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2024 Conference

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Stormwater Pond Sediment Accumulation Assessment Best Practices

Source to Stream

March 26th, 2024

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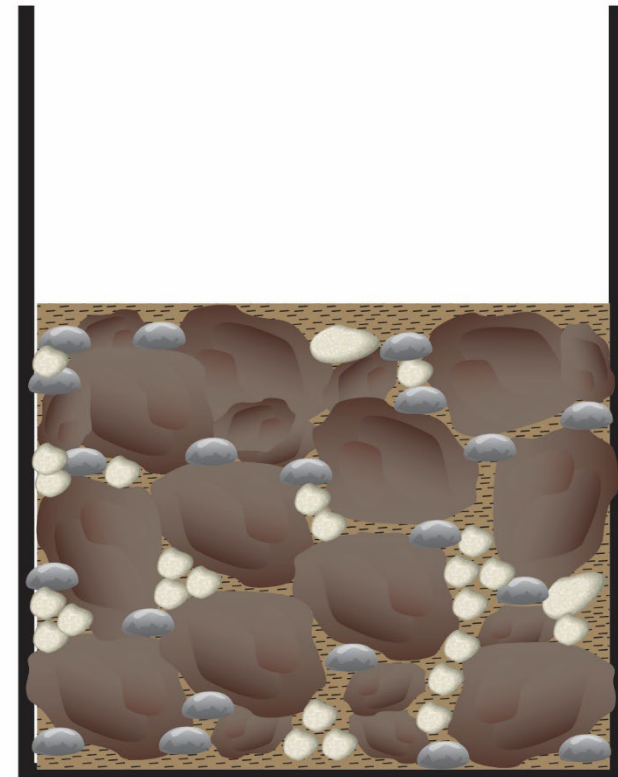
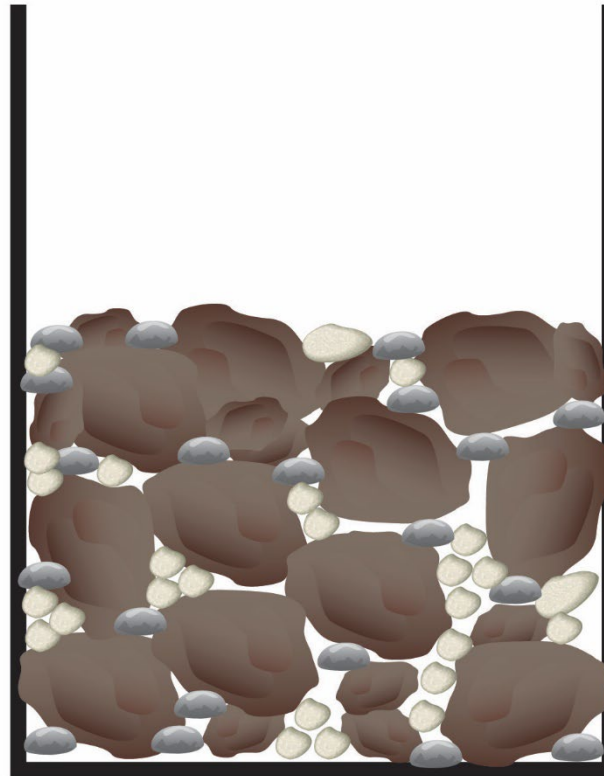
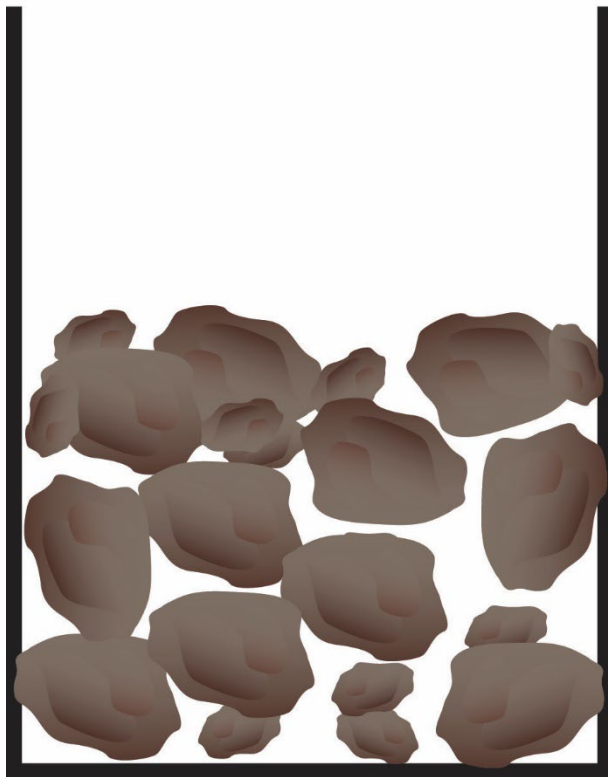
Lake Simcoe Region Conservation Authority



Lake Simcoe Region
conservation authority



What do you mean by half full?



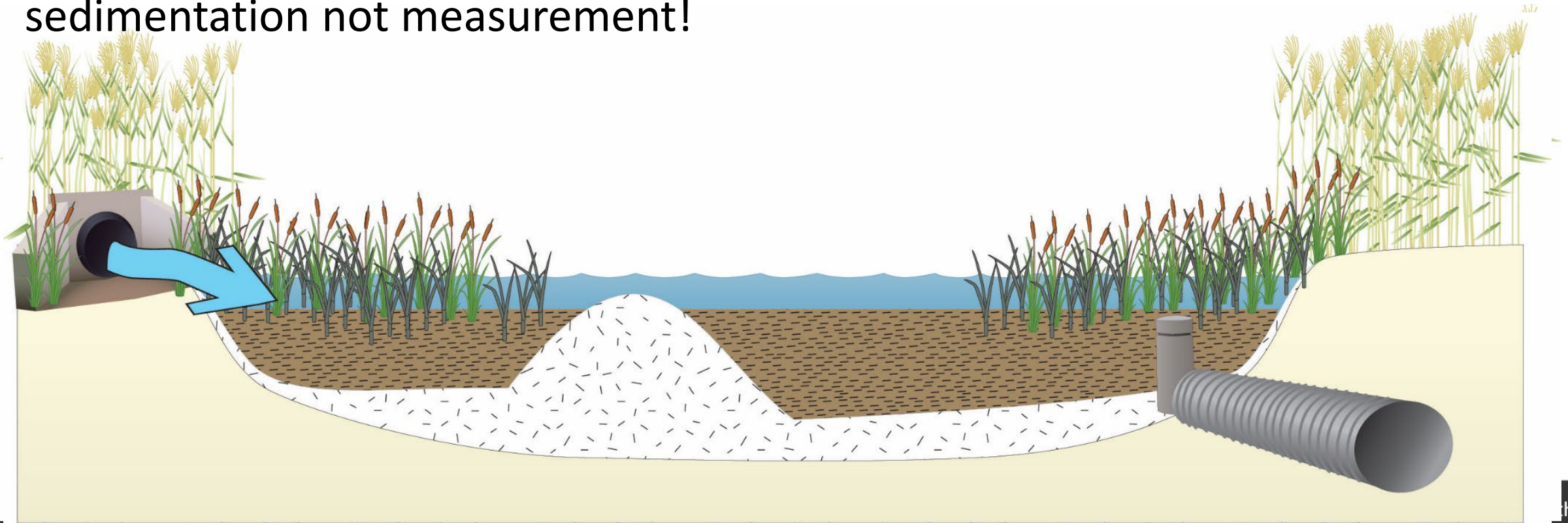
Why Measure the Sediment Volume in your Pond?

