

WATER QUALITY REPORT

The County of Northern Lights (the County) and the North Peace Applied Research Association (NPARA) have maintained an ongoing water quality monitoring program in the Notikewin and Keg rivers since 2011. The study was designed and implemented by Aquality Environmental Consulting Ltd. (Aquality). The purpose of the study was to gather baseline water quality information for a complete suite of parameters, for future planning of land use and environmental management activities on the two rivers, and to determine water quality for use as a drinking and agricultural water source.

Sample sites in the Notikewin and Keg Rivers, 2023

	Name	Longitude	Latitude	Years
1.	Notikewin - Green-White Boundary	56.896° N	-117.706° W	2011-2023
2.	Manning	56.920° N	-117.640° W	2011-2013, 2023
3.	Hotchkiss	57.012° N	-117.490° W	2011-2013, 2023
4.	Notikewan - Peace Confluence	57.277° N	-117.136° W	2011-2023
5.	Keg River	57.746° N	-117.620° W	2013-2023
6.	Keg River New	57.795° N	-117.887° W	2015-2023
7.	Whitemud River	56.508° N	-117.666° W	2022-2023
8.	Hotchkiss River	57.053° N	-117.576° W	2022-2023
9.	Meikle River	57.133° N	-117.535° W	2022-2023
10.	Rousseau Creek	56.741° N	-117.467° W	2022-2023
11.	Buchanan Creek	56.826° N	-117.642° W	2022-2023
12.	Sims Creek	57.229° N	-117.546° W	2022-2023

Sampling was conducted at sites previously established in the Notikewin (Sites 1 and 4) and Keg (Sites 5 and 6) rivers. Additional sampling locations were added in 2022 and 2023 at other locations within the County, to provide better spatial distribution of samples and potentially identify sources of pollutants within these systems.

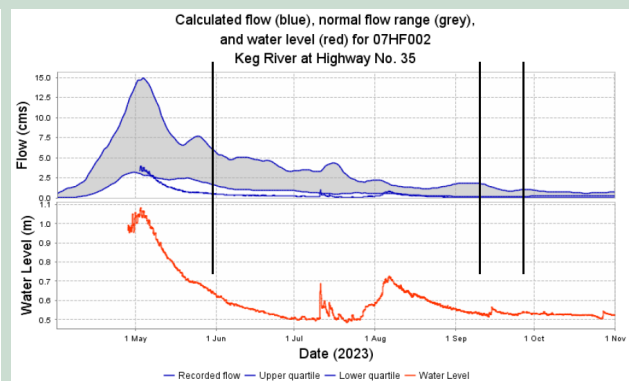
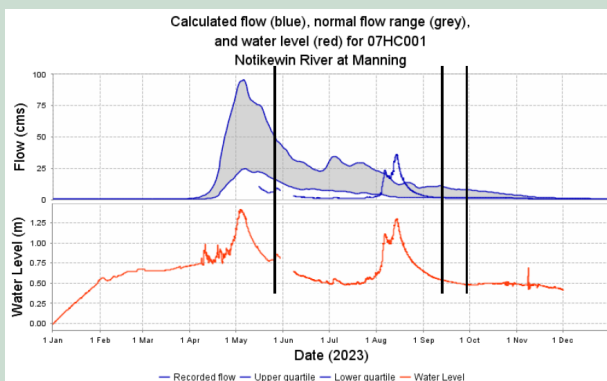
In 2023, sampling was conducted in the Spring and the Fall at two sites on the Notikewin River, two sites on the Keg River and two additional sites surrounding the Notikewin River, and during the Summer at these six sites as well as six additional locations within the County.

Surface waters were sampled at two sites on the Notikewin River and two sites on the Keg River, as well as 8 additional sites distributed across the County. The collected waters were analyzed for the following parameters in the spring and fall sampling:

- Routine Water Chemistry
- Nutrients
- Total and Dissolved Metals
- Turbidity and TSS

All parameters were measured during the spring and fall sampling events in 2023 at Sites 1 – 6. During the summer sampling, only turbidity and total suspended solids (TSS) were analyzed, as previous results had indicated a strong correlation between these parameters and the majority of pollutants of concerns. TSS and turbidity were used as a proxy for these pollutants, increasing the spatial detail of sampling while maintaining reasonable costs for analysis.

