FINAL RESULTS

East Murray Creek
NEWSS meeting deck

Hydrodynamic feasibility, seasonal HRT screening, and pond-entry recommendations

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UNBC · Tecnológico de Monterrey · NEWSS
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MEETING OBJECTIVES

Objectives

Use the HRT results to move from model outputs to practical recommendations for low-flow pond turnover and future monitoring.

OBJECTIVES FOR THE PRESENTATION

- Objective 1 — Present the final HRT findings and explain the seasonal adjustment clearly.
- Objective 2 — Identify which ponds show the strongest retention potential and which need better turnover.
- Objective 3 — Discuss how pond entrances could be moved or reshaped to improve low-flow exchange.
- Objective 4 — Confirm the field data and monitoring needed before design-level recommendations.

Central objective for NEWSS

Translate the Delft3D and seasonal HRT screening to understand the overall performance of the BDA-pond function

Identify a clear pond-prioritization and entrance-modification discussion..

Expected meeting outcome

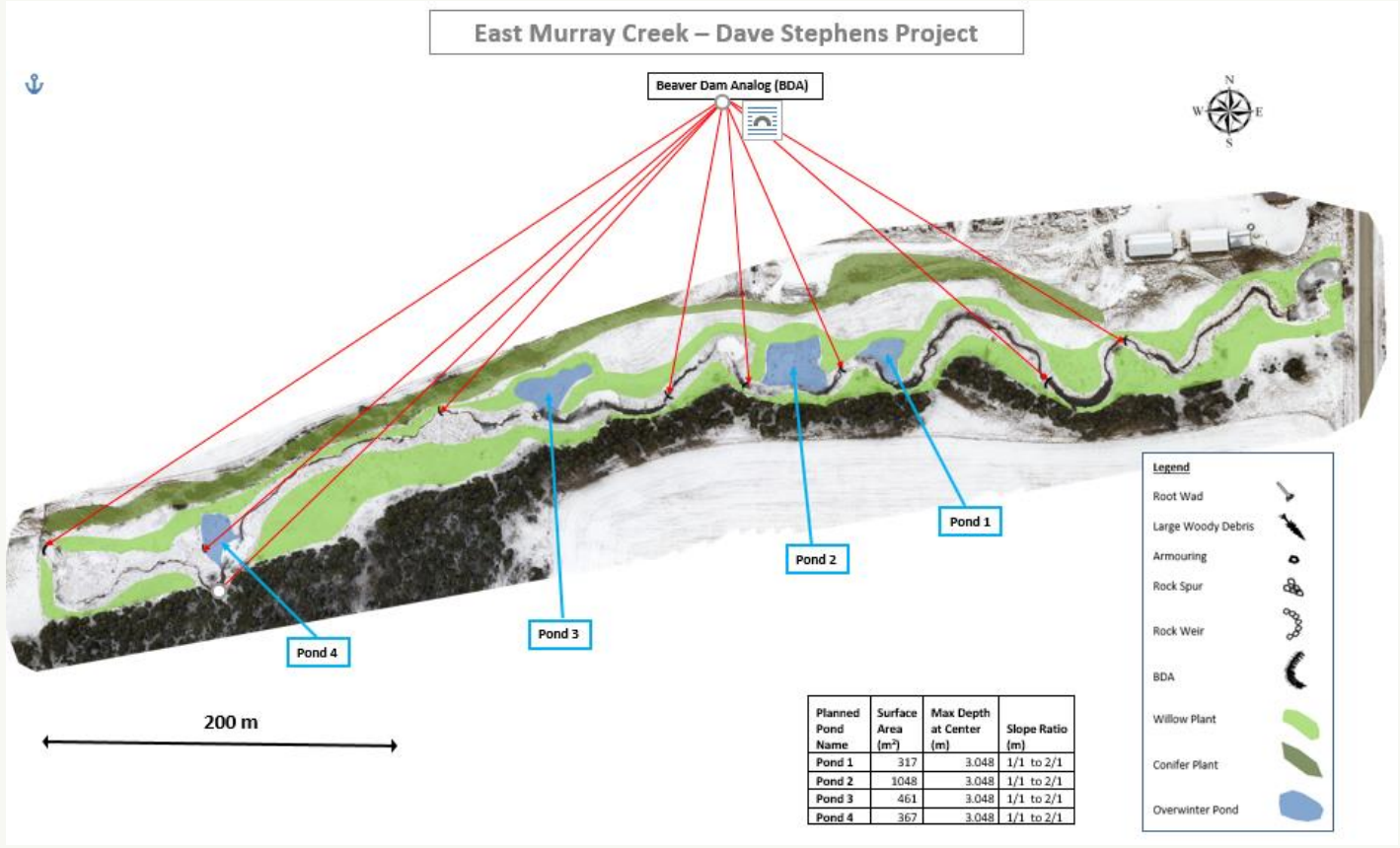
Agree on the most useful final deliverable: monitoring plan, pond-prioritization matrix, entrance-modification guidance, or model documentation.