- Stormwater Ponds fill with sediment, that is their job!
 - Understand total sediment volume for disposal and cost
 - Is the pond functioning as intended / designed
 - Sedimentation rates to help long term planning
 - Prioritize with all other ponds



Consistency = Comparability

- Different survey and analysis methods can yield different sediment estimates
- Need to understand these differences to maximize consistency and accuracy of surveys (your future self will thank you for it)
- The result are sediment volume estimations that differ due to sedimentation not measurement!



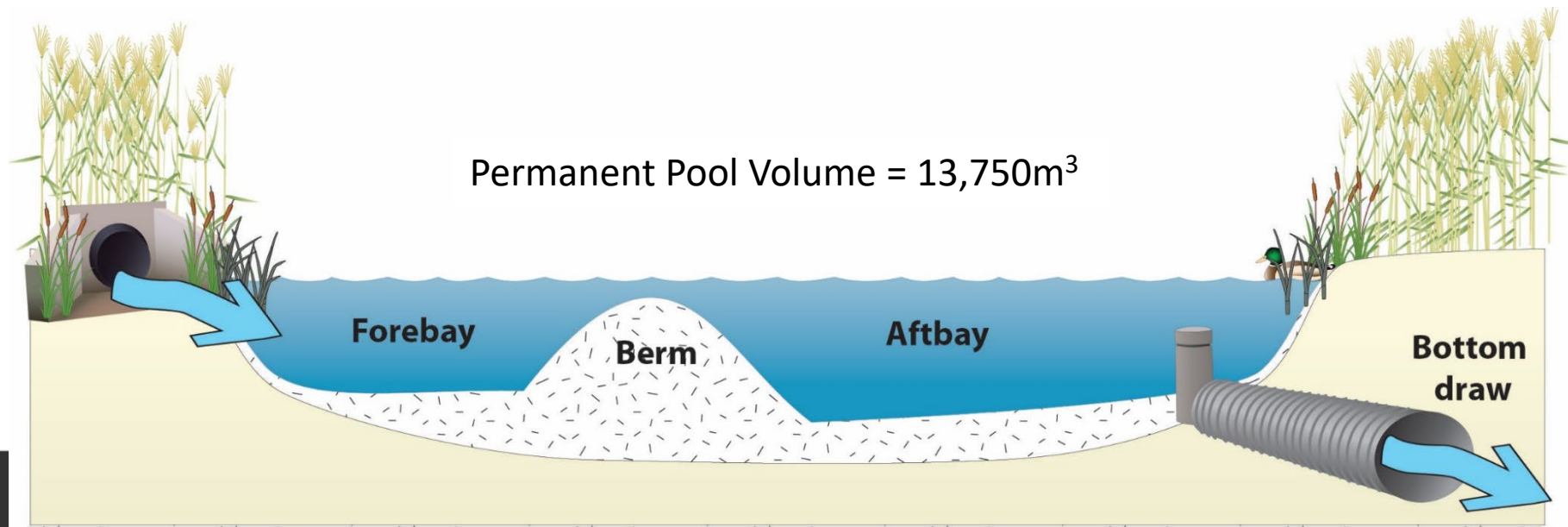
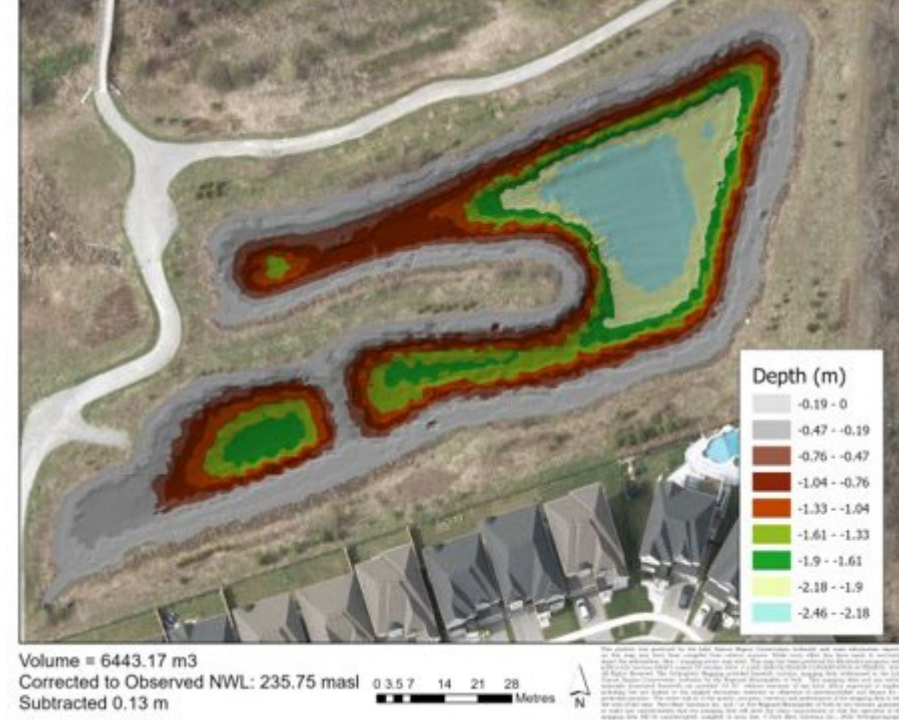
Sediment Survey Best Practice Components



1. Determine the Design Volume
2. Determine the Design Normal Water Level (NWL)
3. Determine / Select your Survey Method
4. Reporting and documenting for posterity

