SASKATCHEWAN

Water Security Agency

Souris River Basin
Spring Runoff Outlook

As of March 4, 2024

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Basin Conditions

Rainfall during the 2023 growing season (April 1 to October 31) over the Saskatchewan portion of the Souris River Basin was below normal (Figure 1). As shown in Figure 2, during the 60-days prior to freeze-up, most of the Saskatchewan portion of the basin received near normal precipitation accumulations. The exception was the head waters of both Long Creek and the Souris River where below normal accumulations were recorded. Most of the precipitation occurred in October. As a result, prior to freeze-up in early November, topsoil moisture was generally considered to vary from near to slightly below normal across the basin.

So far this winter, the basin has received below normal precipitation accumulations (Figure 3). The unseasonably warm temperatures seen throughout the winter have resulted in high sublimation loses and snowpack consolidation. Where the snowpack was light, the warm weather melted most of the snowpack resulting in some infiltration; however, no runoff. As a result of the sublimation loses and the mid-winter melting of the snowpack, the point snowfall data collected across the Saskatchewan portion of the Souris River Basin is not a good indicator of the snow available for runoff in the basin at this time.

Throughout February, the basin generally received near to above normal precipitation accumulations (Figure 4). Thawing temperatures throughout February depleted much of the snowpack in the basin, with the Long Creek being virtually snow free at the end of the month. A heavy snowstorm brought 5 to 25 cm of snow to the basin (Figure 9). The heaviest snow occurred in the Moose Mountain Basin above Grant Devine.

Snow Surveys

The U.S. National Weather Service (NWS) completed their airborne gamma snow surveys within the Canadian portion of the basin on February 16, 2024. The results are shown in Figure 5 and Figure 6. Based on these results, there was about 12 to 15 mm (0.5 to 0.6 inches) of snow above Boundary Reservoir, 15 to 22 mm (0.6 to 0.9 inches) above Rafferty and 30 to 50 mm (1.2 to 2 inches) above Grant Devine Lake. Below the reservoirs, the snowfall estimates were 22 to 48 mm (.9 to 1.9 inches). Since these flights were flown, thawing temperatures followed by a larger snowfall event did occur.

The Water Security Agency (WSA) conducted manual snow surveys in the Souris River Basin from February 27 to the 29 in 2024. These surveys were completed at 12 locations across the basin and were visually estimated to be representative of the vicinity. These manual survey results are shown in Figure 7 below. With all the melting events that have occurred throughout the winter, some of these SWE results are impacted by the presence of ice. The ice layers identified during the snow surveys are shown in Figure 8. These ice layers have the potential to increase runoff in the spring due to reduced infiltration capacity. Following the snow surveys, a winter storm occurred that dropped 5 to 25 cm of snow on the basin (Figure 9). The heaviest snow accumulations occurred in the Moose Mountain Basin above Grant Devine.

Snow water equivalent (SWE) estimates from the NWS's SNODAS model are provided in Figure 10. The SNODAS product is showing 5 to 60 mm across the basin, with the heavier snow being in the Moose Mountain Creek Basin and below the reservoirs, which correlates well with the snow surveys and the additional snow received early in March.

Overall, it is estimated that there is about 5 to 15 mm of SWE present in the Long Creek Basin, which is well below normal. Across the remainder of the basin the snowpack ranges from near normal to below normal. Approximately 30 to 50 mm of SWE is estimated to be above Rafferty. SWE estimates above Grant Devine Lake are in the 40 to 60 mm range. The SWE below the reservoirs there is estimated to be between 25 and 45 mm.

2024 Spring Runoff Forecast

As per the terms of the 1989 Canada-United States Agreement on Water Supply and Flood Control in the Souris River Basin, on February 1 and thereafter on the fifteenth and last day of the month until snowmelt runoff begins, the WSA, in coordination with the NWS, will prepare forecasts of the 30-day and 90-day spring runoff volumes for the basin. This forecast was delayed from March 1 to the 4 to capture the snowstorm that occurred on March 2-3, 2024.

Inflow estimates, based on conditions as of March 4, 2024, are outlined in Table 1. These volumes are the average of the WSA and NWS forecasts. The snowfall received early in March did improve conditions in the basin, and increased the runoff potential; however, the runoff is still generally expected to be below normal at all forecasted points. To illustrate the uncertainty in these forecasted volumes, estimates of the volumes associated with a 10 and 90 per cent probability of exceedance are included in the table.

The forecasted 50th percentile 30-day local runoff volume below the Canadian Reservoirs of 13,200 dam^3 is below the 37,000 dam^3 required to initiate flood operations under the terms of the 1989 Agreement. The forecasted unregulated 30-day volume at Sherwood of 27,200 dam^3 is also well below the 216,110 dam^3 threshold that can also initiate flood operations under the 1989 Agreement. With neither of the conditions being met, the designated entities are in agreement that operations will proceed based on non-flood operating rules, and no further reservoir drawdowns will be initiated at this time.

With Sherwood Natural volumes expected to be below 50,000 dam^3, operations during the freshet will proceed based on an assumption of Saskatchewan retaining up to 50 per cent of the natural flow. This will be revaluated throughout the year and would revert to a 60-40 split if the computed natural flow is greater than 50,000 dam^3.