Seasonal HRT is the main screening layer; baseline HRT remains raw Delft3D transparency.

Meeting framing based on Wayne Salewski's request for learnings, observations, future needs, and recommendations to improve low-flow water turnover.

SITE OVERVIEW

Four over-season ponds connected to East Murray Creek through shallow pond-channel entrances.



Planned Pond Name	Surface Area (m^2)	Max Depth at Center (m)	Slope Ratio (m)
Pond 1	317	3.048	1/1 to 2/1
Pond 2	1048	3.048	1/1 to 2/1
Pond 3	461	3.048	1/1 to 2/1
Pond 4	367	3.048	1/1 to 2/1

Dave Stephens reach map: BDAs, ponds, LWD, willow planting, and pond geometry.

READING THE SYSTEM

- ✓ Creek flow first reaches the right side of the modelled pond system.
- ✓ BDA backwater and high-water pathways control exchange.
- ✓ Pond entries may not be active under low-water conditions.
- ✓ HRT is controlled by both volume and exchange pathway.

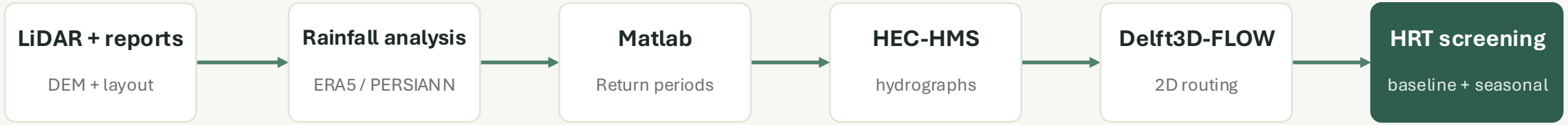
Design question

Where should the entrances be located so the ponds keep exchanging water during low-flow periods without losing all retention?

Source: Avison Management Services Ltd. (2025b), Dave Stephens project map.

METHOD

Terrain, rainfall, hydrologic routing, 2D flow, then seasonal HRT screening.