Generally, 2023 was warmer than historical conditions throughout the year, with the exception of brief cooler periods in the late winter and spring. Precipitation was generally lower through the majority of the year, but with higher than average values in the late summer within the Notikewin basin. Flows in the Notikewin and Keg Rivers reflected this pattern, with generally low to normal flows except during a single major storm event in the spring.



- River flows and levels Notikewin River and Keg River in 2023, compared to historical flow conditions (Alberta Environment and Parks, 2023). Vertical lines indicate sample dates (24 May 2023; 22 September 2023, and 12 October 2023).

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Nutrients

Nutrient analysis focused on various forms of nitrogen and phosphorus, as these are generally the most impacting nutrient pollutants in aquatic systems. Both nitrogen and phosphorus can contribute to eutrophication, where elevated nutrient levels result in elevated plant and algal growth. Exceedances for total nitrogen (TN) and total phosphorus (TP) have generally been limited to the spring sampling period. TN concentrations were generally lower than historical concentrations at all sites, however site 5 exceeded guidelines in the spring and all sites were below guidelines in the fall. Dissolved forms of nitrogen (ammonia, nitrate, and nitrite) continue to make up a minor fraction of TN, although made up a larger component of TN in the spring than in the fall at all sites. Exceedances for average TP concentrations were driven by high concentrations early in the year, with site 5 exceeding the guideline (0.05 mg/L) at 0.06 mg/L in the spring, however concentrations greatly decreased at all sites in the fall. A greater proportion of TP concentrations was due to dissolved fractions in 2023, though concentrations were still below historical averages. Nutrient concentrations appear to represent one of the primary impediments to surface water quality in both the Notikewin and Keg rivers. The contribution of nutrients is likely due to the influx of soil, sediments, and mineral particulates into the rivers occurring during high runoff events (generally during the spring), given the strong seasonal pattern of nutrient concentrations from current and previous sample periods.

Metals

Metal exceedances were within the historically expected range at all sites for which samples were collected. The metal parameters responsible for the exceedances continue to be consistent, though the overall exceedance rate in 2023 fell below that observed historically. A total of 13 metals have had exceedances over the entire study, five (mercury, cadmium, chromium, iron, and nickel) of which showed at least one exceedance in 2023. Most of the metals having the highest rates of exceedance observed within the study are naturally present in soils and rock but may also have industrial sources with the potential for atmospheric deposition. As concluded in previous years, elevated metal concentrations appear to be driven by sediment loadings into the rivers and may more broadly reflect issues with erosion (both natural and anthropogenically induced) and sedimentation rather than metals contamination per se, due to the strong relation between the frequency of metals exceedances and the concentration of total suspended solids (TSS). The reduced number of exceedances observed in 2023 agrees with the lower-than-average concentrations of TSS observed historically. It is not clear whether external loadings from sediment-laden surface runoff or in-stream channel erosion is the driver of these patterns. Similar to nutrients, metals continue to be a primary impediment to water quality in these river systems. Mitigation of such pollutants which are likely to be entering aquatic systems bound to soil particles must occur through reductions in erosion on upland sources or mechanisms to prevent suspended sediment from entering waterways.

Overall Water Quality

Water Quality Index (WQI) scores show an improving trend over the course of the study at most sites. WQI scores in both systems in 2023 were higher (better) than historical averages, based on the reduced WQI calculated only from the Metals and Nutrient & Routine sub-indices. These two subindices have historically had the greatest negative impact on overall water quality. Results from the WQI, both overall and for the individual subindices, generally support that these two systems have relatively good water quality. Sediment as the primary driver of impaired water quality in these systems continued to be supported by the historically high WQI values and historically low TSS concentrations observed in 2023.

Overall Water Quality Index Scores from all sites, 2011-2023



Seasonal Water Quality Index in surface water at all sites in 2023