Table 1: March 4, 2024, Runoff Forecast for the Souris River Basin

	30-Day Runoff Volume ($dam^3 \times 10^3$)			90-Day Runoff Volume ($dam^3 \times 10^3$)			Peak Flow (m^3/s)	Event Return Period (years)
	90% Exceedance Probability	50% Exceedance Probability	10% Exceedance Probability	90% Exceedance Probability	50% Exceedance Probability	10% Exceedance Probability		
Long Creek Near Noonan	2.0	4.0	10.7	2.7	5.4	14.5	10	< 1:2
Inflow into Rafferty Reservoir	1.2	3.5	13.4	1.8	5.0	19.4	15	< 1:2
Diversion to Rafferty Reservoir	0.0	0.0	5.6	0.0	0.3	9.4		
Inflow into Grant Devine Lake	3.0	6.5	27.7	4.4	9.7	41.2	14	< 1:2
Local Runoff	7.6	13.2	23.9	9.3	16.1	29.2	20	< 1:2
Sherwood Crossing Projected	7.6	13.2	40.0	9.3	17.2	58.8	20	< 1:2
Sherwood Crossing Natural	13.3	25.9	70.9	17.5	34.4	97.2	54	< 1:2
Sherwood Crossing Unregulated	13.8	27.2	75.8	18.2	36.2	104.3	59	< 1:2

Notes for the Forecast

During flood events, the 90-Per cent 90-Day inflow forecast to each of the reservoirs is used in Plates A-1, A-2, A-3 of the 1989 Agreement to determine target drawdown levels at Boundary, Rafferty, and Grant Devine Lakes respectively (Long Creek near Noonan, Inflow into Rafferty Reservoir, and Inflow into Grant Devine Lake in the above table).

Inflows into Rafferty Reservoir do not include diversion from Boundary Reservoir.

Local Runoff is the volume of runoff that is expected at the Sherwood Crossing from the basin below the Canadian reservoirs (Boundary, Rafferty, and Grant Devine). Flood Operations as initiated, as per Page A-26 of the 1989 Agreement, should this 30-day, 50 per cent probability of exceedance, local runoff volume exceeds 37,000 dam^3.

Sherwood Crossing Projected is equal to the expected runoff less planned reservoir storage at the Canadian Reservoirs to the end of the forecast period. This is the volume (and associated peak flow) that is expected to occur at the Sherwood Crossing based on the local runoff and expected surpluses at the Canadian Reservoirs.

Sherwood Crossing Natural is equal to the expected runoff, less the volumes from the Yellow Grass and Tatagwa marshes, and minor project diversions. This is a simplified estimate of the natural flow volume at the Sherwood Crossing.

Sherwood Crossing Unregulated is equal to the expected runoff (including runoff from the Yellow Grass and Tatagwa marshes) that would be observed if the Canadian Reservoirs did not exist. If this best estimate (50 per cent probability of exceedance) 30-day Sherwood Crossing Unregulated volume exceeds 216,110 dam^3, Flood Operations, as per page A-26 of the 1989 Agreement, are initiated. The best estimate 30-day volume is used in Plates A-5 and A 6 to determine target flows at Sherwood and Minot.

Proposed Reservoir Operations for the Spring of 2024

Please note that these are preliminary operating plans, based on forecasted inflows. Actual operating decisions will be made based on information available at the time.

Boundary Reservoir

On March 1, 2024, Boundary Reservoir was at an elevation of 559.87 m, approximately 5,100 dam^3 or 0.96 m below the full supply level of 560.83 m.

Due to low projected runoff, flood operations are not in effect and no pre-runoff drawdown is required.

With average conditions going forward to spring melt, Boundary Reservoir has the potential to fill in 2024 and there is a potential that the Boundary to Rafferty Diversion will be used to divert excess water into Rafferty Reservoir.

The preliminary operating plan for Boundary Reservoir is to store all inflows and divert any surplus runoff to Rafferty Reservoir.

Rafferty Reservoir

On March 1, 2024, Rafferty Reservoir was at an elevation of 549.49 m. This is 0.01 m below the Normal Drawdown Level of 549.5 m specified in the Agreement for February 1, and 47,700 dam^3 or 1.01 m below its full supply level (550.5m).

Due to low projected runoff, flood operations are not in effect and no pre-runoff drawdown is required.

With average conditions going forward into spring melt, Rafferty Reservoir is not projected to reach its full supply level in 2024.

The current operating plan for Rafferty Reservoir is to store all inflow in an attempt to raise the reservoir to its full supply level. If Rafferty Reservoir fills, releases will be made at a controlled rate, respecting downstream constraints, including the target flow at the Sherwood Crossing. In the unlikely event that the reservoir is surcharged during the spring runoff event, the reservoir will be returned to its FSL in a timely manner, taking into consideration the downstream flow constraints and obligations, including the Target Flows contained within the 1989 Agreement for the Sherwood Crossing.

Grant Devine Lake

On March 1, 2024, Grant Devine Lake was at an elevation of 561.07 m. This is near the Normal Drawdown Level of 561.0 m specified in the Agreement for February 1. The lake increased slightly during the second week in February, most likely due to snow loading on the reservoir. The elevation was maintained until the snowstorm in early March raised the level another 0.01 m. WSA will continue to keep a close eye on conditions in the basin. The reservoir is still 10,500 dam^3 or 0.93 m below its full supply level (562.0 m). With average conditions going forward to spring melt, Grant Devine Lake is not expected to reach its full supply level in 2024.