Important boundary condition

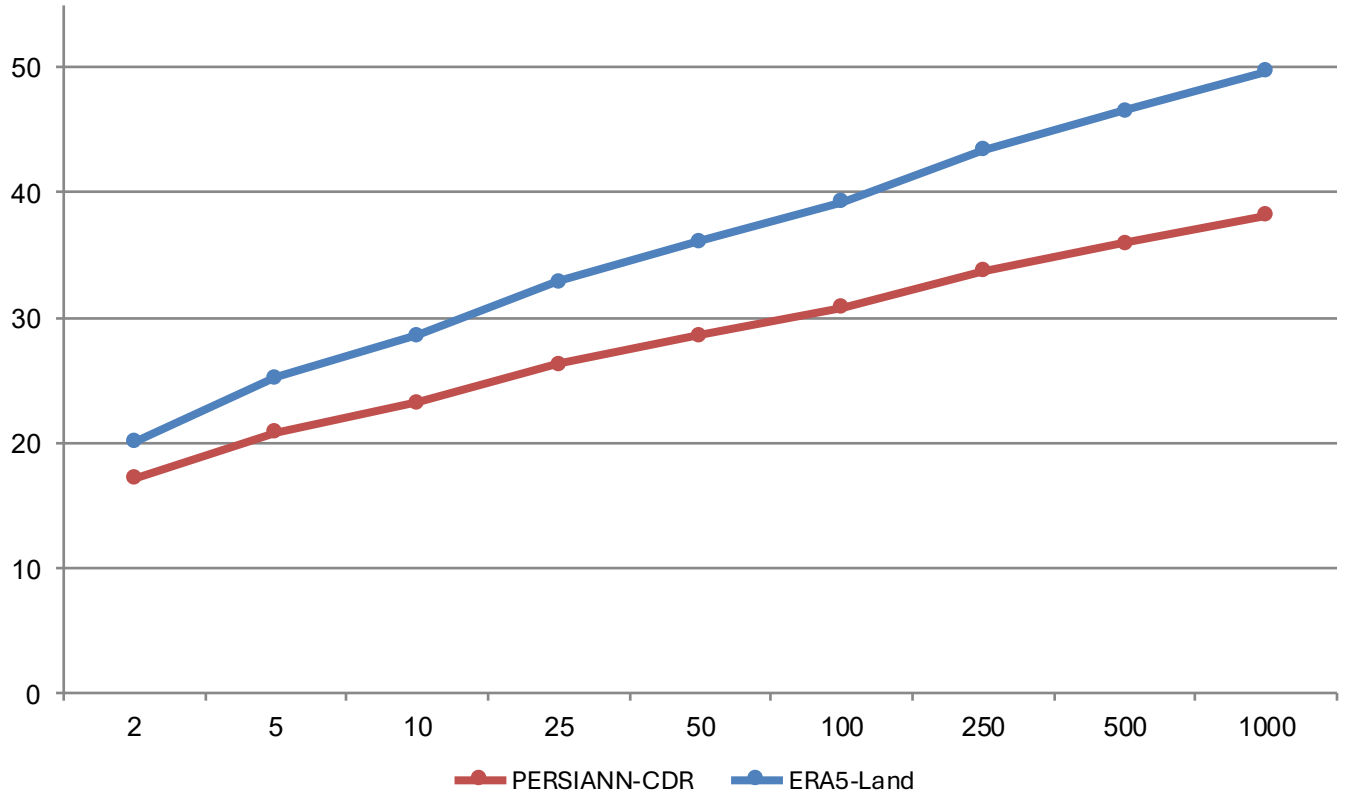
Seasonal factors were applied after Delft3D to the HRT calculation. They do not rerun hydrographs, create new exchange, or convert N/A cases into connected cases.

Why this is acceptable for the meeting

It separates raw model transparency from the seasonal screening that NEWSS needs for field decisions.

Workflow: LiDAR + reports → ERA5/PERSIANN → HEC-HMS → Delft3D-FLOW → seasonal HRT post-processing.

ERA5-Land gives the conservative storm forcing



Key reading

Gumbel fit: acceptable
GEV fit: poor by KS
ERA5 > PERSIANN
Rainfall ≠ freshet

How we use it

ERA5-Land is a conservative stress-test forcing, not automatically the most representative local rainfall record.

Source: ERA5-Land and PERSIANN-CDR extreme precipitation analysis.

RESULT 2

Baseline HRT (Delft3D output)

Useful for transparency, but not the seasonal screening layer

No baseline pond-scenario reached the full 2–5 day range

Pond	Baseline HRT range	Exchange pattern
Pond 1	0.020–0.166 d	Exchange in all scenarios
Pond 2	0.040–0.425 d	Exchange in all scenarios
Pond 3	0.127–0.729 d	N/A in 3 short events
Pond 4	1.394–2.093 d max	N/A in 2 short events

Interpretation

Baseline HRT tells us how Delft3D routed exchange under modelled storm scenarios. It should not be used alone for final screening.

Source: East Murray Creek Discharge and HRT Screening Workbook (2026).

Seasonal HRT adjustment

Provisional seasonal screening pending written NEWSS documentation

Season	fs	HRT multiplier
Spring freshet	0.60	×1.667
Summer	0.15	×6.667
Fall	0.20	×5.000
Winter	0.05	×20.000

HRTseason = HRTbaseline / fs

This is a post-processing correction to support seasonal interpretation of the modelled pond exchange.

