Miami River Pump Station

Preliminary Performance Analysis

Prepared by:

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April 21, 2026
Final Report, Rev. 0

NHC Reference No. 3008265

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The Village of Harrison Hot Springs
495 Hot Springs Road
Harrison Hot Springs, BC V0M 1K0

Attention: Jace Hodgson, PMP, Director of Operations
Via email: operations@harrisonhotsprings.ca

Re: Miami River Pump Station
Preliminary Performance Analysis Final Report, Rev. 0

The Village of Harrison Hot Springs (VHHS) retained Northwest Hydraulic Consultants Ltd. (NHC) to complete a preliminary evaluation of Miami River Pump Station performance. This letter report summarizes initial findings and provides recommendations for additional investigations.

NHC completed an assessment of the Miami River pump station at Harrison Hot Springs to evaluate whether head losses between the Miami River and pump stations' sump are reducing the pump station capacity and to recommend next steps for additional investigations and possible improvements. A site inspection was completed on May 21, 2025, which included measuring water levels at Harrison Lake, the Miami River level station, the pump station inlet culverts, and the pump station sump at varying pump flows to identify the magnitude and course of head losses. Follow-up analysis consisted of a preliminary review of the pump station's expected capacity, evaluated against existing operational targets as established during the pump station's design.

In summary, this preliminary study did not find any apparent deficiencies with the pump station capacity or performance relative to its hydrotechnical design criteria (NHC, 2014). Although the head losses through the conveyance system are high under some operating conditions, they do not appear to adversely impact the pump station capacity at higher Miami River elevations, which indicates that the pump station is likely able to maintain the specified maximum Miami River water levels at the design flow rate. VHHS should validate the findings of this report by recording ongoing operations data. The head loss calculations prepared as part of this study should be refined with any additional data.

Debris-blocked trashracks have the potential to reduce pump performance. VHHS should investigate debris management strategies, such as revised debris barriers upstream of trashracks, or removing trashracks to allow debris to pass through Archimedian pumps, if allowable pending input from the pump manufacturer. VHHS should continue to track performance concerns.

1 EXISTING PUMP STATION

The Miami River Pump Station is located at the confluence of the Miami River and Harrison Lake at the western end of the Harrison Hot Springs Dike. It discharges river flow into Harrison Lake when lake levels exceed those in Miami River. An adjacent floodbox allows Miami River flow to freely drain into Harrison Lake when the lake elevation is below the Miami River elevation. A hinged flood gate on the lake side of the floodbox restricts lake backflow into Miami River when the lake level is higher than the river level.

The existing pump station was constructed in 2016, replacing a previous lower capacity pump station at the site. The design of the replacement pump station was undertaken by CTQ Consultants Ltd. (CTQ) and the pumps were supplied by Landustrie Water Treatment Solutions (Landustrie). A cross-section of the pump station is shown in Figure 1.1, extracted from the design drawing set.

