NBMCA

CHIPPEWA CREEK ECOPATH STREAM STUDY

A Curriculum Resource for Grade 9 Academic and Applied Science Courses

c/o North Bay-Mattawa Conservation Authority
www.chippewaecopath.ca
ecopath@nbmca.on.ca

Chippewa Creek EcoPath

Chippewa Creek EcoPath was launched in 2012 as a community initiative to restore and enhance the natural values and heritage of Chippewa Creek through stewardship and education.

The Nipissing Botanical Gardens and Heritage Gardeners planted a seed of an idea in 2004 – to identify, preserve and create green spaces with plantings and trees that could be grown and used for research, education and ornamental purposes. The North Bay-Mattawa Conservation Authority and the City of North Bay were concerned about the erosion, flooding and pollution along Chippewa Creek and in 1978 began a series of improvement projects. In 2010, these four groups came together and approached RBC Blue Water Project for funding to marry their visions – a project that would incorporate plantings to improve the water quality of the Creek and develop a sustainable watershed as well as an education program to foster the ongoing stewardship of the Creek. Thus the Chippewa Creek EcoPath was born.

For more information visit www.chippewaecopath.ca

www.facebook.com/ChippewaCreekEcoPath www.twitter.com/ChippewaEcoPath

Acknowledgements

This curriculum resource was developed for the Chippewa Creek EcoPath by:
Julia Burke HBSc, BEd, MES

Thank you to Bryan Brouse for providing supporting materials.

Thank you to the members of the Chippewa Creek EcoPath Steering Committee for the stewardship of this initiative:
North Bay-Mattawa Conservation Authority – Troy Storms, Sue Buckle, Paula Loranger
City of North Bay – David Schroeder, Elaine Pepin
North Bay Heritage Gardeners – Harriett Madigan, Monica McLaren
Nipissing Botanical Gardens – Peggy Walsh-Craig
North Bay Indian Friendship Centre – Lise-Anne Beaupre, Lorraine Liberty
Community Members – Jamie Houston, Hal Falk, Taylor Craig

Thank you to everyone for their contribution to the Chippewa Creek EcoPath.

Table of Contents

Chippewa Creek EcoPath 1
Acknowledgements 1
Table of Contents 2
Chippewa Creek EcoPath Stream Study 3
Backgrounder 3
Overview of the Chippewa Creek Study 3
Mapping Chippewa Creek 4
Student Tasks 5
General Creek Health Assessment 8
Student Tasks 9
General Health Assessment Worksheet 10
Glossary 14

Chippewa Creek EcoPath Stream Study

Backgrounder

Chippewa Creek travels through the heart of the City of North Bay. Chippewa Creek has faced many ecological challenges including flooding, erosion, pollution, and a declining riparian area. Partner with the North Bay-Mattawa Conservation Authority to learn more about Chippewa Creek and what you and your students can do to help restore it!

Overview of the Chippewa Creek Study

The Chippewa Creek Study includes two field investigations for Grade 9 science courses. The field investigations may be completed separately or together. Both investigations include objectives, recommended class time, curriculum expectations, prior learning, required materials, learning strategies and student assessment.

Objective: This resource is intended to engage students in hands-on activities to discover the many facets of a local aquatic ecosystem and to spark an interest in local conservation efforts.

1) Mapping Chippewa Creek
Students have the opportunity to investigate the landscape level features of Chippewa Creek. Students will sketch their own site map of Chippewa Creek based on their measurements and observations. Students will discuss how human impacts have influenced the vegetation and surrounding landscape of Chippewa Creek.
Curriculum Expectations: Grade 9 Academic & Applied Science: B1, B2, B3

2) General Creek Health Assessment
Students will conduct a general creek health assessment according to the Community Stream Stewardship Program's *Stream Health Checklist*. Students will use field observations to explain their assessment based on human and natural factors. Students will create a remediation plan to tackle two challenges they observe in Chippewa Creek (ex. stream erosion and riparian zone vegetation).
Curriculum Expectations: Grade 9 Academic & Applied Science: A1, B2, B3

Mapping Chippewa Creek

Objectives
Through detailed site mapping, students will describe the main physical and biological characteristics of Chippewa Creek. Students will apply their observations to determine likely human impacts and effectiveness of remediation efforts.