1. Determine the Design Volume (AKA How big was this pond to start with?)

- Provides a consistent number to be used
- Surveyed volume taken at time of assumption!
- ECA Design volume or As-Built information
 - Typically in Stormwater Management Design Brief
 - Digitize design drawings into GIS / CAD software to generate volume



1. Determine the Design Volume

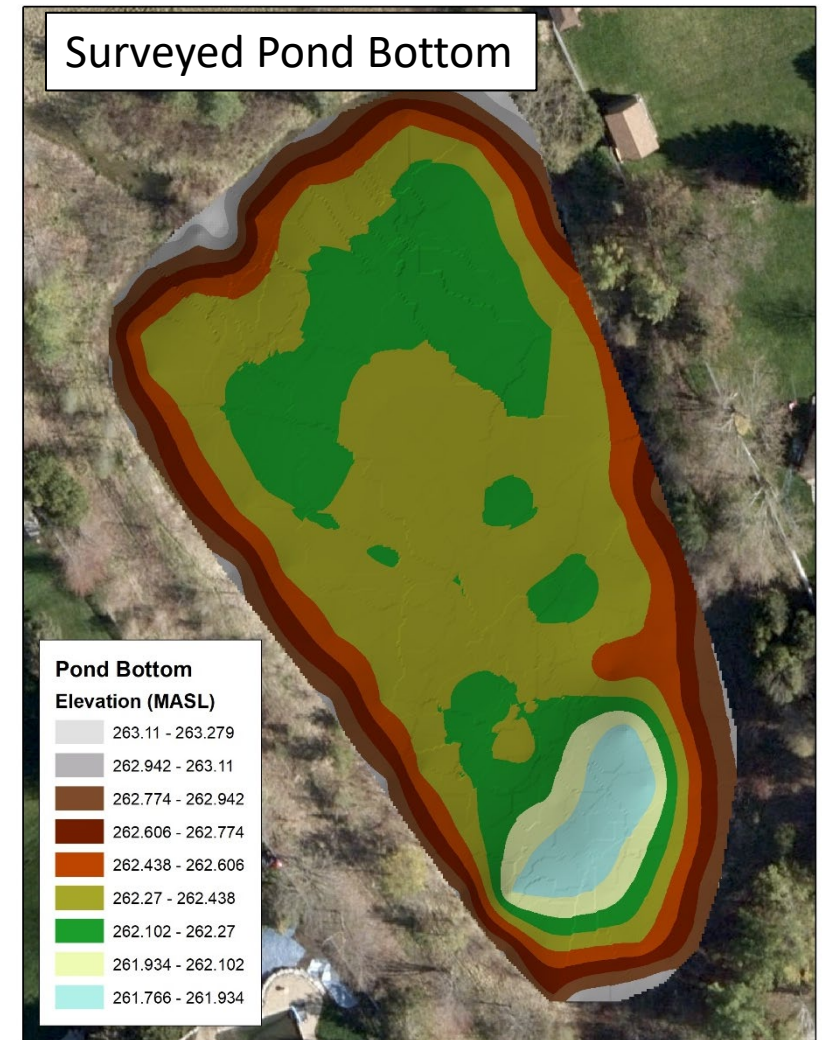
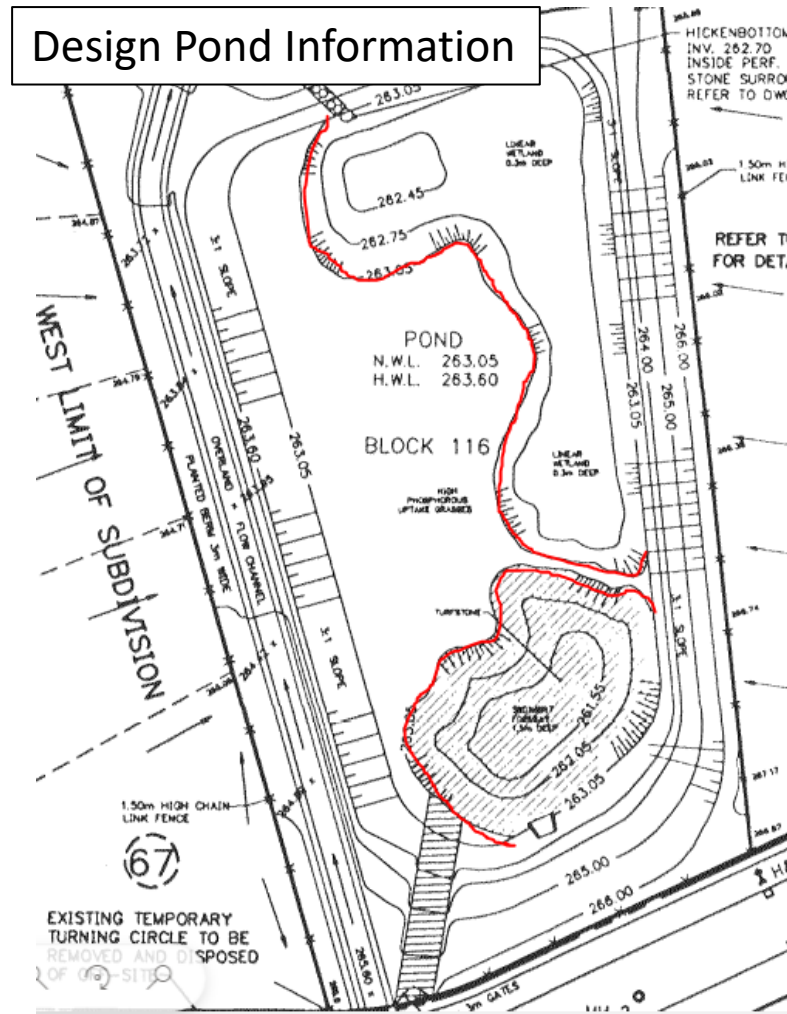
(When no design information can be found!)