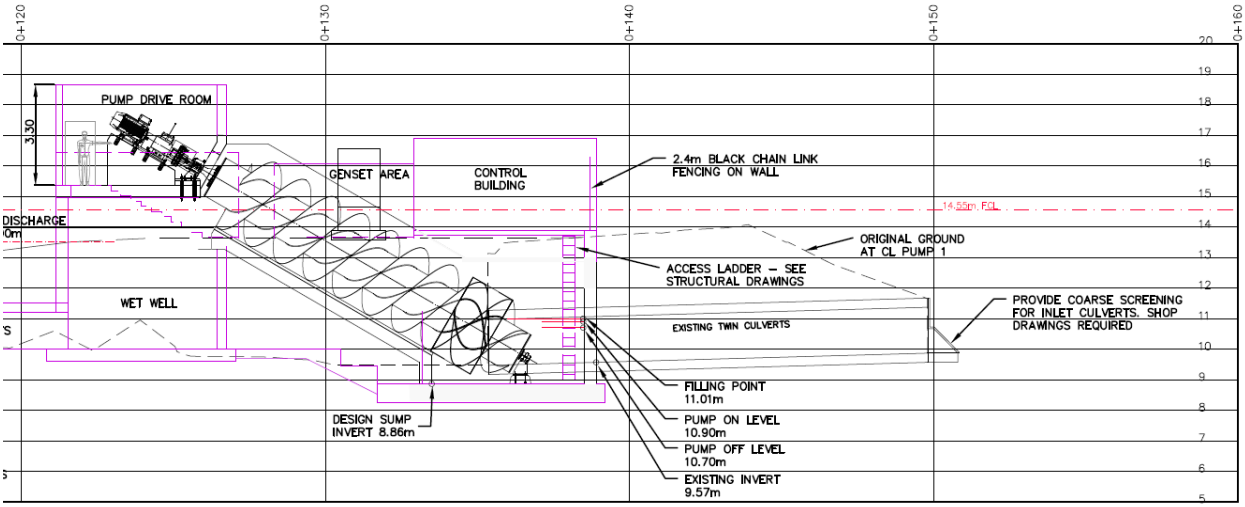

Figure 1.1 Miami River Pump Station cross-section, extracted from Drawing C-51 (CTQ Consultants Ltd., 2015)

Prior to the pump station replacement, a hydrology study recommended a capacity of 3.0 m^3/s at a head of at least 3 m, based on a 200-year average return interval design event and a maximum allowable Miami River water level of 12.0 m CGVD28 (NHC, 2014). The 2016 pump station replacement included two Archimedean screw pumps, each with a maximum capacity of 3.0 m^3/s, providing a total pump station capacity of 6.0 m^3/s. This design capacity doubles the recommended flow rate if both pumps are at maximum capacity, and provides redundancy should only one pump be operational, allowing each pump to achieve the required design flow rate.

Upstream of the pump sump, Miami River flow approaches the pumps through a narrowed approach channel and inlet culvert, which was maintained from the previous pump station arrangement, prior to the 2016 replacement. A trash rack is located at the upstream end of the inlet culvert for screening debris. Figure 1.2 shows this arrangement. Due to hydraulic energy losses through these conveyance features, the water surface elevation in Miami River will be higher than the sump elevation when the pump station is operating.