Due to low projected runoff, flood operations are not in effect and no pre-runoff drawdown is required.

The preliminary operating plan for Grant Devine Lake is to store all inflows until the reservoir nears its FSL and then initiate a release, taking into considerations downstream constraints and obligations, including the Sherwood Target Flow, to limit any surcharge. In the event that the reservoir is surcharged during the spring runoff event, the reservoir will be returned to its FSL in a timely manner, taking into consideration downstream flow constraints and obligations, including the Target Flows contained within the 1989 Agreement for the Sherwood Crossing.

At this time, it appears that local flows below the Canadian Dams will be sufficient to meet Canada’s apportionment obligations; however, the balance will be monitored, and releases will be made, in consultation with downstream jurisdictions, to eliminate any deficit that may emerge. If needed, those releases would likely come from Grant Devine Dam unless there was a water supply benefit of releasing from Rafferty Dam.

Figure 1: 2023 Growing Season (April 1 to Oct. 31, 2023) Rainfall Per Cent of Normal

Figure 2: Per cent Normal Precipitation 60-days Prior to Freeze-up (September 17 to November 15, 2023)

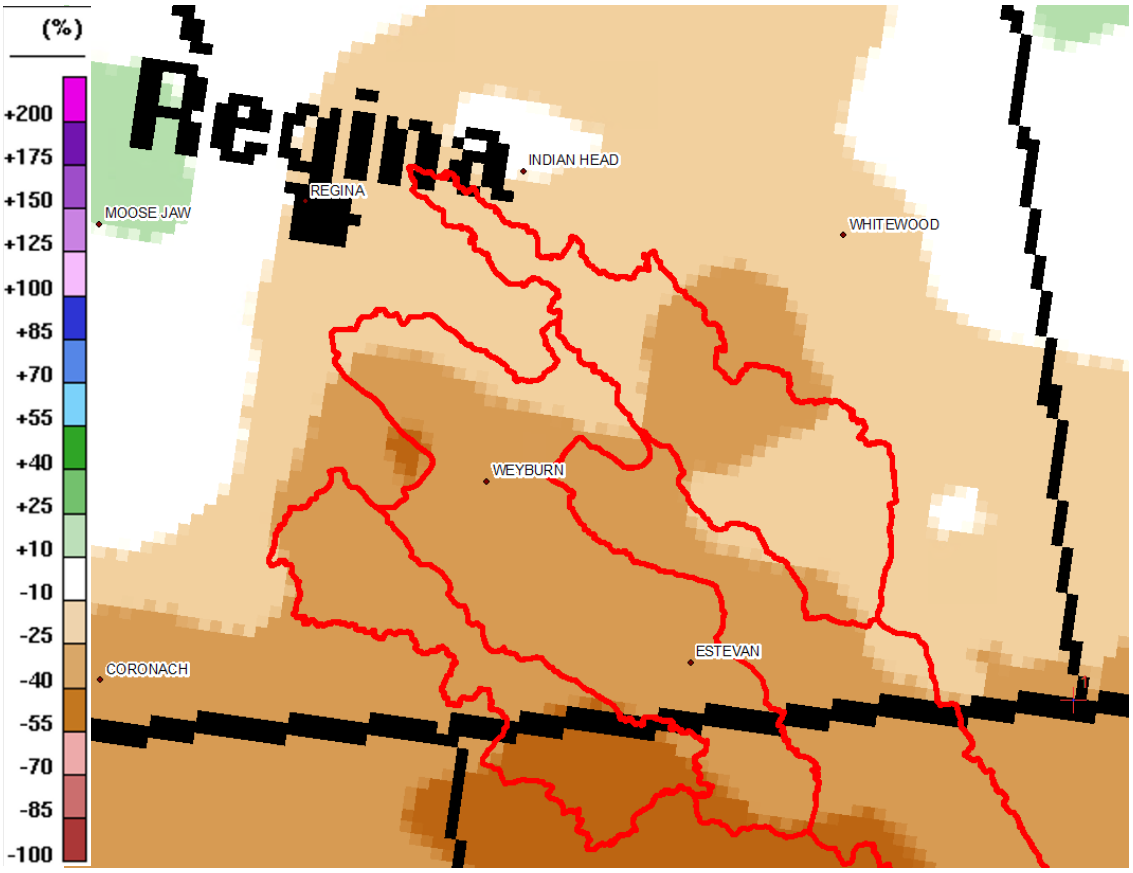

Figure 3: Percent Average Winter Precipitation (Dec. 1, 2023 – Feb 29, 2024)
(Map Courtesy of Environment and Climate Change Canada)