Notify North-Bay Mattawa Conservation Authority (NBMCA)
Please notify NBMCA that you are accessing Chippewa Creek for the purpose of this creek study. Please advise NBMCA where and when you will be accessing the creek. ecopath@nbmca.on.ca

Recommended Class Time: Two 60-minute periods
This lesson will require two 60-minute periods to complete. One period will focus on creek mapping at the Chippewa Creek site. The second in-class period will allow students to complete the final copy of their site map and finish discussion questions.

*Please note***:** This activity will require outdoor fieldwork. As such, it is important to schedule this activity in advance to complete all required permission forms.

Ontario Curriculum Expectations

- *Grade 9 Academic Science:*
  - **B1.** Assess the impact of human activities on the sustainability of terrestrial and/or aquatic ecosystems, and evaluate the effectiveness of courses of action intended to remedy or mitigate negative impacts;
  - **B2.** Investigate factors related to human activity that affect terrestrial and aquatic ecosystems, and explain how they affect the sustainability of ecosystems;
  - **B3.** Demonstrate an understanding of the dynamic nature of ecosystems, particularly in terms of ecological balance and the impact of human activity on the sustainability of terrestrial and aquatic ecosystems.
- *Grade 9 Applied Science:*
  - **B1.** Analyse the impact of human activity on terrestrial or aquatic ecosystems, and assess the effectiveness of selected initiatives related to environmental sustainability;
  - **B2.** Investigate some factors related to human activity that affect terrestrial and aquatic ecosystems, and explain how they affect the sustainability of ecosystems;
  - **B3.** Demonstrate an understanding of characteristics of terrestrial and aquatic ecosystems, the interdependence within and between ecosystems, and the impact humans have on the sustainability of these ecosystems.

Prior Learning
Students will need to have a basic familiarity with the abiotic and biotic components of a sustainable and unsustainable ecosystem. Students should be able to look at key traits to be able to differentiate one type of vegetation from another. Students should also be familiar with how to treat an ecosystem with respect.

Required Resources

- Tape Measure (20m)
- Meter Stick
- Graphing paper
- Rubber boots or hip waders (depending on creek depth)

Safety

Site Selection

- Be sure to choose a site along Chippewa creek that does not surpass a depth of 1 meter and has a slow current.

Volunteers

- Adult volunteers are recommended to ensure students are safely monitoring the creek.

Students

- Students must not enter the water unless given permission by an adult.
- All students must treat the creek with respect. Organisms should ***not*** be removed from the site. This includes vegetation, aquatic, and terrestrial species.

Student Tasks

Creek Dimensions and Abiotic Features

Review the sample site map in Figure 1 throughout activity. You will be required to have a legend and create a site map to scale.

1. Select a section of the creek that is 15 m long. Whenever possible your site should contain both **riffles** (small rapids) and **pools** (deep, quiet water).
2. Use the tape measure to determine the length of your section along both shorelines. Mark these points with a stick or rock.
3. On graph paper, prepare a map of your stream site. Draw the contours of the shoreline. Indicate the length and major obstructions in or over the water (ex. large rocks over 0.5 m in diameter or length, fallen trees and branches, bridges, etc.)
4. At two-metre intervals along the shoreline, measure the width of the creek.
5. Measure the depth at the centre of the creek with a meter stick at each point where you measured stream width. Record these values on your map.
6. Measure and record the deepest part of any pool that you find in the stream. If your section of the stream has riffles, indicate their location on the map.