Do not over-use

Does not prove treatment, water quality improvement, or sediment removal.

Use for screening

Ranks ponds and seasons by likely retention potential.

RESULT 4

Seasonal adjustment changes the screening picture

Envelope = adjusted HRT range across valid non-N/A scenarios; 100-year uses Dt = 0.005 min

Pond	Spring	Summer	Fall	Winter	Passes
Pond 1	0.033–0.395	0.134–1.582	0.100–1.186	0.401–4.746	2 / 40
Pond 2	0.141–0.708	0.563–2.833	0.422–2.125	1.690–8.498	4 / 40
Pond 3	0.212–1.214	0.847–4.858	0.635–3.643	2.540–14.574	10 / 28
Pond 4	0.184–3.488	0.738–13.952	0.553–10.464	2.213–41.856	6 / 32

Main provisional reading

Pond 3 has the broadest pass count.
Pond 4 is strongest in summer and fall.
Ponds 1–2 are mainly winter-limited.

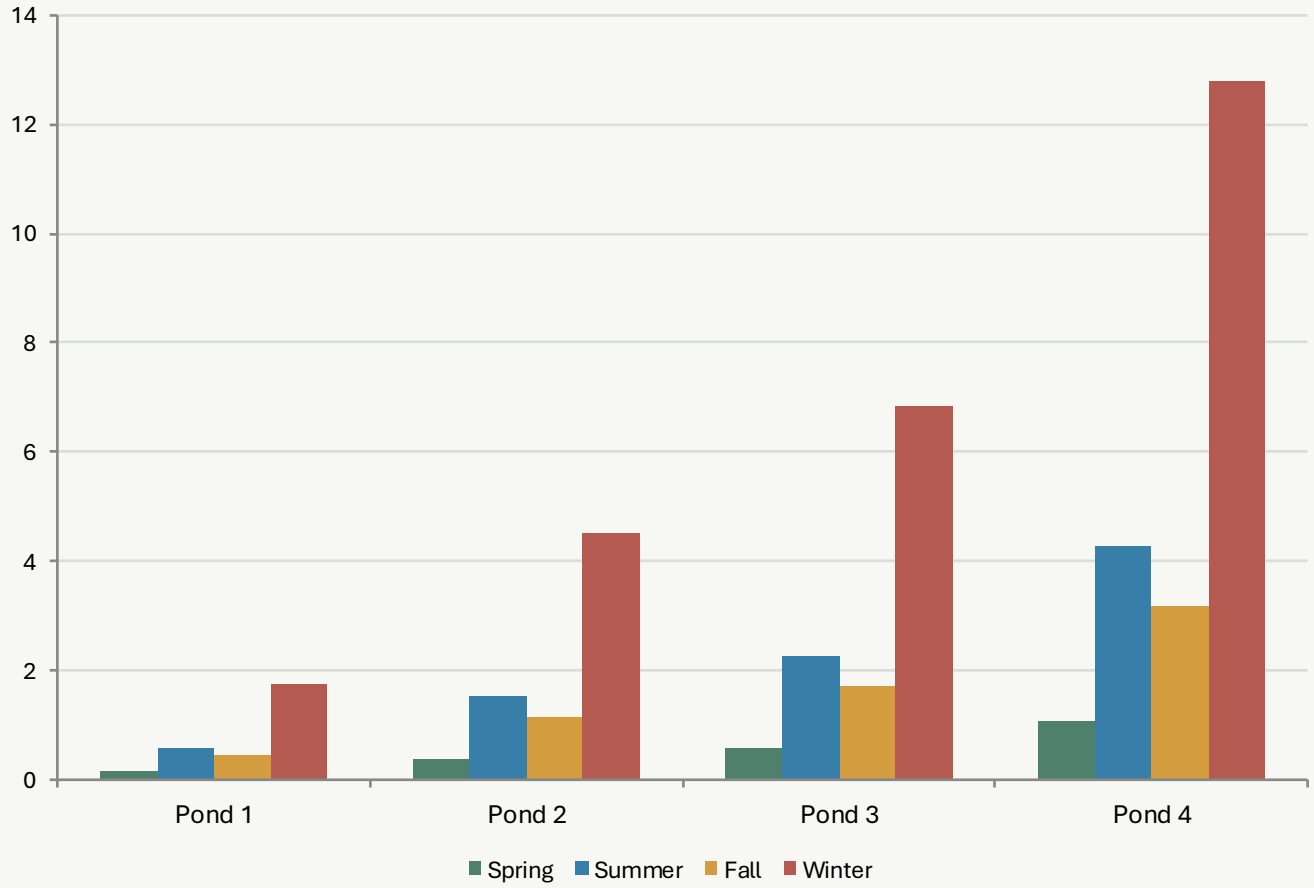
Still needs confirmation

These rankings remain provisional until the seasonal factors are documented in the project archive.

RESULT 3

Seasonally adjusted mean HRT

Target screening range shown for context: 2–5 days. Mean values summarize valid non-N/A scenarios.



Target range: 2–5 d

Pond 3: reaches summer target mean
Pond 4: strongest summer/fall mean
Pond 2: near winter target mean
Pond 1: generally below target

Important for Wayne

High winter HRT may also mean low turnover. For water-quality operation, the goal is not simply “longer”; it is controlled exchange.

Source: seasonal HRT post-processing workbook; target HRT screening range: 2–5 days.

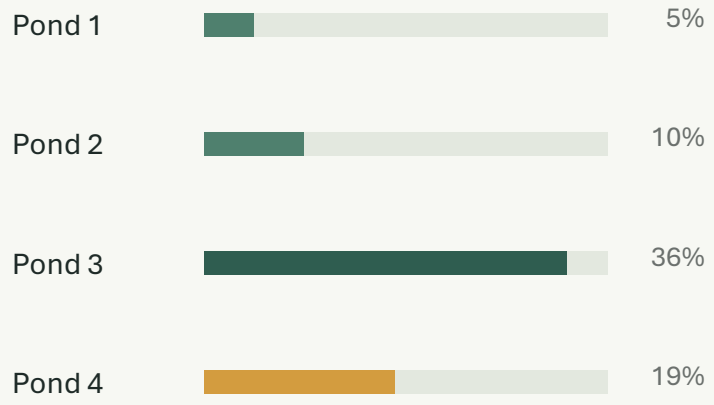
