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Item No. Info 2
North West Community Council
July 15, 2024

TO: Chair and Members of North West Community Council

SUBMITTED BY: Original Signed

Brad Anguish, Acting Chief Administrative Officer

DATE: June 14, 2024

SUBJECT: **Bedford West Water Quality Status Update - 2023**

INFORMATION REPORT

ORIGIN

Bedford Municipal Planning Strategy, Bedford West Secondary Planning Strategy, Policies BW-3, BW-4 and BW-5. Development Agreements between the Halifax Regional Municipality and West Bedford Holdings Ltd, between Halifax Regional Municipality and Cresco Ltd, and between Halifax Regional Municipality and Clayton Developments Ltd.

LEGISLATIVE AUTHORITY

The Halifax Regional Municipality Charter, Part VIII, Planning and Development, Section 240, Development Agreements.

BACKGROUND

The Bedford West area is one of three areas designated as existing growth areas under the Regional Plan for serviced development (municipal water and wastewater systems). The Bedford West area is approximately 1,052 hectares (2,600 acres) in size and located on the west side of the Bicentennial Highway, in the vicinity of Hammonds Plains Road and Kearney Lake Road. In 2006, the Bedford West Secondary Planning Strategy (BWSPS) was adopted with the policy directive to enable new mixed-use communities while ensuring their design considered protection of the natural environment. *Figure 1* illustrates the areas encompassed by the BWSPS. Sub Areas 2 to 9 have approved development agreements and are either constructed or under construction. Sub Areas 1, 10 and 12 are Special Planning Areas designated through the Province of Nova Scotia's Housing in the Halifax Regional Municipality Act.

Policy BW-3 of the BWSPS requires a water quality monitoring program for the Paper Mill Lake watershed to track the eutrophication process. Eutrophication is the process of nutrient enrichment in lakes. While this eutrophication can happen naturally, it is primarily caused by human activities. Policy BW-3 aims to prevent nutrient enrichment from impacts of human activities in the Paper Mill Lake watershed. Land disturbances

during construction, surface hardening, the use of chemical fertilizers, stormwater inputs, in-use and historic on-site septic systems, and vegetation removal are all potential sources of nutrients in lakes. These changes can result in relatively rapid changes in trophic status, from lower trophic states (fewer nutrients) to higher trophic states (more nutrients). This rapid change in water quality leads to excessive plant growth, excessive algae growth, cyanobacteria blooms, and conditions generally resembling a poorly circulating backyard pond.

The water quality monitoring program was specified in the BWSPS in response to the Municipality's statement "that best management practices may be needed both during development and afterward to maintain water quality in the lakes" and "that a water quality monitoring program be established on lakes throughout the watershed" as published in the BWSPS in 2006.¹

¹ The Bedford West Secondary Planning Strategy can be found online here: [THE BEDFORD WEST SECONDARY PLANNING STRATEGY.pdf \(halifax.ca\)](#)

