum discharge/level on record for each station, and the interquartile range of flow/level (between the 25th and 75th percentiles) based on daily mean measurements over the entire period of record. Note that percentiles are not shown when the period of record does not include at least 5 years of data for a given day. As noted in Appendix B, the statistical record used includes monitoring that occurred under the Regional Aquatics Monitoring Program (RAMP). Data included from RAMP has not been verified by WSC.

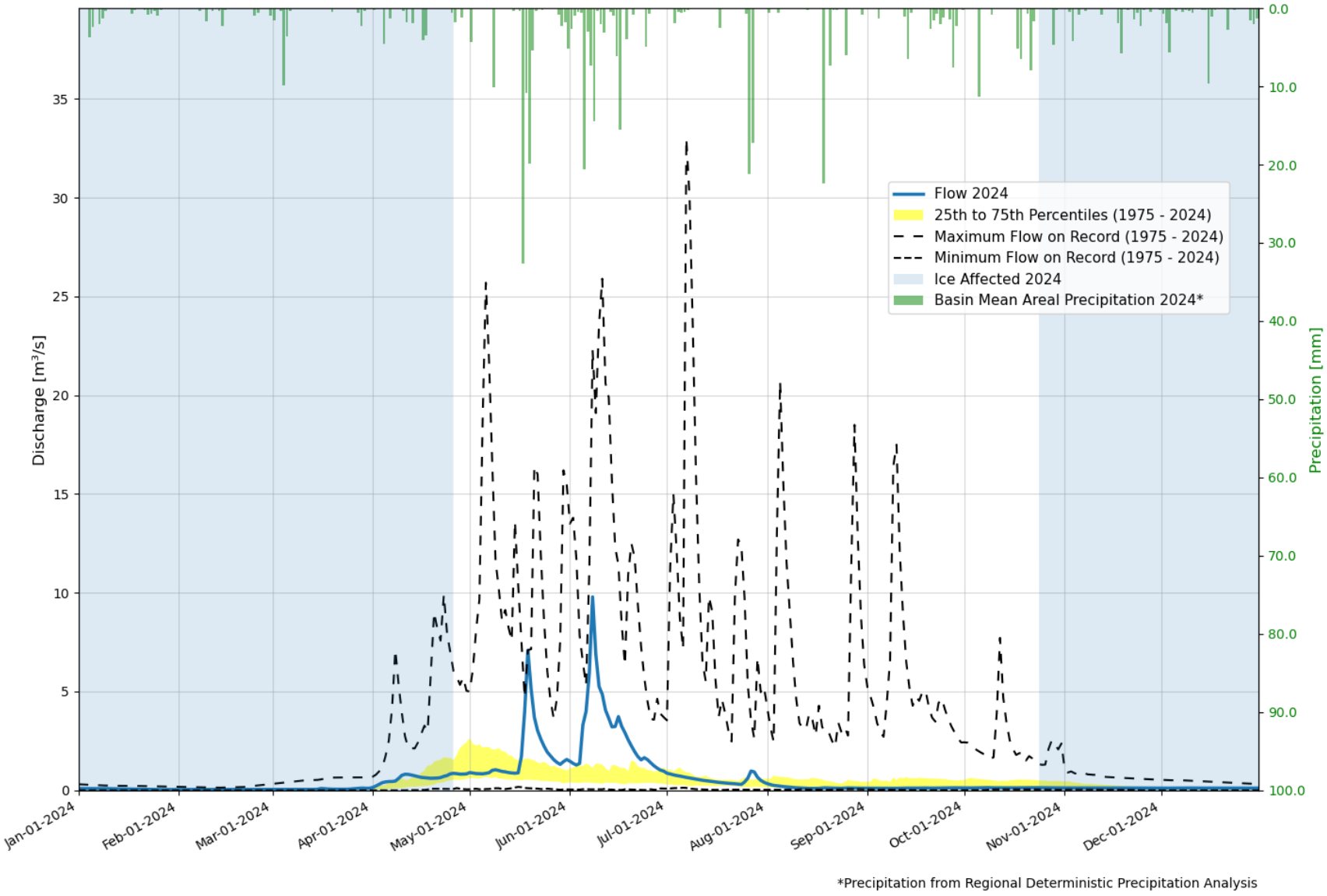

Figure C1: Beaver River above Syncrude (07DA018)

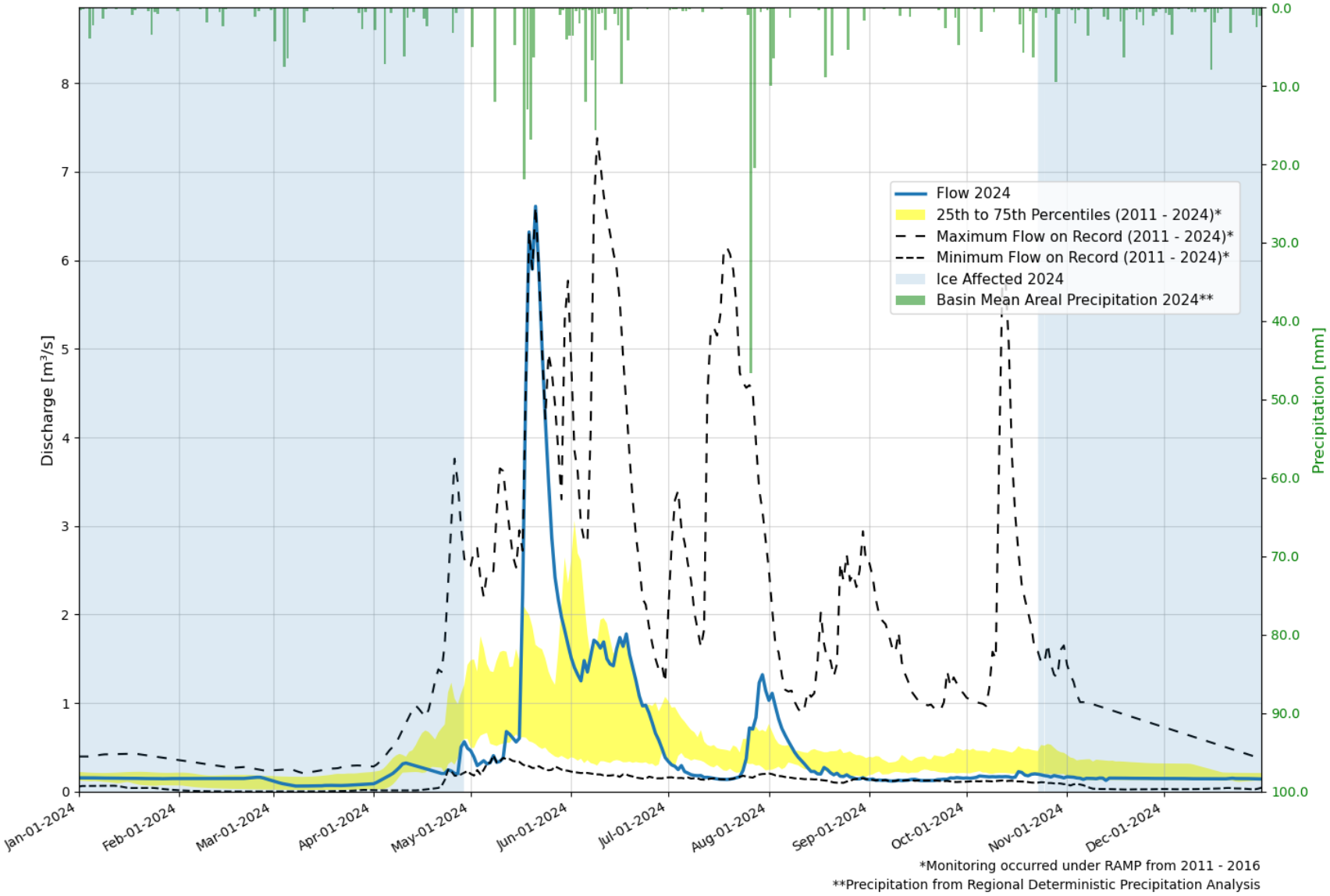

Figure C2: Big Creek near the Mouth (07DA040)

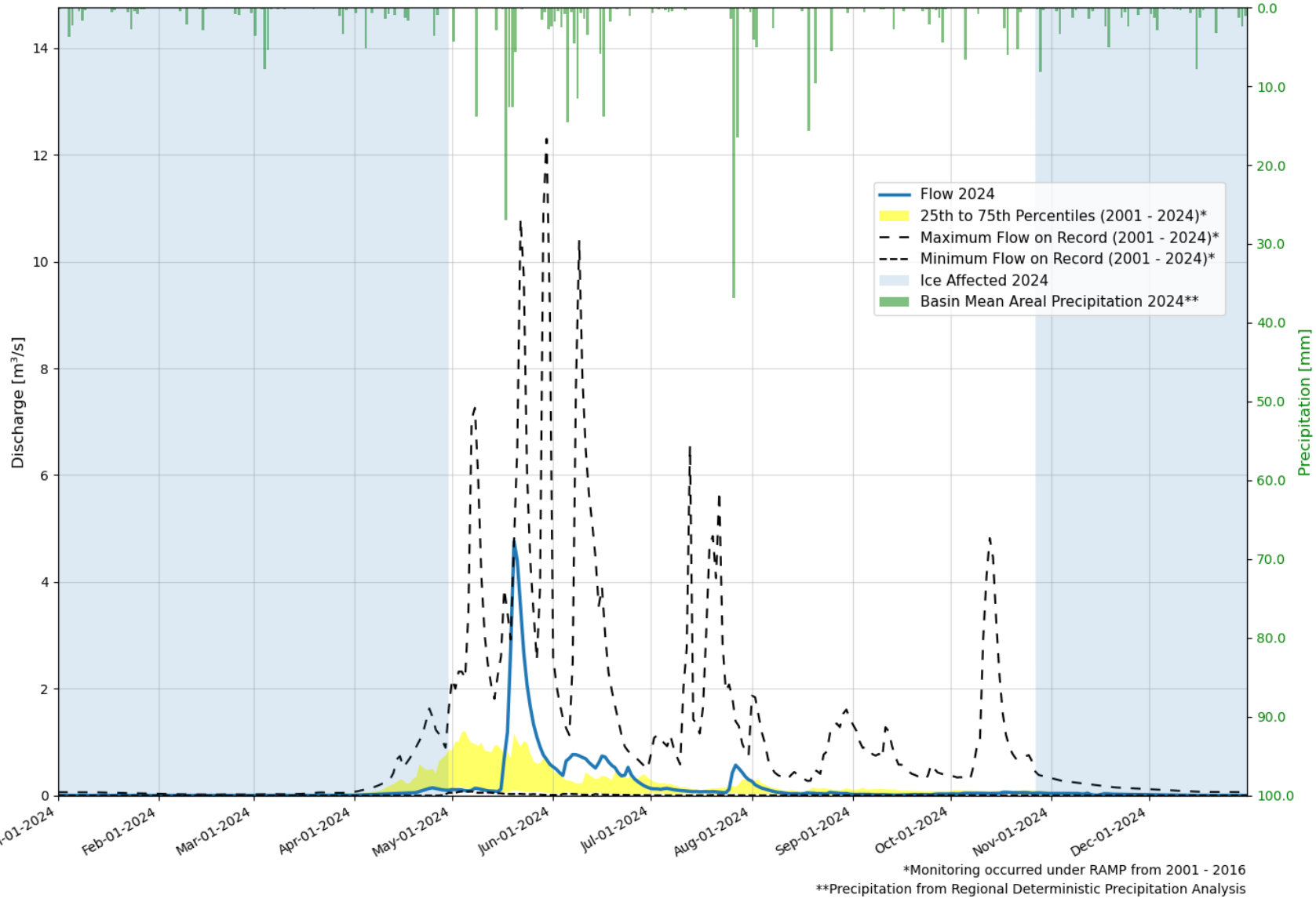

Figure C3: Calumet River near the Mouth (07DA033)

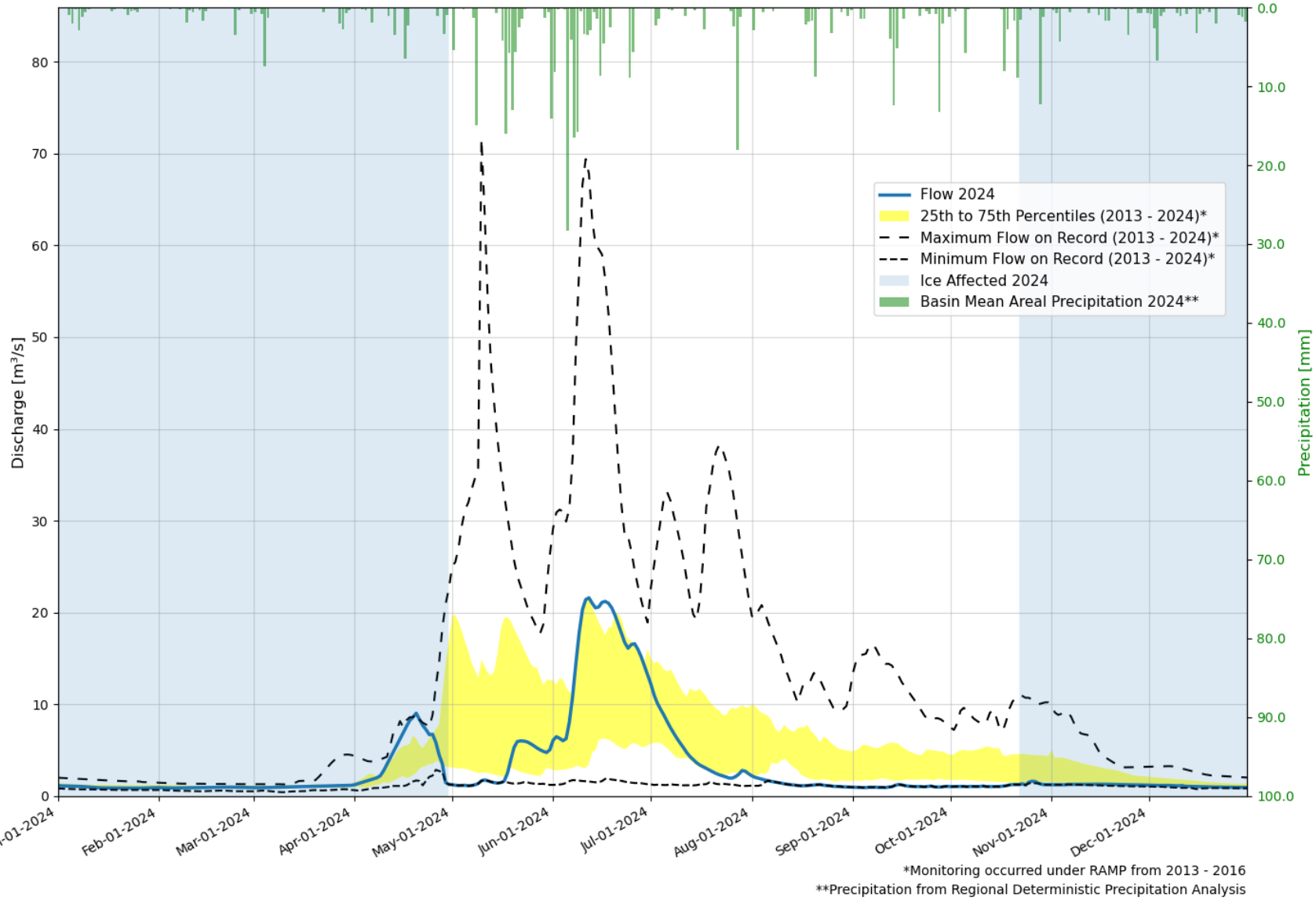

Figure C4: Christina River above Statoil Leismer (07CE013)

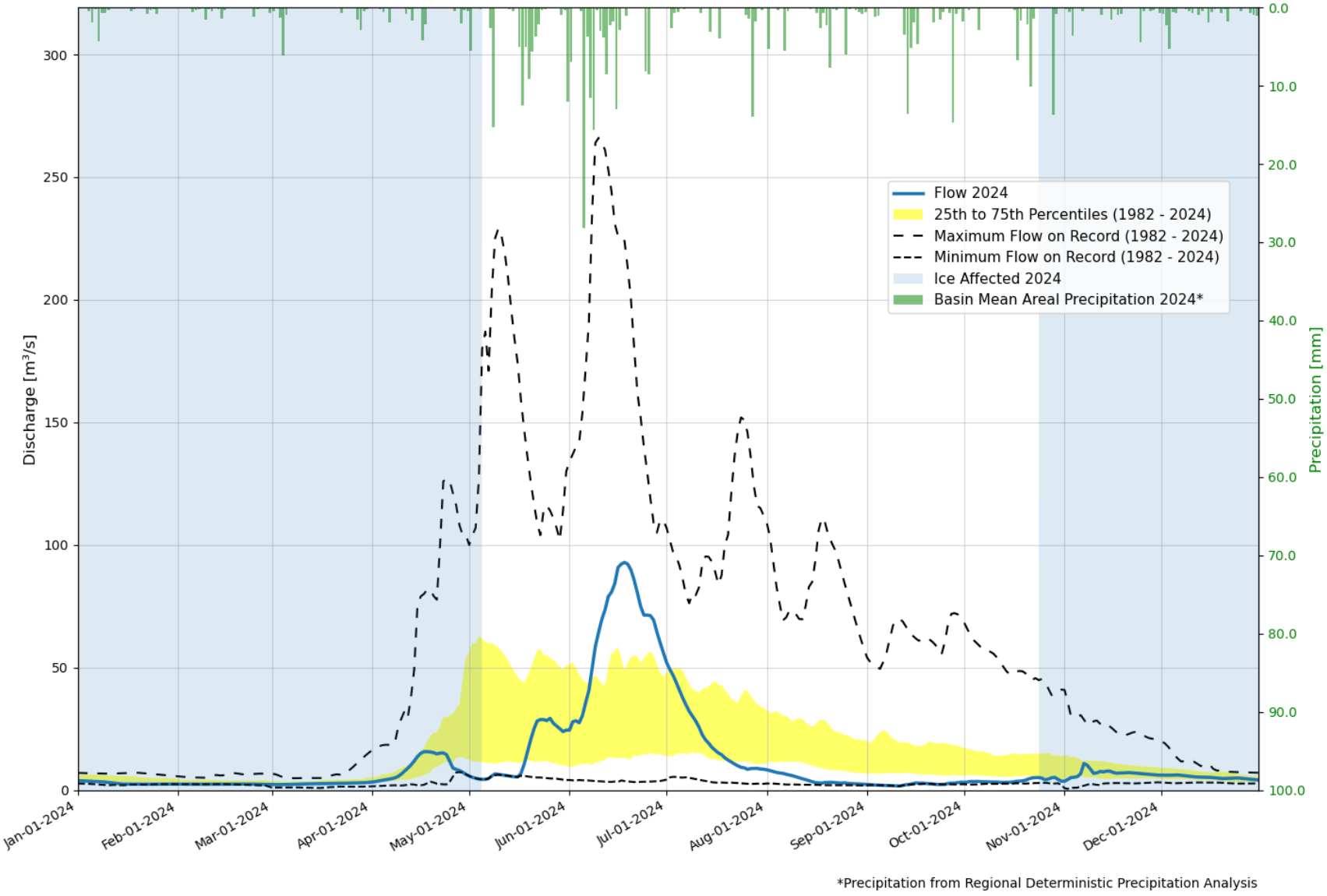

Figure C5: Christina River near Chard (07CE002)