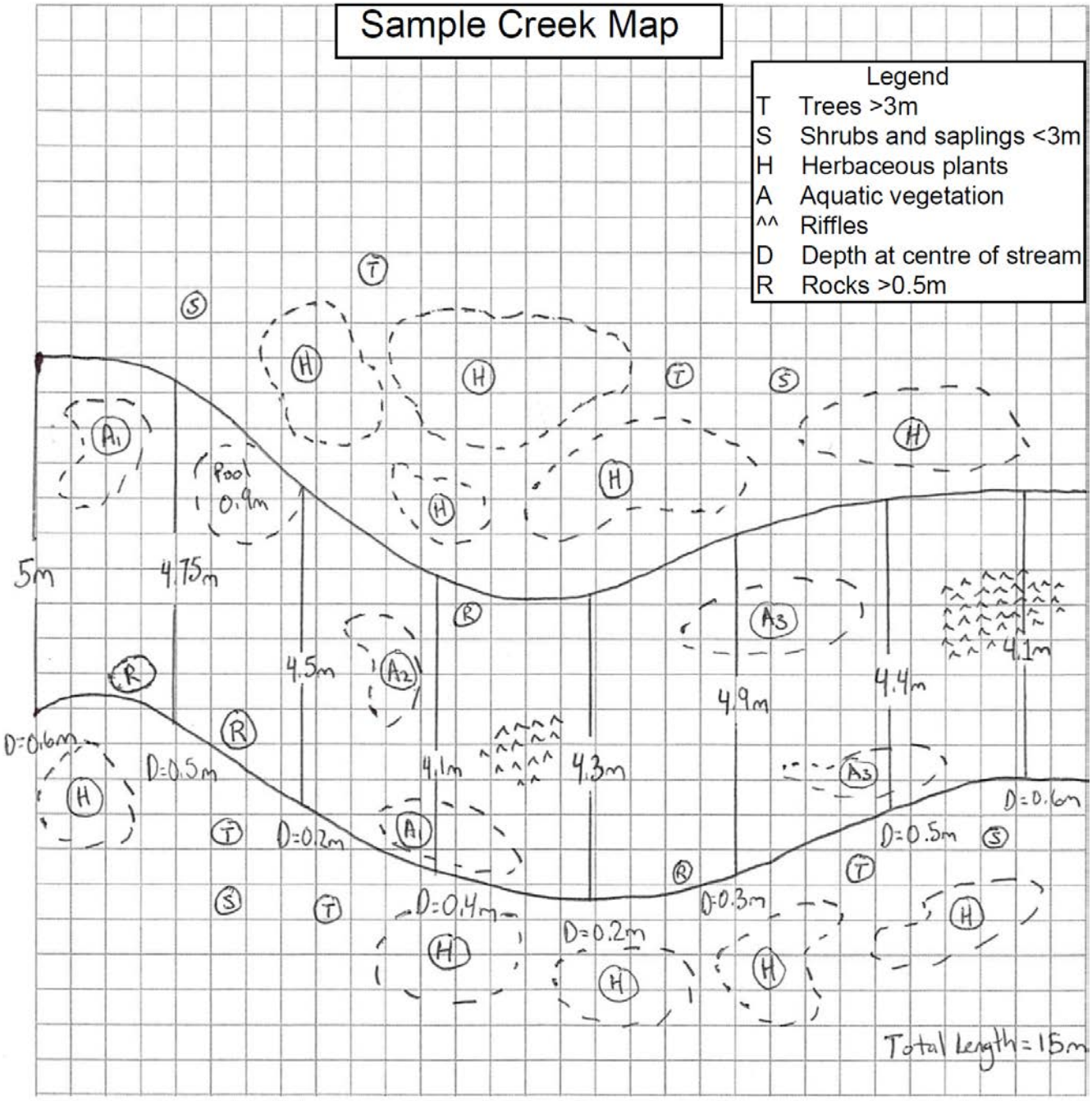
Mapping Vegetation

On your site map, indicate the location of major plant types within 5m of the creek shore, using the legend below.

T = trees over 3m in height
S = shrubs and saplings up to 3m in height
H = herbaceous plants, including grasses
A = aquatic vegetation

1. Record the location of the centre of large trees and shrubs and the approximate centre of herbaceous plants that grow over a large area, e.g., grasses and weeds.
2. Use a dotted line to mark the approximate boundary of an area covered by a large growth of plants.
3. Locate aquatic vegetation in the same manner. Use the symbol A to mark beds of vegetation, and use subscripts (A_1, A_2, A_3) to indicate different types of vegetation.