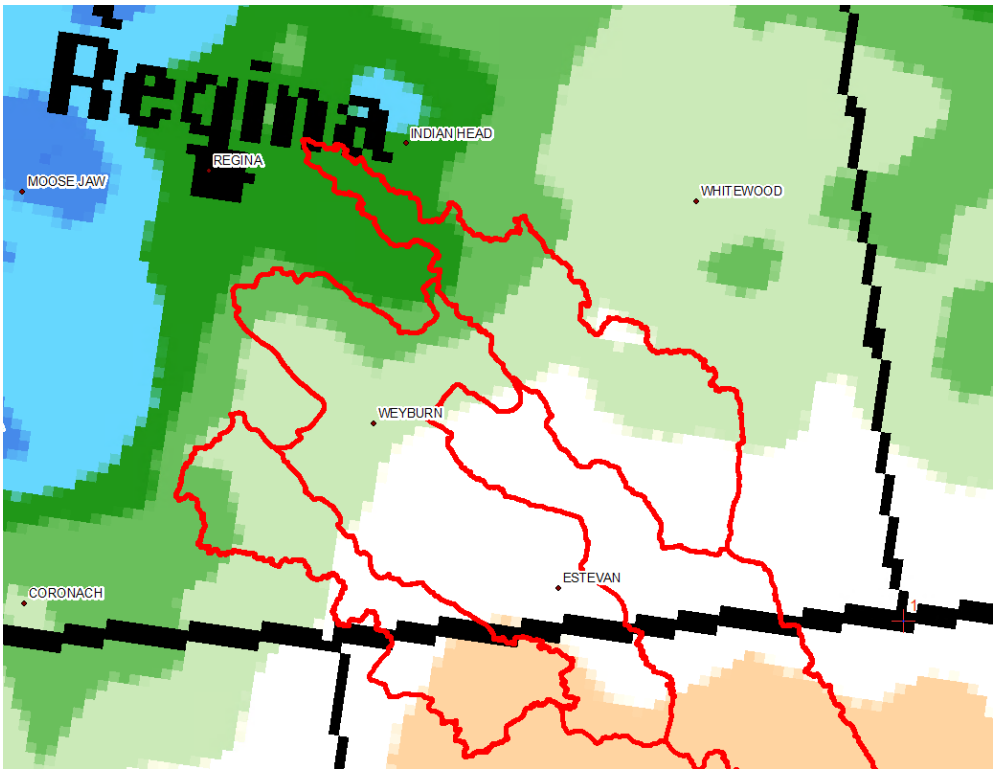

Figure 4: Percent Average Precipitation Feb 1 – Feb 29, 2024
(Map Courtesy of Environment and Climate Change Canada)