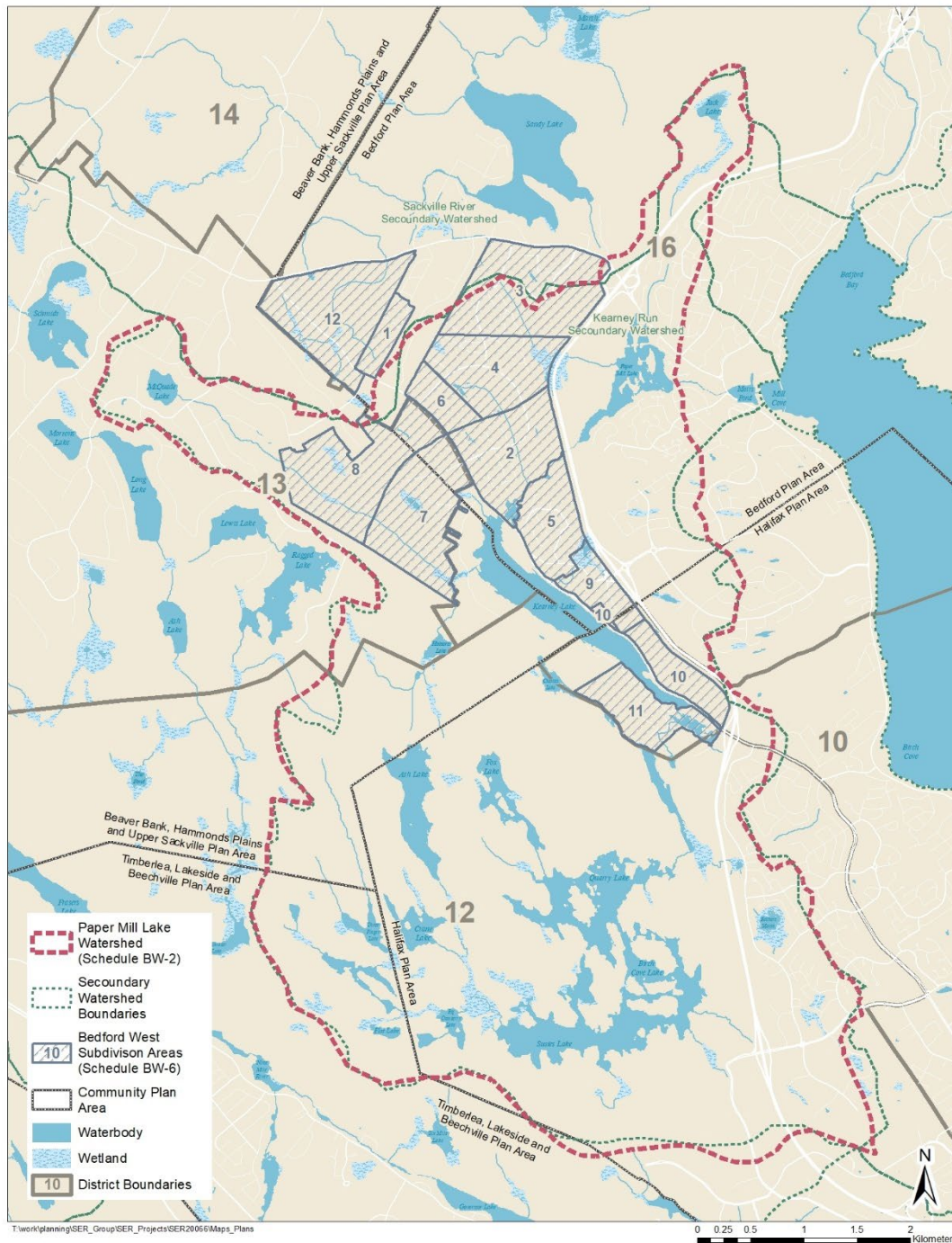


Figure 1: Sub-areas identified under the Bedford West Secondary Planning Strategy within the Paper Mill Lake watershed.

The terms of the monitoring program are specified within the Development Agreements that have been negotiated in consultation with the former Bedford Watershed Advisory Board (Sub Areas 1-9). This board was dissolved in 2013 and replaced with the broader Regional Watersheds Advisory Board (RWAB). Development agreements for the Bedford West subdivision negotiated between 2013-2022 occurred in consultation with RWAB, with the exception of those identified as Special Planning Areas (Figure 1: Bedford West Subdivision Areas 1, 10 and 12).

All Development Agreements under the BWSPS have identified the value of 10 micrograms per litre (µg/L) of total phosphorus (TP) as a “trigger value,” representing the transition point between the oligotrophic and mesotrophic states per Environment and Climate Change Canada’s criteria (*Table 1*).

Table 1: Summary of Canadian trophic status triggers. Environment and Climate Change Canada (2004).

Trophic Status	Total Phosphorus (µg/L)
Ultra-oligotrophic	<4
Oligotrophic	4-10
Mesotrophic	10-20
Meso-Eutrophic	20-35
Eutrophic	35-100
Hyper-eutrophic	>100

Threshold values for acceptable *E. coli* concentration under the terms of the Bedford West Development Agreements conform to Health Canada’s Guidelines for Canadian Recreational Water Quality.² Threshold values for other parameters monitored under the terms of the Bedford West Development Agreements conform to Canadian Council of Environment Ministers (CCME) Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CCME FAL).³

In accordance with the terms for the Bedford West Development Agreements, the Municipality is required to submit test results to the Developer, the North West Community Council (NWCC), and RWAB within three months of being received from the consultant, or immediately, if TP or bacterial results exceed management thresholds identified therein. This provision assumes that development activity bears relation to the test results. Research done by the Centre for Water Resource Studies⁴ in the Paper Mill Lake Watershed has since pointed out that site-specific changes in water quality identified from lake sampling cannot be attributed to a single source and has recommended that individual developments should not be regulated based on trophic state indicators in a lake. Some reasons for this are:

1. Development-derived surface water contamination tends to originate from non-point sources, for example contamination tends to come from overland water flow across an entire site rather than from a single discharge pipe into a lake.
2. In-lake phosphorus, while easily measured, cannot be traced back to a single source. For example, phosphorus released by decomposing plant material in a lake cannot be differentiated analytically from phosphorus released by sediment flowing into a lake from a development site.

