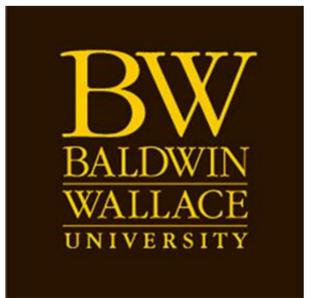


Stream Assessment of Rocky River Tributary

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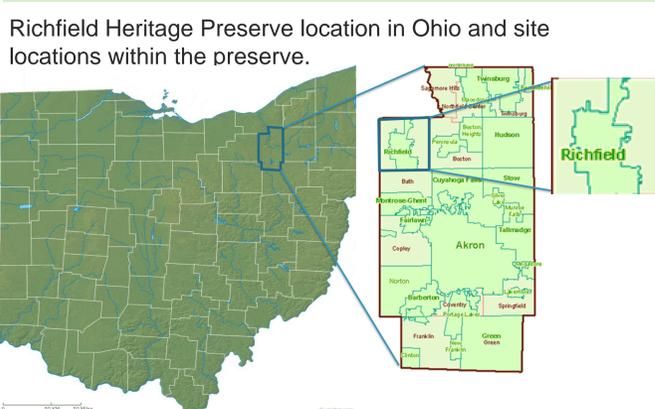
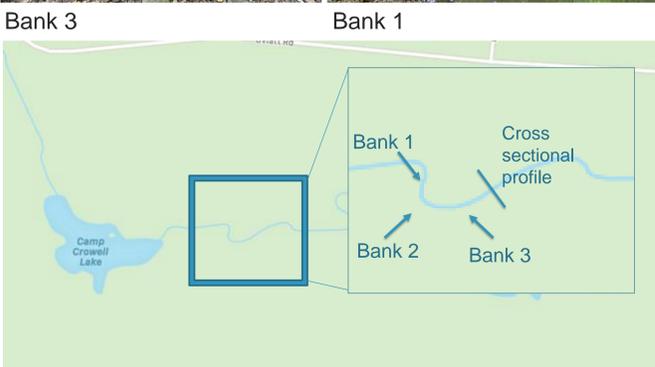
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Introduction

Streams are an essential part of ecosystems. Healthy meandering streams yield diverse aquatic communities while plants on the riverbanks prevent erosion and improve water quality by taking up nutrients. A functioning stream will be storage for water, connected to its floodplain which protects against flood events, and provide a habitat for a variety of different organisms depending on the composition of the stream bed. A headwater stream is defined as a primary stream with no tributaries. The stream studied is located in Richfield Heritage Preserve and is within the Lake Erie Watershed. It is a headwater for Rocky River East Branch with a drainage basin of less than a square mile. We accessed this stream in terms of water quality and its headwater macroinvertebrate diversity and abundance. Our objective was to determine a stream classification, both biologically and geomorphologically to access the overall functionality of the stream. We hypothesize that the study stream will be a class-III based on previous research and assessment of the study area.

Study Area



Materials and Methods

- A transit was used to measure the cross-section profile of the stream.
- To measure the width of the flood prone area, an elevation that corresponded to twice the maximum bankfull channel depths was determined by the vertical distance between the bankfull stage and the thalweg.
- Large Woody Debris: Large Woody Debris was recorded and index calculated. The score is expected to be low because of the limited presence of debris in the study section.
- Pebble Count: The count was expected to give results of a large percentage of boulder and cobble sized pebbles because of the headwater nature of the study stream.
- Bank Erosion Hazard Index (BEHI): The bank height, root depth, root density, bank angle, surface protection, and bank material were measured and used to determine bank erosion hazard. Banks were expected to have high scores because of the exposed roots, and high erosion observed.
- Qualitative Habitat Evaluation Index (QHEI): The bed substrate, instream cover, channel morphology, bank erosion, pool/glide and riffle/run quality, and stream gradient were measured. The corresponding scoring system was followed. A high score was expected.
- Primary Headwater Habitat Evaluation (HHEI): The bed substrate, maximum pool depth, and bankfull width were measured. The scores were determined with the scoring system. A high score was expected.
- Headwater Macroinvertebrate Field Evaluation Index (HMFEI): Each category of stream was sampled for 30 minutes or until there was no novel taxa found. Taxa were collected using D-frame kick nets to collect the specimens after substrate was disturbed. Voucher specimens were collected in 10% ethanol, and abundance was noted. Specimens were transported to a lab and identified using standard field guides. The species abundance was recorded, and the corresponding scores were added. We expected a score greater than 19.
- Water quality measurements were obtained using a YSI multiparameter probe. Measurements that were taken include pH, salinity, specific conductance, conductance, temperature, total dissolved solids, and mg/L of dissolved oxygen. We expected the values to be within the Ohio EPA standards.