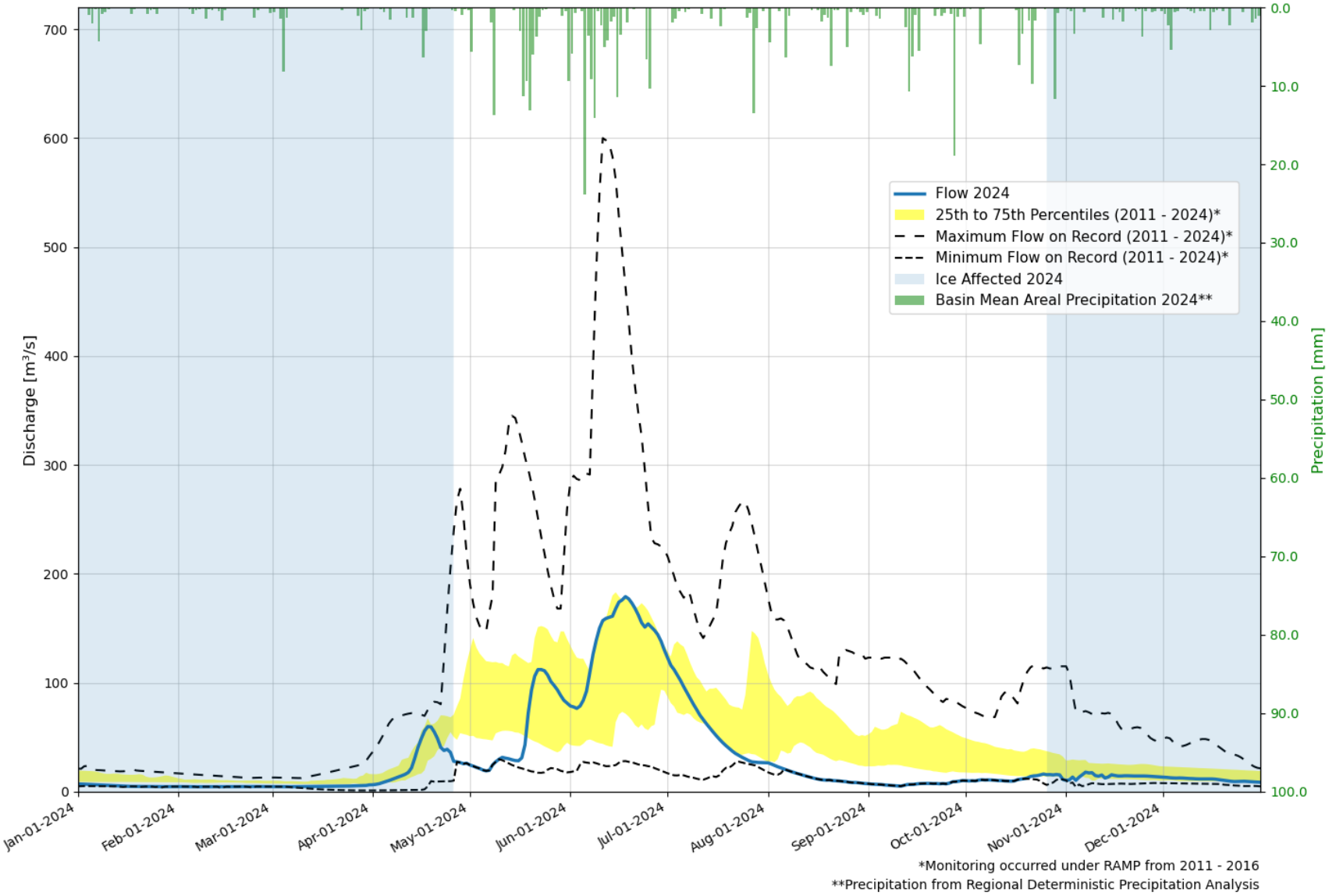

Figure C6: Christina River near the Mouth (07CE007)

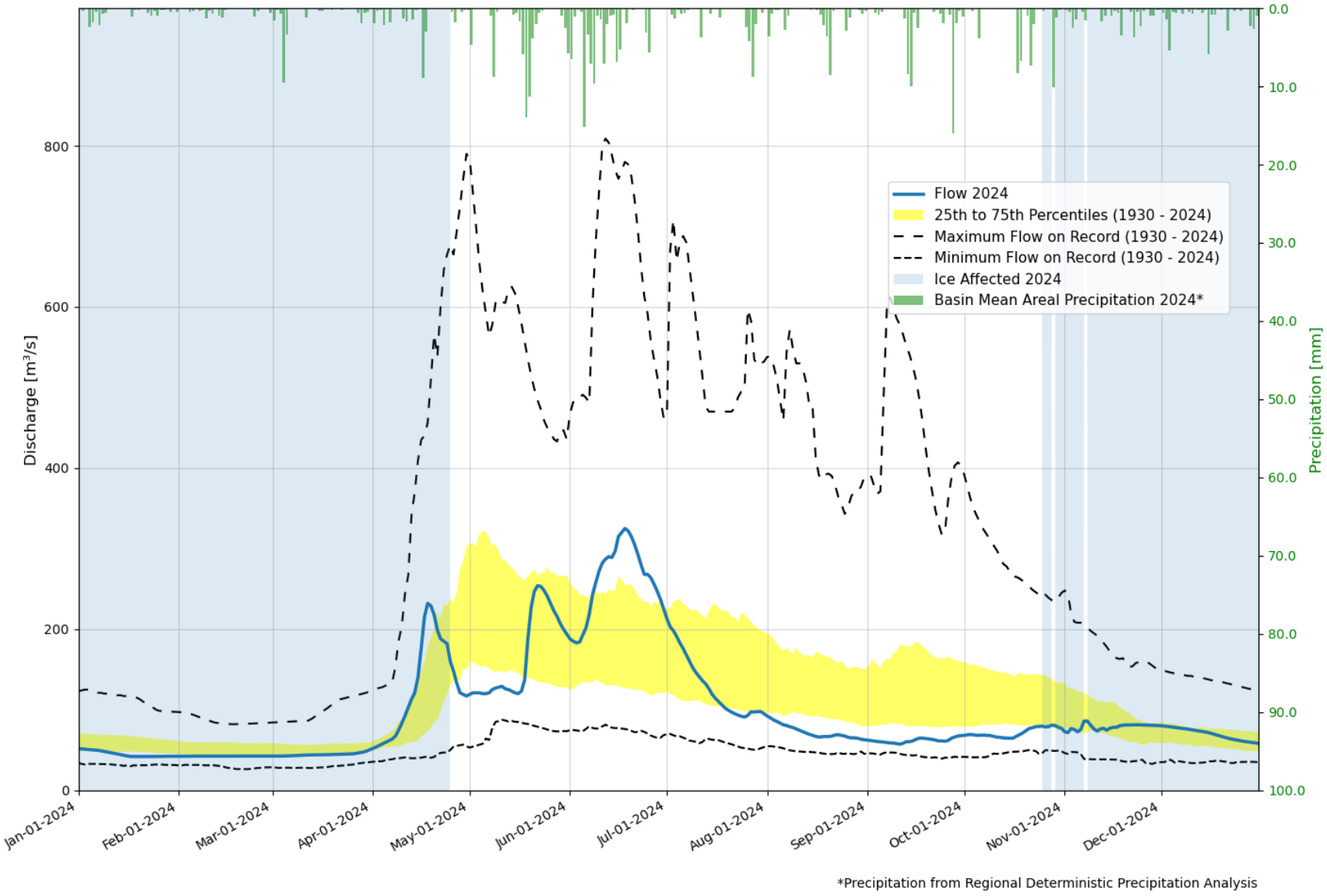

Figure C7: Clearwater River at Draper (07CD001)

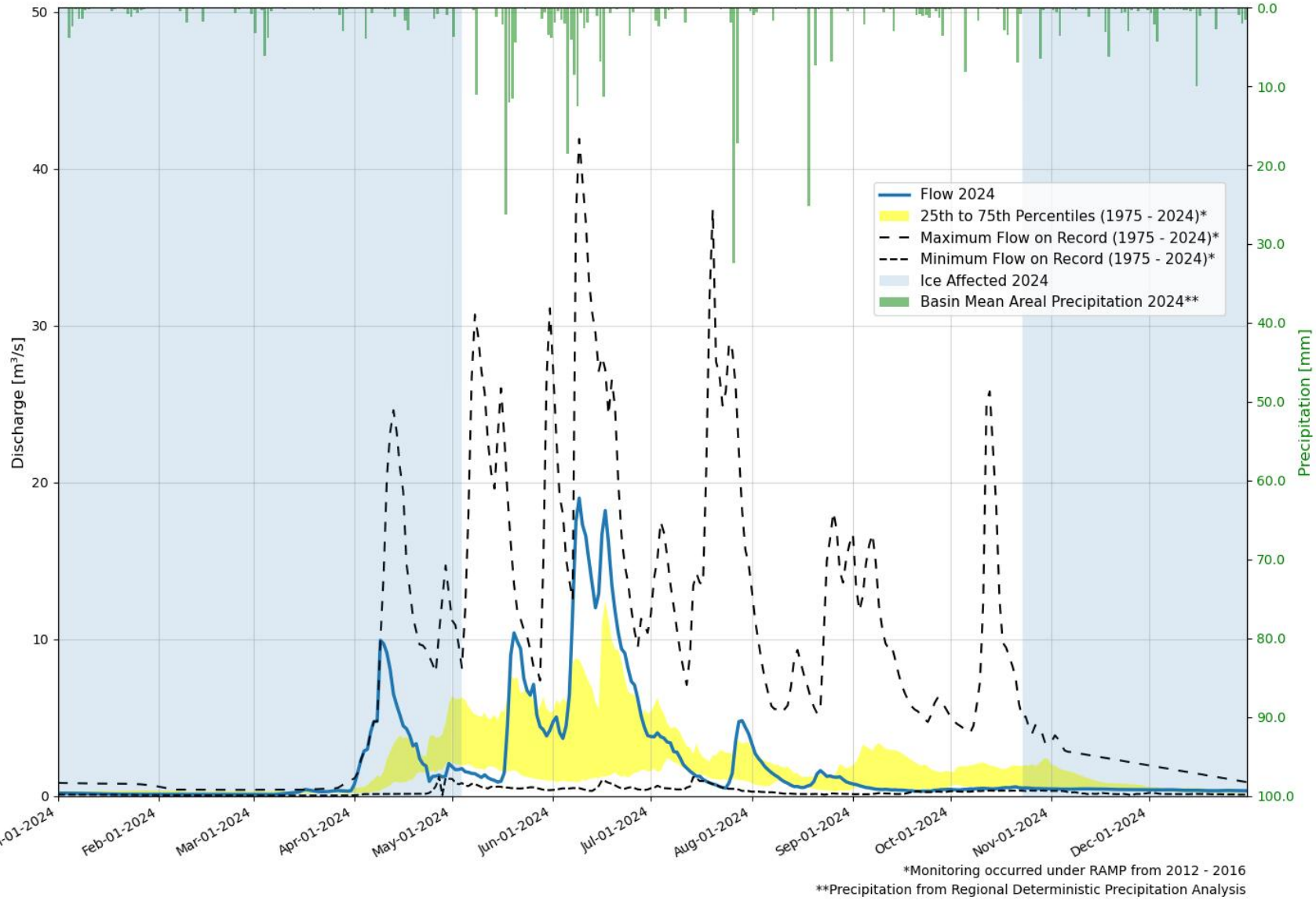

Figure C8: Dover River near the Mouth (07DB002)

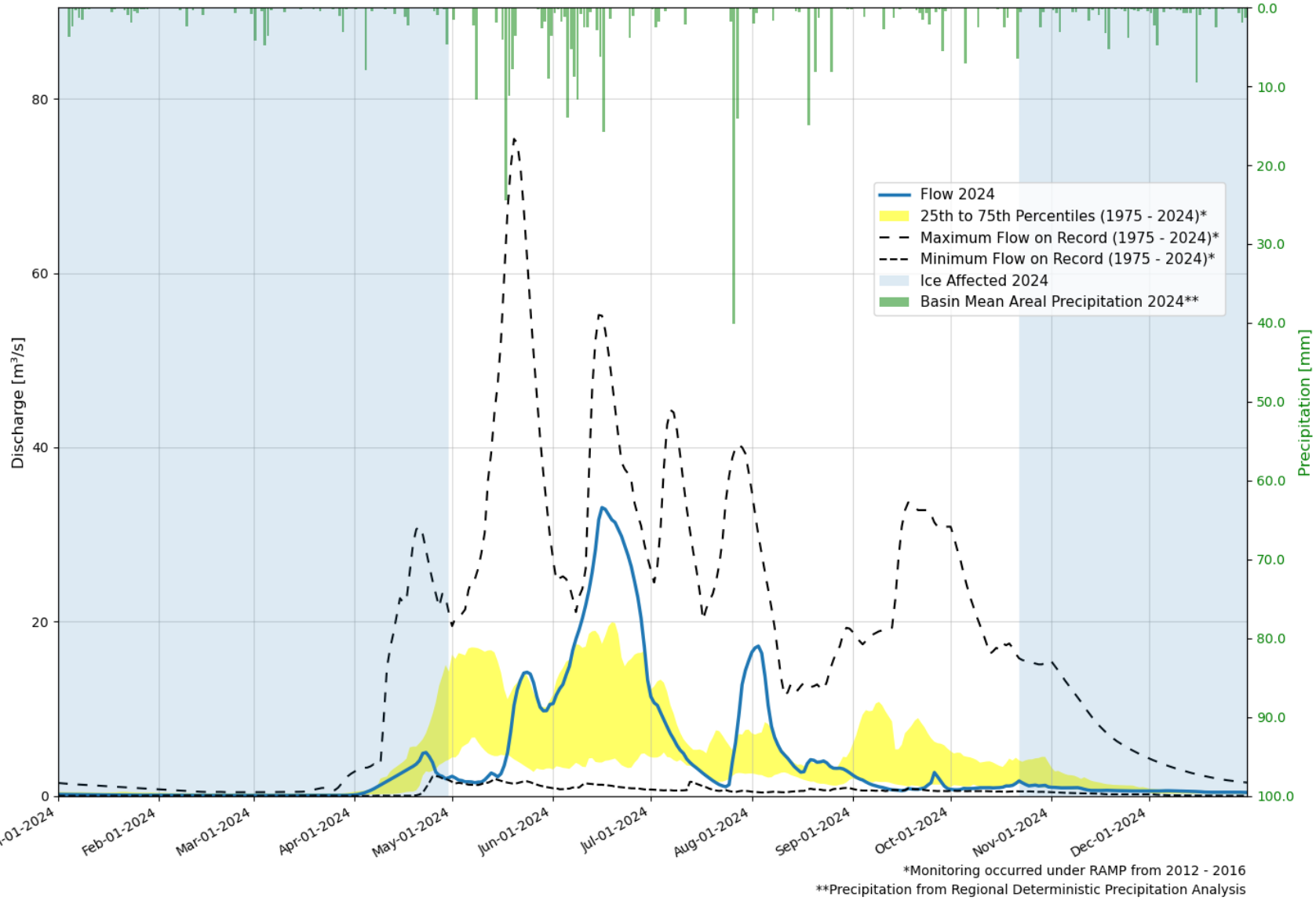

Figure C9: Dunkirk River near Fort Mackay (07DB003)

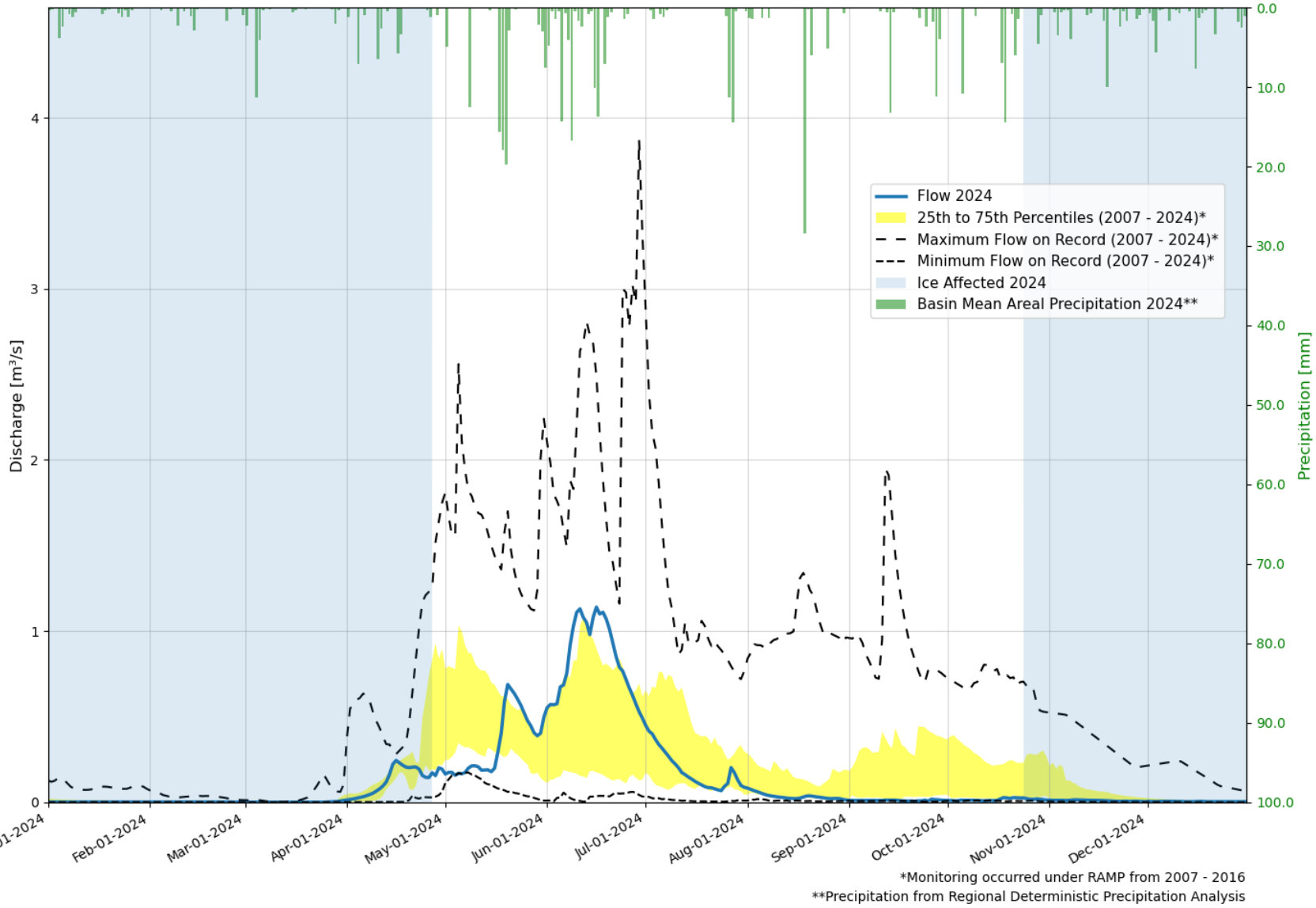

Figure C10: East Jackpine Creek near the 1300 Ft Contour (07DA038)

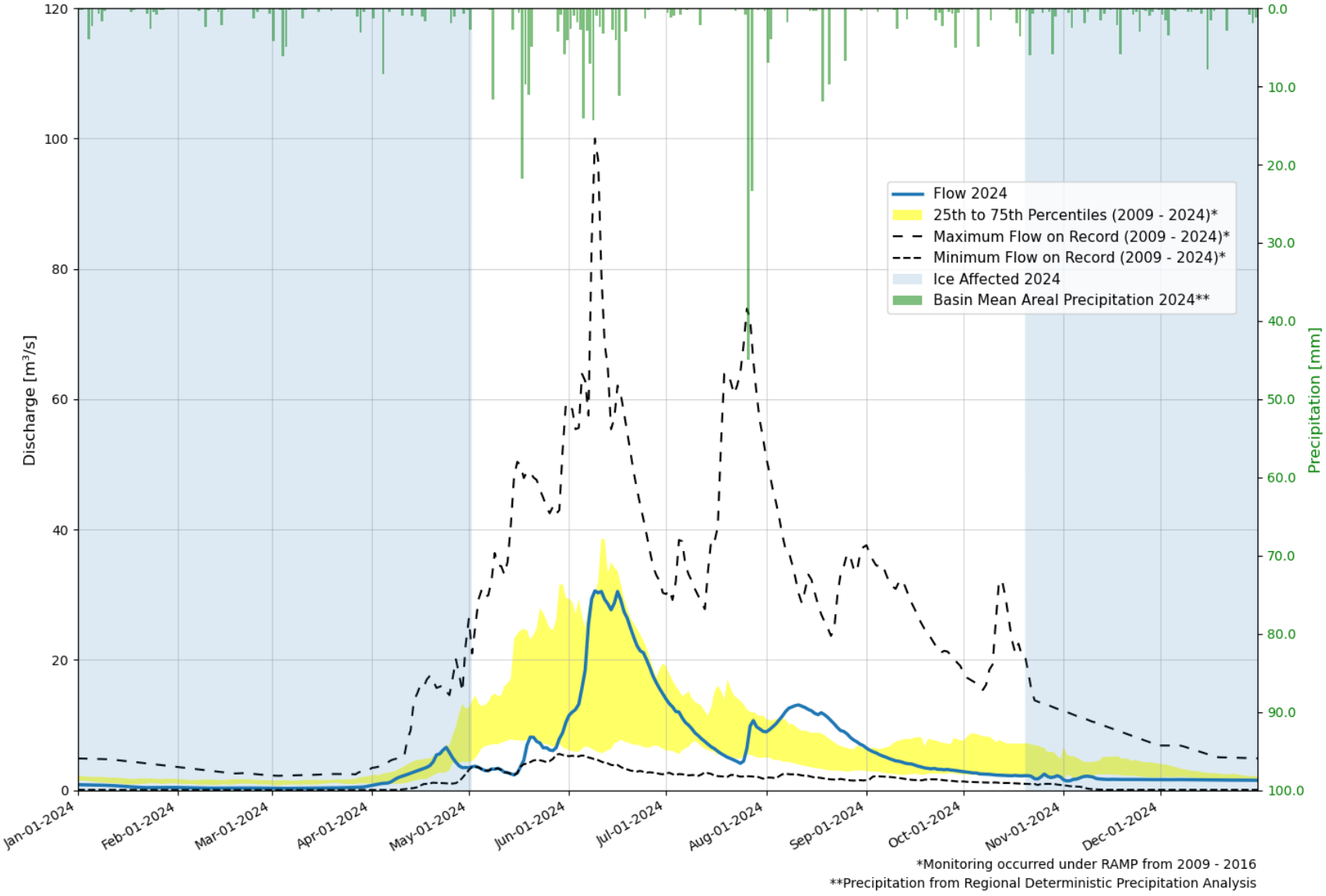

Figure C11: Ells River above Joslyn Creek Diversion (07DA039)