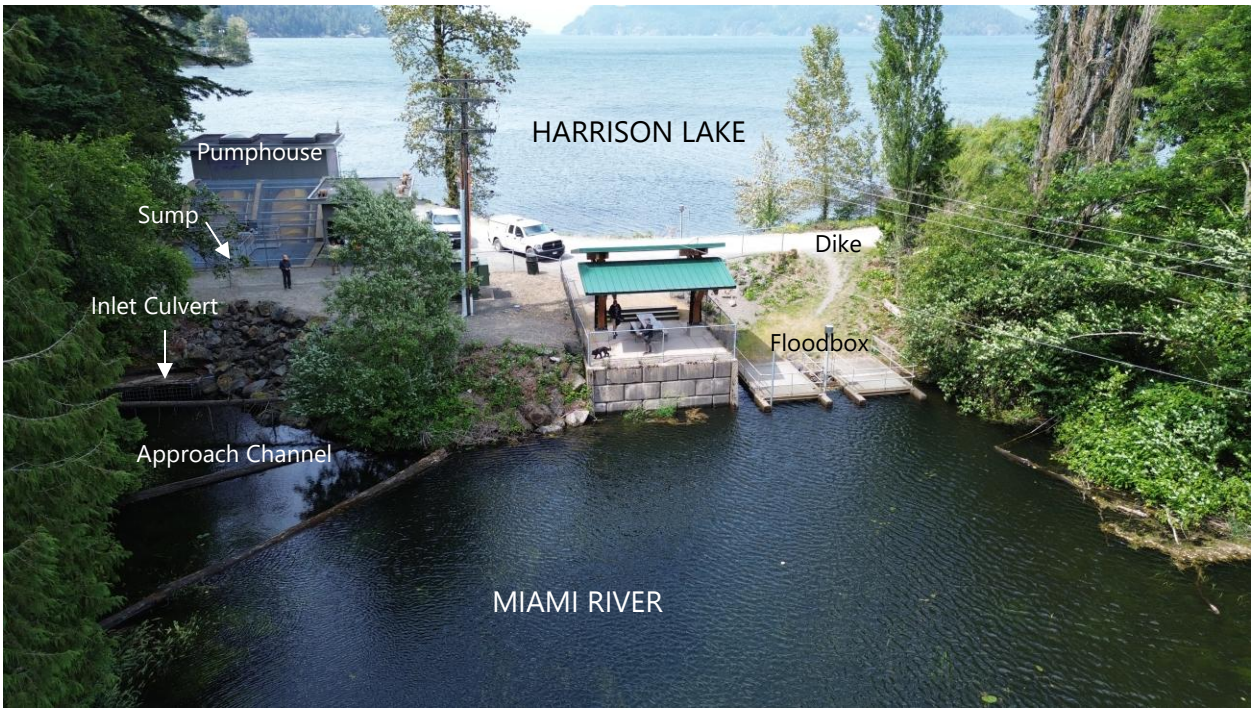

Figure 1.2 Miami River Pump Station, viewed from upstream (NHC photo, May 21, 2025)

Figure 1.3 shows the pump performance curve for each of the two pump units, as supplied to CTQ by Landustrie. This curve indicates pump capacity in relation to sump water level. As indicted on this documentation, sump water elevations must be vertically translated by -0.539 m to correspond to as-built pump station elevations (in CGVD28 vertical datum). Figure 1.4 shows the performance curve with this elevation conversion applied.

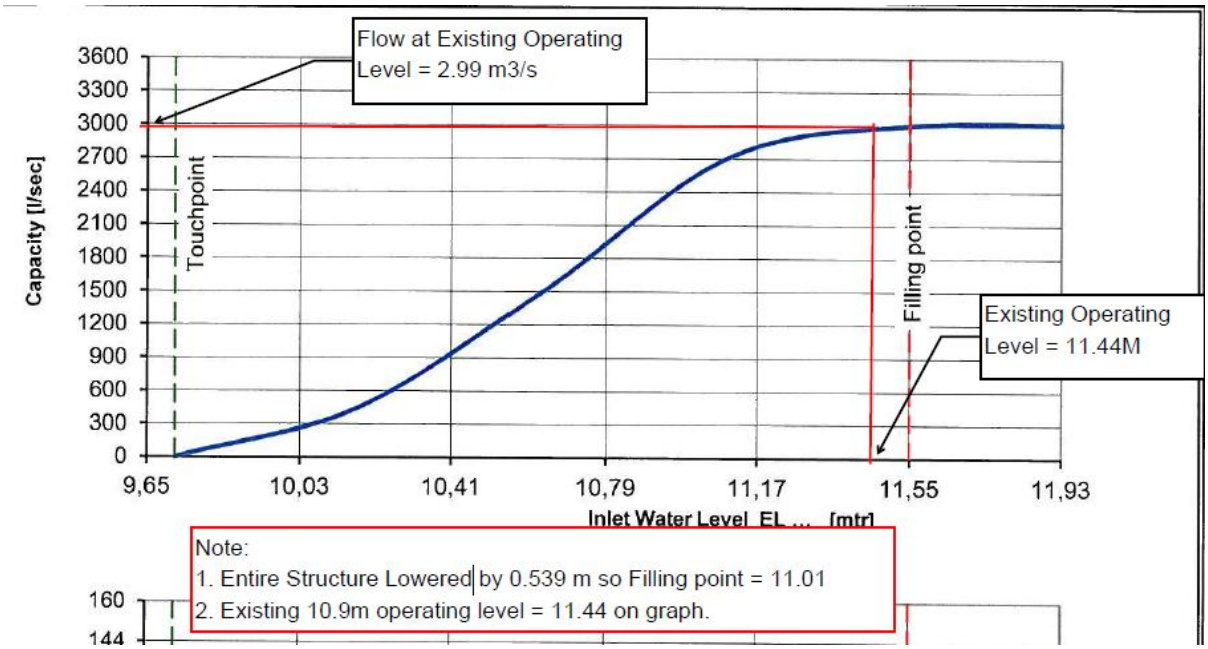

Figure 1.3 Pump performance curve for each pump unit, relating achievable pump capacity to inlet water level, extracted from Landustrie documentation