In cases where an exceedance of phosphorus is noted, staff can request confirmation testing and determine

² Health Canada’s Guidelines for Recreational Water Quality can be found online here: [recreational-water-quality-guidelines-indicators-fecal-contamination.pdf \(canada.ca\)](https://www.healthcanada.gc.ca/recreational-water-quality-guidelines-indicators-fecal-contamination.pdf)

³ The CCME Water Quality Guidelines for the Protection of Freshwater Aquatic Life can be found online here: [Canadian Council of Ministers of the Environment | Le Conseil canadien des ministres de l'environnement \(ccme.ca\)](https://www.ccme.ca/en/~/media/000001/201605/20160520_ccme_water_quality_guidelines_for_the_protection_of_freshwater_aquatic_life.pdf)

⁴ Presentation by Rob Jamieson, Ph.D., P.Eng., entitled “Phosphorus Loading and Trophic State Assessment in the Paper Mill Lake Watershed”, North West Community Council, November 15, 2016. The presentation can be found online here: <https://legacycontent.halifax.ca/Commcoun/central/documents/161115nwcc1131pres.pdf>.

whether any corrective action is required by the developer as per their sedimentation and erosion plan.

DISCUSSION

Fall 2023 Results

The purpose of this report is to share the results of the water quality monitoring program in the Paper Mill Lake watershed undertaken as part of the Bedford West Development Agreements on three sampling events in 2023. A map identifying sampling locations is included in Attachment A.

The final report from the 2023 season, prepared by WSP Canada Inc., is posted publicly on the [HRM Lakes & Rivers webpage](#). Two exceedances of total phosphorus were observed during the Fall 2023 sampling event, which took place on October 16, 2023. The exceedances were observed at sampling sites PML-1 and LSD, with concentrations of 11 µg/L and 146 µg/L, respectively. Measured phosphorus levels are listed in Table 2. Concentrations above the 10 µg/L threshold are tabulated in red.

Table 2: Total Phosphorus Measured Under the Bedford West Program in 2023

Sampling Location	Acceptable Phosphorus Concentration (µg/L)	Spring 2023 Total Phosphorus (µg/L)	Summer 2023 Total Phosphorus (µg/L)	Fall 2023 Total Phosphorus (µg/L)
PML-1	10	7	5	11
PML-2	10	8	2	3
HWY102-1	10	7	ND ⁵	4
HWY102-2	10	7	2	4
LU	10	8	ND	4
KL-1	10	8	ND	5
KL-2	10	8	ND	7
KL-3	10	8	ND	6
KL-4	10	8	4	6
KL-5	10	8	8	6
LSD	10	8	ND	146

Exceedances were observed at PML-1 and LSD. Water at LSD was observed to be ‘very cloudy’ when samples were collected. Cloudy or otherwise abnormal conditions were not observed at PML-1.

Per the BWSPS, staff requested PML-1 and LSD be resampled to confirm the phosphorus concentrations at those sites. Resampling took place on November 21, 2023. The measured phosphorus concentrations from that sampling date were 21 µg/L at PML-1 and 42 µg/L at LSD, both of which exceed the acceptable phosphorus concentration stated in the BWSPS.

Resampling was not requested after the November 21 event. The measured pH was <6 at both sites, which is likely contributing to the release of sediment-bound phosphorus into the water column, and indicates mixing was occurring at PML-1. Previous sampling events did not capture mixing in lakes, which in Nova Scotia typically takes place in lakes that stratify in early April and late November. To better capture mixing

⁵ ND = non-detect, meaning the sample’s phosphorus concentration was below the limit at which the laboratory’s instrumentation can detect. This not necessarily a zero value.

conditions in the water column, starting in 2024, the spring sampling event will take place in late April.