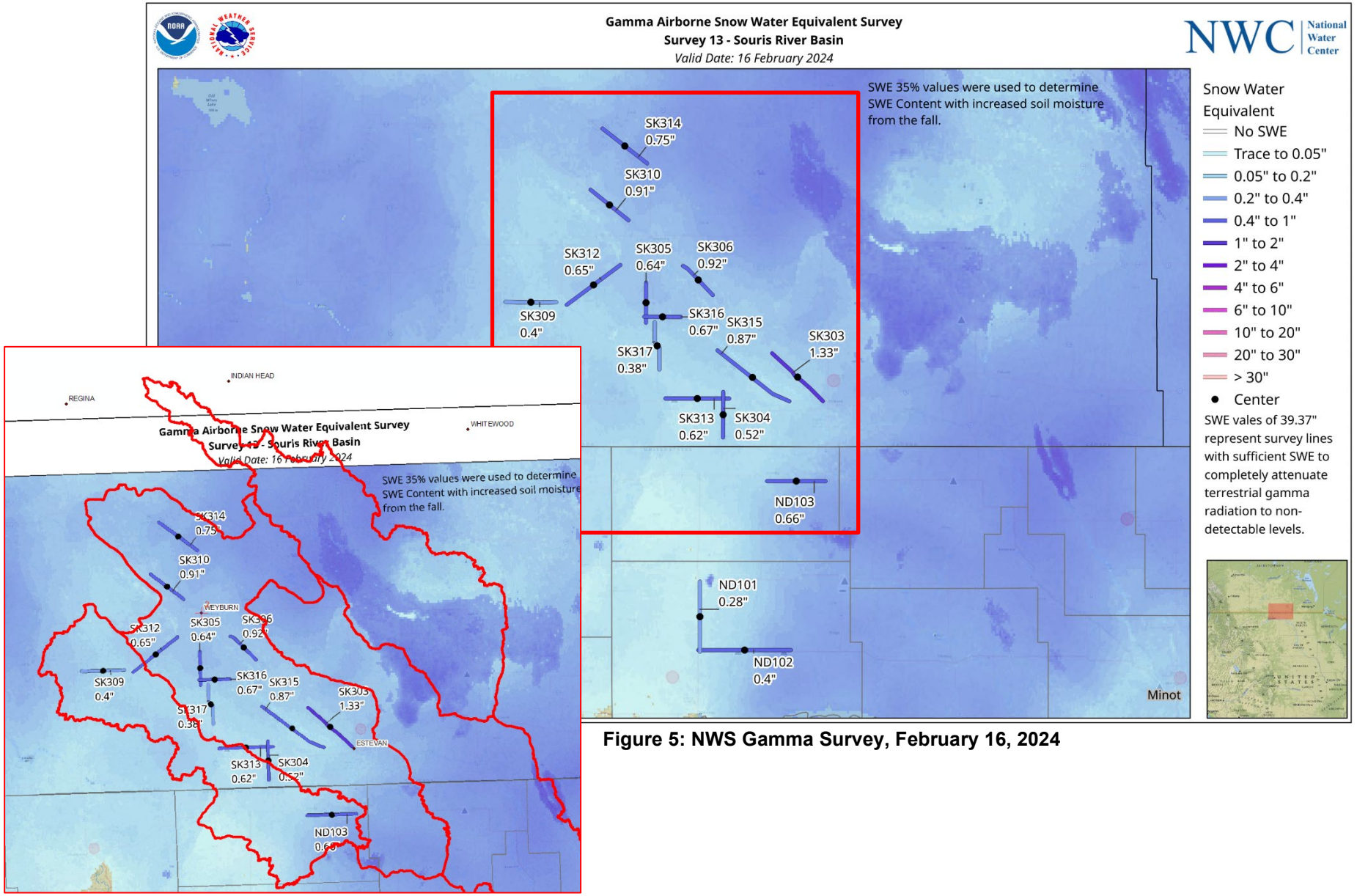

Figure 5: NWS Gamma Survey, February 16, 2024

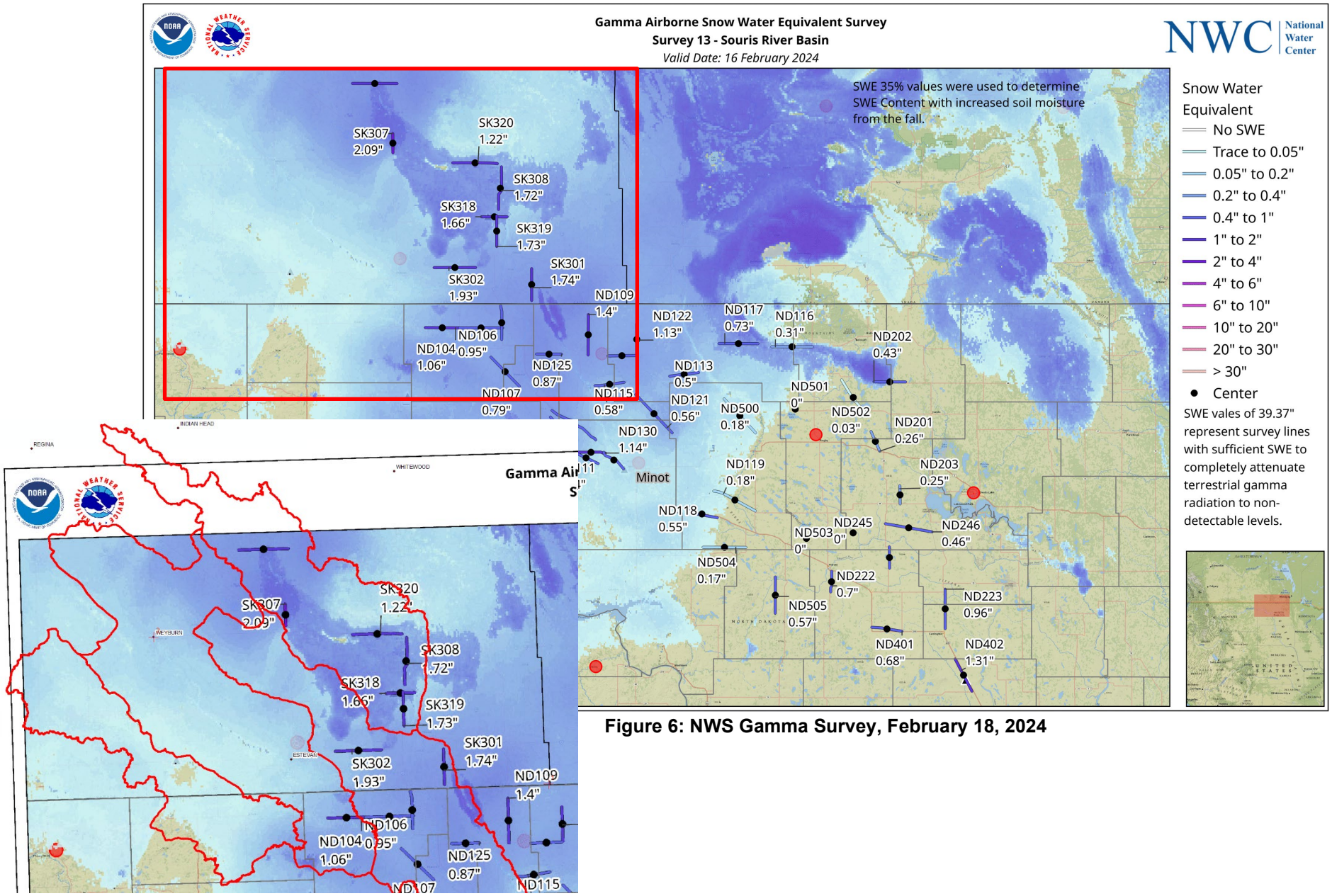

Figure 6: NWS Gamma Survey, February 18, 2024