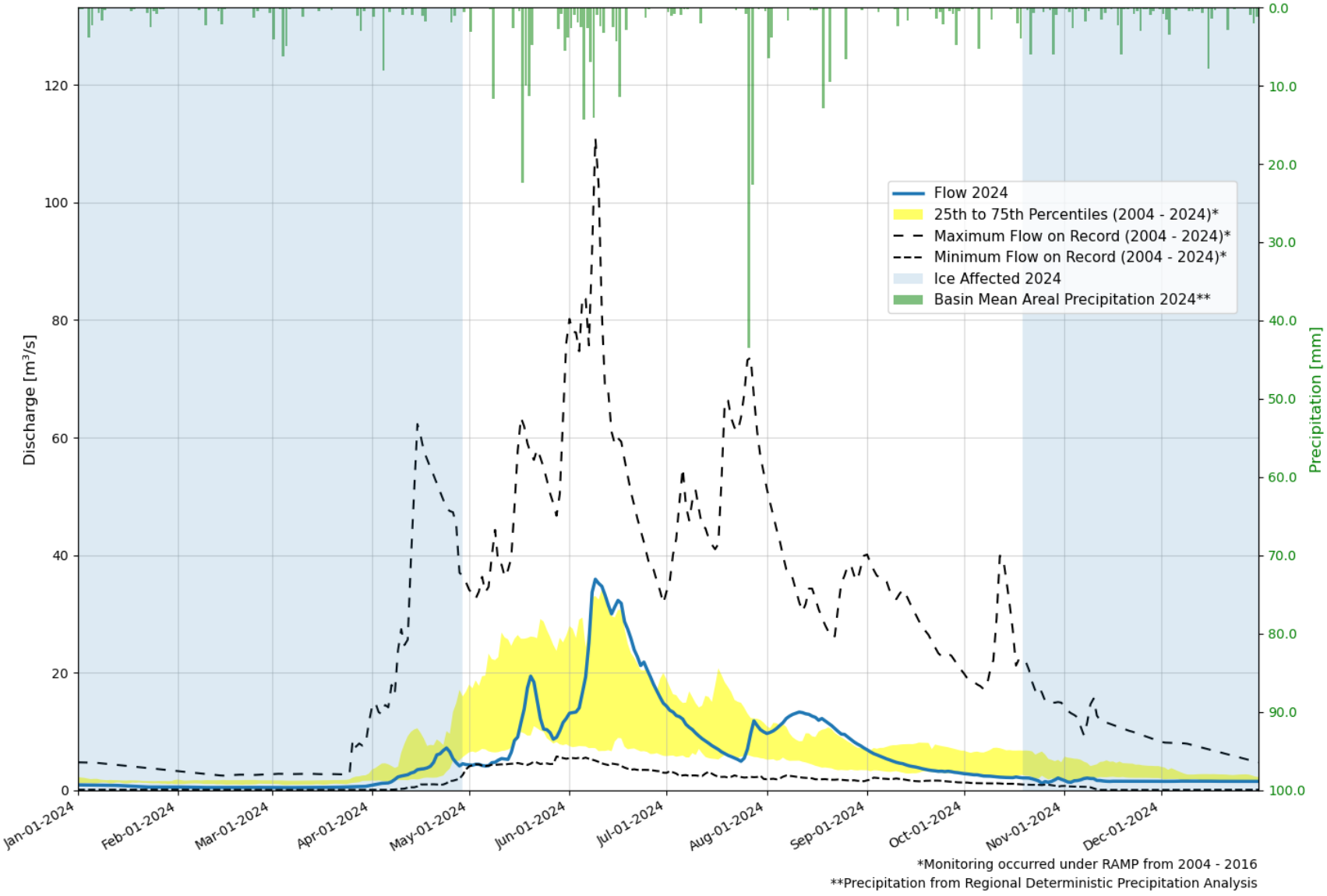

Figure C12: Ells River at Canadian Natural Resources Limited Bridge (07DA032)

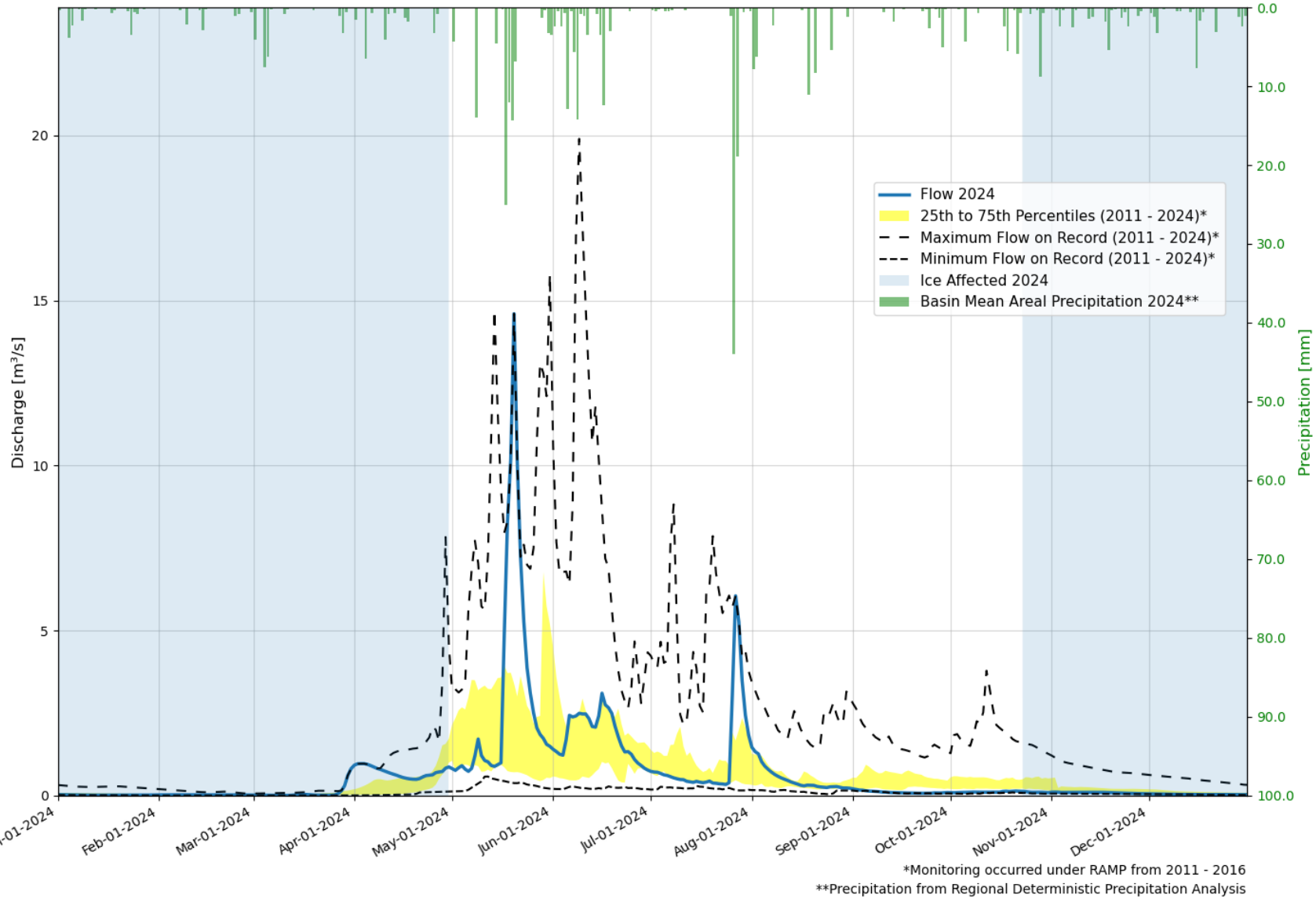

Figure C13: Eymundson Creek near the Mouth (07DA041)

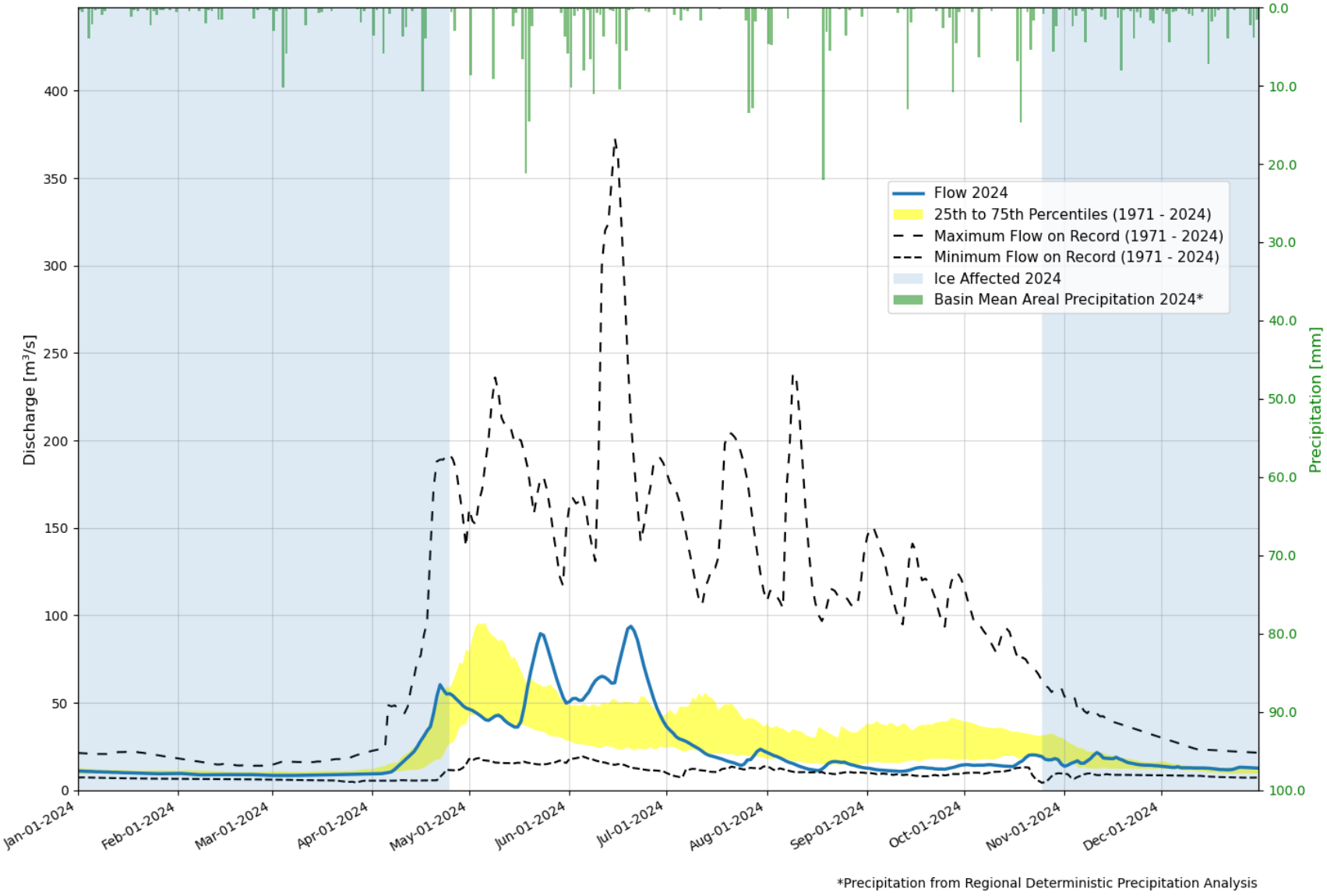

Figure C14: Firebag River near the Mouth (07DC001)

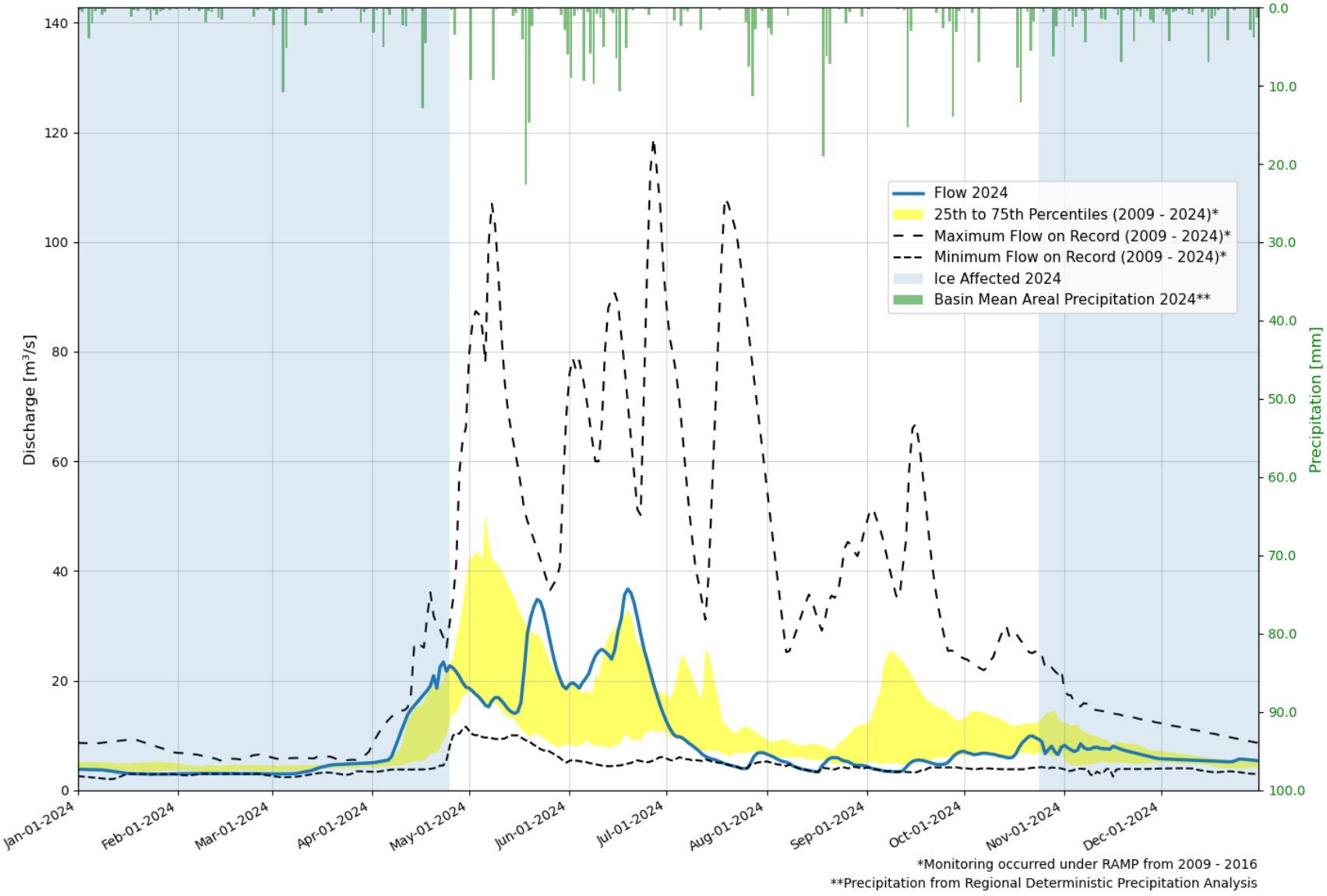

Figure C15: Firebag River upstream of Suncor Firebag (07DC003)

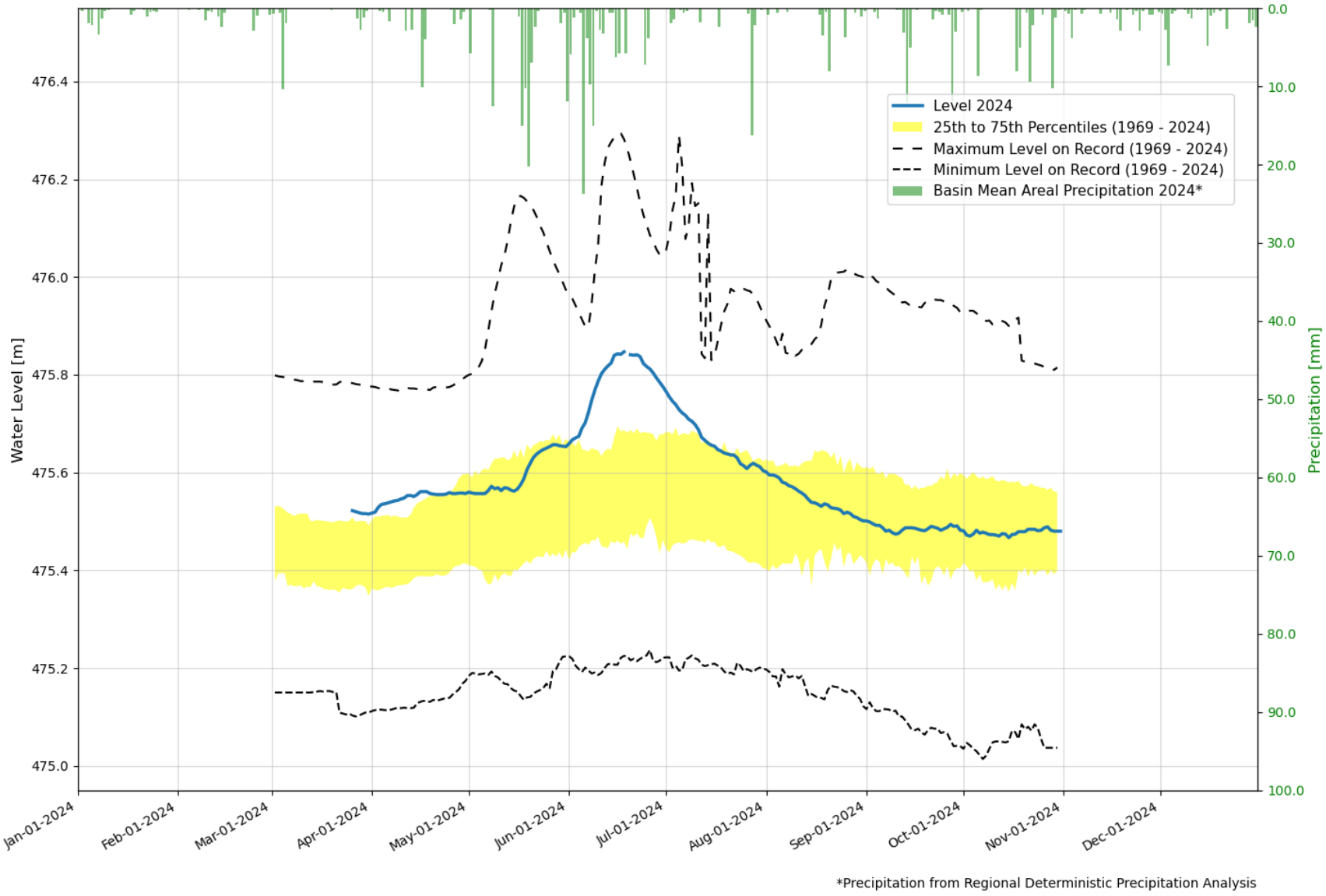

Figure C16: Gregoire Lake near Fort Mcmurray (07CE001)