Water Quality Trends

As discussed in the previous section, the BWSPS sets an objective to maintain the oligotrophic state in lakes in the Paper Mill Lake watershed, indicated by a phosphorus concentration of $\leq 10 \mu\text{g/L}$. While there is no clearly increasing trend in phosphorus concentrations over the course sampling program, roughly 55% of all phosphorus samples collected through the program were in exceedance of the $10 \mu\text{g/L}$ threshold between 2009-2023. These consistent exceedances indicate lakes in the watershed may be in or approaching a mesotrophic state.

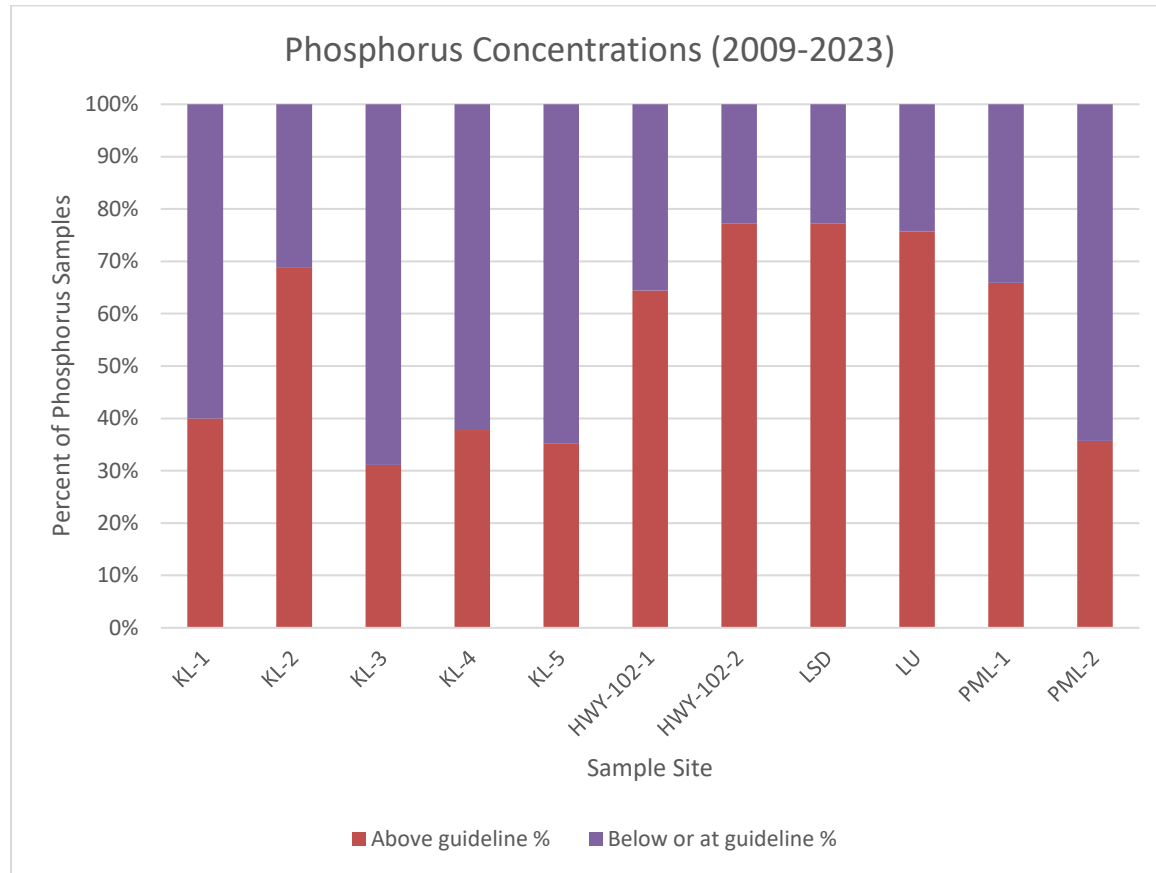


Figure 2: Percent of phosphorus samples with results above the $10 \mu\text{g/L}$ threshold per sample site since the beginning of the Bedford West Water Quality Monitoring program in 2009.

Additional key parameters indicating the impacts of development on the Paper Mill Lake watershed include dissolved chloride and pH. These parameters are discussed below.

The primary source of dissolved chloride in surface water in the Halifax Regional Municipality is stormwater runoff containing de-icing salt. This is the most likely source of dissolved chloride in the Paper Mill Lake watershed.