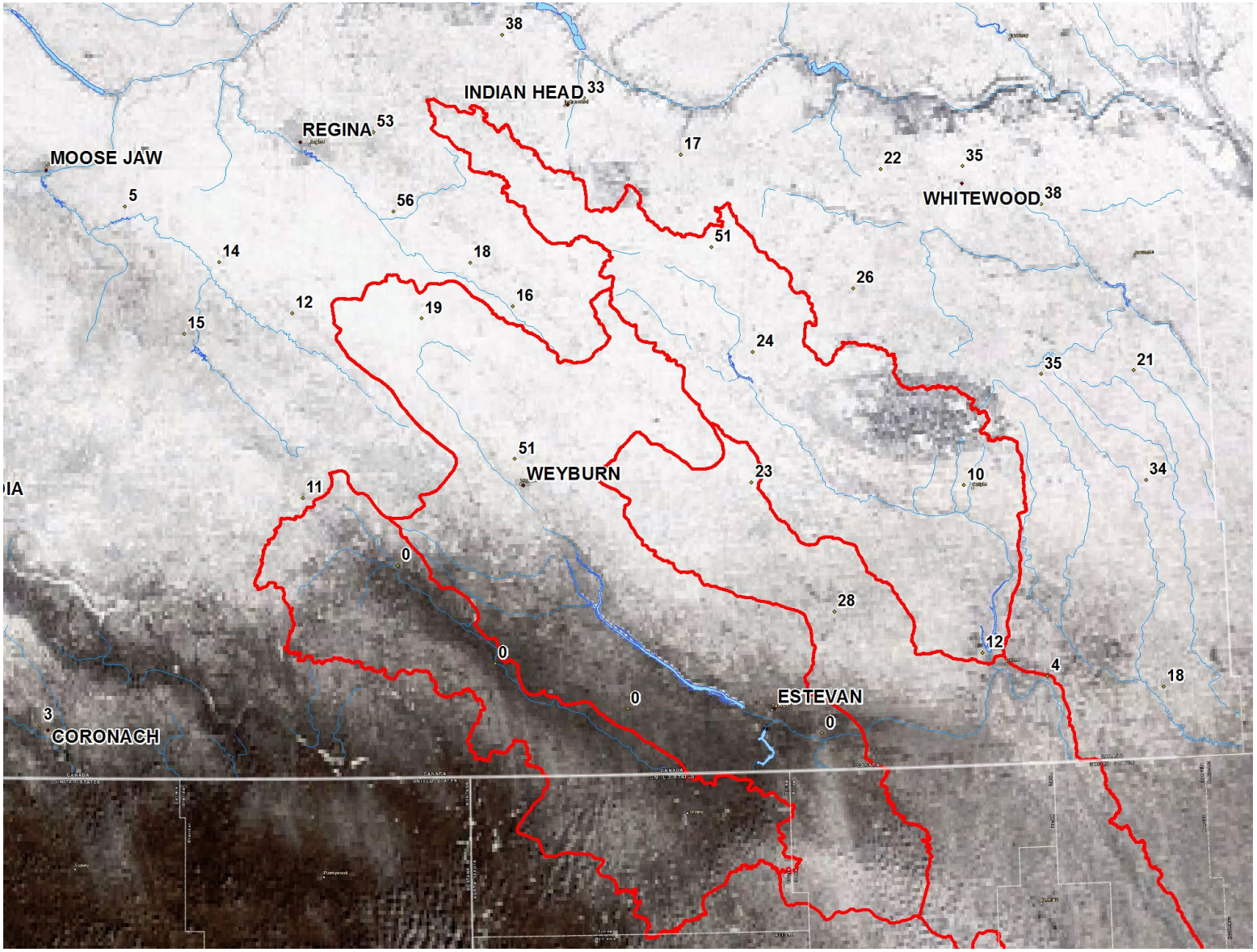

Figure 7: WSA Manual Snow Sampling (mm of Snow Water Equivalent) February 27-29, 2024 (February 27, 2024 Satellite Image)