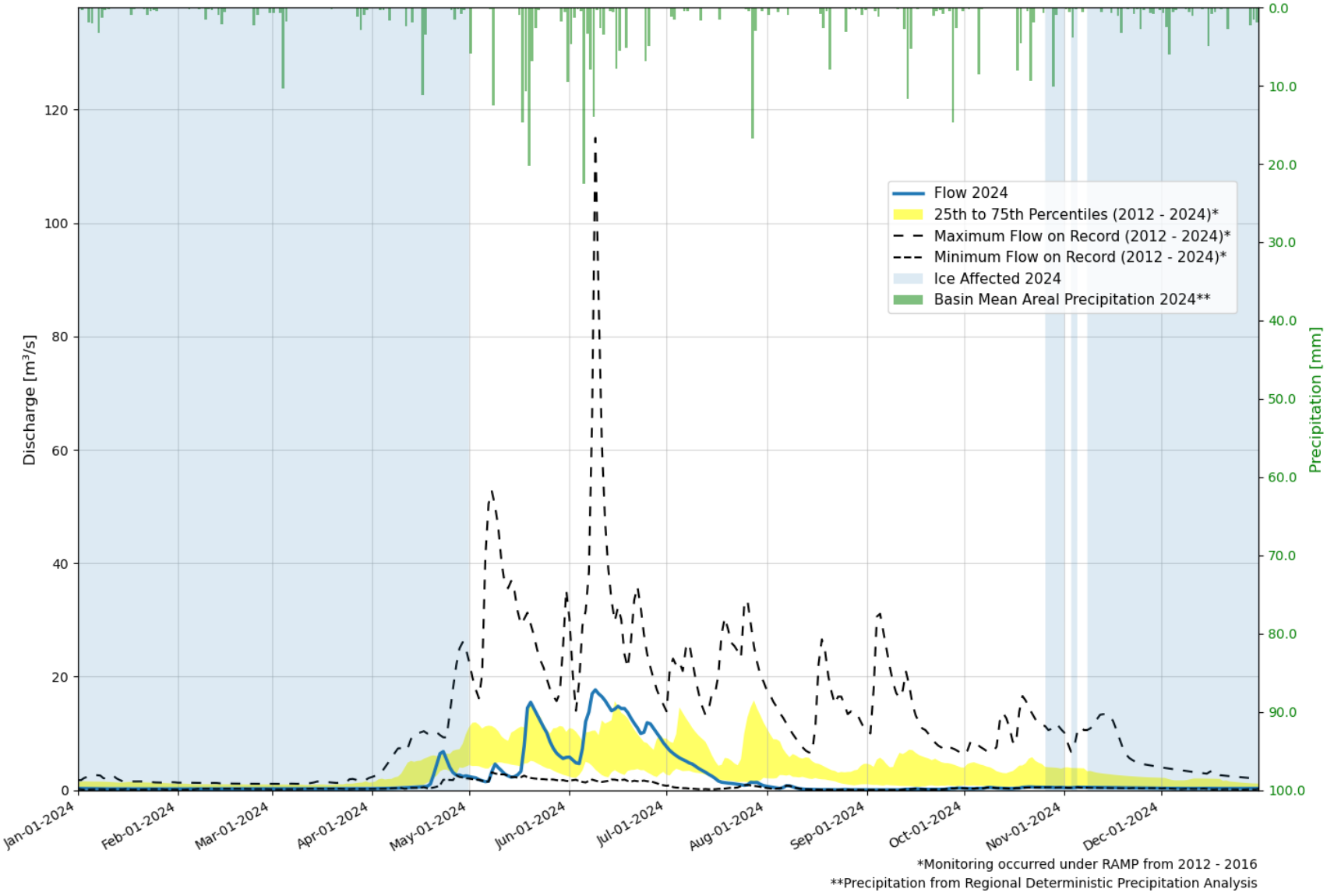

Figure C17: Gregoire River near the Mouth (07CE008)

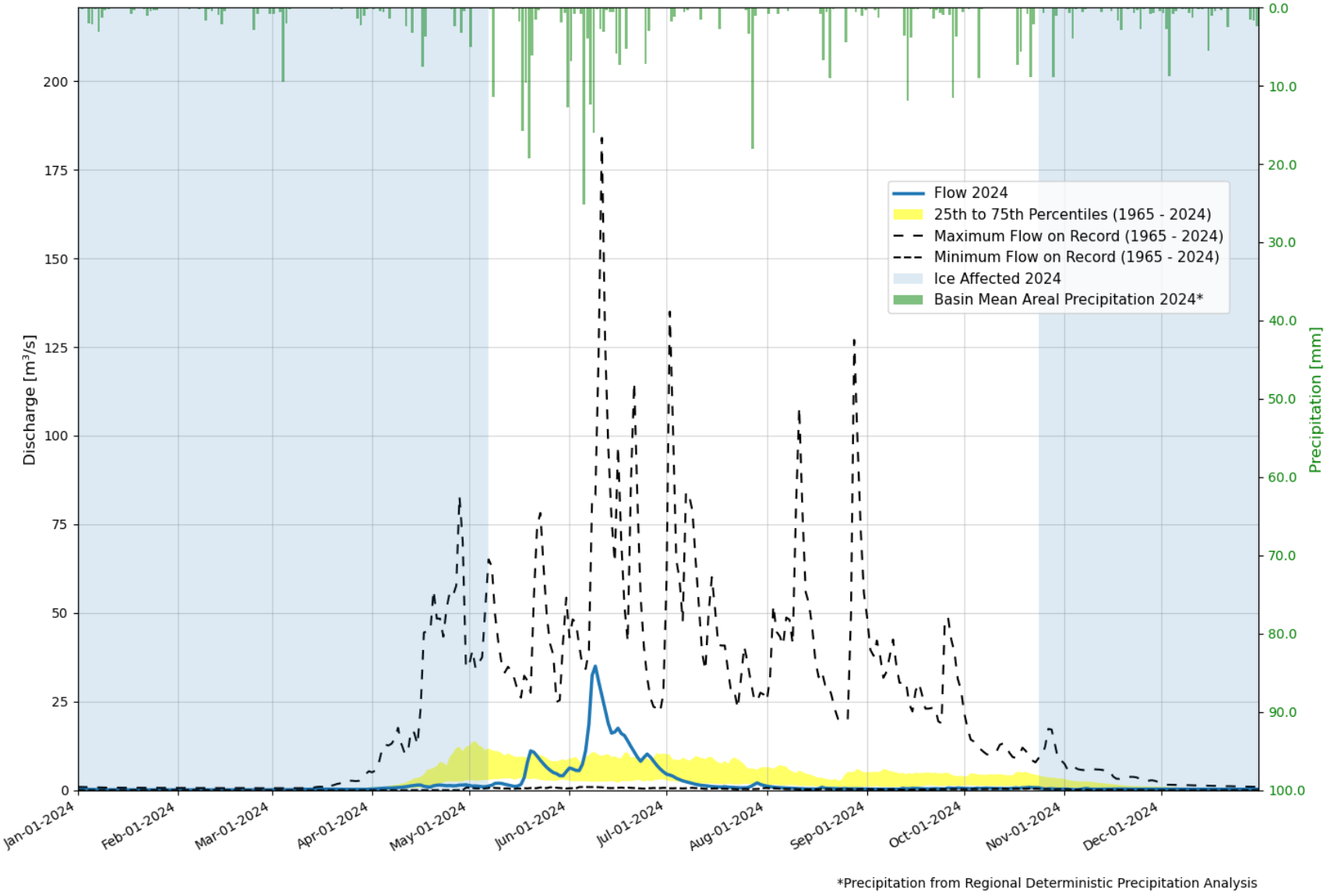

Figure C18: Hangingstone River at Fort Mcmurray (07CD004)

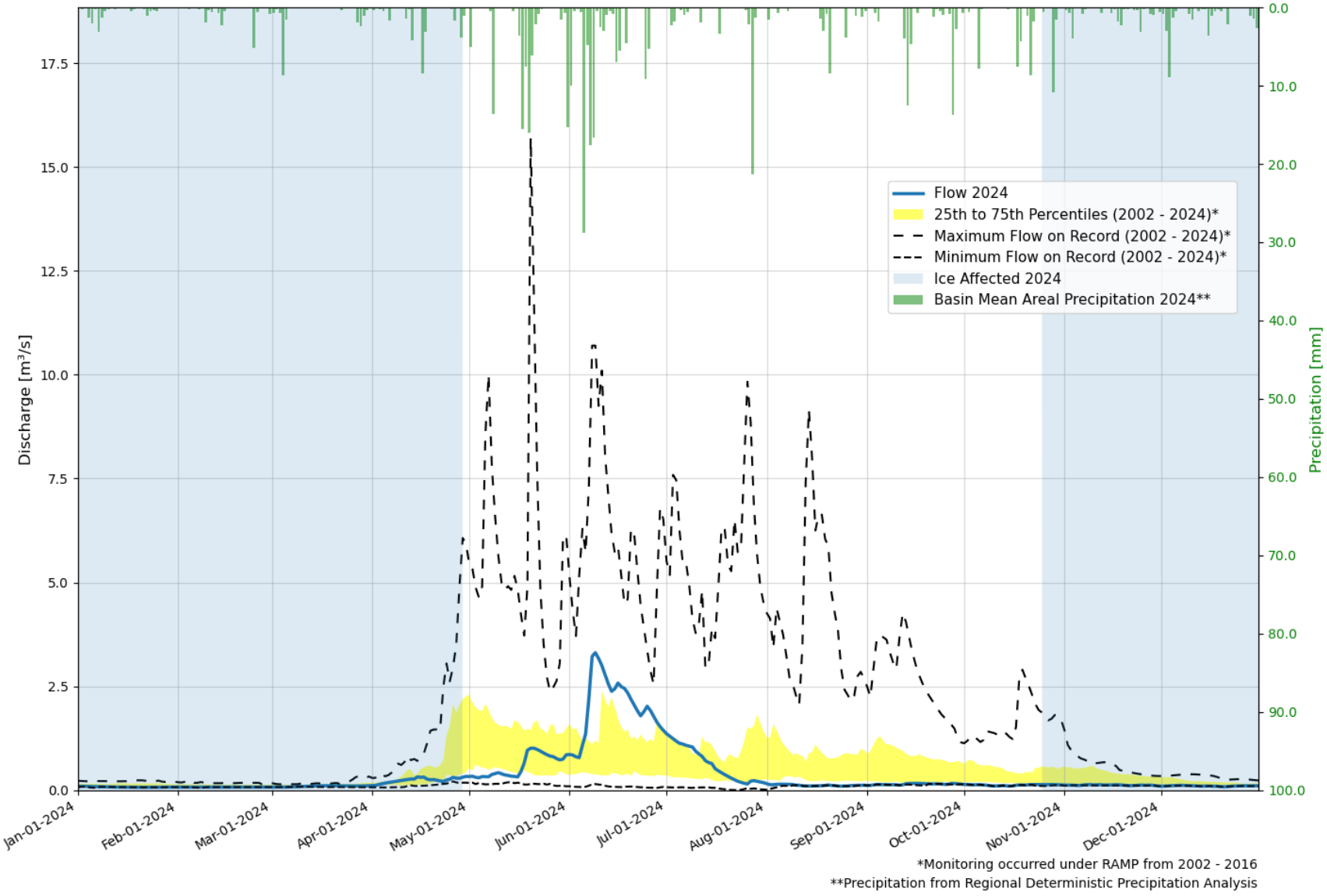

Figure C19: Hangingstone River at North Star Road (07CD008)

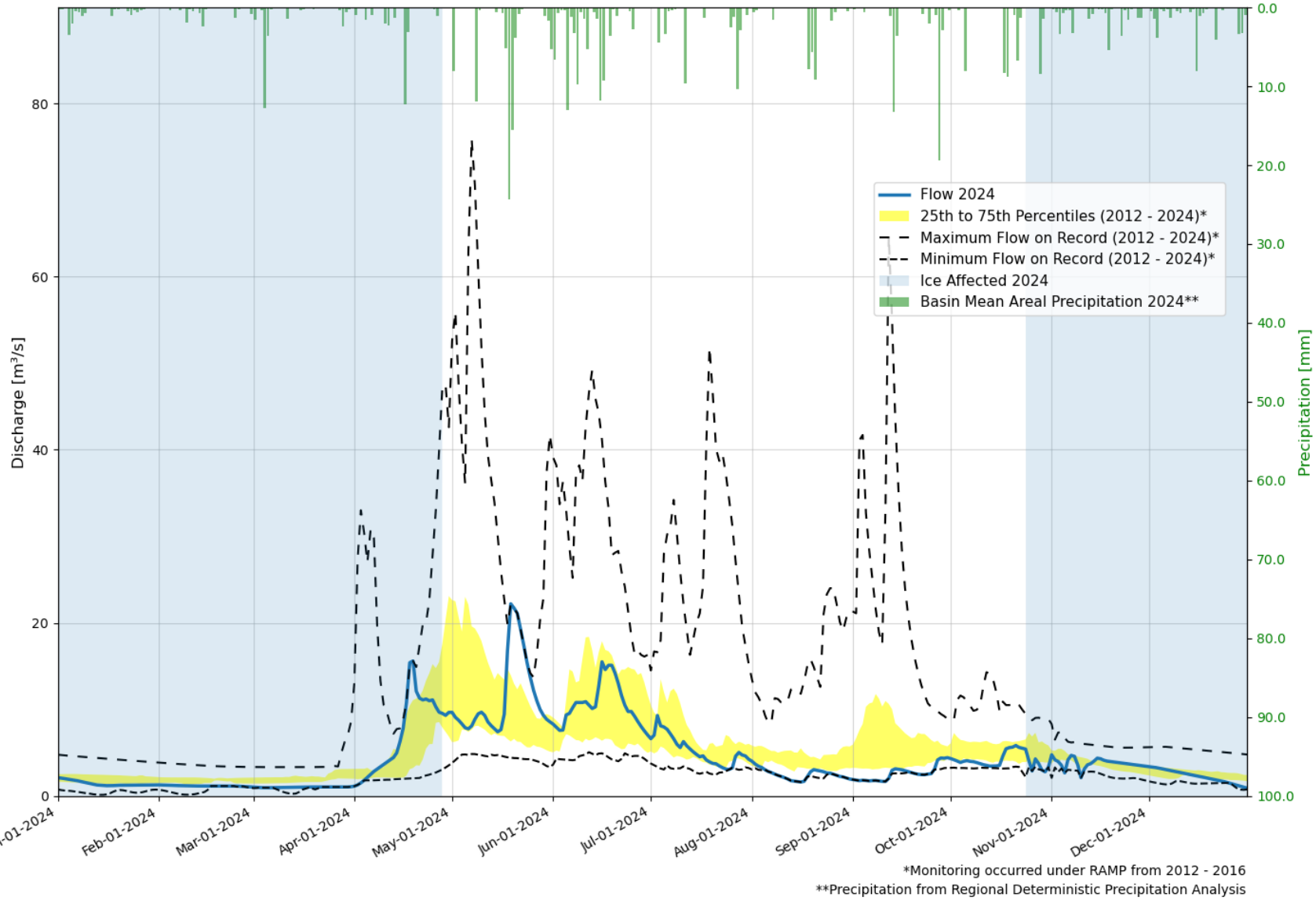

Figure C20: High Hill River near the Mouth (07CD009)

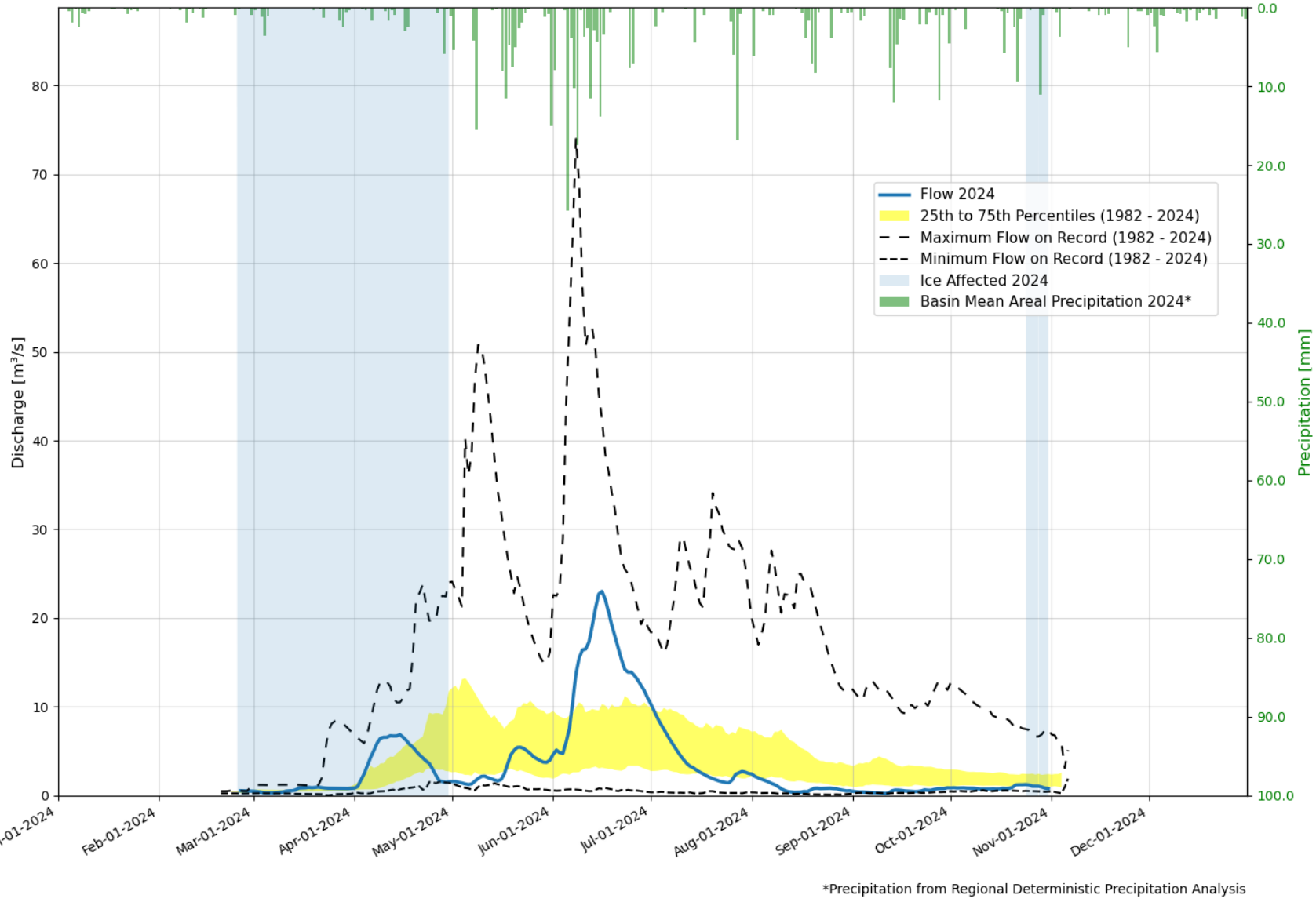

Figure C21: House River at Highway No. 63 (07CB002)

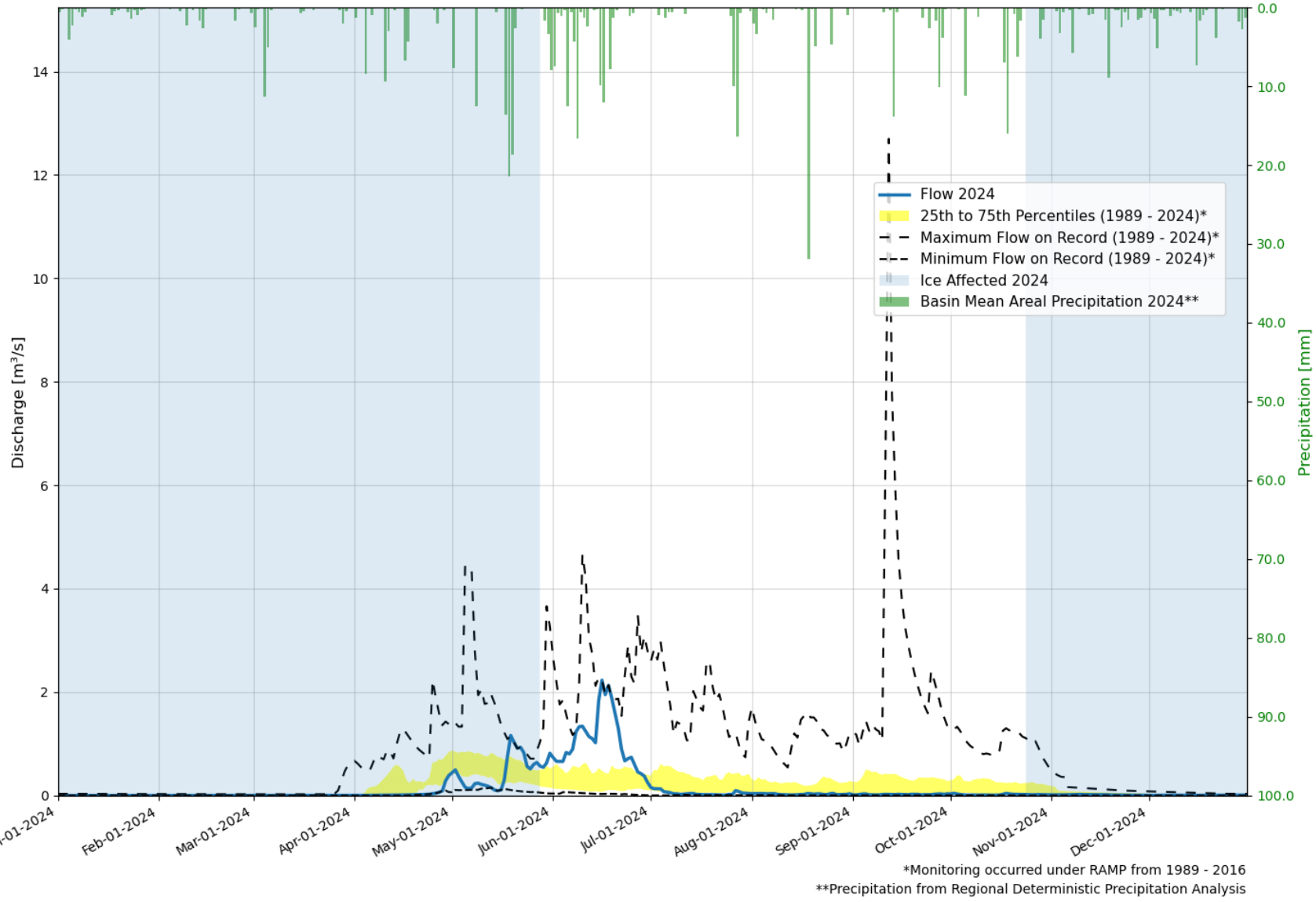

Figure C22: Iyinimin Creek above Kearl Lake (07DA027)