- Recalculate sizing requirements based on MECP SWP Design criteria
- Survey rod to penetrate sediment and “feel” native / clay liner



1. Design Volume Vs. Survey Design Volume

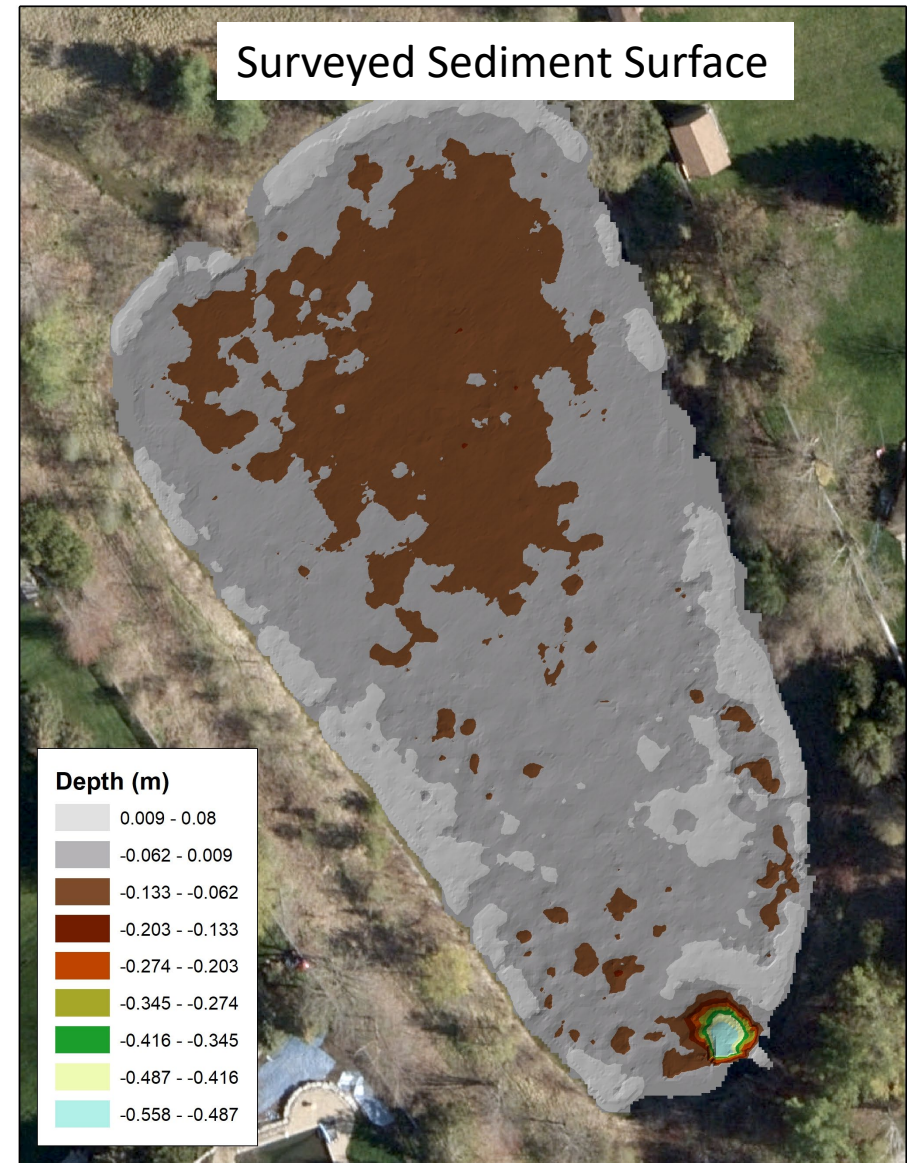
- Permanent pool volume from design compared to volume from rod survey
- Design pond shelf at 263.05masl
- Survey pond bottom at 262.3masl



Estimate of Percent Full Design Volume Vs. Survey Volume

- Two different surveys of same pond
- Sediment surface surveys are comparable. Similar method used
- Permanent pool volumes very different. Different methods used

Data Source	Permanent Pool Volume (m3)	Survey Sediment Volume (m3)	Ave Sediment Surface (MASL)	% Full
Design	1,300	1,112	263.02	85.5
Survey Rod	4,815	2,305	262.9	48



2. Determine the Design Normal Water Level (NWL)

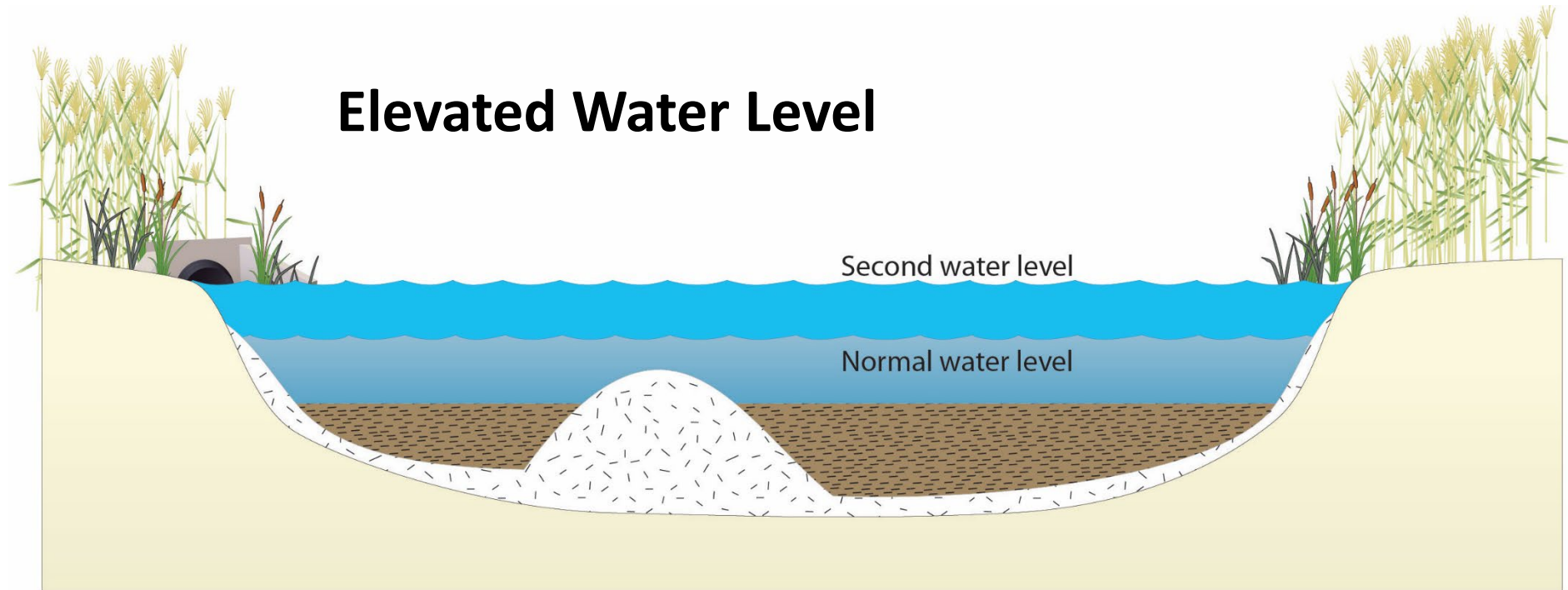
- Pond levels can fluctuate or be permanently altered
- Correcting survey to the NWL provides a consistent benchmark for surveys = improved consistency in measurements!
- Consistency in both vertical extent as well as horizontal extent of the pond.
- Source
 - Design brief or drawings
 - Inlet invert