The CCME FAL long-term exposure limit for dissolved chloride in freshwater is 120 mg/L . Long-term in this context is ≥ 7 days for fish and invertebrates. Chloride concentrations above this threshold can be toxic to fish and invertebrates, and can disrupt normal mixing cycles within a lake. Dissolved chloride does not break down in freshwater, and is only removed by flushing (flow out of) lakes where it accumulates.

Apart from sampling locations HWY102-2, LU, and HWY102-1, regular exceedances of the FAL long-term exposure limits have not been observed through this water quality monitoring program. These sites commonly experience low flow, reducing opportunities for flushing chloride from the system. Stormwater, the primary source of dissolved chloride, is piped in directly into all sampling locations in this water quality monitoring program. Chloride concentrations observed through this program since 2009 are displayed in Figure 3.

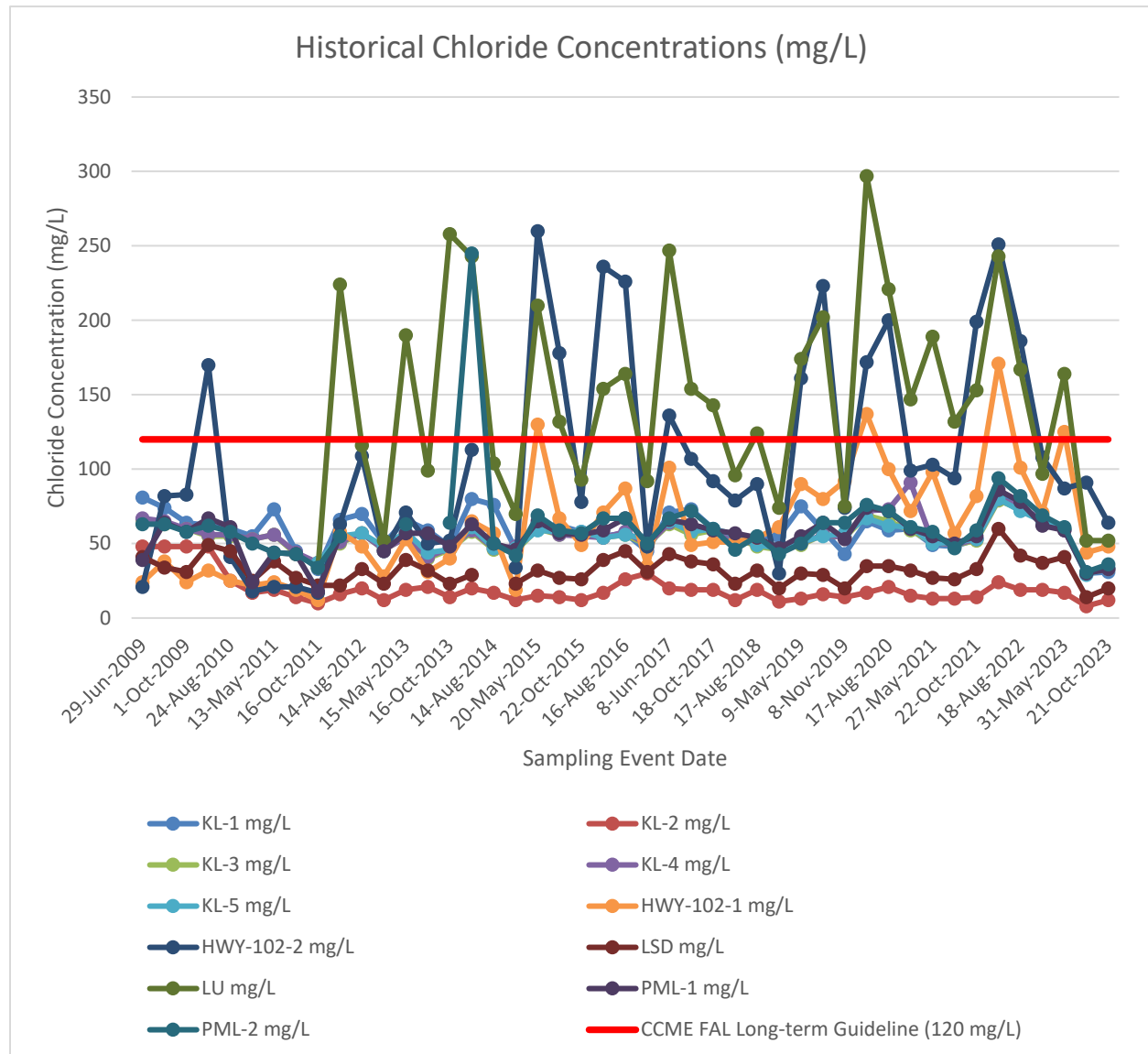


Figure 3: Historic chloride concentration, 2009-2023.

