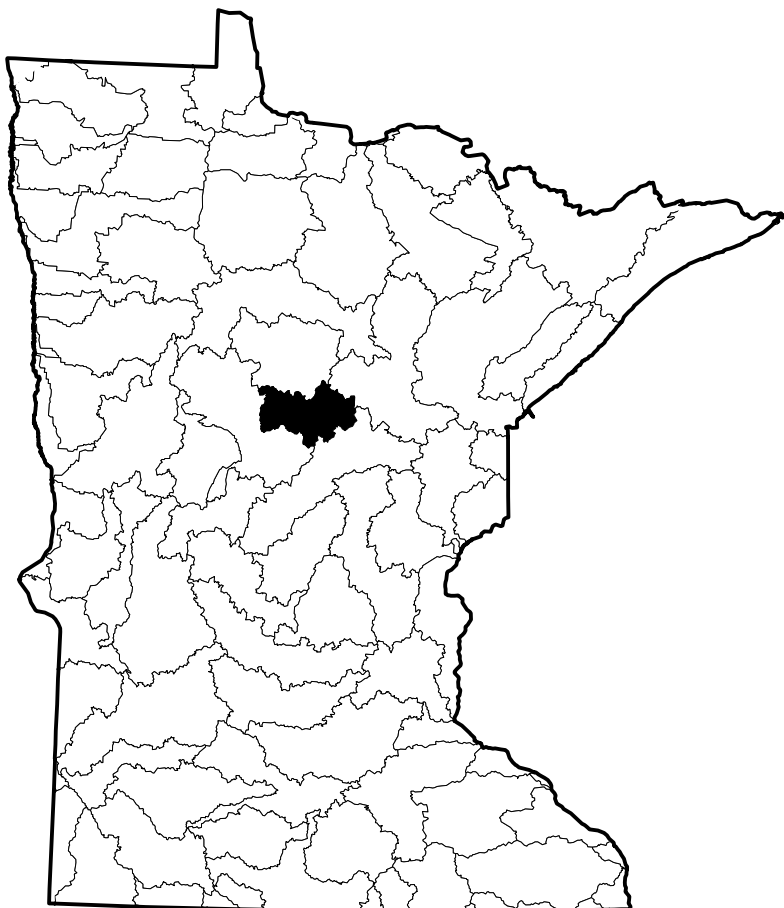


# PHYSICAL CHARACTERISTICS OF STREAM SUBBASINS IN THE PINE RIVER BASIN, CENTRAL MINNESOTA

By B. C. Fischer and C. A. Sanocki

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U.S. Geological Survey

# **Physical Characteristics of Stream Subbasins in the Pine River Basin, Central Minnesota**

**By Brian C. Fischer and Christopher A. Sanocki**

## **Abstract**

Data that describe the physical characteristics of stream subbasins upstream from selected sites on streams in the Pine River Basin, located in central Minnesota, are presented in this report. The physical characteristics are the drainage area of the subbasin, the percentage area of the subbasin covered only by lakes, the percentage area of the subbasin covered by both lakes and wetlands, the main-channel length, and the main-channel slope. Stream sites include outlets of subbasins of at least 5 square miles, and locations of U.S. Geological Survey high-flow, and continuous-record gaging stations.

## **Introduction**

This report is part of a series detailing subbasin characteristics of streams in Minnesota and adjacent states. The Pine River Basin drains an area of 785 square miles and is represented by hydrologic accounting unit 07010105 (U.S. Geological Survey, 1974). The Pine River Basin includes parts of Aitkin, Cass, Crow Wing, and Hubbard Counties in central Minnesota.

Selected data for sites on streams at outlets of subbasins larger than about 5 square miles; at locations of U.S. Geological Survey (USGS) high-flow, and continuous-record gaging stations located in the Pine River Basin are presented in this report. This report was prepared in cooperation with the Minnesota Department of Transportation.