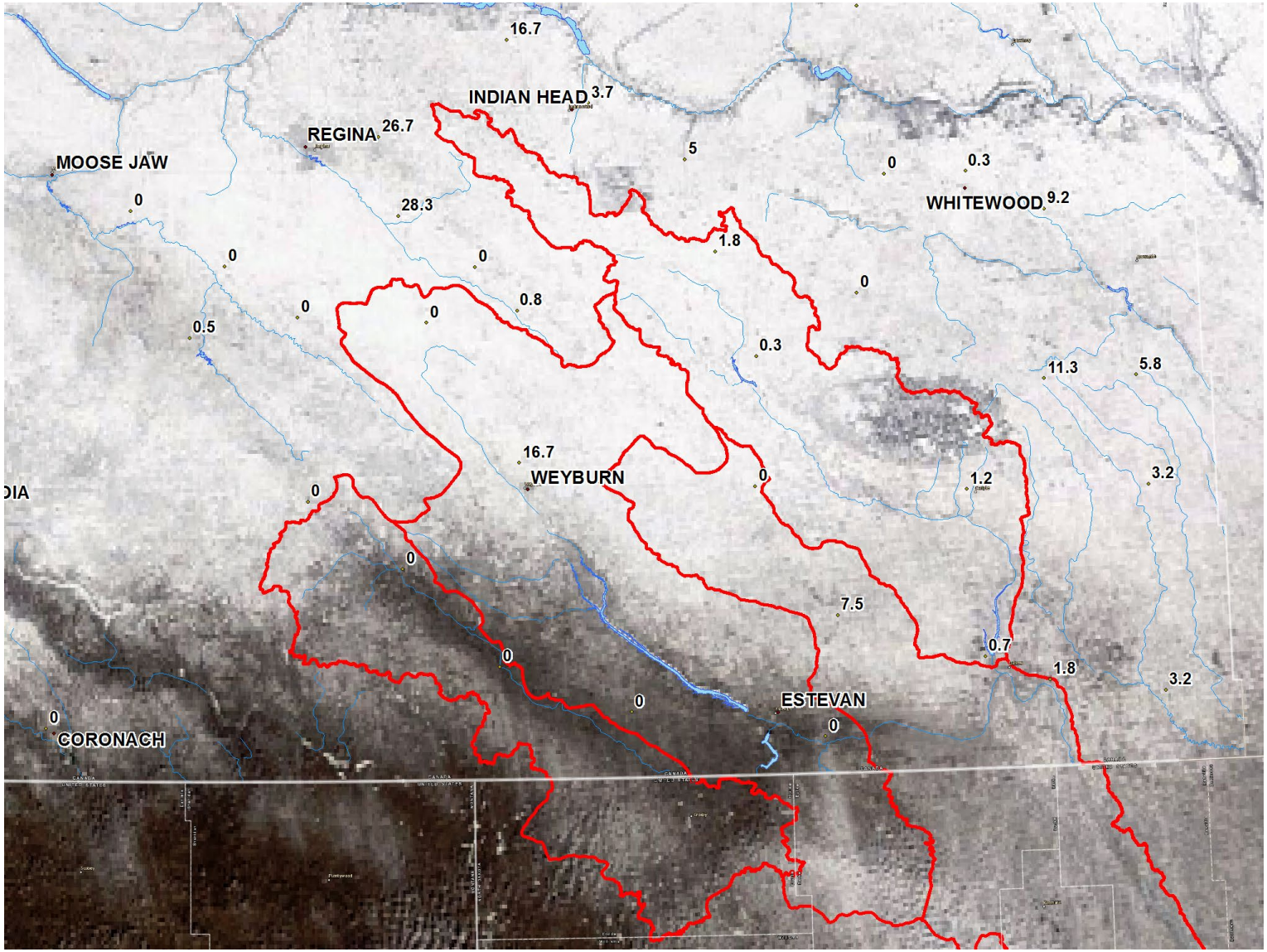

Figure 8: WSA Manual Snow Sampling Ice Layers (mm) February 27-29, 2024 (February 27, 2024 Satellite Image)