2. NWL Correction for Vertical Extent

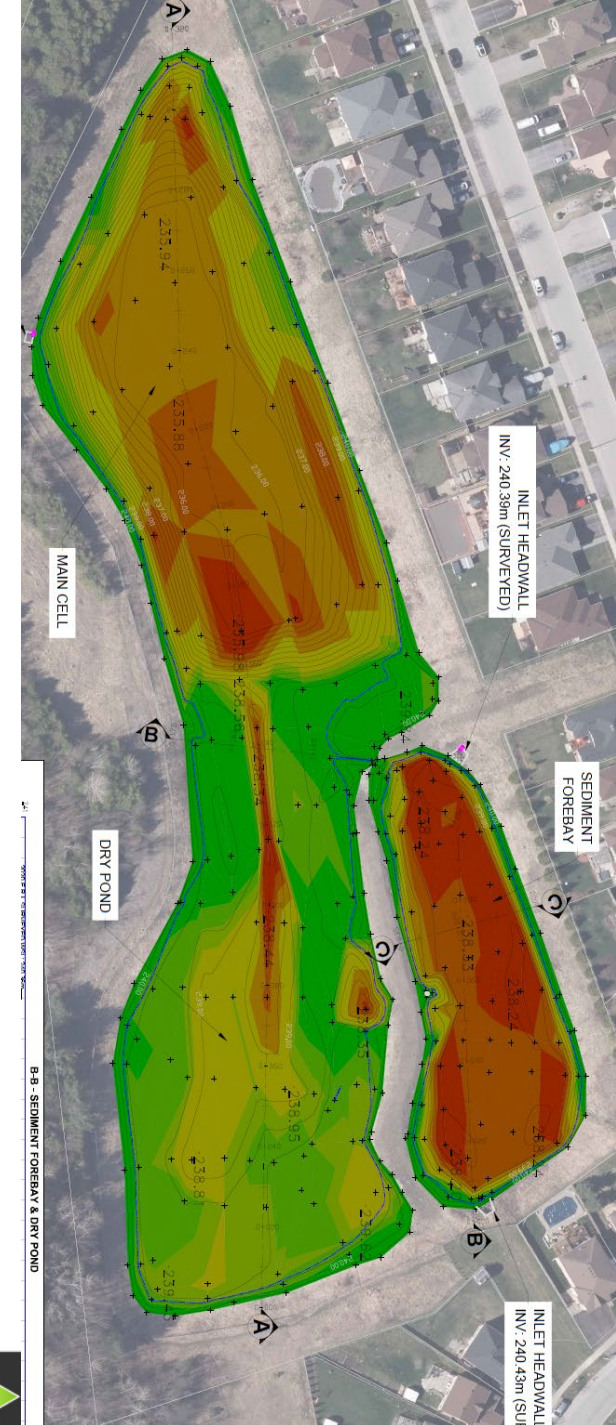
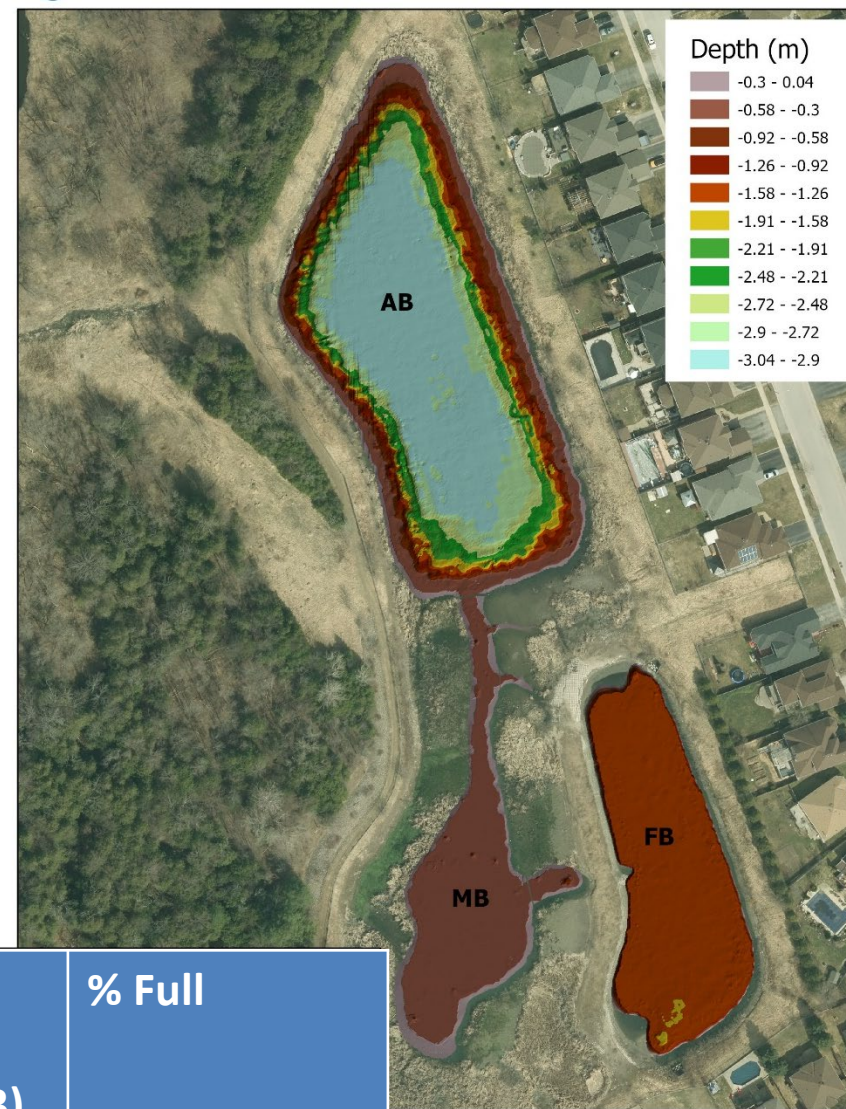
- Pond surveyed at NWL found 50% full of sediment
- Pond surveyed at elevated water level now found to be 25% full of sediment

	Survey Volume (m3)	Sediment Volume (m3)	% Full
NWL	1,000	500	50%
Elevated WL	2,000	500	25%