Major pool (left) and riffle (right) studied in the habitat evaluation.

Results and Discussion

| Water Quality | Stream Average (n=2) | Ohio standards |
|-------------------------------|----------------------|----------------|
| pH | 7.12 | 8 |
| Temperature (°C) | 32.9 | 22.2 |
| Total Dissolved Solids (mg/L) | 171.6 | 1500 |
| Dissolved Oxygen (mg/L) | 2.95 | 5.0 |
| Salinity (ppt) | 0.13 | 0.5 |
| Specific Conductance (µS/cm) | 258.1 | >171 |
| Conductance (µS/cm) | 221.2 | >100 |

The pH, specific conductance, and conductance are within standards and support our hypothesis. Temperature, Dissolved Oxygen, and salinity aren't within compliance of the Ohio EPA standards and refute our hypothesis.

| Pebble | Count(%) |
|---------|----------|
| Sand | 3 |
| Gravel | 24 |
| Cobble | 50 |
| Boulder | 22 |
| Bedrock | 1 |

The stream contained mainly gravel and cobbles which supports our hypothesis and corresponds to the expectations of a headwater stream.

Three banks were scored. The banks were on opposite sides of the stream and all recorded high scores. These support our hypothesis due to the entrenched nature of the stream. The stream has unstable banks due to the high velocity of the water causing high erosion.

| BEHI Scores | |
|-------------|-------|
| Bank 1 | 26.2 |
| Bank 2 | 33.45 |
| Bank 3 | 32.95 |

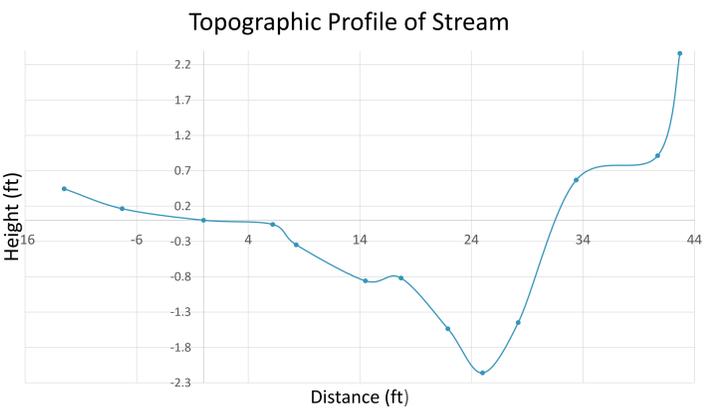
Ratios

| | | |
|--------------------|-------|--|
| Entrenchment | 1.89 | The stream is slightly entrenched which indicates a high degree of functionality. The high width-depth shows there is instability in the banks from the increase of hydraulic stress. A high sinuosity results in a more stable stream caused by the natural flow of water. Large woody debris score is low as expected. |
| Width-Depth | 15.29 | |
| Sinuosity | 1.38 | |
| Slope | 0.016 | |
| Large Woody Debris | 74 | |

The high scores of QHEI and HHEI indicate a high degree of habitat diversity. The characteristics of the stream channel create a variety of habitats for macroinvertebrates. The HMFEI score was greater than 19 which classifies the stream as Class-III. This supports our hypothesis.

| Habitat Scores | |
|----------------|----|
| QHEI | 82 |
| HHEI | 62 |
| HMFEI | 37 |

Results and Discussion



The section shows the lack of connectivity between the channel and the floodplain. This stresses the banks if there were to be an increase of discharge of the stream.

Conclusion

This section of stream is a functioning stream with instable banks. We determined that our section of stream was classified as a Type B3 stream based on geomorphological conditions indicating that it is functioning and has a moderate risk of erosion. With the low large woody debris score, there is a small influence of the debris and decreases the habitats available. The abundance of several taxa indicates the high diversity of macroinvertebrates that the stream supports. The Class-III stream is the most stable and healthy stream class and should be observed as a model system. A Class-III stream has an assemblage of cool-cold water species and requires flowing water on an annual basis for the resident species.

With the addition of the primary headwater macroinvertebrate diversity, the stream is highly functional with a large diversity of macroinvertebrates. Further assessment needs to be done to determine the cause of the none compliant water quality standards. This study site should be used as a model for stream health and quality in the Richfield Heritage Preserve.

Acknowledgments

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