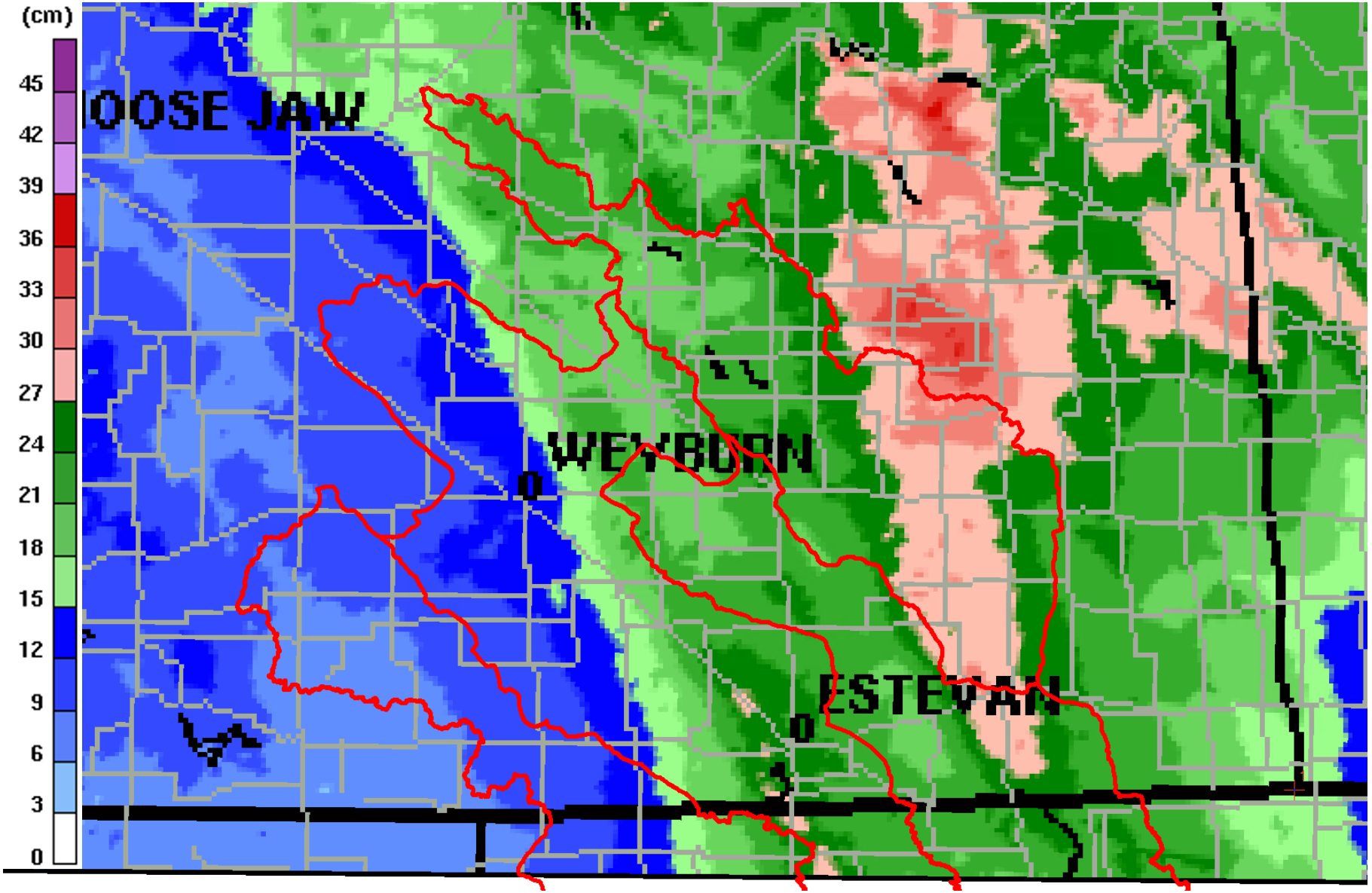

Figure 9: March 2 to 3, 2024 Precipitation (cm)
(Map Courtesy of Environment and Climate Change Canada)

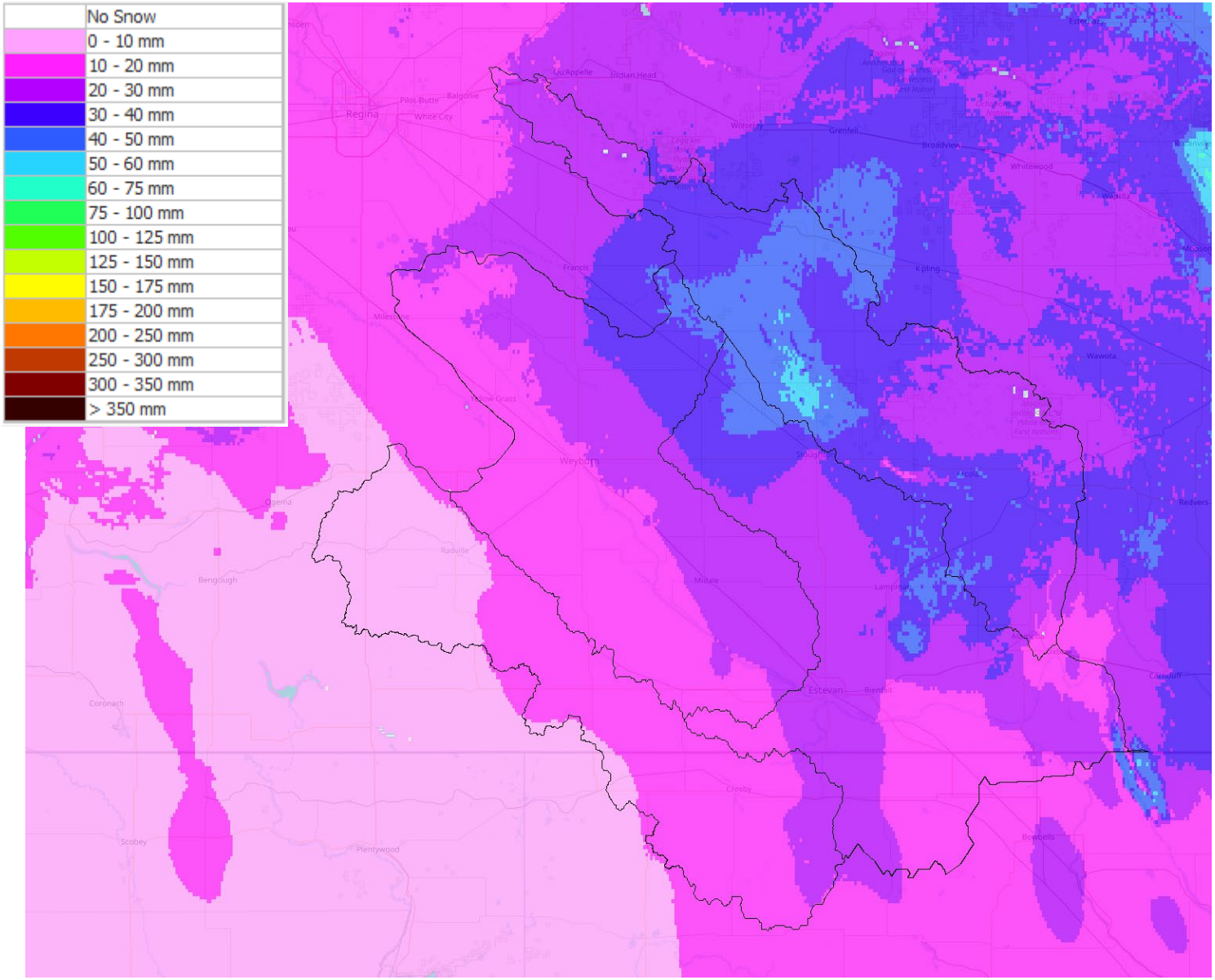

Figure 10: NWS SNODAS Modelled SWE Map March 4, 2024