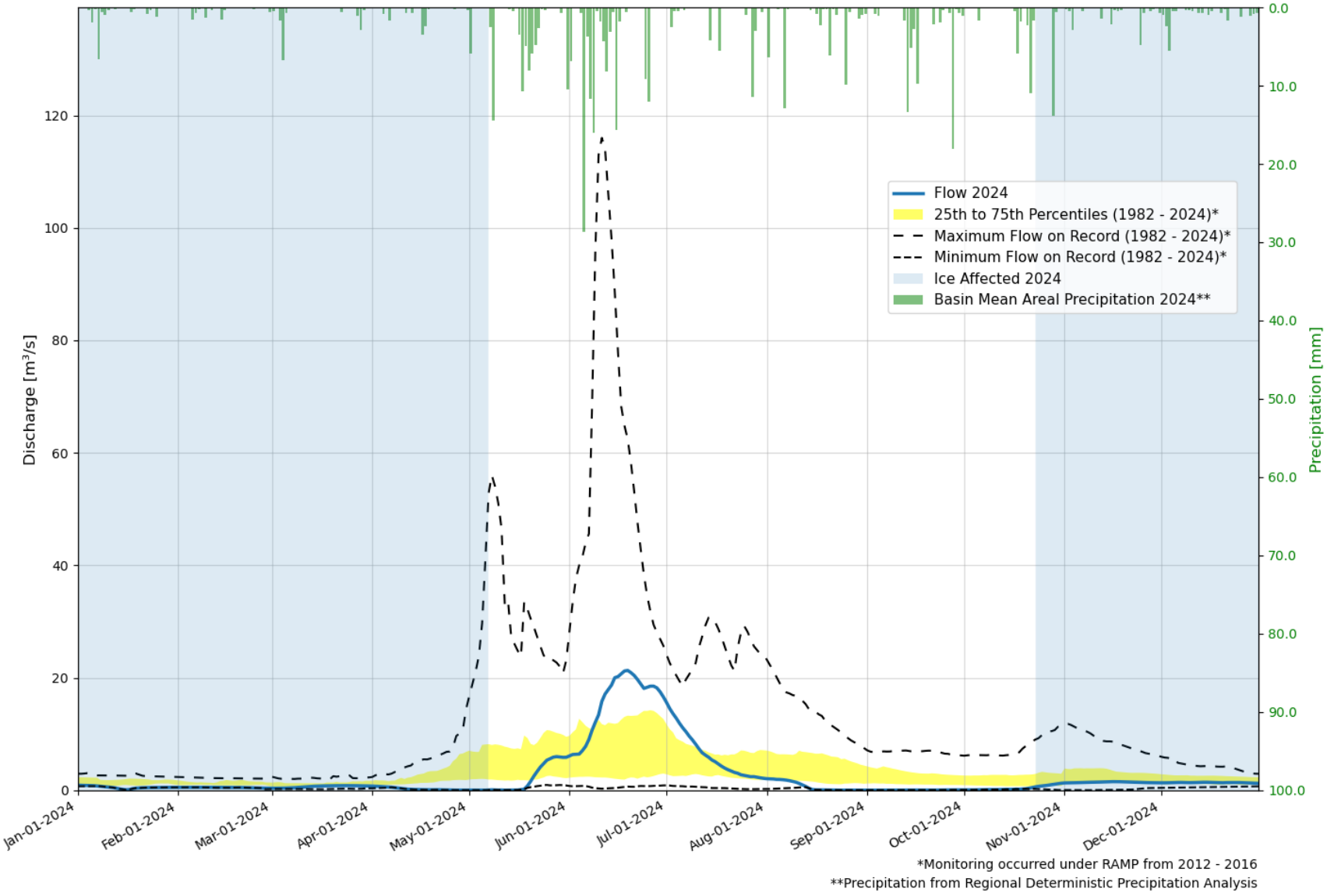

Figure C23: Jackfish River below Christina Lake (07CE005)

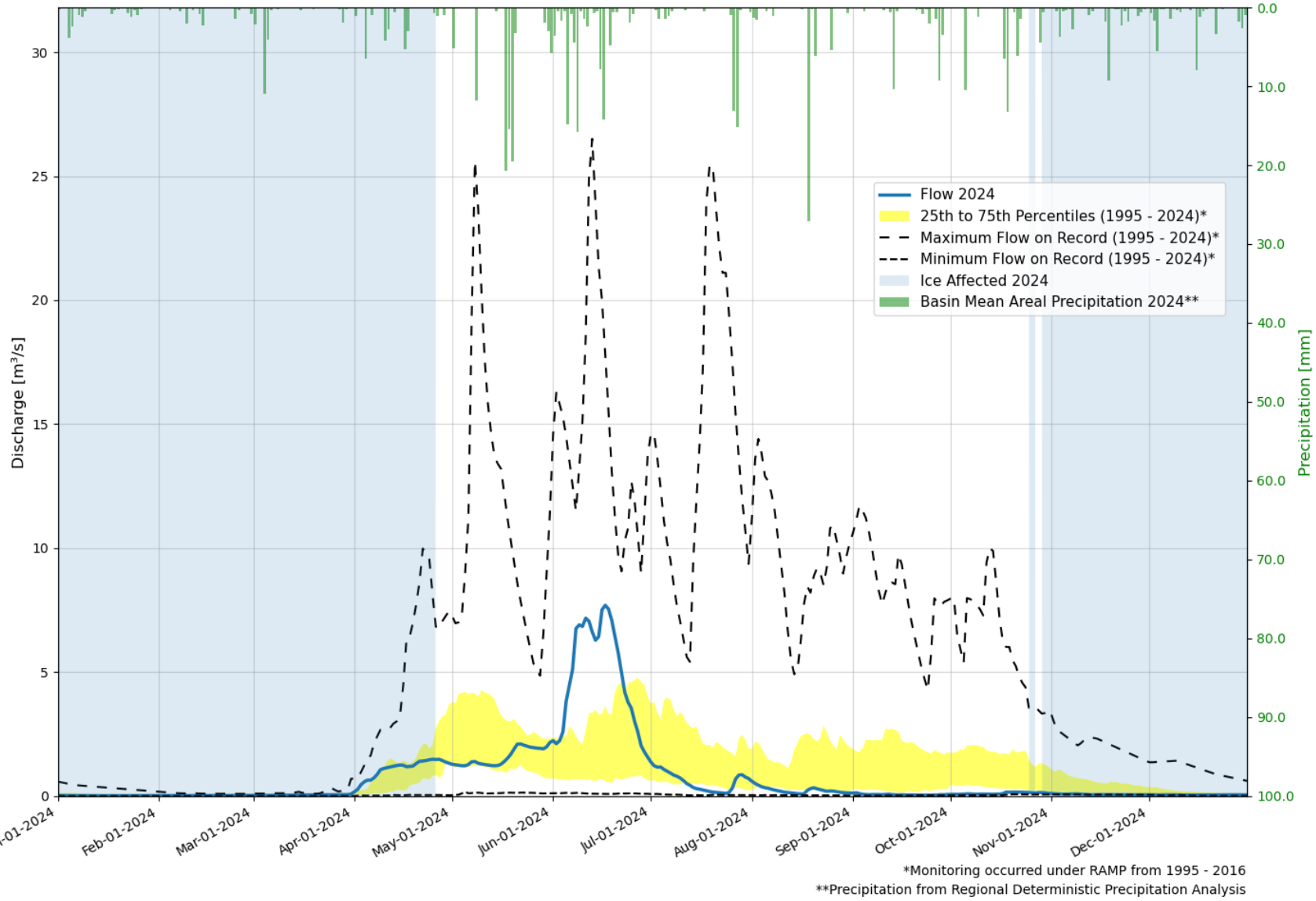

Figure C24: Jackpine Creek at Canterra Road (07DA026)

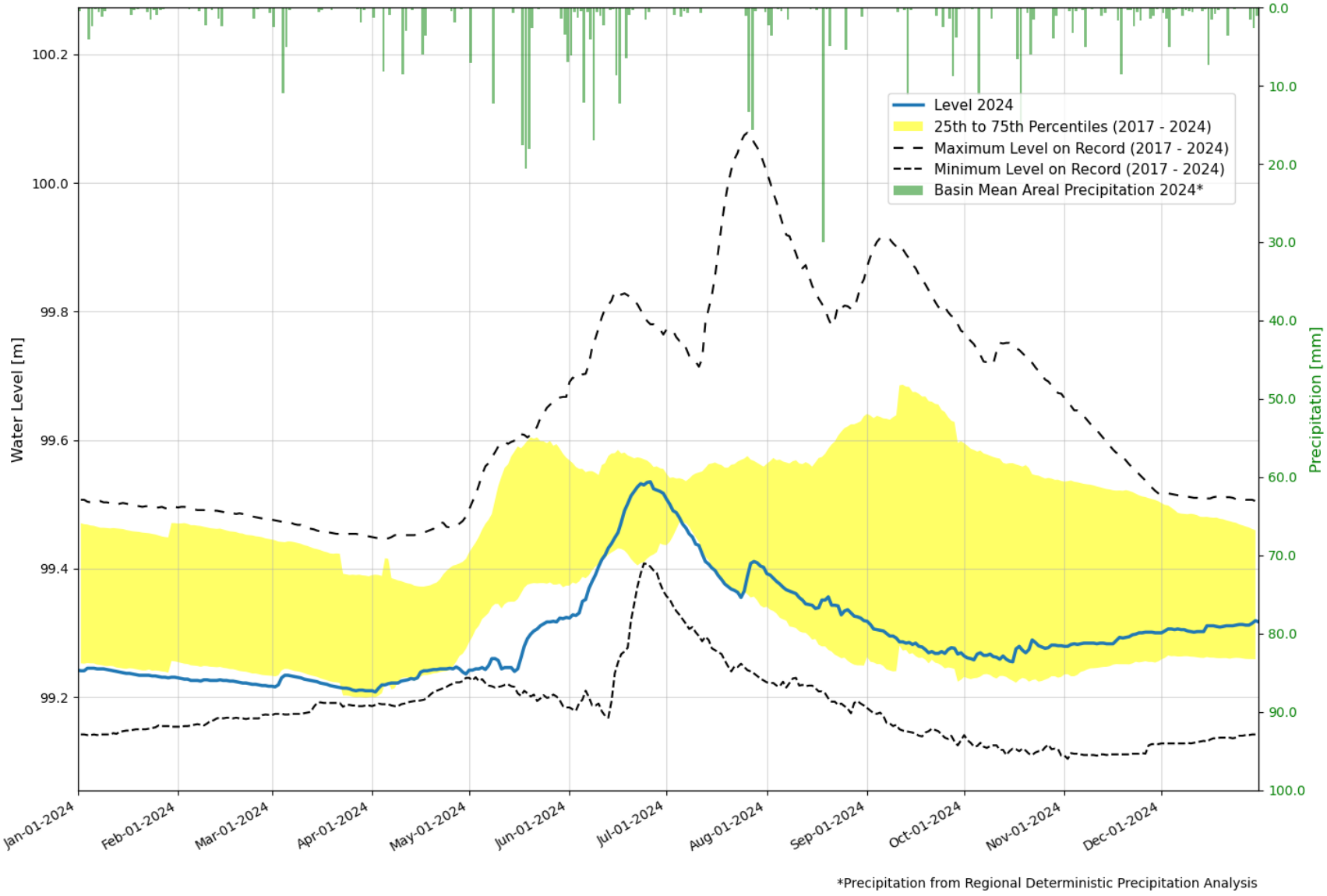

Figure C25: Kearl Lake at Canterra Road (07DA024)

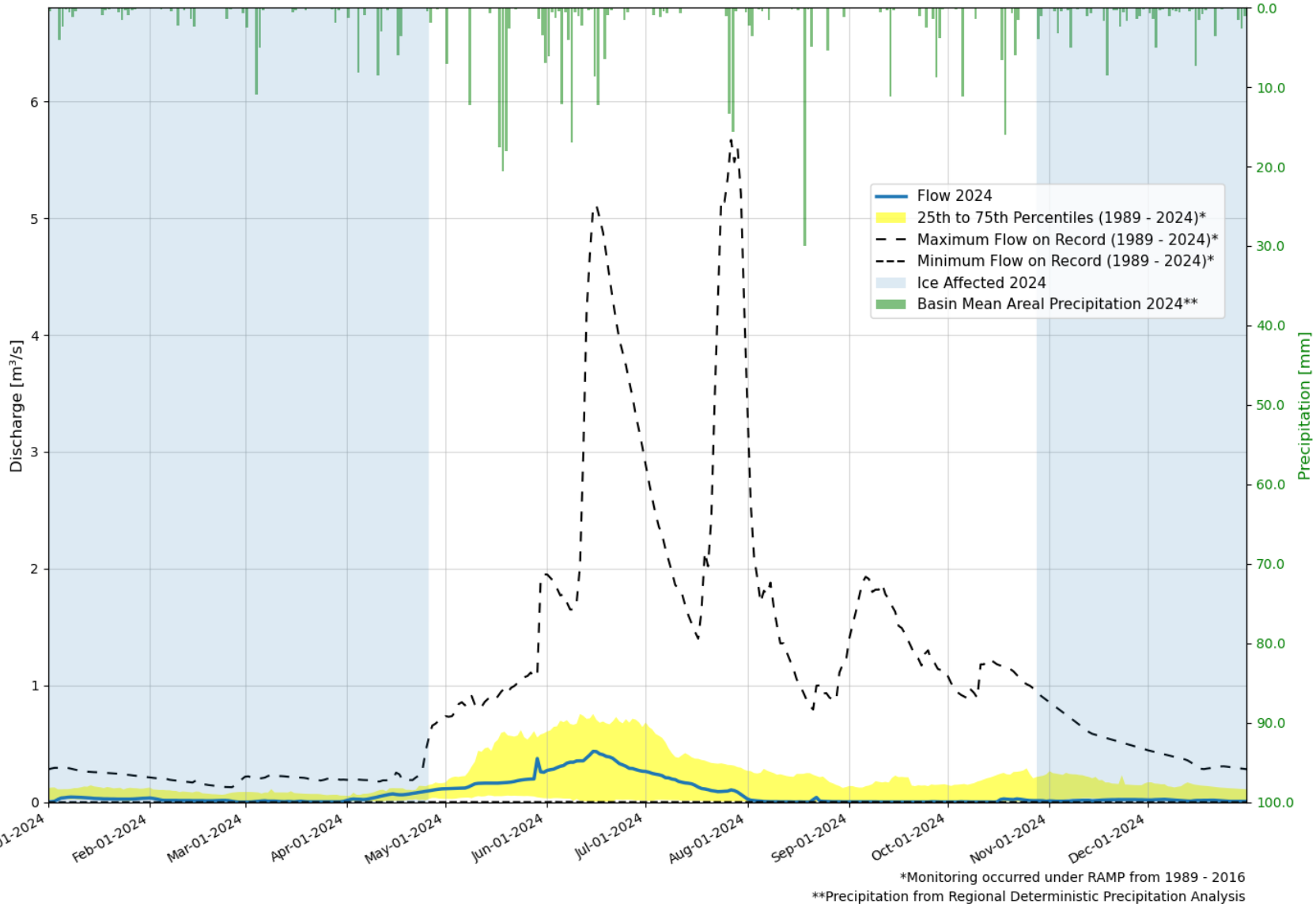

Figure C26: Kearl Lake Outlet (07DA030)

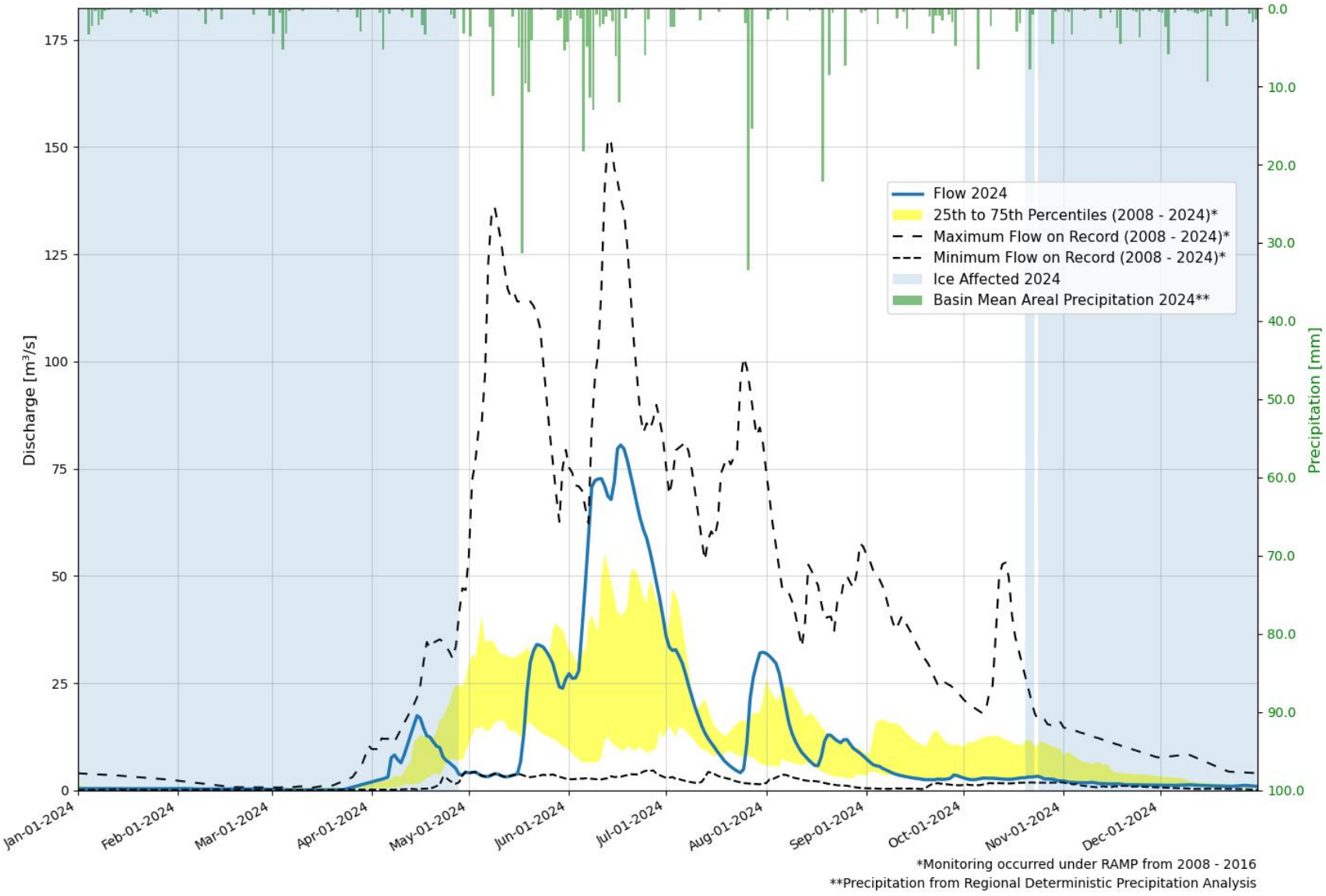

Figure C27: Mackay River at Petro-Canada Bridge (07DB006)