pH is a measure of acidity or basicity, with 0 being the most acidic, 7 being neutral, and 14 being the most basic. The CCME FAL pH guidelines state the acceptable range is between 6.5-9, however, many surface water bodies in the Halifax Regional Municipality naturally fall below that range. Measured pH observed through this program since 2009 are displayed in Figure 6.

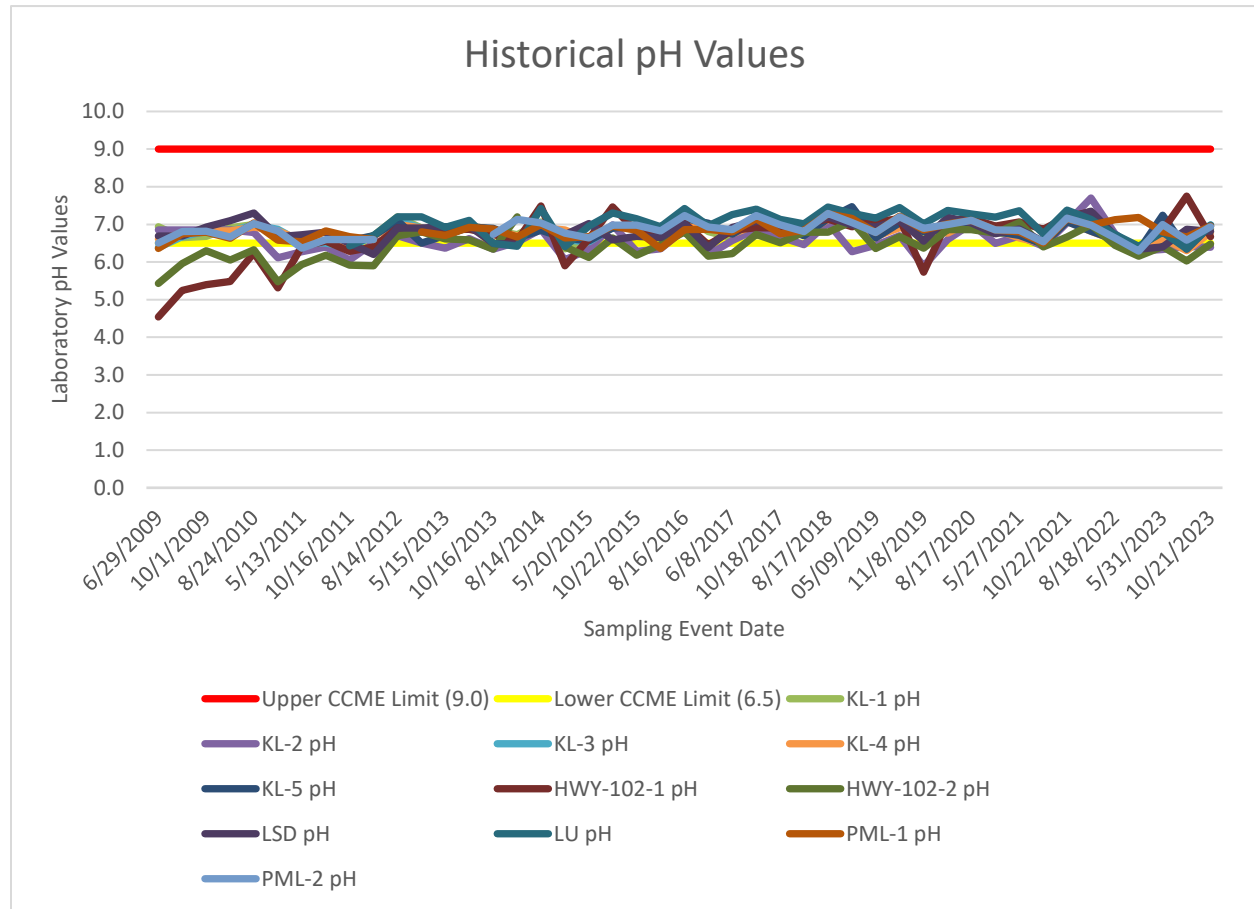


Figure 4: Historic pH, 2009-2023.