## **Methods**

USGS 7-1/2 minute series topographic maps were used as source maps to define subbasin boundaries and to obtain main-channel length, and contour elevation points used in this report. Paper copies of the maps were used. Lake and marsh data were obtained from U.S. Fish and Wildlife Service National Wetlands Inventory Data (U.S. Fish & Wildlife Service, 1981-present). A geographic information system (GIS) was used to define the geographic location and extent of the subbasins, lakes, marshes, main-channels, and elevation points. Data digitized from paper copies were in error by no more than twice the horizontal accuracy of National Mapping Standards of 40 feet (Thompson, 1987, p.

104). All thematic (digitized) data were projected into an Albers Equal-Area projection for storage and analysis.

Subbasin boundaries were delineated on the basis of anthropogenic activities and topographic contours. Anthropogenic activities, such as the installation of storm sewers, the drainage of wetlands, and the diversion of streams, may alter the drainage area of a stream; therefore data from field inspections and recent drainage-ditch maps, were transferred to the topographic maps. The subbasin boundaries were digitized by the Minnesota Department of Natural Resources (DNR), and the USGS Minnesota District using a GIS.

Lake and marsh boundaries were overlaid on the subbasin boundaries to associate each lake and marsh with a subbasin. The total area of lakes and marshes within each subbasin was calculated by the GIS. Total marsh area plus total lake area is defined as storage area.

Main channels were delineated for each subbasin on the 7-1/2 minute topographic maps starting at the outflow of the subbasin and continuing upstream. Whenever the main channel joined with another stream, the stream upstream of the junction that drained the largest area was selected as the main channel. The main channel, which represents the watercourse that drains the greatest area, is continuous and is defined as a single trace that passes through marshes, lakes, and midline of rivers and braided streams from the basin outlet to an endpoint in the basin, generally at the basin divide. The main channels were digitized by the Minnesota Department of Transportation, using a computer aided

drafting system and transferred to the GIS. Stream extensions that represent a portion of the main channel from the end of the mapped stream (blue line on 7-1/2 minute topographic maps) to an endpoint within the basin, generally at the basin divide, were digitized by USGS Minnesota District using a GIS. The main-channel data were overlaid onto the subbasin data to associate each main channel with its subbasin.

Elevation points were digitized at the intersection of topographic contour lines and main channel. The elevation data were digitized using a GIS. The elevation data was overlaid onto the main channel data to associate each elevation data point with a main channel. Two points on the main-channel, at 10 percent and at 85 percent of the main channel length from the basin outlet to the drainage divide, were located by the GIS. The elevations of these two points were interpolated from the digitized elevation data. Main-channel slope was calculated by dividing the difference in elevation between these points by the distance along the stream channel between these points.

## Physical Characteristics of Pine River Subbasins

Physical characteristics determined for each of the subbasins shown on plate 1 are presented in table 1. Subbasins are presented in order from headwaters to mouth. The rank of the subbasin stream is shown by indentation; whenever two subbasin streams joined, the stream draining the least cumulative area was assigned a lower rank and indented in the table.

The data for drainage area, and main-channel length are reported using three significant figures or rounded to the nearest one-hundredth of a unit. The data for lake area and storage area are reported to the nearest one-tenth of a percent. The data for main-channel slope is reported to the nearest one-tenth of a foot per mile.

The following is an explanation of the terms used in table 1 and plate 1:

**Subbasin number.** A seven digit number based on the Minnesota Common Stream and Watershed Numbering System (Minnesota Department of Natural Resources, 1981). The first two digits are "11" and identify the Pine River Basin. The following three digits are arbitrary and were assigned by the DNR. The last two digits were added by the USGS Minnesota District, to identify additional subdivisions to the DNR's watersheds at locations of USGS gaging stations and to identify noncontributing areas.

**Stream name.** The name of the stream or ditch shown on 7-1/2 minute topographic maps. The relative position

of the subbasin above other subbasins, streams, and gaging stations.

**Outlet location.** The U.S. Public Lands Survey System is used to describe the location where the stream exits the subbasin, down to quarter-quarter section. The description includes quarter-quarter section, section, township, and range.