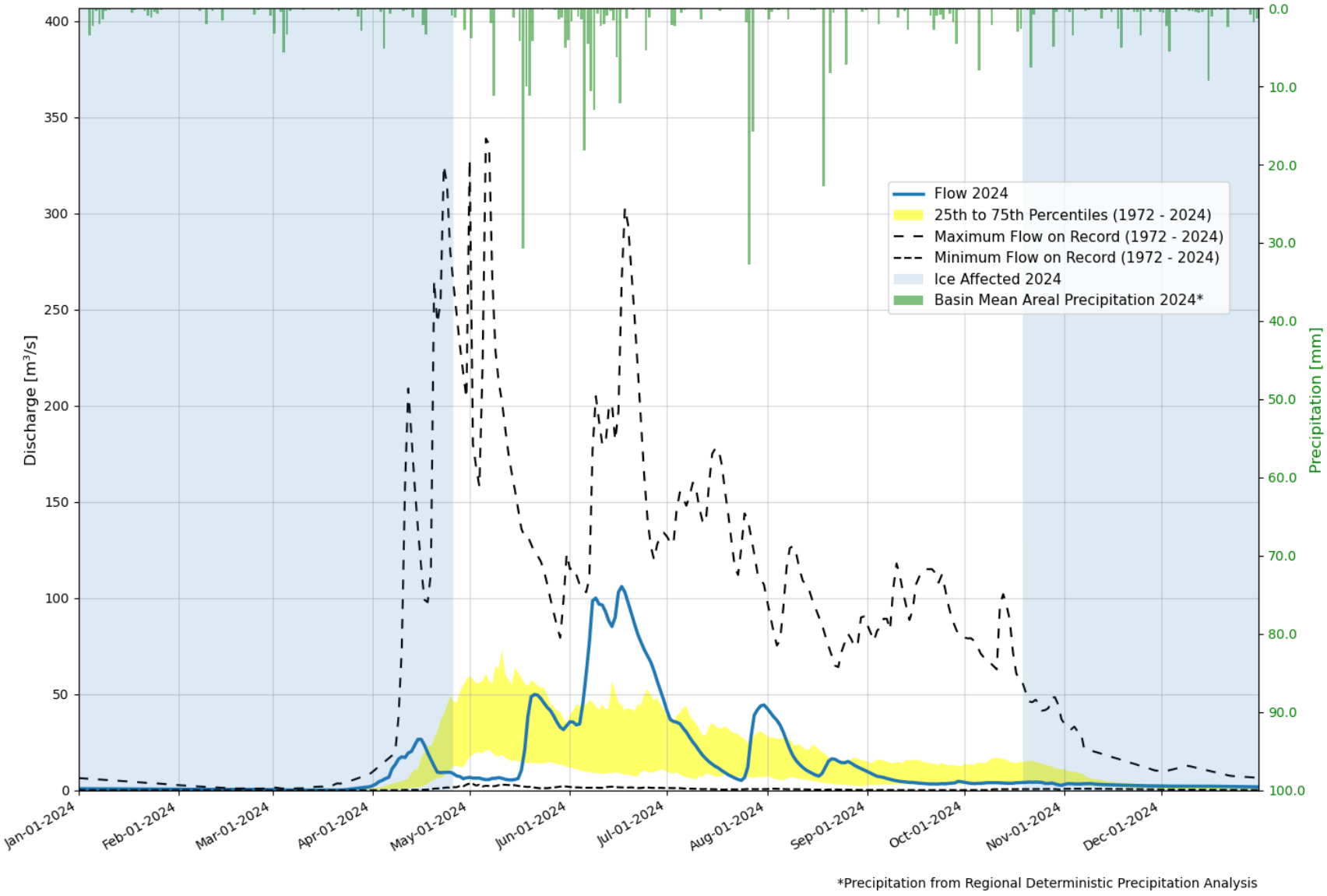

Figure C28: Mackay River near Fort Mackay (07DB001)

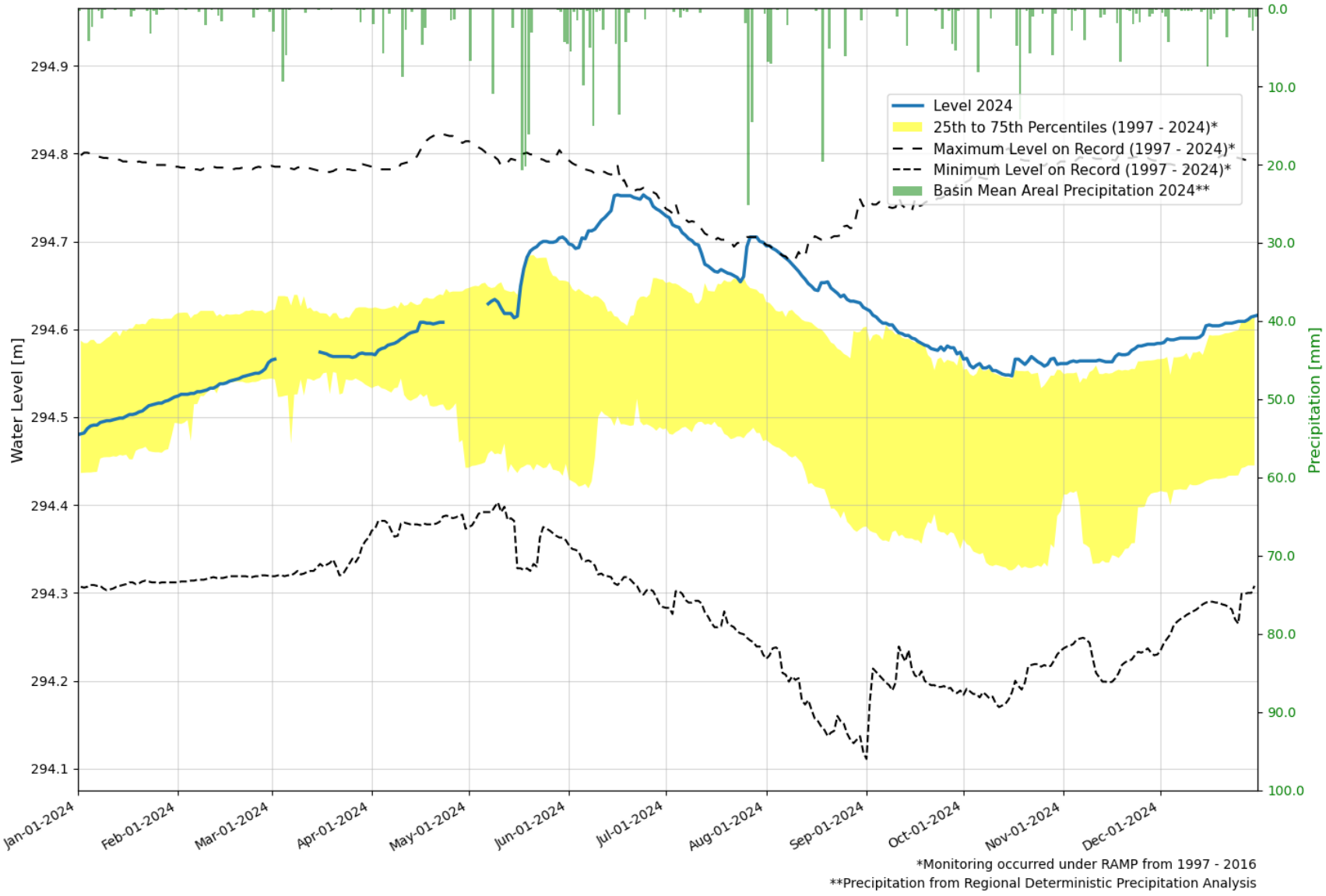

Figure C29: Mcclelland Lake at East End (07DA023)

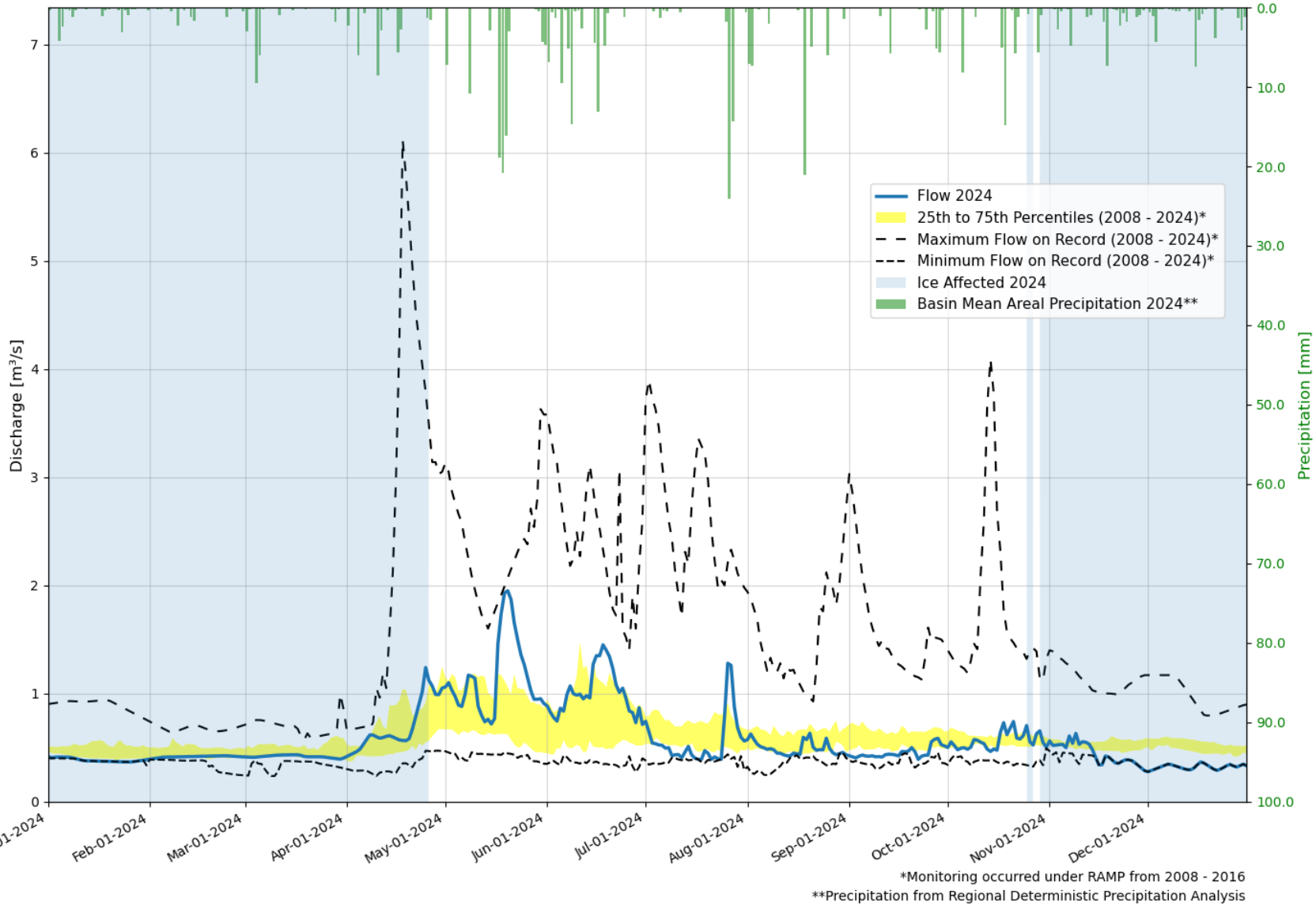

Figure C30: Mcclelland Lake Outlet above Firebag River (07DC004)

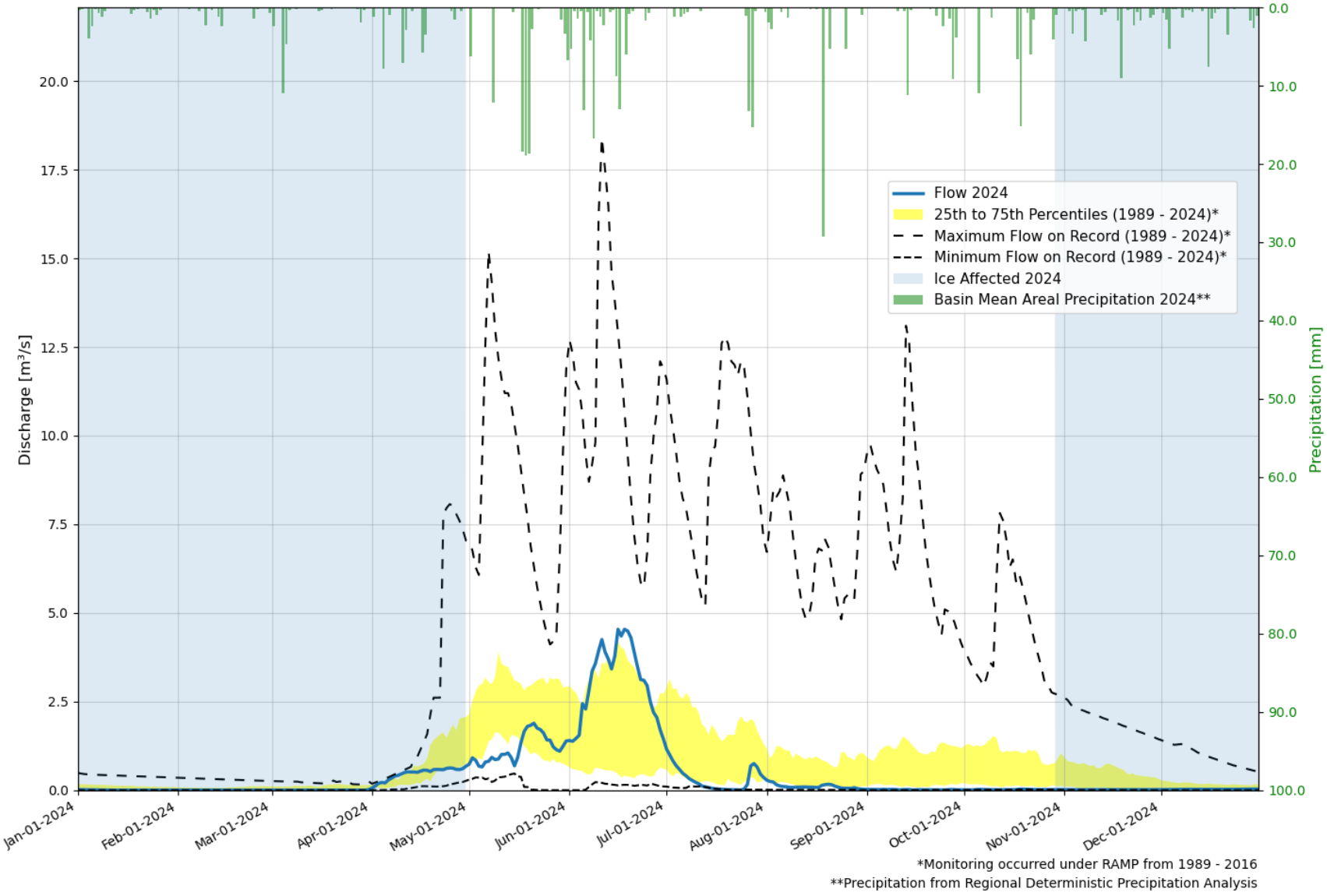

Figure C31: Muskeg Creek near the Mouth (07DA035)

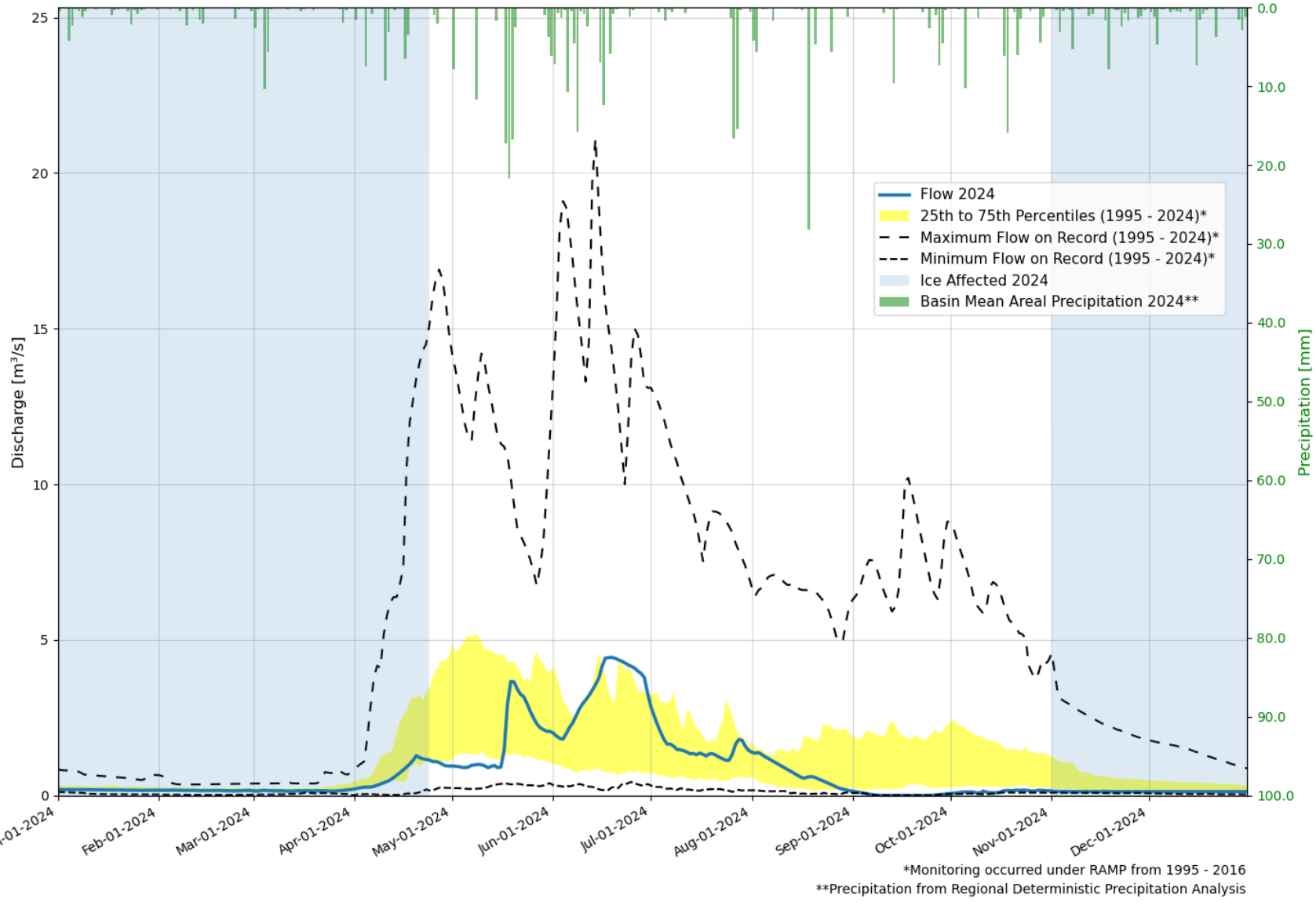

Figure C32: Muskeg River above Muskeg Creek (07DA029)

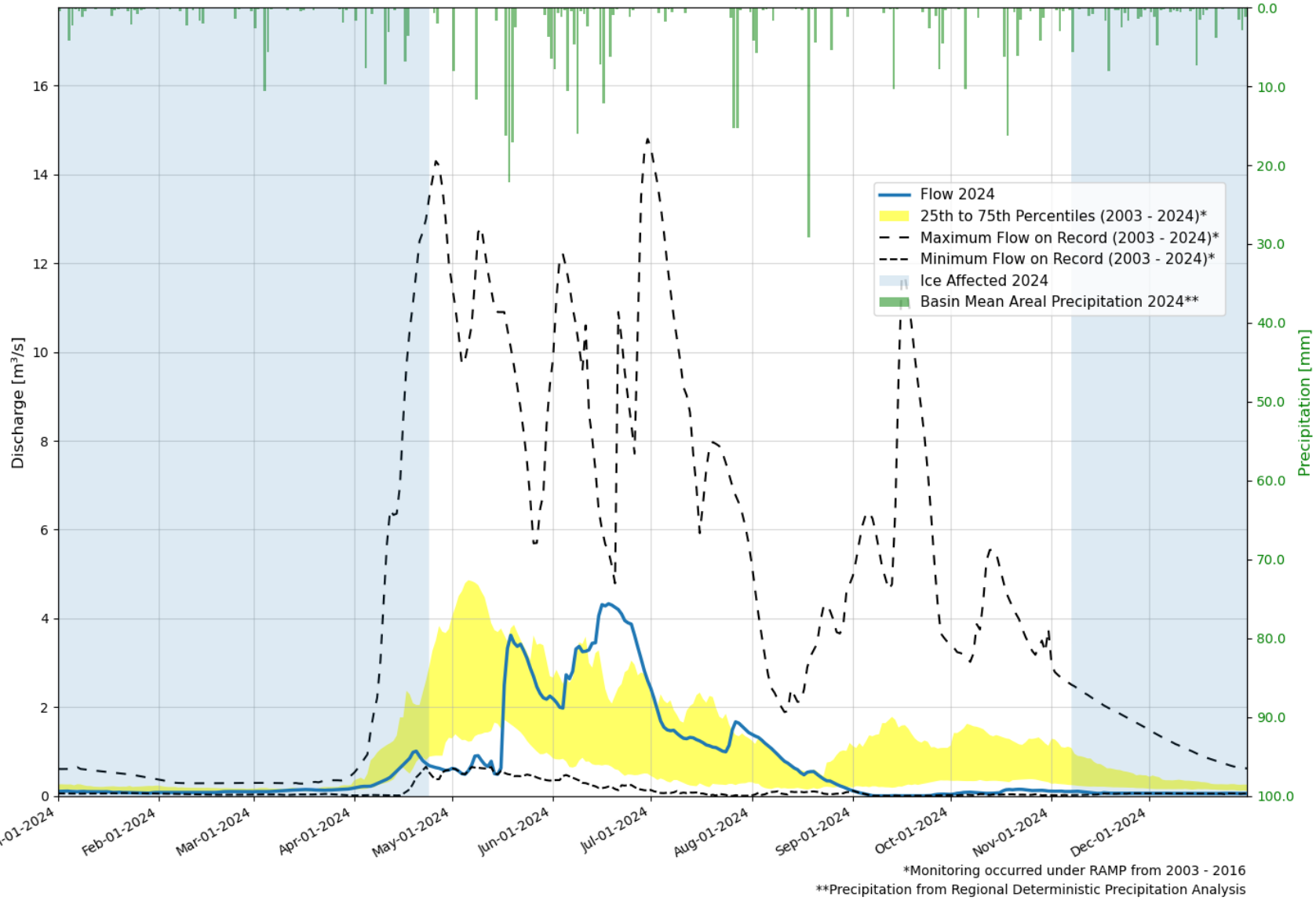

Figure C33: Muskeg River above Stanley Creek (07DA028)