2. NWL Correction for Horizontal Extent

- Large portion of pond sitting above NWL
- Design survey corrected to NWL
- Survey Rod did not correct to NWL resulting in larger pond surface area



	Permanent Pool Volume (m3)	Survey Sediment Volume (m3)	% Full
Design	19,820	1,167	6%
Survey Rod	23,150	5,092	19%

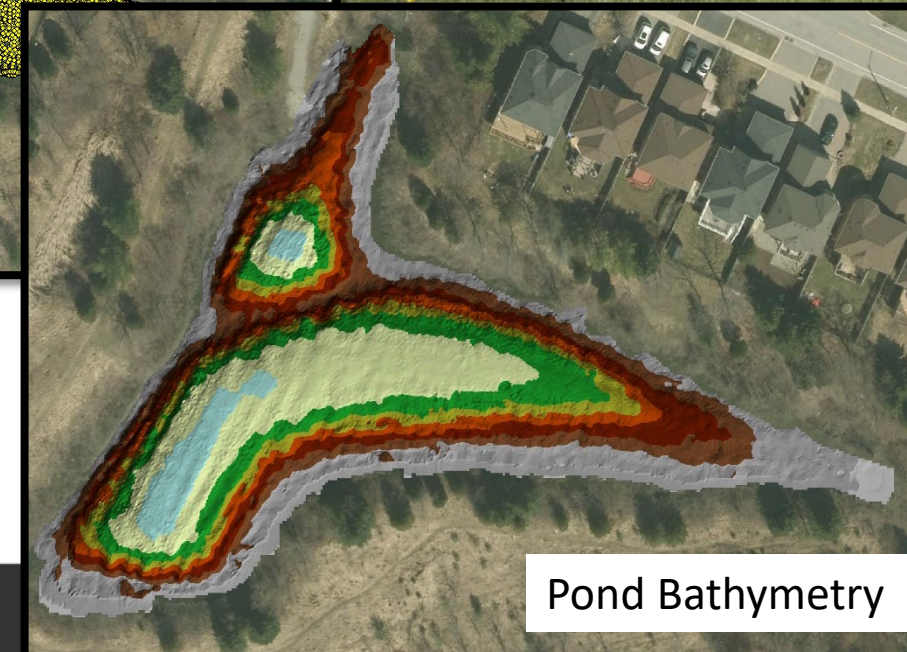
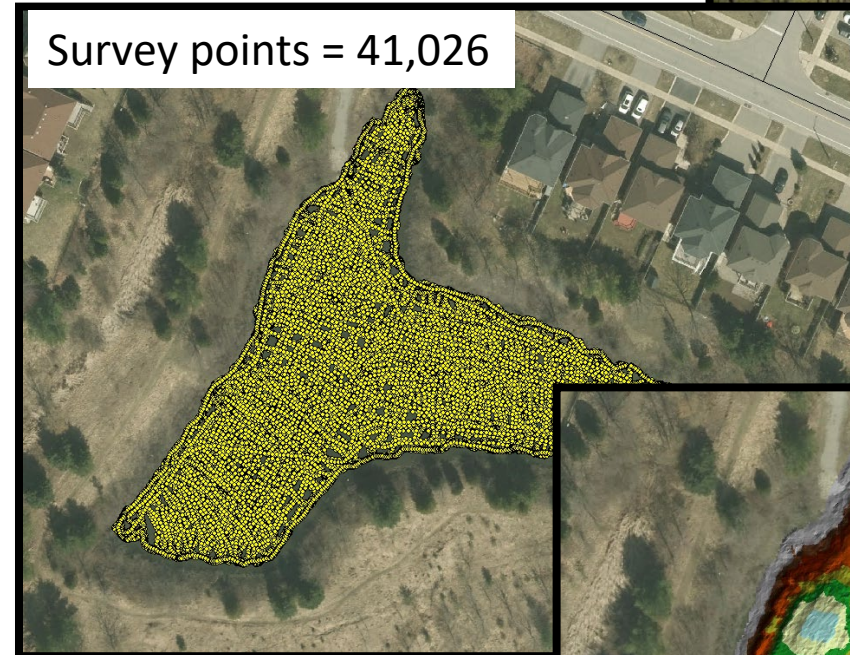
3. Determine Survey Method

- Three common methods,
 1. Sonar depth sounding (sediment surface) with GPS,
 2. Disk and rod (sediment surface) with GPS, and
 3. Direct Sediment Depth Measurement (rod or corer)