**Drainage area.** That area, measured on a horizontal plane, enclosed by a topographic divide, within which direct surface runoff from precipitation normally flows by gravity into a watercourse above a specific point. This may include closed basins and other areas that do not contribute directly to surface runoff.

**Lake area.** The percentage of the drainage area labeled lacustrine (lakes) on U.S. Fish and Wildlife Service National Wetlands Inventory Data.

**Storage area.** The percentage of a drainage area labeled lacustrine (lakes) and palustrine (wetlands) on U.S. Fish and Wildlife Service National Wetlands Inventory Data. Marsh areas shown on plate 1 are from USGS 1:100,000 digital line graph data 1993.

**Main-channel length.** The total length of the main channel from the basin outlet to a point within the basin (generally at the basin divide) representing the watercourse that drains the greatest area.

**Main-channel slope.** The average slope of the watercourse between the points at 10 and at 85 percent of the distance along the main channel from the basin outlet to the drainage divide.

**Stream extension.** A representation of the main channel from the end of the mapped stream line (blue line on 7-1/2 minute topographic maps) to an endpoint within the basin, generally at the basin divide. This is done by interpreting topographic relief so that the extension of the main channel represents the watercourse draining the greatest area.

## References Cited

- Minnesota Department of Natural Resources, 1981, The common stream and watershed numbering system: Minnesota Department of Natural Resources Stream Inventory and Data Retrieval Systems Report 7002, unpagged.
- Thompson, M.M., 1987, Maps for America, 3d edition: U.S. Geological Survey, 265 p.
- U.S. Geological Survey, 1974, Hydrologic unit map—1974 State of Minnesota: 1 plate, scale 1:500,000.
- U.S. Fish & Wildlife Service, National Wetlands Inventory Digital Data: Oct. 1981 to present

Table 1.—Physical characteristic data for the Pine River Basin.

Basin number	Stream name and location	Outlet location				By subbasin			Cumulative to mouth of basin					
		Quarter-quarter section	Section	Town-ship	Range	Drainage area (square miles)	Lake area (percent of subbasin area)	Storage area (percent of subbasin area)	Drainage area (square miles)	Lake area (percent of total area)	Storage area (percent of total area)	Main channel length (miles)	Main channel slope (foot per mile)	
<div><div></div><div><div>First Rank</div><div>Second Rank</div><div>Third Rank</div><div>Fourth Rank</div><div>Fifth Rank</div></div></div>	1102600	Stony Creek above Pine Mountain Lake	SW NE	24	139N	31W	33.1	5.6	25.	33.1	5.6	25.	15.0	7.2
	1100600	Pine Mountain Lake outlet	NE NW	06	138N	30W	12.4	23.	36.	45.5	10.	28.	17.8	5.5
	1100709	Noncontributing area to basin 1100700 (Lindsey Lake)	--	--	--	--	1.84	22.	30.	1.84	22.	30.	--	--
	1100700	Pine River above Brockway Lake	SW NW	35	139N	30W	11.5	9.2	23.	58.8	11.	27.	24.1	4.7
	1102709	Noncontributing area to Basin 1102700	--	--	--	--	2.94	15.	22.	2.94	15.	22.	--	--
	1102700	Unnamed tributary to Pine River	SW SW	25	139N	30W	9.96	21.	32.	12.9	20.	30.	7.28	2.8
	1102800	Unnamed tributary to Little Lake Hattie	NW SW	29	139N	29W	5.99	7.0	21.	5.99	7.0	21.	5.09	8.5
	1100800	Pine River above Lizzie Creek	SE SE	06	138N	29W	12.4	17.	32.	90.1	13.	28.	30.5	3.7
	1103001	Blind Lake Creek above unnamed tributary (basin 1102900)	SW SW	26	139N	29W	21.7	4.7	31.	21.7	4.7	31.	14.4	8.6
	1102900	Unnamed tributary to Blind Lake Creek	NW NW	35	139N	29W	14.9	23.	44.	14.9	23.	44.	13.1	1.9
	1103000	Unnamed tributary to Lizzie Lake	SE SW	35	139N	29W	0.73	0.0	31.	37.3	12.	36.	16.5	8.2
	1103100	Unnamed tributary to Lizzie Lake	NW SE	03	138N	29W	9.19	8.2	27.	9.19	8.2	27.	7.65	3.1
	1100900	Lizzie Creek above Pine River	SE SE	06	138N	29W	6.08	14.	31.	52.6	12.	34.	21.5	6.8
	1101301	Pine River above gaging station near Pine River: station number is 05229450	SW NE	06	137N	29W	12.9	7.1	20.	156.	12.	29.	38.2	3.3
	1101300	Pine River above South Fork Pine River	NE NE	07	137N	29W	0.48	0.0	1.5	156.	12.	29.	39.3	3.2
	1107000	South Fork Pine River above unnamed tributary (basin 1102400)	SE SW	14	138N	31W	9.35	2.2	26.	9.35	2.2	26.	7.98	26.6
	1102400	Unnamed tributary to South Fork Pine River	SE SW	14	138N	31W	4.91	0.0	27.	4.91	0.0	27.	3.91	35.8
	1101001	South Fork Pine River above Cedar Creek	NE SW	23	138N	31W	0.45	0.0	45.	14.7	1.4	27.	8.75	24.5