RESULT 4

Pass counts identify the best retention candidates

Pass = adjusted HRT within 2–5 days across valid non-N/A scenarios; 100-year uses Dt = 0.005 min.

Pond	Passes	Pass rate	Interpretation
Pond 1	2 / 40	5%	Short HRT; turnover improvement priority
Pond 2	4 / 40	10%	Moderate; mostly winter-limited
Pond 3	10 / 28	36%	Broadest pass count; strong candidate
Pond 4	6 / 32	19%	Strong summer/fall HRT potential

PASS RATE VISUAL



Ranking for discussion

1) Pond 3 for broad retention reliability
2) Pond 4 for strongest seasonal HRT
3) Ponds 1–2 for connection and turnover improvements

Pass counts from seasonal HRT screening across valid non-N/A modelled scenarios.

INTERPRETATION

What the HRT results mean for pond entrances

The model suggests where retention exists, but the entrance controls whether low-flow turnover actually happens.

Pond habitat and LWD show the need to balance circulation and retention.

HYDRAULIC READING

- Too little exchange → stagnation risk and weak water turnover.
- Too much exchange → lower HRT and reduced retention benefit.
- The best design target is controlled exchange during low flow.
- Entrances should be located where the creek remains hydraulically connected at low-water stage.

Practical implication

Move or reshape pond entrances only after confirming low-flow water surface, active channels, and bypass routes in the field.

Field image source: Avison Management Services Ltd. (2025b), Dave Stephens project report.