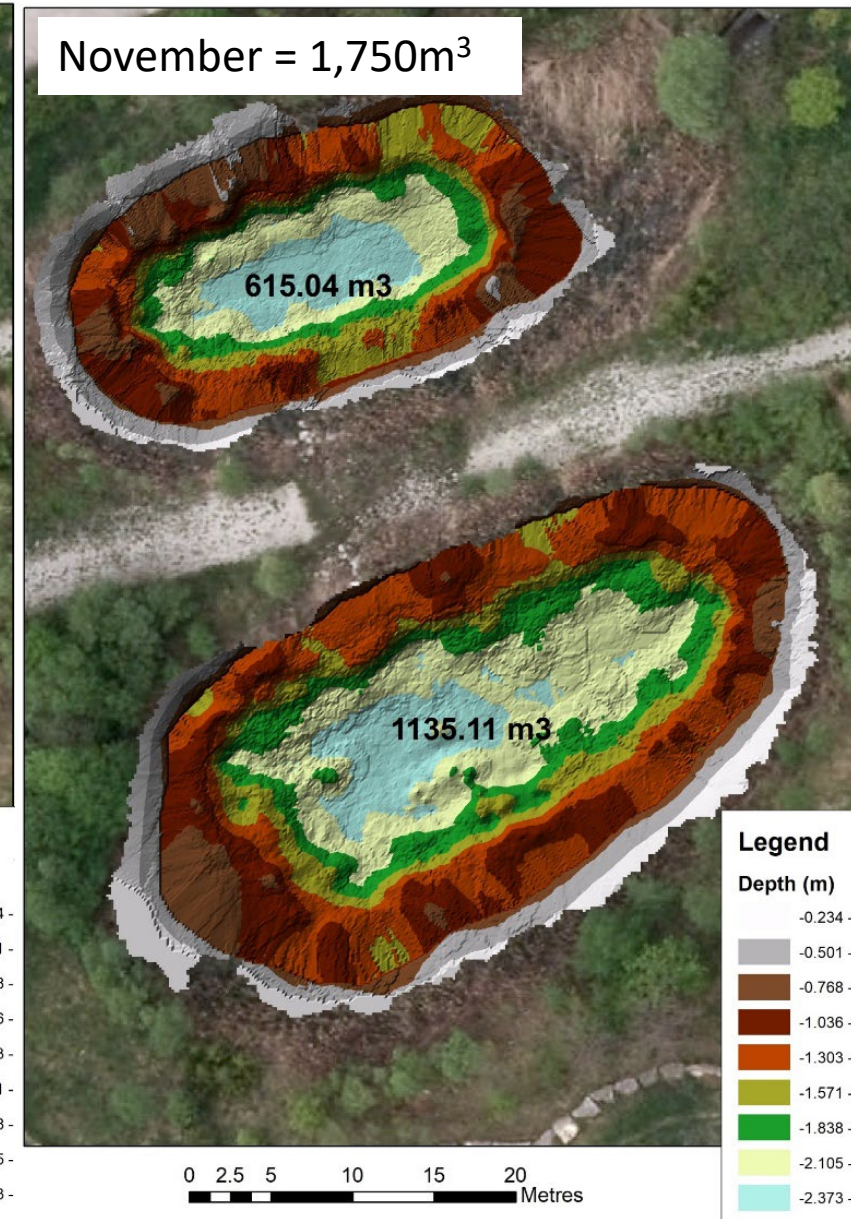
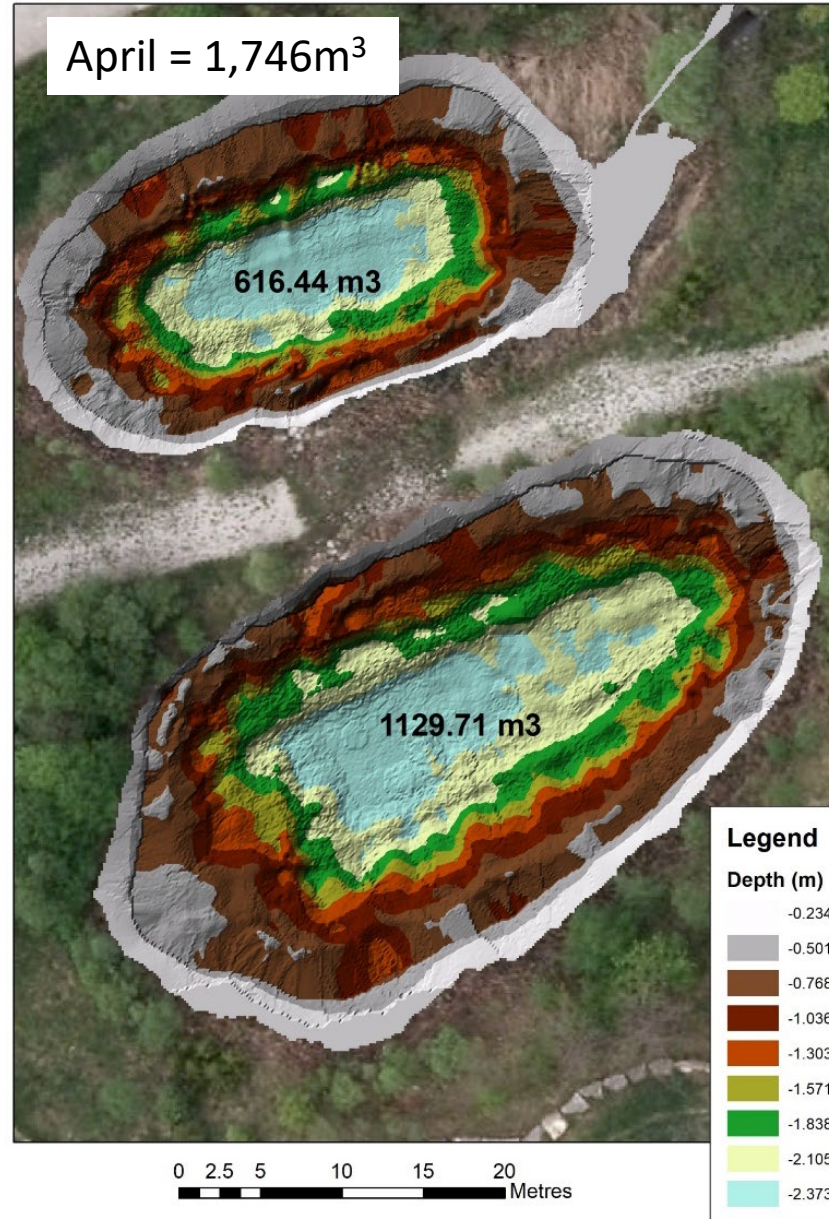
3.1 Sonar Depth Sounding Method Considerations

- Produces very detailed pond bathymetry
- Produce very consistent results
- Plant material or loose unconsolidated sediment interpreted as bottom surface
- Sonar will typically produce a volume less than Disk and Rod of ~15%



3.1 Sonar Method can yield consistent results

- Pond volume measured in April (pre plant growth) = $1,746\text{m}^3$
- Pond volume measured in November (after plant die off) = $1,750\text{m}^3$
- Less than 1% difference!