Table 1.—Physical characteristic data for the Pine River Basin—Continued.

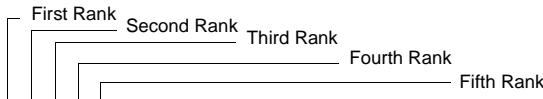
Basin number	Stream name and location	Outlet location				By subbasin			Cumulative to mouth of basin				
		Quarter-quarter section	Section	Town-ship	Range	Drainage area (square miles)	Lake area (percent of subbasin area)	Storage area (percent of subbasin area)	Drainage area (square miles)	Lake area (percent of total area)	Storage area (percent of total area)	Main channel length (miles)	Main channel slope (foot per mile)
													
1102509	Noncontributing area to basin 1102500	--	--	--	--	2.63	9.2	20.	2.63	9.2	20.	--	--
1102500	Cedar Creek to South Fork Pine River	NE SW	23	138N	31W	5.42	3.2	27.	8.05	5.2	25.	5.89	28.7
1101000	South Fork Pine River above unnamed tributary (basin 1102301)	SE NW	31	138N	30W	9.89	1.8	35.	32.7	2.5	29.	12.5	16.6
1102300	Brittan Creek above Dabill Creek	NE SW	36	138N	31W	8.91	1.9	24.	8.91	1.9	24.	7.82	26.1
1102200	Dabill Creek above Brittan Creek	NE SW	36	138N	31W	7.19	0.5	23.	7.19	0.5	23.	6.74	32.1
1102301	Unnamed tributary to South Fork Pine River	SE NW	31	138N	30W	0.54	0.0	37.	16.6	1.2	24.	9.03	22.5
1101002	South Fork Pine River above Bungo Creek	NW SW	32	138N	30W	0.43	0.0	30.	49.7	2.0	27.	13.8	13.5
1102100	Unnamed tributary to Bungo Creek	NE NW	23	137N	31W	7.56	1.5	21.	7.56	1.5	21.	5.73	27.4
1102001	Bungo Creek above unnamed tributary (basin 1102100)	NE NW	23	137N	31W	3.17	0.0	13.	3.17	0.0	13.	4.87	21.2
1102000	Bungo Creek to South Fork Pine River	NW SW	32	138N	30W	7.71	0.0	18.	18.4	0.6	18.	11.9	15.5
1101103	South Fork Pine River above Hoblin Creek	SE SW	03	137N	30W	9.45	3.6	24.	77.6	1.9	25.	18.1	8.3
1101800	Wilson Creek to Hoblin Creek	NE NW	09	137N	30W	7.77	0.0	15.	7.77	0.0	15.	8.60	21.3
1101900	Hoblin Creek above Wilson Creek	NW NW	09	137N	30W	4.64	0.0	36.	4.64	0.0	36.	4.45	29.4
1101901	Hoblin Creek to South Fork Pine River	SE SW	03	137N	30W	0.73	0.0	23.	13.1	0.0	23.	9.87	19.6
1101102	South Fork Pine River above unnamed tributary (basin 1101200)	NE SE	03	137N	30W	0.78	0.0	40.	91.5	1.6	25.	18.8	8.0
1101209	Noncontributing area to basin 1101200	--	--	--	--	5.34	0.0	3.2	5.34	0.0	3.2	--	--
1101200	Unnamed tributary to South Fork Pine River	NE SE	03	137N	30W	4.94	4.6	36.	10.3	2.2	19.	3.70	13.0
1101101	South Fork Pine River above Behler Creek	SE SW	01	137N	30W	2.89	0.0	35.	105.	1.6	24.	22.0	6.2
1101700	Behler Creek to South Fork Pine River	SE SW	01	137N	30W	6.67	0.0	35.	6.67	0.0	35.	6.54	14.9