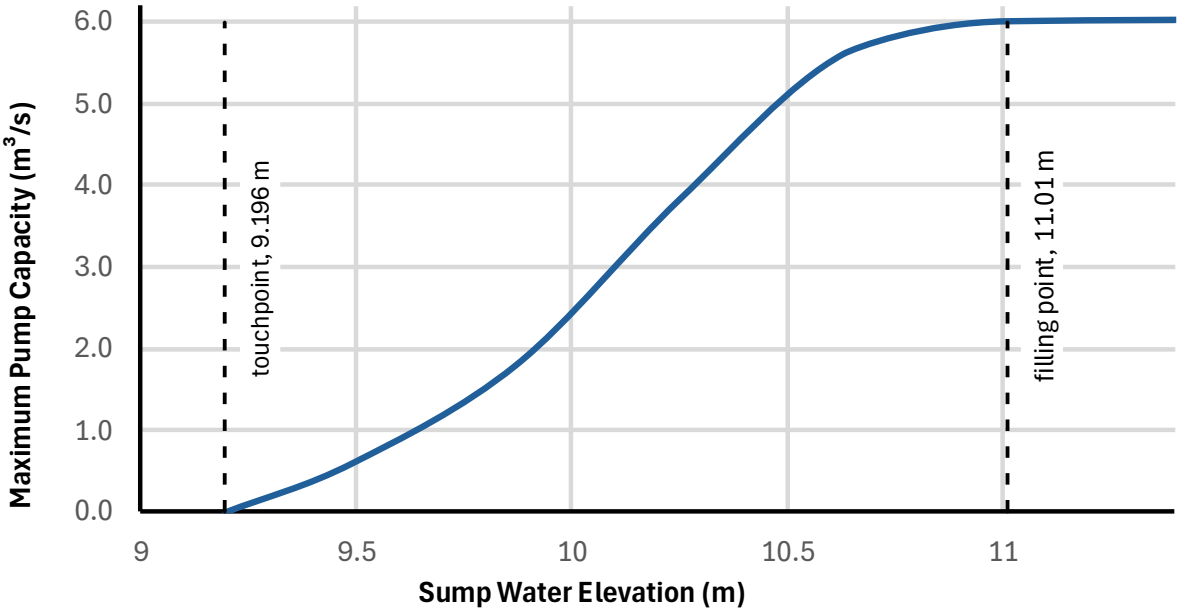

Figure 1.4 Pump performance curve for each pump unit, with sump water level converted to as-built pump station elevations (in CGVD28 vertical datum)

The relation in Figure 1.4 shows that the pump is ineffective below a sump water elevation of El. 9.196 m, corresponding to the touchpoint indicated in the drawing package. At sump water levels above the touchpoint, achievable pump capacity increases, up to a maximum capacity of 3 m^3/s per unit at the sump levels equal to or exceeding the filling point of 10.471 m.

2 FIELD INVESTIGATION AND ANALYSIS

The focus of NHC's analyses was to review hydraulic losses between Miami River upstream of the pump station inlet and the pump station sump. The goal was to verify whether the pump station is capable of achieving target flow rates and Miami River water levels required to mitigate flooding, as specified in the design.

This water surface elevation differential between Miami River and the sump will vary based on the following variables:

1. The water elevation in Miami River: The lower the water surface elevation in Miami River, the faster the velocities will be through the conveyance features, which will result in greater head loss and larger water surface elevation differential.
2. The pumped flow: As the pumped flow increases, the velocity through the conveyance system increases, along with the system head losses and resulting water elevation differential.

NHC[1] visited the site on May 21, 2025 and took several measurements with a theodolite level to measure the water elevations at various points through the system at various pump frequencies, which ranged in each pump from 0 Hz (not operating) to a maximum of 60 Hz. Corresponding flow rates were estimated using the corrected pump performance curve (Figure 1.4).

The data collected on-site has been summarized in Table 2.1.