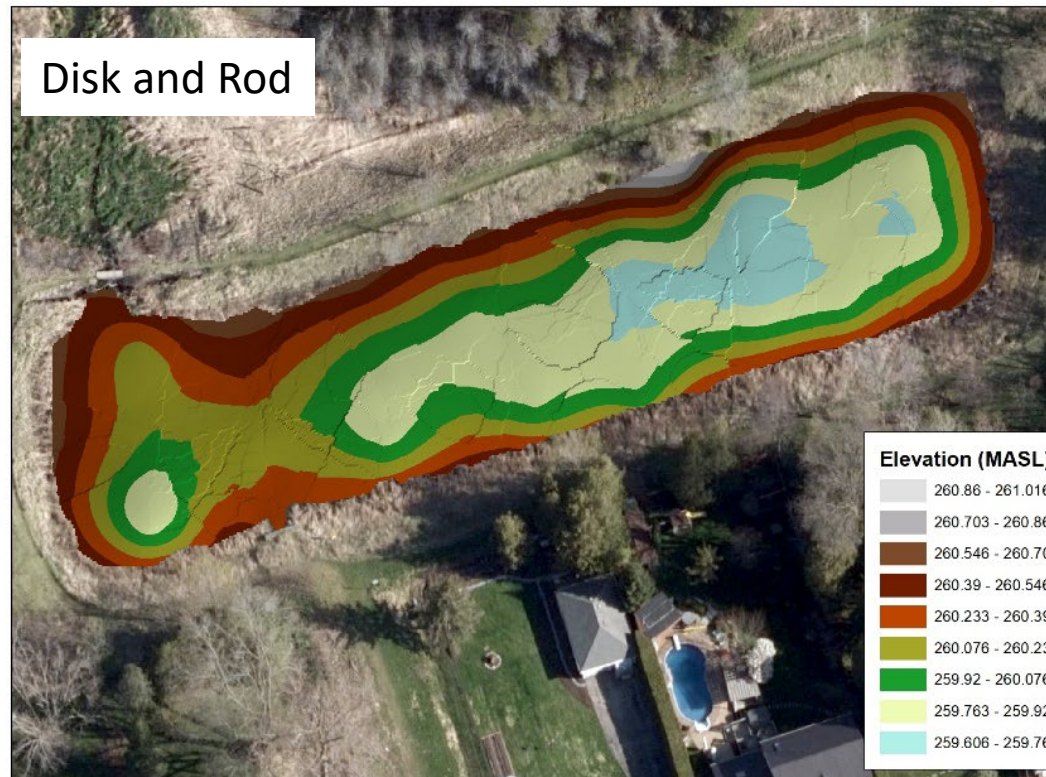
3.2 Disk and Rod

3.3 Direct Sediment Measurement

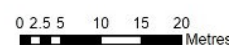
- Commonly available equipment and survey practice
- Rod or corer will compact / penetrate sediment surface
- Greater variation possible based on user, experience and equipment
- Can be hard to determine pond bottom
- Disk and Rod will typically produce a volume greater than sonar of ~15%
- Direct sediment measure will compact sediment yield lower sediment volume



Comparison of Disk and Rod Vs. Sonar



LSRCA Observed NWL: 260.69 masl



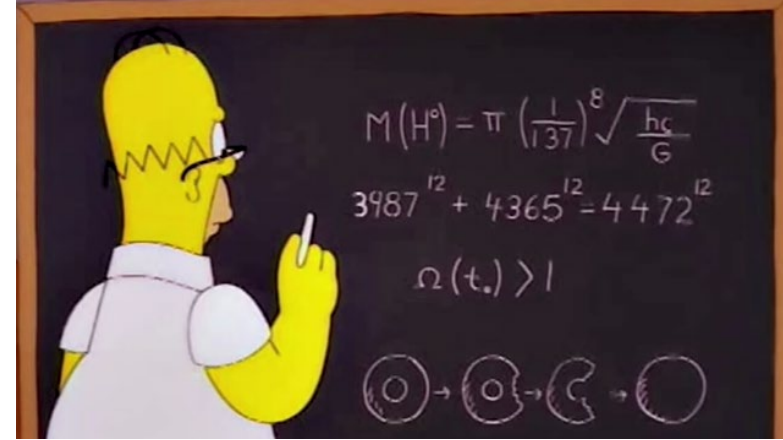
Volume = 329.87 m³
 Corrected to Observed NWL: 260.69 masl
 Subtracted 0.20 m



	Survey Data Points	Permanent Pool Volume	Sediment Volume	% Full
Sonar	15,461	3,406	3,076	90
Disk and Rod	98	3,406	1,147	34

4. Reporting and Documenting

“Show Your Work”



	Date	Design NWL	Survey WL / correction method	Design Volume*	Survey Volume	Sediment Accumulation**
Value	May-2023	289.04 masl	289.34 masl	6,048 m ³	5,771 m ³	637 m ³
Source			Survey from benchmark / survey corrected to design NWL	From ECA # 35-2004 - permanent pool compliance volume	Measured value using sonar method	= design volume – survey volume

- *value from ECA or from field survey?
- **method could also be from direct sediment depth measurements

Summary

(on how to make your future self thank you!)

1. Determine the Design Volume

- Use design or assumption volume for consistent benchmark for future surveys

2. Determine the Design Normal Water Level (NWL)

- Correct to NWL for consistent vertical and horizontal pond extent

3. Determine / Select your Survey Method

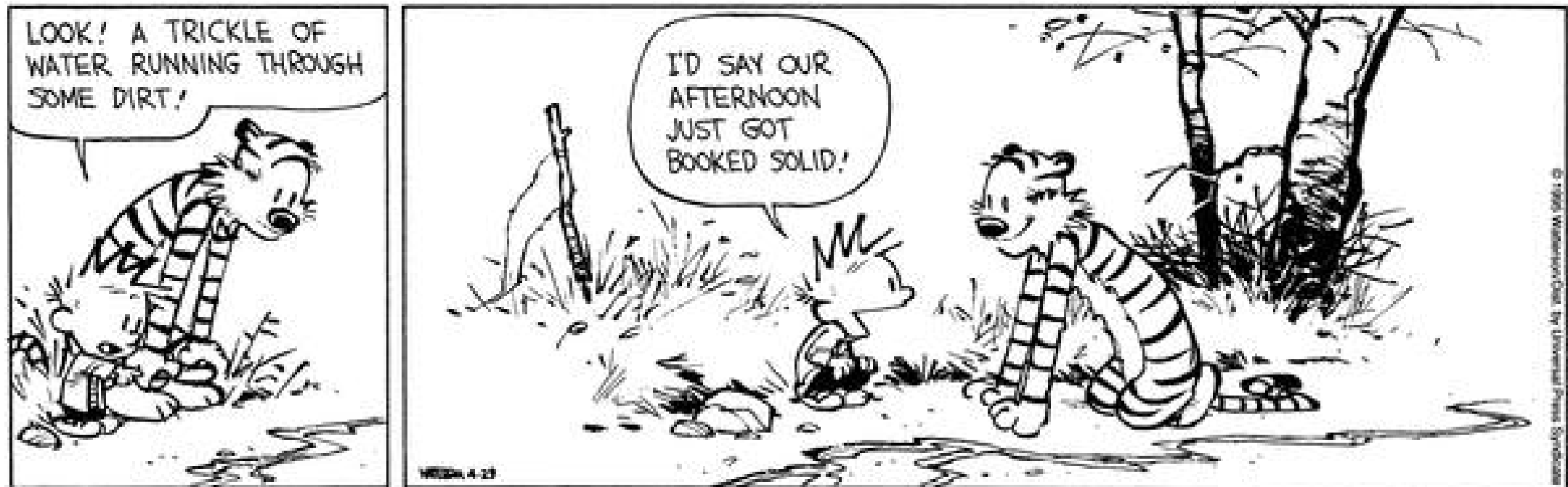
- Different method may produce different result, strive for consistency

4. Reporting and documenting for posterity

- Show your work to ensure the next survey can follow your method



Questions?





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