Table 1.—Physical characteristic data for the Pine River Basin—Continued.

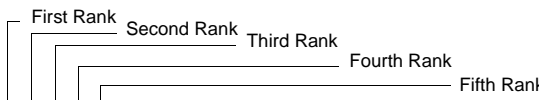
Basin number	Stream name and location	Outlet location				By subbasin			Cumulative to mouth of basin				
		Quarter-quarter section	Section	Township	Range	Drainage area (square miles)	Lake area (percent of subbasin area)	Storage area (percent of subbasin area)	Drainage area (square miles)	Lake area (percent of total area)	Storage area (percent of total area)	Main channel length (miles)	Main channel slope (foot per mile)
9													
	1101100 South Fork Pine River to Pine River	NE NE	07	137N	29W	0.58	0.0	18.	268.	7.5	27.	23.7	5.4
	1101501 Pine River above Arvig Creek	NE SE	08	137N	29W	0.92	0.0	1.5	269.	7.4	27.	40.7	3.1
	1101400 Arvig Creek to Pine River	NE SE	08	137N	29W	18.5	1.2	24.	18.5	1.2	24.	11.4	15.8
	1101500 Pine River to Upper Whitefish Lake	NE NE	13	137N	29W	5.50	0.3	12.	293.	6.9	27.	45.7	3.2
	1101600 Hay Creek to Upper Hay Lake	NE SE	26	137N	29W	14.9	0.0	28.	14.9	0.0	28.	9.54	6.6
	1104700 Lower Hay Lake outlet to Upper Whitefish Lake	NW NE	19	137N	28W	11.3	21.	30.	26.2	9.2	29.	13.8	5.0
	1106700 Willow Creek to Upper Whitefish Lake	SE NE	06	137N	28W	10.5	0.0	22.	10.5	0.0	22.	6.92	37.2
	1103200 Thompson Creek to Arrowhead Lake	SE SE	34	138N	28W	10.1	0.0	27.	10.1	0.0	27.	10.6	22.3
	1106601 Spring Brook to Arrowhead Lake	SE SE	34	138N	28W	3.72	0.0	5.5	3.72	0.0	5.5	4.34	44.6
	1106600 Arrowhead Lake outlet to Upper Whitefish Lake	SW SE	04	137N	28W	4.47	9.1	19.	18.2	2.2	21.	12.1	20.9
	1106500 Big Trout Lake outlet to Lower Whitefish Lake	NW NW	12	137N	28W	16.0	17.	24.	16.0	17.	24.	7.64	26.2
	1106800 Lower Whitefish Lake outlet to Rush Lake	NE SW	07	137N	27W	25.1	53.	57.	389.	10.	28.	52.4	3.5
	1103600 Unnamed tributary to Daggett Brook	NE NW	35	140N	27W	11.4	10.	34.	11.4	10.	34.	6.59	8.0
	1103500 Daggett Brook above unnamed tributary (basin 1103600)	NE NW	35	140N	27W	8.74	0.0	30.	8.74	0.0	30.	7.76	16.0
	1103700 Daggett Brook above Washburn Lake	NW SW	05	139N	26W	13.8	8.2	36.	33.9	6.7	34.	12.0	4.0
	1103800 Washburn Lake outlet	NE NE	17	139N	26W	10.5	25.	36.	44.4	11.	34.	13.7	3.4
	1103900 Daggett Brook above Hay Creek	NE NE	25	139N	27W	8.30	4.3	21.	52.7	10.	32.	18.5	3.2
	1103400 Hay Creek to Daggett Brook	NE NE	25	139N	27W	14.9	1.8	24.	14.9	1.8	24.	6.99	22.6
	1104300 Lawrence Lake outlet	NW SW	26	139N	26W	15.7	6.3	32.	15.7	6.3	32.	6.44	5.7
	1104200 Spring Branch to Roosevelt Lake	SW NW	14	139N	26W	6.06	0.2	17.	6.06	0.2	17.	4.94	28.9
	1104100 Crooked Creek to Mitchell Lake	NE SE	12	138N	27W	21.1	16.	29.	42.9	10.	28.	13.6	2.6