Successful international efforts to reduce sulphide pollution has had a positive impact in Nova Scotian lakes. Surface water pH is generally observed to be increasing as sulphuric acid inputs, from atmospheric sulphur dioxide and acid rock drainage, are removed. Evidence of pH rebound is visible in *Figure 5* roughly until 2012, when pH appears to stabilize. No samples exceed the CCME FAL pH maximum. Many samples are below the CCME FAL pH minimum, but not outside the normal pH range for similar lakes in the region.

Other water quality parameters were measured that exceed thresholds set in the Nova Scotia Tier 1 Environmental Quality Standards for Surface Water and Groundwater Discharging to Surface Water (EQS).⁶ These values are described in the final report prepared by WSP, available online [here](#). These exceedances are consistent with results found during other sampling events under this program, and likely reflect background concentrations in the watershed. Staff has requested the consultant take increased care to avoid shoreline sediment during sampling in case this is affecting results.

To address the requirements of BWSPS Policy BW-5⁷ moving forward, staff are taking a combination of approaches to monitoring and managing development impacts on water systems. Water quality data

⁶ These standards can be found online here: Tab 3, NS Tier I EQS Surface Water and GW discharging to SW.xlsx (novascotia.ca)

⁷ Policy BW-5 states: In the event that water quality threshold levels, as specified under clause (c) of Policy BW-3, for Paper Mill Lake of Kearney Lake are reached, the Municipality shall undertake an assessment and determine an appropriate course of action respecting watershed management and future land use development in the area. An assessment shall consider the CCME guidelines. Water quality thresholds and any assessment reports shall be made available to the public.

collected under this program and through other programs underway in the area subject to the Bedford West Development Agreements is being considered collectively to assess current watershed health and lake trophic status. Staff are using this information to inform future development approvals, and to develop a watershed management framework for the entire municipality. A description of these programs is below.

Development with the potential to affect lakes is being monitored as part of the Lake Watchers baseline water quality monitoring program. This program samples 76 lakes in the municipality semi-annually and reports the results against CCME thresholds. An example of this is the development underway at the former Penhorn Mall, upslope from Penhorn Lake.

A specific management plan for Kearney Lake, one of two primary lakes sampled under this program, was requested by Regional Council. A report recommending remediation actions was presented to Regional Council on August 23, 2022,⁸ and the recommendations put forward by staff in the report were accepted by Regional Council at that time. Staff are currently working to complete the recommended remediation, including sourcing designs to install floating treatment wetlands in Kearney Lake to lower the concentration of phosphorus in the water column.

In addition, staff are developing a framework for improved watershed-level management at the request of Regional Council. In coordination with the Green Network Plan and Regional Plan, this framework will support proactive protection of aquatic ecosystems and set water quality targets for managing land-based activities affecting water quality, aquatic and riparian ecosystems, and water resources. This framework will seek to manage collective land-use impacts on a watershed scale, in alignment with the terms of Policy BW-5 as quoted above.

As described above, the spring sampling date will be moved from late May to late April in 2024, to capture mixing conditions in lakes in the watershed. Staff anticipate data collected during the spring sampling may show higher than usual phosphorus and dissolved chloride concentrations. The potential increases are expected to better reflect concentrations in the watershed than spring samples collected later in the season when stratification has begun.

FINANCIAL IMPLICATIONS

There are no financial implications associated with this report.

COMMUNITY ENGAGEMENT

No community engagement was required for this report.

