Minnesota Pollution Control Agency

Minnesota River Basin

Pomme de Terre River Watershed.

Physiography And Description

Situated in the North Central Hardwood Forests Ecoregion, the headwaters of the 866-square mile Pomme De Terre River Watershed, a major watershed of the Minnesota River Basin, begin in the predominantly high, well drained, loamy soils of Minnesota's famed lake region (Pomme De Terre is French for "potato," and the river was named for the prairie turnip, a potato like food of the Sioux).

Originating in lakes and ponds of the rugged, undulating to steep sloped (6- 45%) Alexandria Glacial Moraine, the Pomme De Terre River starts it's journey as a distinct stream tumbling cool and clear from Stalker and Long lakes in southern Otter Tail County. Bordered by wooded hills and grassy meadows, the Pomme De Terre, while having no major tributaries, flows south through several lakes in Otter Tail, Grant, and Stevens counties. Most of these lakes have small water-control dams in the outlets, maintaining lake levels. In many stretches between lakes, the River meanders quietly through cattail and reed canary grass marshes.

Below the headwaters, the Pomme de Terre enters the Northern Glaciated Plains Ecoregion. Drainage on the eastern side of the river in this ecoregion is off the Big Stone Moraine, characterized by landscapes that are gently sloping to moderately steep (6-12%) and well drained silty and loamy soils. Water erosion potential within the Big Stone Moraine is generally classified as moderate. Waters falling on the western side of the basin drain the Fergus Falls Till Plain, an outwash plain of nearly level to moderately sloping (0-6%) composed of poorly drained clayey and loamy soils. Slight to high water and wind erosion potentials exist across this section of the basin and are reflected by the character of the Pomme De Terre below the town of Morris. South of this point, flowing through southern Stevens and eastern Swift counties, the River is bordered by eroding, muddy banks, becoming increasingly turbid before discharging into the Minnesota River at Marsh Lake. Overall river gradient is 3.5 feet per mile.

Geology and Land Use

The oldest and deepest rocks in the Pomme De Terre River Watershed are Precambrian in age. These hard, relatively impermeable, crystalline rocks are of igneous and metamorphic origins. Overlying the Precambrian rocks are shales and sandstones of the Cretaceous age. Covering these deposits and extending over the entire watershed, lay deposits of glacial drift, including: till, clay, silt, sand, and gravel. Till depths range from 150 to 300 feet deep.

Land use within the Pomme De Terre River Watershed is primarily agricultural, accounting for approximately 81% of the available acres. Located in the northwest quadrant of the Minnesota River Basin, cropping systems in the Pomme De Terre Watershed are more diverse than those of other major watersheds draining the southwest and southeast quadrants. There are roughly one million cattle and three million hogs in the Minnesota River Basin, with 24% of the cattle and 14% of the hogs located within the northwest quadrant.

Within the Pomme De Terre River Watershed, corn and soybeans only account for approximately 50% of the crops grown on agricultural lands. Small grains, hay, and grasslands enrolled in the Conservation Reserve Program (CRP) make up the majority of the balance. In early 1996; it was estimated that 7% of the agricultural acres within the Pomme De Terre Watershed were enrolled in the CRP program, a voluntary federal program that offers annual rental payments to farmers in exchange for planting areas of grass and trees on lands subject to erosion. Cropped lands are generally classified as moderately productive (73%), although nearly 24% are ranked as low production acres.

Climate

The climate within the Pomme De Terre River Watershed is continental, with cold dry winters and warm wet summers. Average monthly temperatures recorded near Morris range from 7.10 F in Jan., to 70.80 F in July. An average of twenty four to twenty six inches of precipitation annually fall within the watershed with two thirds of this precipitation normally falling in the five months from May through September. The effect of low average precipitation combined with high rates of evapotranspiration (22.4" annual average) results in this region having the lowest annual average runoff (1"-2") in the Minnesota River Basin.

Ground Water

Within overlying till deposits, good quality ground water is available everywhere in the watershed. High yield aquifers are largely confined to ice-contact sand and gravel till deposits within the Alexandria Moraine and the outwash plain of the river. According to a 1966 report by United States Geological Survey, these same aquifers also have the

potential to be easily contaminated. The Cretaceous and Precambrian rocks beneath the drift are poor aquifers and few wells are completed in them. The north half of the watershed is separated from the south half by a groundwater divide. Water flows through the north half from northeast to southwest. Calculated underflow from the south half of the watershed is a negligible quantity.