Table 1.—Physical characteristic data for the Pine River Basin—Continued.

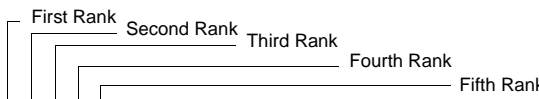
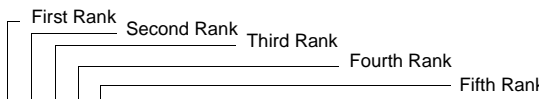
Basin number	Stream name and location	Outlet location				By subbasin			Cumulative to mouth of basin				
		Quarter-quarter section	Section	Township	Range	Drainage area (square miles)	Lake area (percent of subbasin area)	Storage area (percent of subbasin area)	Drainage area (square miles)	Lake area (percent of total area)	Storage area (percent of total area)	Main channel length (miles)	Main channel slope (foot per mile)
													
1104001	Daggett Brook above Fox Creek	SE NW	35	138N	27W	14.6	9.9	21.	125.	9.1	28.	30.0	3.8
1103300	Fox Creek above Daggett Brook	SE NW	35	138N	27W	16.1	11.	25.	16.1	11.	25.	12.0	22.3
1104000	Daggett Lake outlet	SW NW	16	137N	27W	5.19	18.	25.	146.	9.6	28.	35.2	3.9
1106000	Cross Lake outlet above gaging station near Cross Lake: station number 05231000	SW NW	21	137N	27W	7.22	57.	59.	543.	11.	29.	55.2	3.2
1105301	Pine River above unnamed tributary (basin 1105900)	NW SW	27	137N	27W	3.56	5.2	12.	546.	11.	29.	57.8	3.0
1105908	Noncontributing area to basin 1105900	--	--	--	--	0.92	2.9	7.2	0.92	2.9	7.2	--	--
1105909	Noncontributing area to basin 1105900	--	--	--	--	5.12	10.	19.	5.12	10.	19.	--	--
1105900	Unnamed tributary above Pine River	NE SW	27	137N	27W	11.8	13.	28.	17.8	12.	24.	8.89	5.7
1105300	Pine Lake outlet	NE SW	34	137N	27W	3.12	19.	27.	567.	11.	28.	59.3	2.9
1106300	Unnamed tributary to Pine River	SE NW	34	137N	27W	8.36	16.	39.	8.36	16.	39.	7.51	5.4
1105201	Pine River above Pelican Brook	NE NE	08	136N	27W	1.59	0.0	17.	577.	11.	28.	63.3	3.1
1106200	Pelican Lake outlet	SW NW	11	136N	28W	32.3	50.	54.	32.3	50.	54.	6.65	0.0
1106100	Pelican Brook to Pine River	NE NE	08	136N	27W	20.1	14.	24.	52.4	36.	42.	14.4	0.8
1105200	Pine River above Little Pine River	SW SW	12	136N	27W	6.14	0.0	17.	636.	13.	30.	68.7	3.0
1100100	East Creek to Little Pine Lake	SE SW	02	138N	25W	12.8	4.9	46.	12.8	4.9	46.	7.58	9.9
1104601	West Creek to Little Pine Lake	SE SE	03	138N	25W	5.34	0.0	52.	5.34	0.0	52.	4.80	18.3
1104600	Unnamed tributary from Little Pine Lake above unnamed tributary (basin 1100202)	NW NE	11	138N	25W	1.01	19.	44.	19.2	4.3	48.	8.45	18.1
1100202	Unnamed tributary to Little Pine River	NW NE	11	138N	25W	0.88	0.0	33.	0.88	0.0	33.	2.16	31.4
1100201	Little Pine River above unnamed tributary (basin 1100300)	SW SE	15	138N	25W	4.25	0.0	49.	24.3	3.4	47.	11.3	8.4