Pond screening summary

Seasonally adjusted mean HRT, days

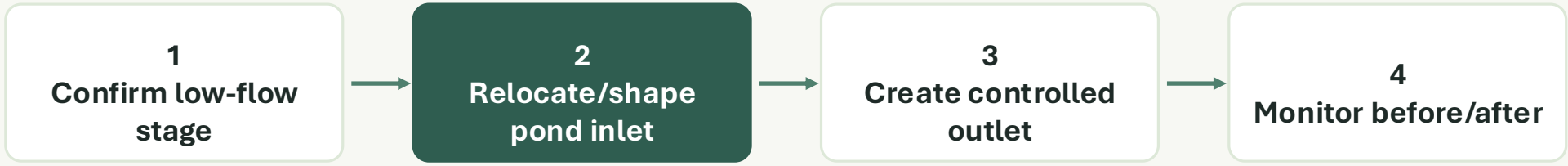
Pond 1	Pond 2	Pond 3	Pond 4
Spring 0.15 Summer 0.58 Fall 0.44 Winter 1.75 Generally below target	Spring 0.38 Summer 1.51 Fall 1.13 Winter 4.53 Moderate; mainly winter	Spring 0.57 Summer 2.28 Fall 1.71 Winter 6.83 Strong summer potential	Spring 1.06 Summer 4.26 Fall 3.19 Winter 12.77 Strongest summer/fall

Target HRT screening range: 2–5 days. Mean values summarize valid non-N/A scenarios, not final treatment performance.

RECOMMENDATIONS

Screening-level modifications to improve low-flow turnover

These are not construction drawings; they are design directions to evaluate with NEWSS and the field team.



DESIGN DIRECTIONS TO DISCUSS

- ✓ Prioritize Pond 3 and Pond 4 as retention candidates; evaluate Pond 1 and Pond 2 for connection upgrades.
- ✓ Move inlets toward stable low-flow connection points, not only toward high-water/freshet pathways.
- ✓ Use a defined inlet + outlet path to avoid dead-end storage and improve turnover.
- ✓ Keep modifications small and staged, then verify with water level and tracer/visual monitoring.

Caution: design must preserve fish passage, avoid erosion, and remain compatible with permits and landowner constraints.

Recommendations inferred from seasonal HRT screening, modelled exchange patterns, and Wayne's request regarding pond entrances.

Minimum monitoring to turn screening into design guidance

The next phase should measure connectivity, turnover, and water-quality response.

FIELD CONFIRMATION

- ✓ Cross-section orientation: which sign means pond entry?
- ✓ Active entrances and bypass paths at low-water and freshet stages.
- ✓ Pond bathymetry and water levels using staff gauges or loggers.

PERFORMANCE MONITORING

- ✓ Turbidity and sediment deposition before/after modifications.
- ✓ Water-quality samples at pond inlet, pond centre, and outlet.
- ✓ Drone imagery from consistent flight paths and seasonal windows.

Goal

Confirm whether entrance modifications increase turnover without reducing HRT below the useful screening range.

Monitoring priorities based on project reports and final HRT screening needs.

The system has retention potential, but low-flow performance depends on active pond connection.

1. Seasonal HRT is the decision layer
Baseline HRT is raw Delft3D transparency; seasonal factors better represent the screening question.

2. Pond 3 and Pond 4 are the retention priorities
Pond 3 has the broadest pass count. Pond 4 has the strongest summer/fall HRT.

3. Entrances are the main design lever
Improve low-flow turnover by confirming and, if appropriate, moving/reshaping pond inlets and controlled outlets.

Decision requested from Wayne

Which final deliverable is most useful for NEWSS: pond-prioritization matrix, monitoring plan, entrance-modification guidance, model documentation, replication criteria, or stakeholder summary?

Next step

Use tomorrow's feedback to finalize the report and recommendations without overclaiming treatment performance.

Outputs

Academic products

- ✓ IWA Conference
- ✓ Hydrologist Latinamerican Society
- ✓ Pond bathymetry and water levels using staff gauges or loggers.

Potential future work

- ✓ Global Affairs Canada call (submitted in June 2026)
- ✓ MITACS Globalinks Research internship
- ✓ Seeking dditional fund

Monitoring priorities based on project reports and final HRT screening needs.