Surface Water

It appears degraded discharges from the Pomme de Terre may be a phenomenon of the more recent past, as Eric Sevareid, canoeing up the Minnesota River in the summer of 1930 wrote; "We paddled on, nagging at the heat and flies, until we came to the Pomme de Terre, or Potato River, clear as crystal, flowing into the muddy Minnesota" (T. Waters, 1974).

Today, pollution of surface waters in the Minnesota River's major watersheds is a moderate to severe problem. Constituents of concern often include: suspended sediments, excess nutrients (primarily nitrogen and phosphorus), pesticides, pathogens, and biochemical oxygen demand. High concentrations and loads of suspended sediments and nutrients can often be linked to artificial drainage patterns (ditches, tile, etc.) and wetland reductions. Alone or in combination, these landscape alterations have effectively increased the hydraulic efficiency and magnitude of storm and snowmelt runoff events.

Estimates vary, but about 80 percent of the wetlands in the Minnesota River Basin have been drained and converted to other uses. High nutrient levels in lakes and streams often result from over-land runoff across erodible soils. Eroded soils and the runoff which transport these particles often carry pesticides and excess nutrients to receiving waters.

Increased discharges and elevated flood peaks also erode streambanks, destroy shoreline vegetation and deposit sediment on floodplains, in streams, and in downstream receiving waters. Sediment in water often leads to impaired habitat for aquatic life, decreased photosynthetic activity, and reduced recreational quality.

Excessive levels of nutrients often promote eutrophication; defined as nutrient rich oxygen poor water. Elevated nutrient levels often promote abundant algal populations which in turn can cause large diurnal fluctuations in dissolved oxygen concentrations (photosynthesis being responsible for daytime highs, respiration for nighttime lows). In addition, algal decomposition is often a major factor responsible for high biochemical oxygen demand (BOD) levels. BOD is the amount of oxygen consumed -- biologically and chemically -- over a five day period. The BOD test reflects the effect of easily decomposed organic materials on oxygen depletion.

Other sources of organic materials include: eroded organic materials associated with sediment or manure, and discharges from faulty wastewater treatment plants, and faulty septic systems. The presence of water-borne pathogens is often characterized by determining the population of fecal coliform in water quality monitoring samples. Fecal

coliform are a subset of bacterial populations, and generally arise from the fecal excrement of humans, livestock, and water fowl. Common sources of fecal coliform include feedlots, faulty wastewater treatment plants, and faulty septic systems.

Table 4.09: Estimate of Point Source Phosphorus Loads for the Pomme de Terre River (1996)

7020002	Pomme de Terre Watershed				
NPDES #	**Permittee**	**Avg. Annual (MGD)**	**Discharge Facility**	**Total Phos Conc. (mg/l)**	**Total Phos. Load (lbs./yr)**
MN0055182	Alberta	0.0115	POTW*-pond	2.00	70
MN0022713	Barrett	0.0337	POTW	4.00	410
MN0025071	Underwood	0.0529	POTW-pond	2.00	322
MN0053261	Ashby	0.0642	POTW-pond	2.00	390
MN0052264	Chokio	0.0685	POTW-pond	2.00	416
MN0021890	Appleton	0.2659	POTW	6.00	4849
MN0021318	Morris	0.6798	POTW-pond	3.00	6363
MNG640022	Chokio WTP	0.0009	water	1.00	3
					Total 12,823

* - Public Owned Treatment Works

Table 4.10: Mean Total Phosphorus Concentrations Pomme de Terre River

		Mean Annual TP Concentration (mg/l)
Pomme de Terre River	annual	NA
Pomme de Terre River	summer only	NA

Northern Glaciated Plains Ecoregion	annual	0.218
Northern Hardwood Forests Ecoregion	annual	0.145
Minnesota River Basin	annual	0.251

Among the nutrients, phosphorus is a pollutant of major concern to the water quality of the Minnesota River and its tributaries. Any strategy to restore the Minnesota River will require the major watersheds to take part in reducing phosphorus loadings to the main stem. Eventually, through basin management, a basinwide phosphorus loading reduction goal can be established. Through a collaborative process involving local, state and federal government, in addition to watershed residents and other stakeholders, this whole-basin load-reduction goal can be allocated among the 13 major watersheds. Within each major watershed, in turn, the total watershed load-reduction goal can be further allocated among point and nonpoint sources.