Table 1.—Physical characteristic data for the Pine River Basin—Continued.

Basin number	Stream name and location	Outlet location				By subbasin			Cumulative to mouth of basin				
		Quarter-quarter section	Section	Township	Range	Drainage area (square miles)	Lake area (percent of subbasin area)	Storage area (percent of subbasin area)	Drainage area (square miles)	Lake area (percent of total area)	Storage area (percent of total area)	Main channel length (miles)	Main channel slope (foot per mile)
													
1100300	Unnamed tributary to Little Pine River	SW SE	15	138N	25W	9.24	1.4	44.	9.24	1.4	44.	5.85	8.3
1100200	Little Pine River above unnamed tributary (basin 1104400)	SE NE	20	138N	25W	2.18	0.0	44.	35.7	2.7	46.	13.4	7.4
1104400	Unnamed tributary to Little Pine River	NE NE	20	138N	25W	6.23	1.0	39.	6.23	1.0	39.	6.07	10.3
1105800	Van Sickle Brook to Lake Mary	SE SE	23	138N	26W	10.3	9.1	28.	10.3	9.1	28.	4.94	9.8
1104500	Little Pine River above Lake Emily	NE SW	26	138N	26W	7.00	12.	36.	59.3	4.7	41.	18.8	6.3
1105700	Lake Emily outlet	SW SW	35	138N	26W	6.69	26.	44.	66.0	6.9	42.	20.2	5.8
1105600	Little Pine River above unnamed tributary (basin 1106400)	SW NW	15	137N	26W	7.59	0.0	30.	73.6	6.2	40.	24.4	5.1
1106400	Unnamed tributary to Little Pine River	SW NW	15	137N	26W	5.22	8.2	30.	5.22	8.2	30.	4.13	2.1
1105500	Little Pine River above Mud Brook	SE NE	33	137N	26W	4.02	1.7	31.	82.8	6.1	39.	30.8	4.8
1100400	Mud Brook above Lows Lake	SW SE	27	138N	25W	7.58	6.8	37.	7.58	6.8	37.	5.05	7.7
1104800	Mud Brook above Ross Brook	SE SE	17	137N	25W	14.0	4.4	48.	21.6	5.3	44.	14.5	5.5
1100500	Johnson Creek to Ross Lake	NE SE	22	137N	25W	8.32	2.1	42.	8.32	2.1	42.	6.46	12.2
1104900	Ross Lake outlet	SE SE	21	137N	25W	6.17	14.	45.	14.5	7.3	43.	7.65	11.1
1105001	Ross Brook to Mud Brook	SE SE	17	137N	25W	1.68	0.0	37.	16.2	6.5	42.	9.56	10.0
1105000	Mud Brook to Little Pine River	SE NE	33	137N	26W	10.5	6.5	27.	48.3	6.0	40.	25.6	3.7
1105401	Perry Lake Creek to Little Pine River	NW SE	05	136N	26W	3.92	6.3	31.	3.92	6.3	31.	5.11	17.2
1105400	Little Pine River above Pine River	SW SW	12	136N	27W	6.24	12.	31.	141.	6.3	39.	37.9	4.0
1105100	Pine River	NW SE	08	47N	29W	7.82	4.9	33.	785.	11.	31.	74.5	2.5