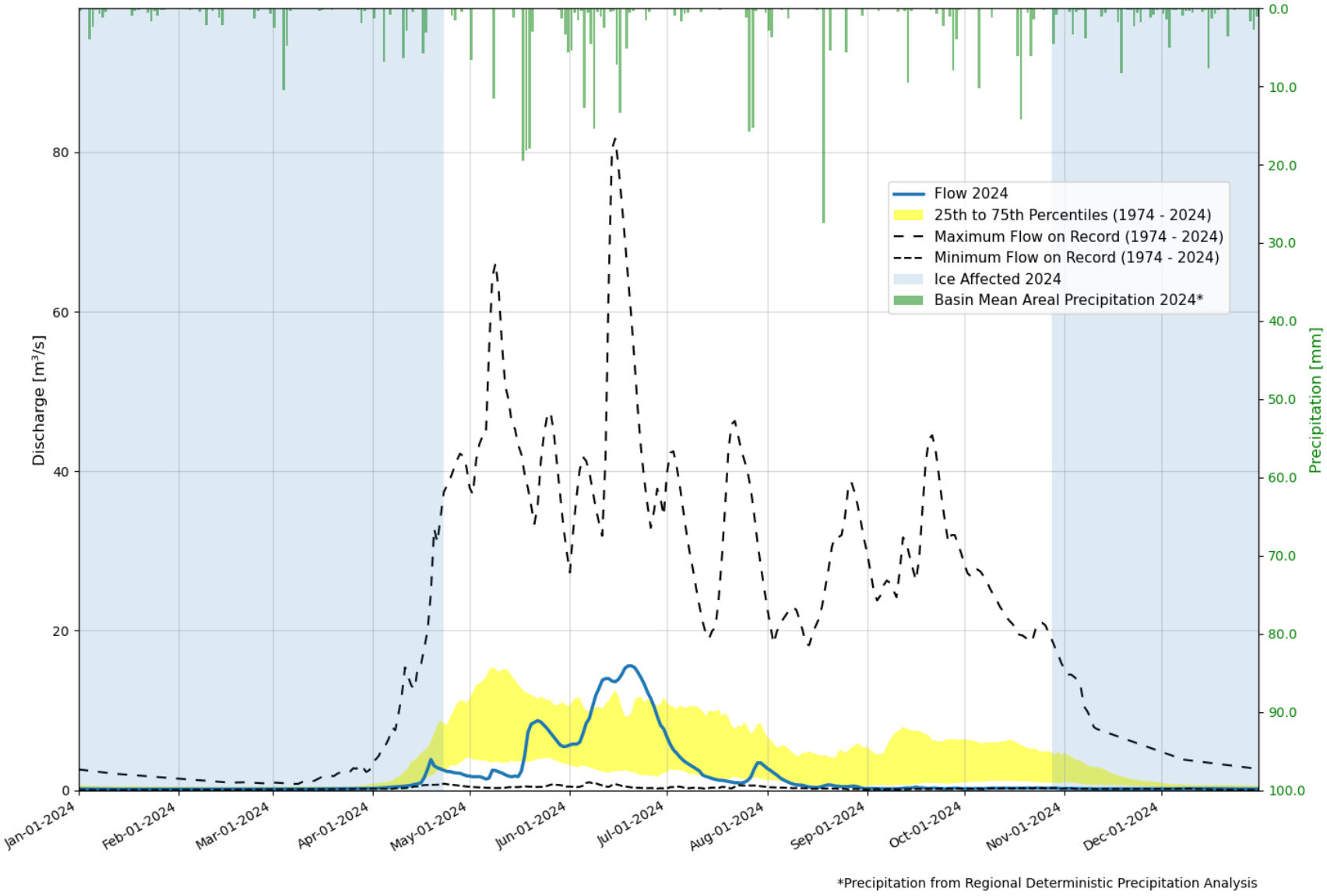

Figure C34: Muskeg River near Fort Mackay (07DA008)

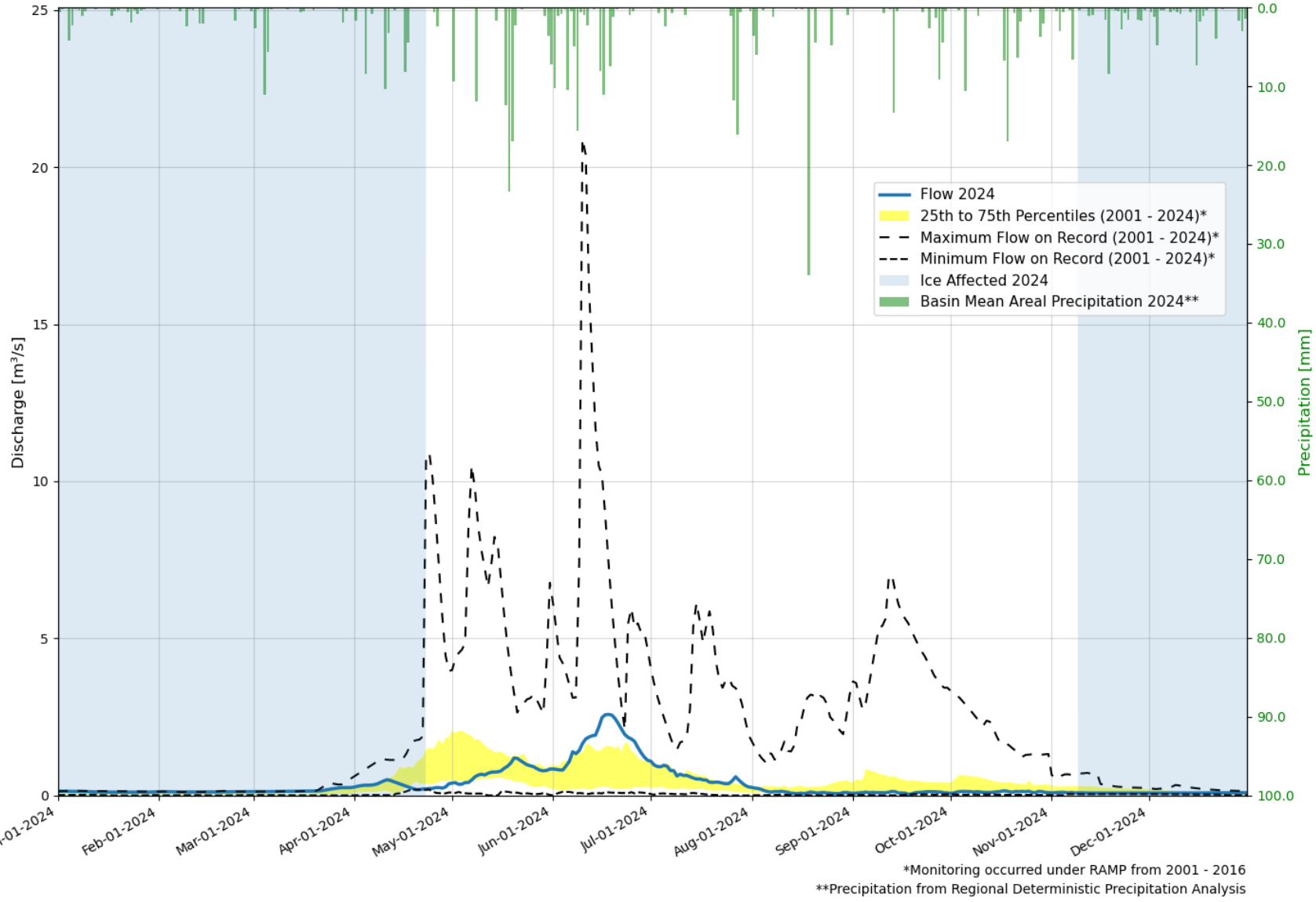

Figure C35: Muskeg River Upland (07DA034)

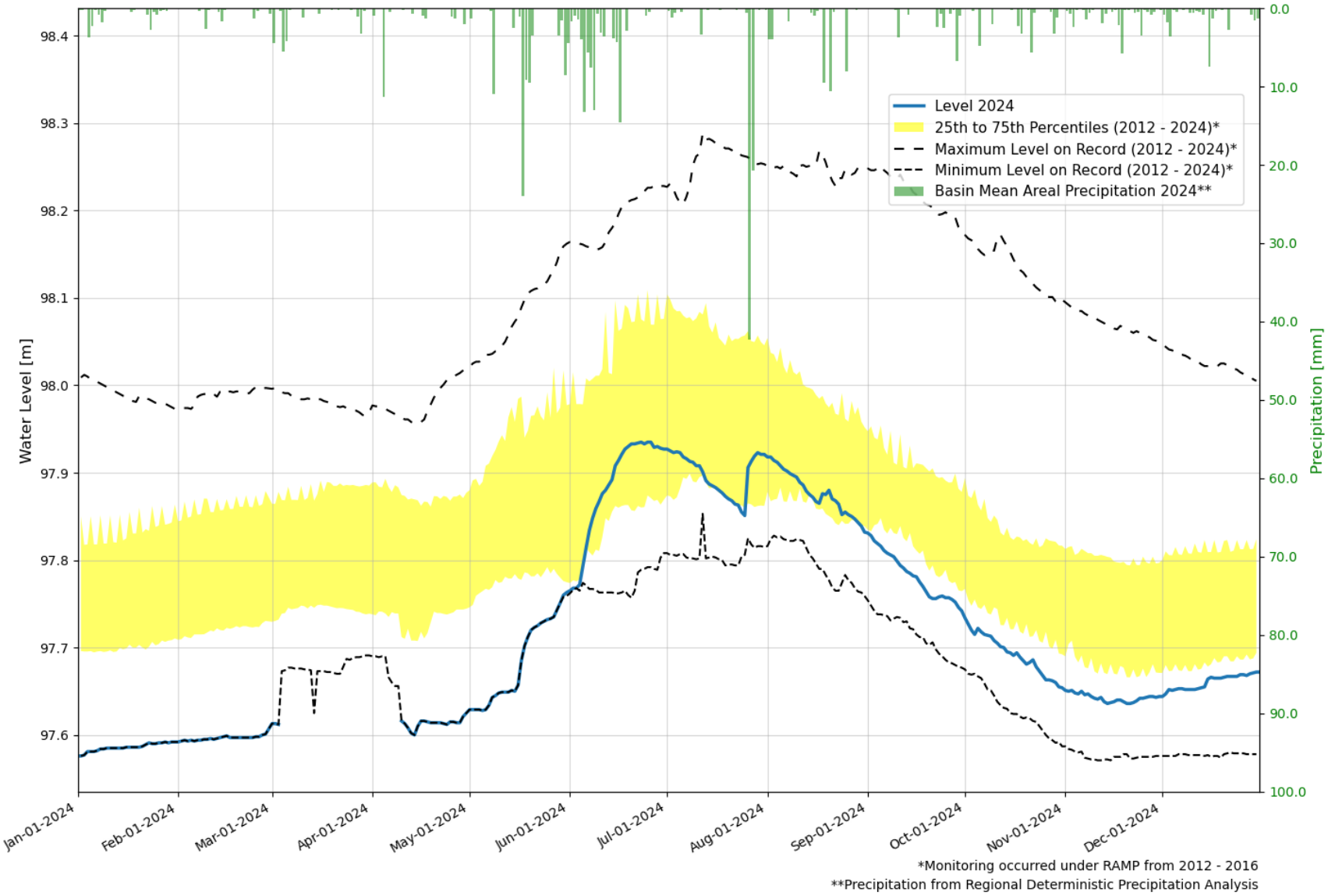

Figure C36: Namur Lake near the Outlet (07DA025)

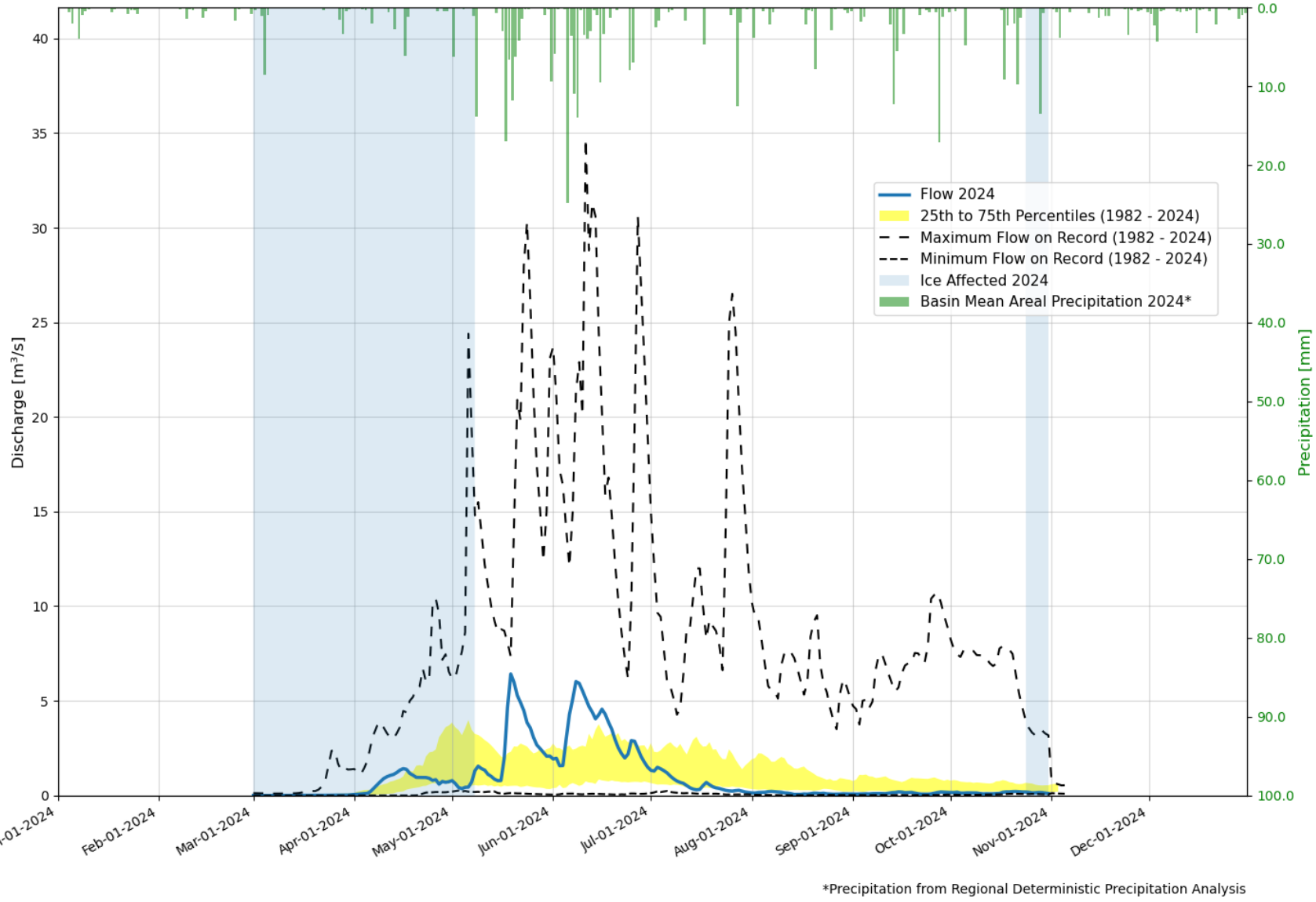

Figure C37: Pony Creek near Chard (07CE003)

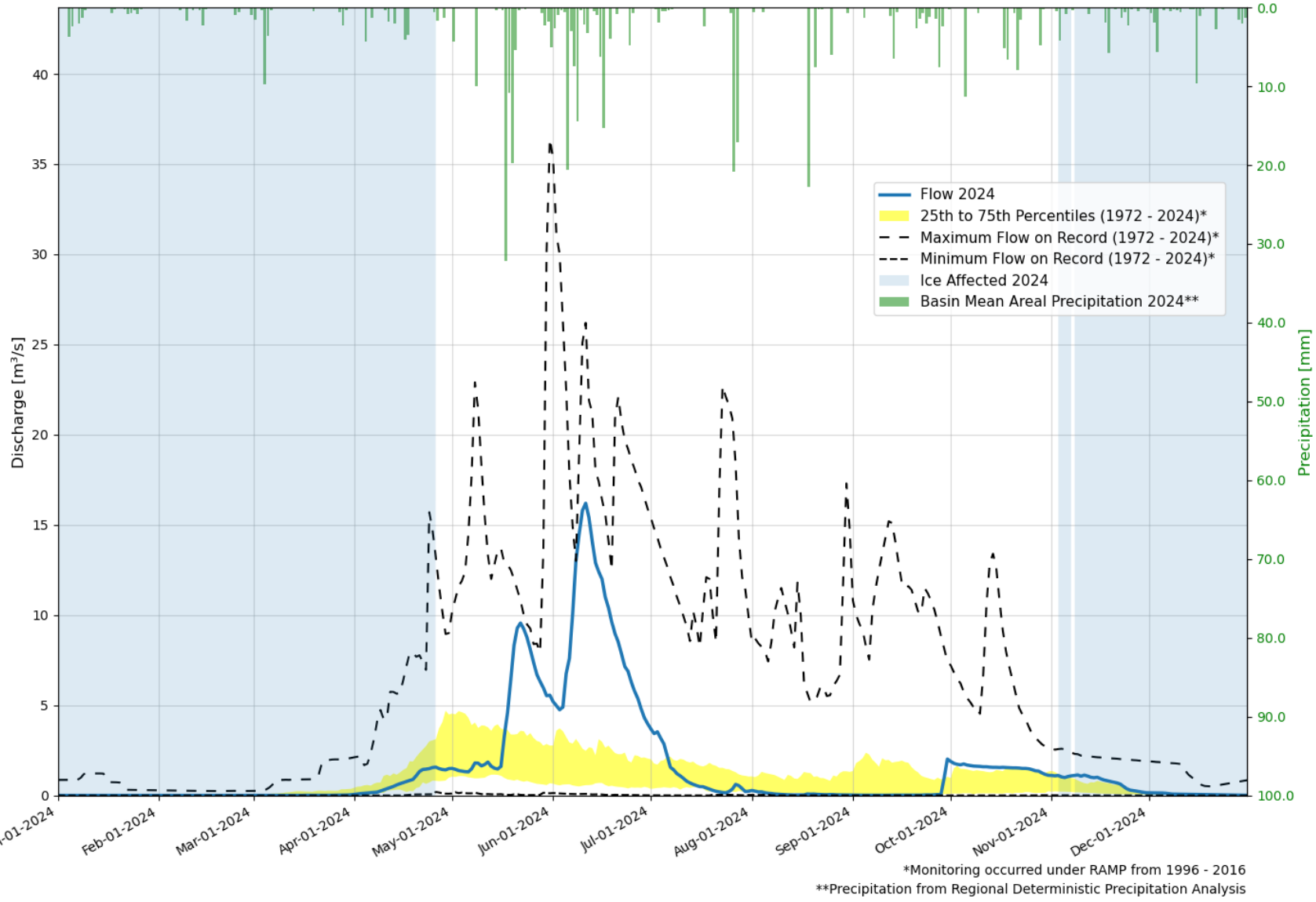

Figure C38: Poplar Creek near Fort Mcmurray (07DA007)