[1] Daniel Maldoff and Ned Atkins

Table 2.1 Site data collection

Pump 1 Frequency (Hz)	Pump 2 Frequency (Hz)	Sump water elevation (m, CGVD28)	River Elevation (m, CGVD28)	Estimated Flow rate (m^3/s)
from pump station instrumentation readout	from pump station instrumentation readout	measured by NHC	from pump station instrumentation readout	from theoretical chart
30	0	10.96	10.98	1.49
40	0	10.93	10.97	1.97
50	0	10.88	10.96	2.45
60	0	10.8.	10.95	2.92
60	30	10.62	10.94	4.22
60	60	10.25	10.93	4.05

Based on the collected data, NHC estimated the hydraulic loss coefficients between the Miami River gauge and the pump station sump. Those coefficients were then applied to extrapolate the pump performance curves and determine the theoretical water elevations required at the Miami River gauge for various pumping rates. Consequently, for any given river elevation and flow rate, it is possible to compute the corresponding theoretical sump water level. The resulting maximum pump capacity for each river elevation is illustrated in Figure 2.1.

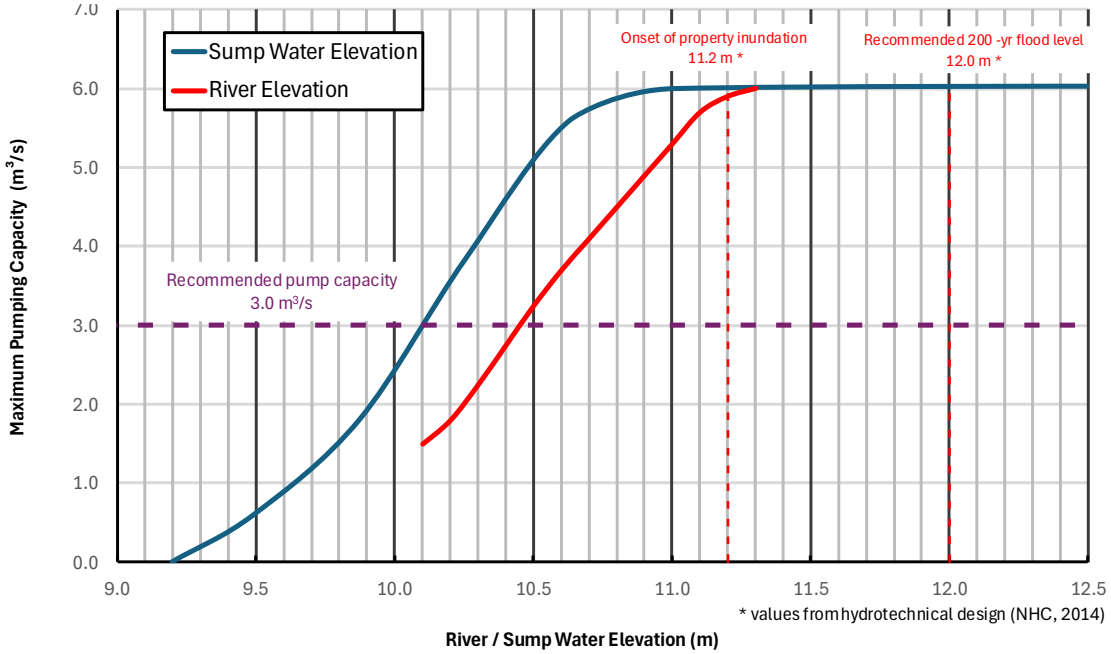

Figure 2.1 Extrapolated pump performance expectations

This analysis indicates that the design pump flow of 3 m^3/s is achievable at a Miami River water surface elevation of approximately El. 10.5 m or higher. Achievable pumping rates are expected to exceed 3 m^3/s with river levels approaching the specified target maximum of El. 12.0 m. At river levels below El. 10.5 m, achievable flow rates below 3 m^3/s should be expected.

These theoretical capacity curves do not account for potential blockages of the trashrack, which is an issue that has been reported. Debris blockage will increase head loss between the river and pump sump, which would result in higher water levels within Miami River for the same pump rates. Recommendations include investigating debris management. The pump station's excess capacity relative to recommended design flow rate will improve resilience under debris blockage; it may be possible to achieve the target flow rate even under reduced efficiency due to trashrack debris blockage.

3 SUMMARY OF FINDINGS AND RECOMMENDATIONS

The measurements taken on site, combined with the pump performance curves, have been used to evaluate potential maximum pump capacity for a given water elevation in Miami River.