ATTACHMENTS

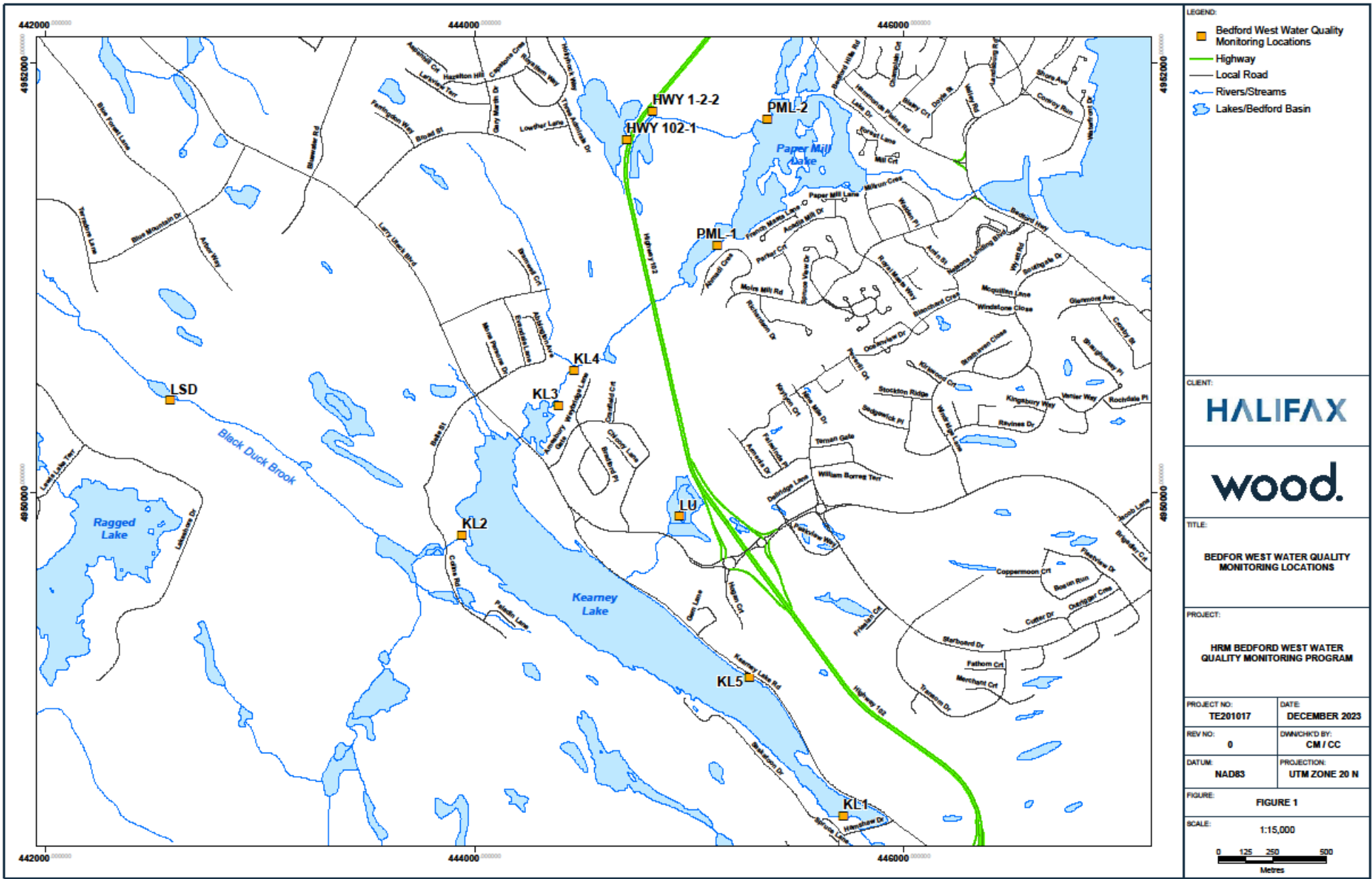
Attachment A Bedford West Water Quality Monitoring Program Sampling Locations

A copy of this report can be obtained online at [halifax.ca](https://www.halifax.ca) or by contacting the Office of the Municipal Clerk at 902.490.4210.

Report Prepared by: Elizabeth Montgomery / Water Resources Specialist / Environment & Climate Change
902.943.1954

⁸The staff report can be found online here: <https://cdn.halifax.ca/sites/default/files/documents/city-hall/regional-council/220823rc15112.pdf>

Attachment A – Bedford West Water Quality Monitoring Program Sampling Locations



CLIENT: **HALIFAX**

wood.

TITLE: **BEDFORD WEST WATER QUALITY MONITORING LOCATIONS**

PROJECT: **HRM BEDFORD WEST WATER QUALITY MONITORING PROGRAM**

PROJECT NO: TE201017	DATE: DECEMBER 2023
REV NO: 0	DRAWN/CHK'D BY: CM / CC
DATUM: NAD83	PROJECTION: UTM ZONE 20 N

FIGURE: **FIGURE 1**

SCALE: **1:15,000**

0 125 250 500
Metres