In preparation for this process, several kinds of information on phosphorus pollution sources, concentrations and loads have been collected. This includes an estimate of phosphorus loads from point sources within the major watershed (Table 4.09), together with watershed specific monitoring data on recent phosphorus concentrations, flows, total phosphorus load estimates, ecoregion specific phosphorus values, and basin wide ecoregion weighted phosphorus values (Table 4.10 and 4.11).

Table 4.11: Water Quality Characteristics Pomme de Terre RiverPhosphorus and Total Suspended Sediment

Pomme de Terre Mean Annual Flow Minnesota River Mean Annual Flow	110 cfs[c] 4,266 cfs	
Total Phosphorus Estimated TP Load (March - Aug)[a] % of MN R Basin TP Load[b]		15.88 tons 1.34%
Total Suspended Sediment Estimated TSS Load (March - Aug)[a] % of MN R Basin TSS Load[b]	3,116 tons .66%	

[a] - estimated by the University of Minnesota's Department of Soil, Water and Climate
[b] - based on total load contributions to the Minnesota River (point and nonpoint sources)

As mentioned, livestock feedlots are a major potential source of several pollutants: phosphorus, nitrogen, and pathogens in particular. Considerable progress has been made through the state feedlot program in recent years. Attached is a map (Figure 4.04) of feedlots in the Pomme De Terre River Watershed that have received certificates of compliance, often referred to as feedlot permits *(coming soon)*.

Table 4.12: Water Quality Standard Exceedances
Pomme de Terre River Watershed

Parameter	Percent of Samples Exceeding State Water Quality Standards		
	Assigned Limits	**April - June**	**July - August**
Turbidity	25 NTU	17%	41%
Fecal Coliform*	200 org./100 ml	26%	64%

* percent of samples in violation do not meet the frequency of sampling requirements of state law (see above), but only represent the percentage of pre-1997 samples collected over the last thirty years, which have exceeded 200 organisms/100 ml.

Seasonal patterns often influence flow discharge patterns in the Pomme De Terre River; the general trend is for flows to increase in spring, peak in late spring to early summer, and decline through late summer. Higher soil moisture contents, undeveloped crop canopies, and lower evapotranspiration rates, are the most likely factors influencing the observed trends. The mean annual flow discharge rate for the Pomme De Terre is 110 cubic feet per second (cfs). Flows average 226 cfs from April through June, while lesser flows averaging 74 cfs are the norm from July through August. Maximum recorded discharge of the Pomme De Terre at Appleton was 5050 cfs in 1952.

As with discharge, seasonal patterns of turbidity and fecal coliform are evident on the Pomme De Terre River. Levels of these parameters are generally greater for the July to September period than for the April through June period. Monitoring data collected periodically over the last 30 years was compiled and summarized by the University of Minnesota's Department of Soil Water and Climate according to the percent of samples in the entire record that exceed state or federal water quality standards (where available).

State standards for turbidity are expressed in terms of nephelometric turbidity units (NTU's), which is a measure of light scattered by suspended sediment and organic particles. The state standard for turbidity is exceeded in water with turbidities greater than 25 NTU's. For swimming areas and sewage effluent, state standards for bacteria are exceeded when fecal coliform counts are greater than 200 organisms per 100 ml of water as a geometric mean of not less than five samples in a calendar month, or if more than ten percent of all samples taken during and calendar month individually exceed 2,000 organisms per 100 milliliters. The presence of fecal coliforms indicates recent fecal contamination from warm blooded animals and the possible presence of enteric (intestinal) pathogens.

Most of the lakes within the Pomme De Terre River Watershed are located in the northern third of the watershed, including: Stalker, Pomme De Terre, Artichoke, North Turtle, South Ten Mile, as well as several others. In addition to providing recreational

benefits, these water bodies provide a valuable water storage function, thus reducing peakflows in the Pomme De Terre River.

Recreation

There are over one hundred lakes of the upper Pomme De Terre Watershed. These lakes are used primarily for hunting, fishing, and watersports, in addition to providing excellent habitat for fish and wildlife. Fish species present include walleye and northern pike, bass, and panfish. Public access to most of the fishing lakes in the headwater regions of the Pomme De Terre are available, as well as access to the Pomme De Terre River at Appleton Lake County Park in Swift County. Many state wildlife management areas and federal waterfowl production areas are located in the watershed along small tributaries, wetlands, and the river itself.

References

Waters, T. F., 1977. THE STREAMS AND RIVERS OF MINNESOTA: University of Minnesota Press, Mpls., Minnesota

More Information

For questions about the Minnesota River Basin management framework, contact Larry Gunderson at 651-297-3825.