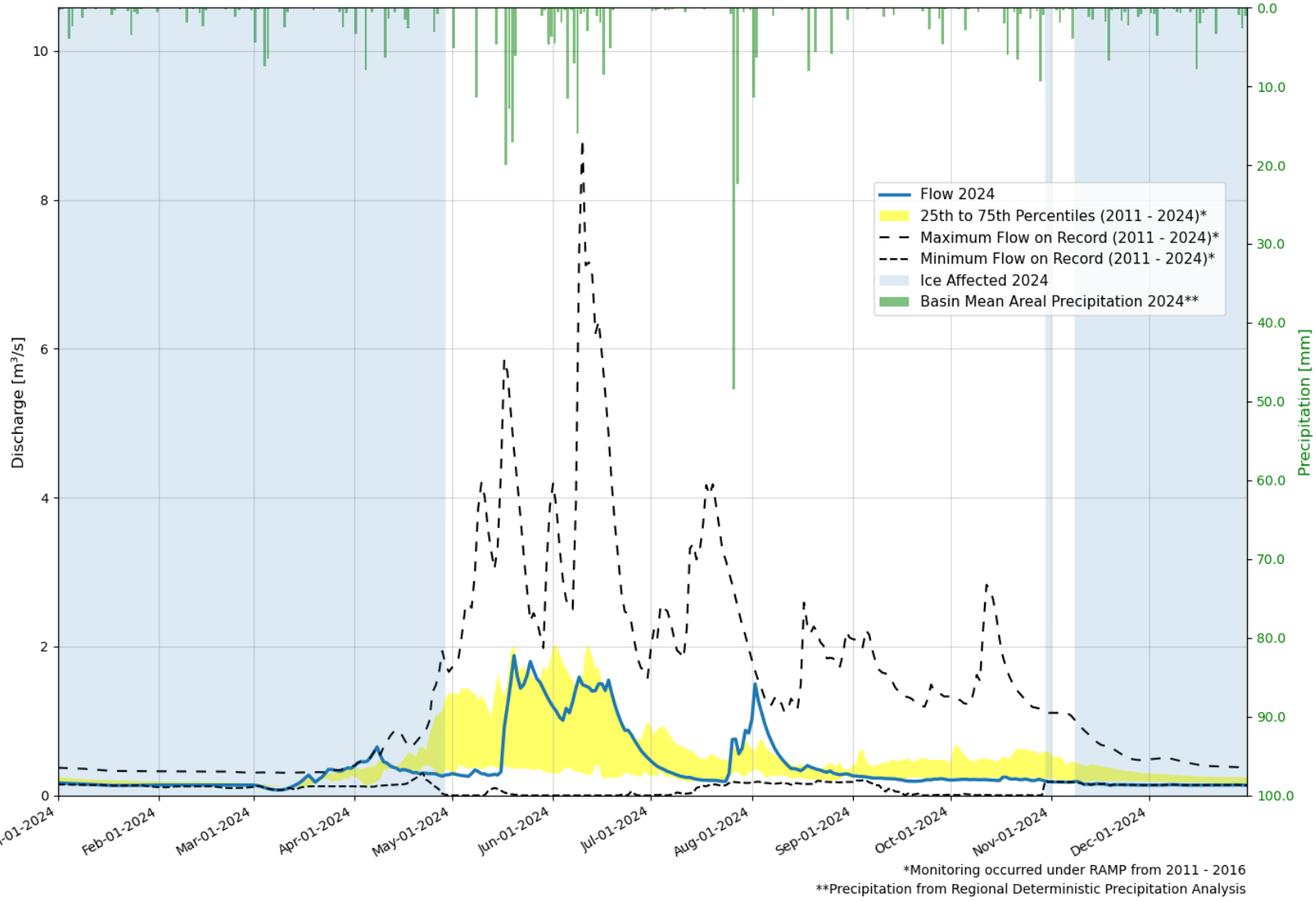

Figure C39: Red Clay Creek near the Mouth (07DA042)

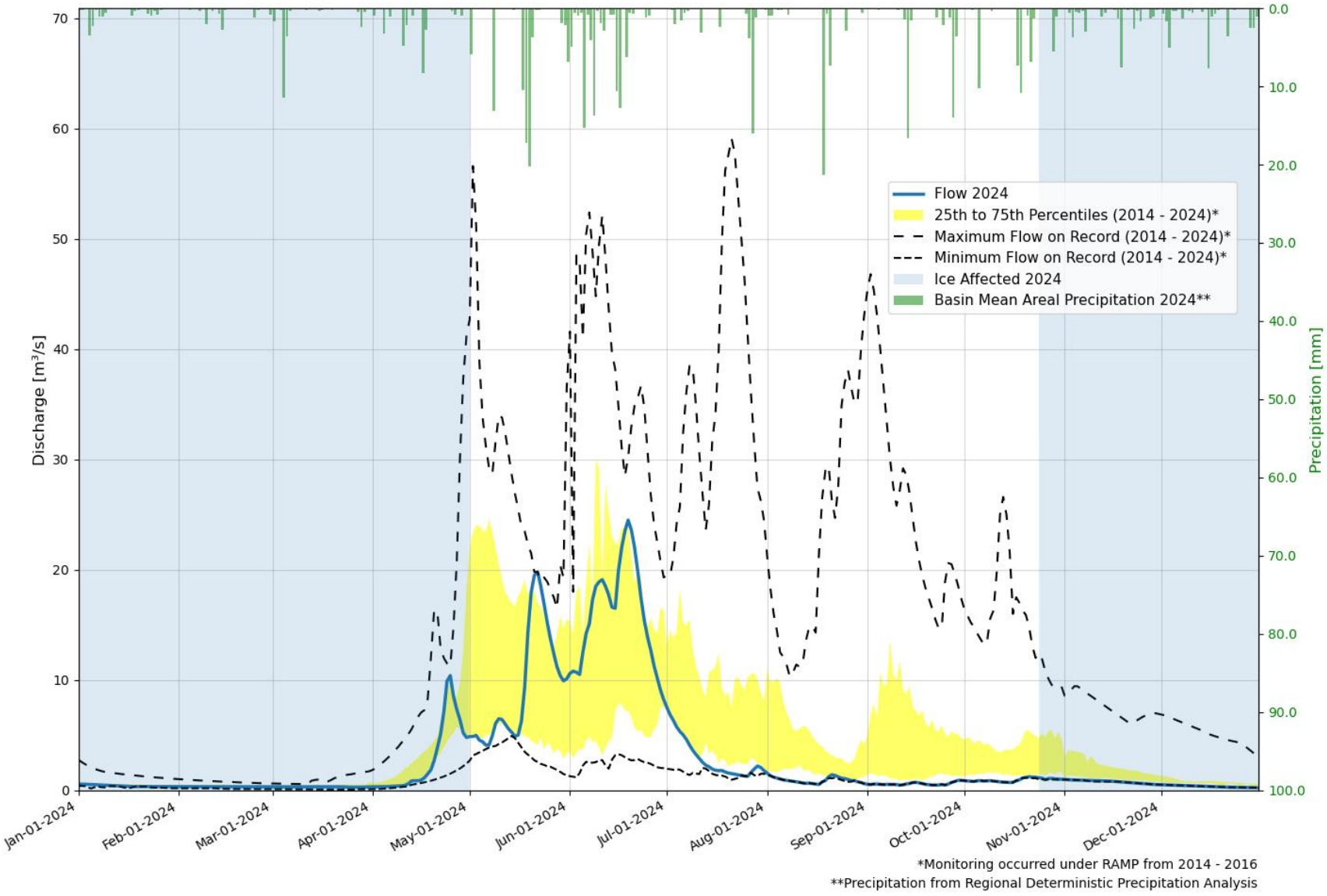

Figure C40: Steepbank River Below North Steepbank River (07DA044)

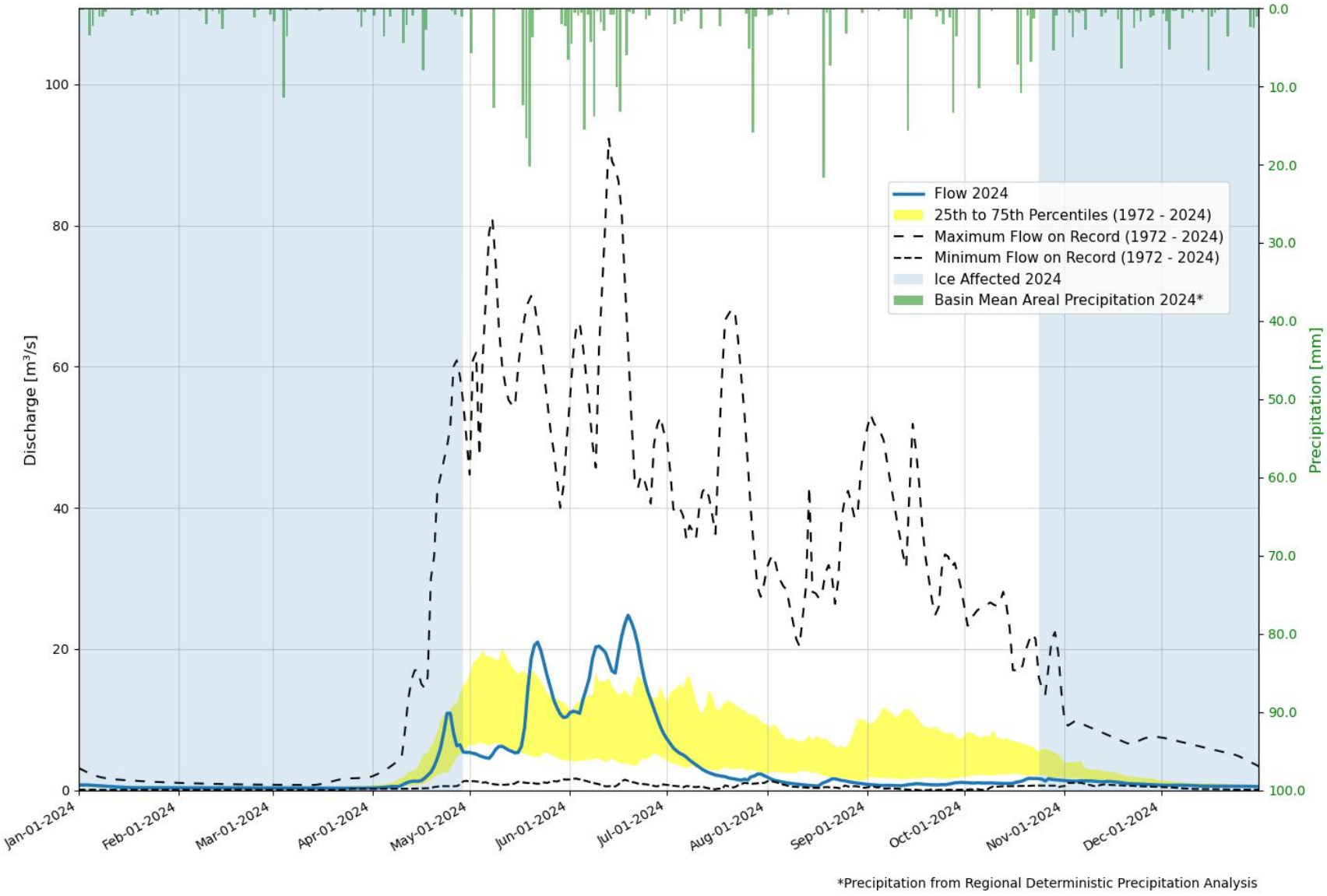

Figure C41: Steepbank River near Fort Mcmurray (07DA006)

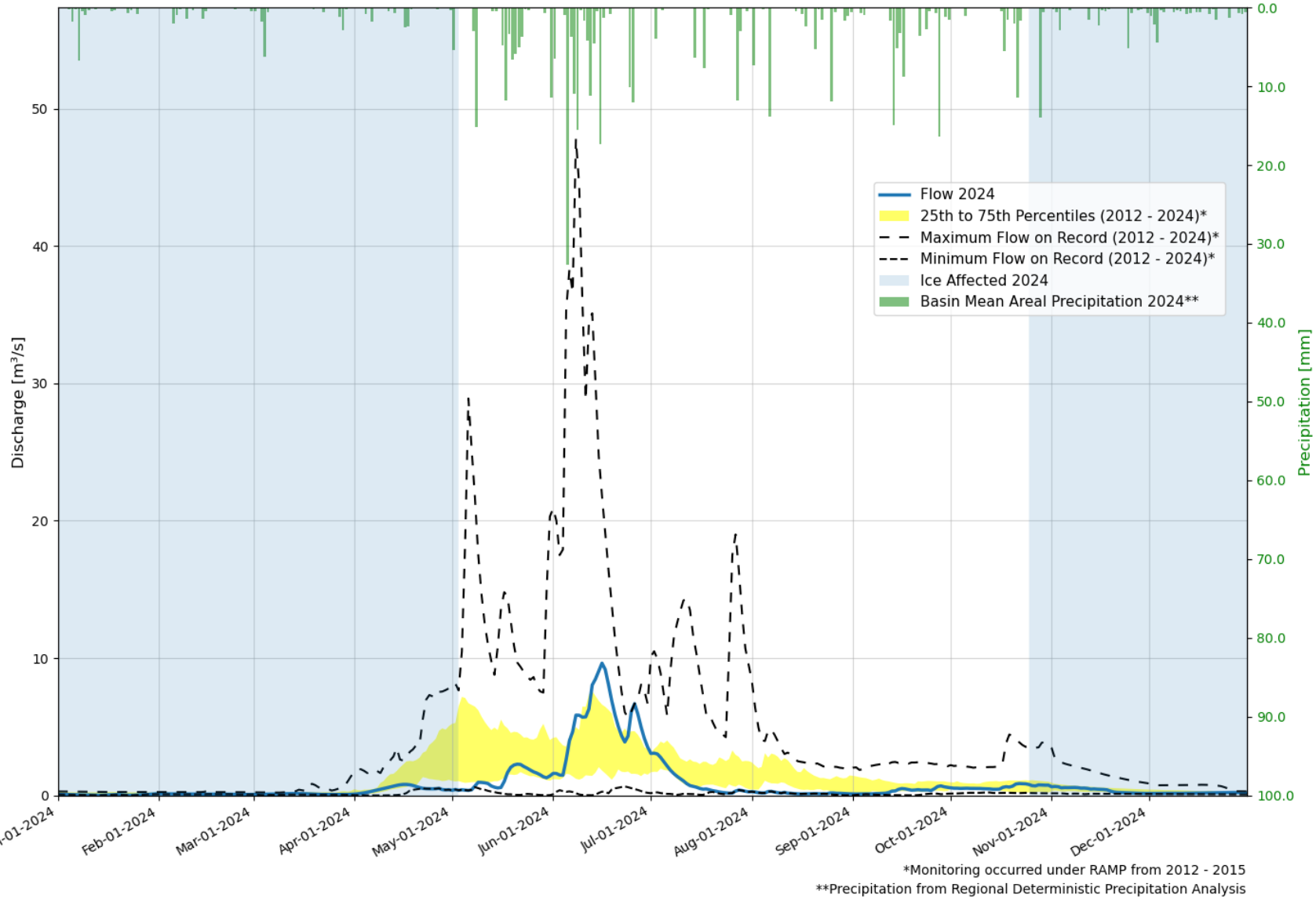

Figure C42: Sunday Creek above Christina Lake (07CE010)

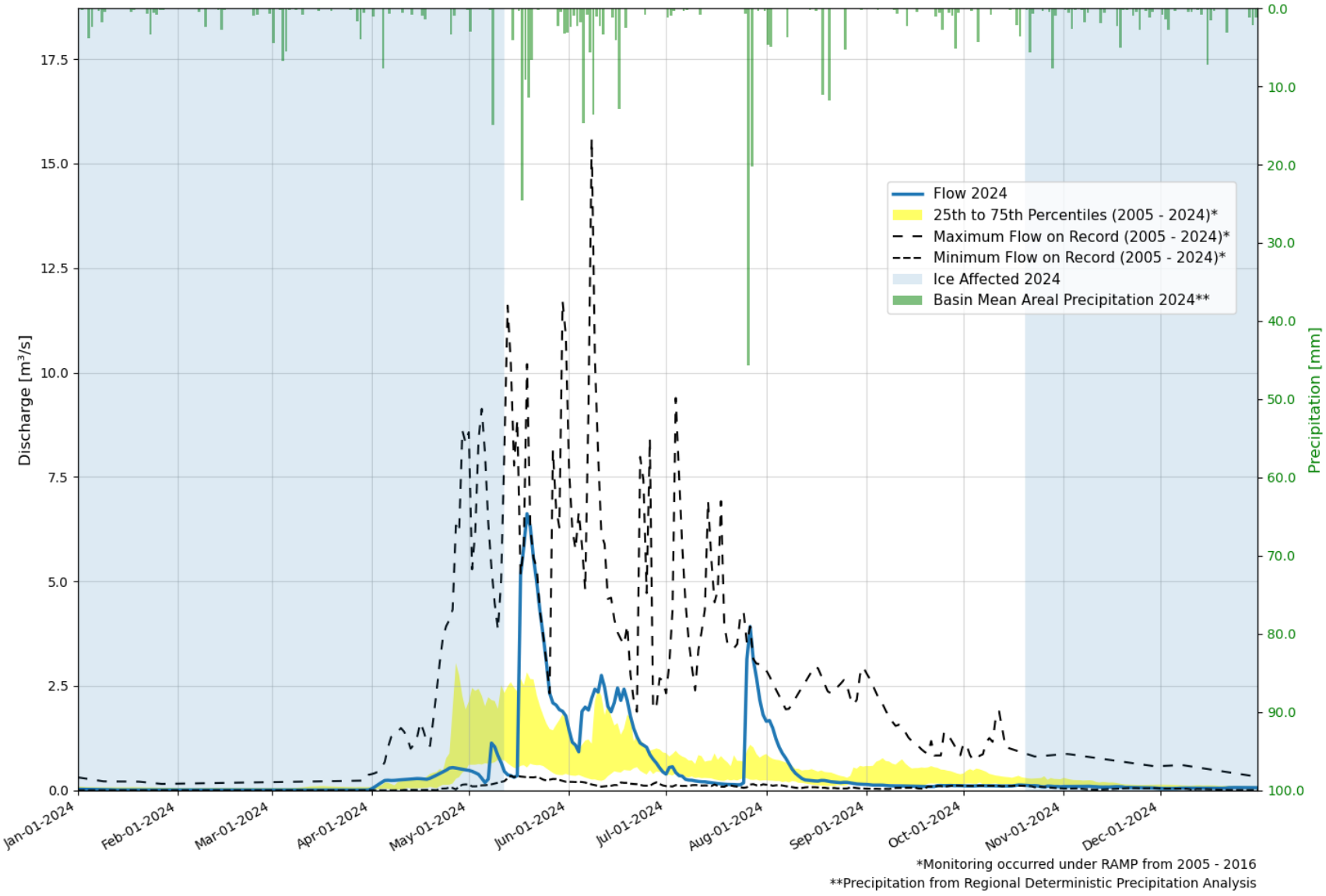

Figure C43: Tar River above Canadian Natural Resources Limited Lake (07DA037)

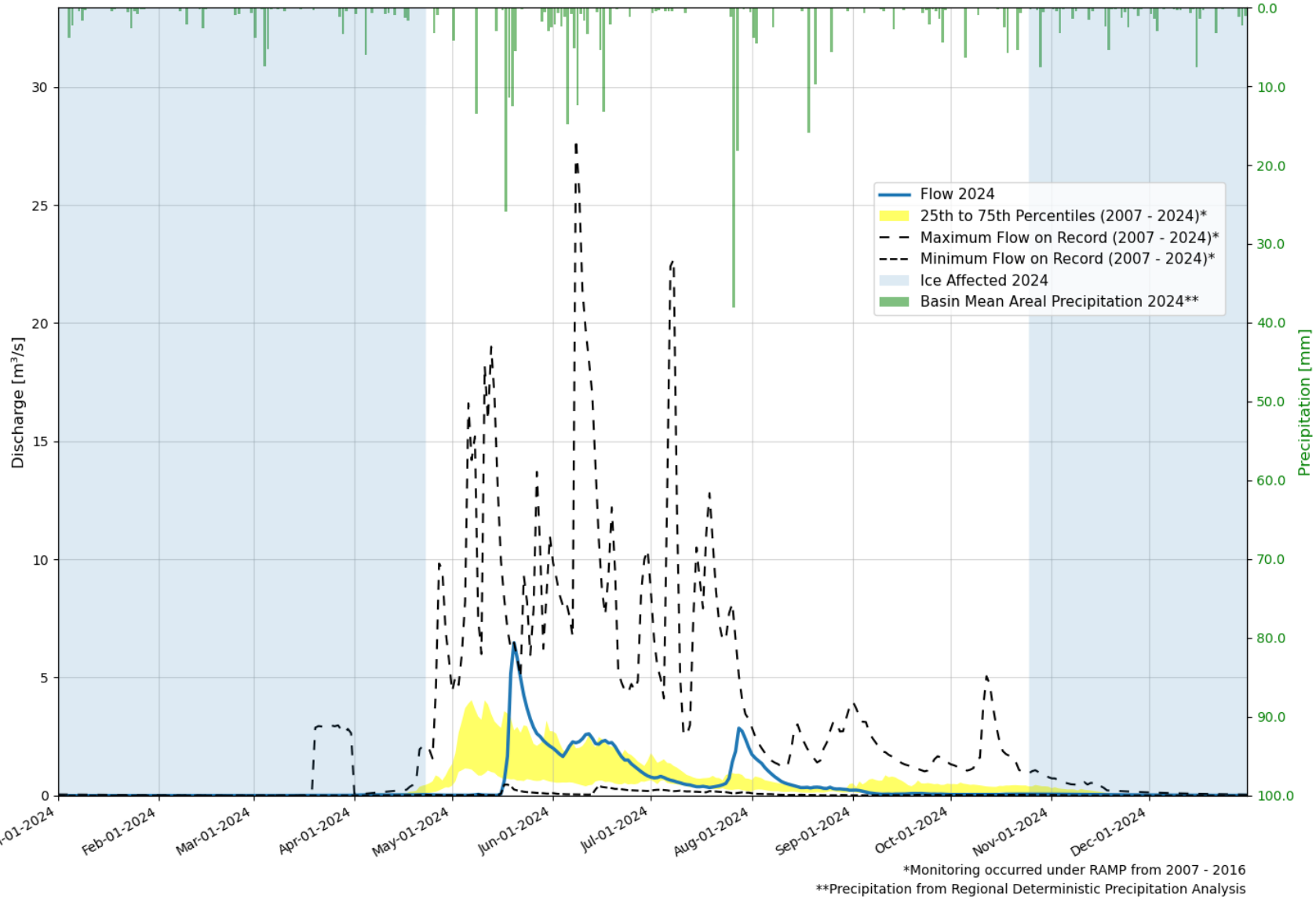

Figure C44: Tar River near the Mouth (07DA045)