As a preliminary hydraulic evaluation of the pump station, NHC recommends the following steps to continue to advance this evaluation of the pump station performance.

1. **Review performance criteria**; Performance requirements were assessed prior to the design of the replacement pump station, concluding that a simulations using a screw pump with a 3.0 m^3/s capacity resulted in Miami Creek water levels being maintained below El. 12.0 m for all 200-year joint probability events simulated except for winter flows with blocked flood boxes (NHC, 2014). Subsequently, the pump station was installed with two pumps of 3 m^3/s capacity for a total of 6 m^3/s, doubling the minimum identified flow requirement. This design provides surplus capacity, and a potential back-up pump should one be out of commission. It is expected that the pump station will therefore be effective in meeting target flow rate while keeping the river water level below the targeted maximum.

   The current scope did not include the re-evaluation of the pump performance requirements; it evaluated the pump station against existing targets. NHC recommends that VHHS complete additional review of pumping requirements and target maximum Miami River elevations and review the operation plan to suit the requirements. The review should focus on the pump station's ability to mitigate flooding, while understanding that achieving the maximum design flow rate of 3 m^3/s may not be possible or required at lower river levels.
2. **Collect performance data**; NHC recommends that VHHS operations staff implement consistent and ongoing logging of performance data, including Miami River water surface elevation, pumping rate, sump water elevation, and any noteworthy operational difficulties. Water elevation in the sump could be collected with a transducer or via a manual measurement (potentially simplified with the addition of a visual staff gauge, if not already

installed). This practice would help to validate and/or calibrate the calculations completed for this report to evaluate pump performance expectations and would provide a database for further study should it be required.

3. **Investigate running the pumps without the trashrack**; debris accumulation on the existing trashrack will increase drawdown from Miami River to the sump, which could negatively impact pumping performance. NHC recommends contacting Landusturie to enquire how much debris the pumps can convey without causing operational issues. In an emergency situation, a simpler solution to the constantly blocking trashracks may be to remove the racks and allow the debris to be conveyed via the pump if the manufacturer approves. If acceptable from an operational and safety standpoint, the trashracks could be permanently removed.
4. **Investigate concepts for alternative debris management infrastructure**; the installation of a simple log boom to shear larger floating debris away from the culvert inlets might prove as a more effective method to mitigate the entrainment of debris.
5. **Check performance of water level sensors**; As part of ongoing maintenance, NHC recommends checking that the Miami River level gauge is reporting accurate elevation data to the correct datum.
6. **Develop concept for removing the culverts**; Should the pump station's performance continue to concern the operation staff, then a redesign of the approach channel and removal or replacement of the two culverts with a higher capacity water conveyance system may offer a hydraulic performance upgrade to the system by increasing conveyance capacity at lower Miami River elevations.

4 CLOSURE

We trust this report meets your needs. If you have any questions or requests, please feel free to contact the undersigned.

Sincerely,

Northwest Hydraulic Consultants Ltd.

Report prepared by	**Report reviewed by**	**Report approved by**
		
Ned Atkins, MEng, PEng Hydrotechnical Engineer	Daniel Maldoff, MEng, PEng Hydrotechnical Engineer	Dale Muir, MEng, PEng Principal

EGBC Permit to Practice Number: 1003221 DPM

DISCLAIMER

This report has been prepared by Northwest Hydraulic Consultants Ltd. for the benefit of **The Village of Harrison Hot Springs** for specific application to preliminary hydraulic evaluation of the **Miami River Pump Station**. The information and data contained herein represent **Northwest Hydraulic Consultants Ltd.'s** professional judgment in light of the knowledge and information available to **Northwest Hydraulic Consultants Ltd.** at the time of preparation and were prepared in accordance with generally accepted engineering and geoscience practices.

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5 REFERENCES

CTQ Consultants Ltd. (2015). Village of Harrison Hot Springs, 2015 Flood protection Project (Miami Creek Pumpstation). Issued for Tender Drawings.

NHC (2014). Miami Creek Pump Station Hydrologic Assessment. Northwest Hydraulic Consultants LTD., Prepared for The Village of Harrison Hot Springs.