Figure 1. Sample Creek Map



Assessment

- Site Map: Students will complete a site map of Chippewa Creek following the steps and sample site map provided (see rubric below)
- Discussion Questions
    a. Based on your observations, what were the two most evident human impacts at your site area?
    b. How do these human impacts impact the water quality of Chippewa Creek?
    c. What would a more sustainable creek look like? Be sure to include both biotic and abiotic factors in your description.
    d. What is the Chippewa Creek Adopt-the-Creek program (visit chippewaecopath.ca)? How can this program help to effectively create a more sustainable creek?

Site Map Rubric

Category	Marks available	Mark received	Comments
Physical Characteristics			
The width is clearly labeled every 2m and the overall length is labeled	2		
Abiotic features (rocks, fallen trees etc.) are clearly and accurately drawn	1		
Pools and riffles are clearly written	1		
Biological Characteristics			
Different types of terrestrial vegetation (trees, shrubs, and herbaceous plants) are clearly and accurately drawn	3		
A diversity of aquatic vegetation are clearly and accurately drawn	2		
Layout			
The overall site map is well layed out and neatly drawn	1		
Total:	**10**		

References

Hodgson, C. (2005). *Laboratory manual for Bio 102, Principles of modern Biology, 6th Ed.* Courtenay: North Island College.

Brouse, B. (2000). Assessing the health of Chippewa Creek.

General Creek Health Assessment

Objectives
Students will make detailed field observations and apply their observations to assess the health of an aquatic ecosystem. Throughout this activity, students will become more familiar with ecosystem health and potential remediation strategies.

Notify North-Bay Mattawa Conservation Authority (NBMCA)
Please notify NBMCA that you are accessing Chippewa Creek for the purpose of this creek study. Please advise NBMCA where and when you will be accessing the creek. ecopath@nbmca.on.ca

Recommended Class Time: Two 60 minute periods
This lesson will require two 60-minute periods to complete. One period will focus on making field observations at the Chippewa Creek site. The second in-class period will allow students to complete the rationale for their creek health assessment and create their remediation plan.

Curriculum Expectations

- Grade 9 Academic Sciences:
  - **A1.** Demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analysing and interpreting, and communicating);
  - **B2**. Investigate factors related to human activity that affect terrestrial and aquatic ecosystems, and explain how they affect the sustainability of ecosystems;
  - **B3.** Demonstrate an understanding of the dynamic nature of ecosystems, particularly in terms of ecological balance and the impact of human activity on the sustainability of terrestrial and aquatic ecosystems.
- Grade 9 Applied Sciences
  - **A1.** Demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analysing and interpreting, and communicating);
  - **B2.** Investigate some factors related to human activity that affect terrestrial or aquatic ecosystems, and explain how they affect the sustainability of ecosystems;
  - **B3.** Demonstrate an understanding of characteristics of terrestrial and aquatic ecosystems, the interdependence within and between ecosystems, and the impact humans have on the sustainability of these ecosystems.

Prior Learning
Students will need to be aware of key components that affect the health of aquatic ecosystems: riparian zones, nutrient levels, erosion, canopy cover, sediment deposition, vegetation, and human activities. Students should be familiar with recording their observations and using their observations to support a conclusion.

Required Resources

- Tape Measurer
- General Health Assessment Worksheet

Safety

Volunteers

- Adult volunteers are recommended for this activity to ensure students are safely monitoring the creek.

Students

- Students must ***not*** enter the water.
- All students must treat the creek with respect. Organisms should ***not*** be removed from the site. This includes aquatic vegetation, and terrestrial species

Student Tasks

Students will use the attached General Health Assessment to assess the health of Chippewa Creek:

1. Students will section off 20m of the creek to assess.
2. Students will rate each characteristic on a scale of 1 to 3 using the Creek General Health Assessment Worksheet. The maximum and minimum of the scale represented by unhealthy (1) and healthy (3) are defined through pictures and text in the worksheet.
3. Students will provide a written rationale for their overall health rating of the creek. Students must make reference to specific field observations of the creek as well as possible explanations for their observations in relation to ecosystem function and human impact (250 words).
4. Based on their rating, the student will provide a written remediation plan for Chippewa Creek for ***two*** of the criteria that scored poorly (300 words). Be sure to check out NBMCA's Chippewa Creek EcoPath project for ideas on how to protect and manage the creek www.chippewaecopath.ca

Assessment

Students' ratings and written work will be assessed according to the success criteria below:

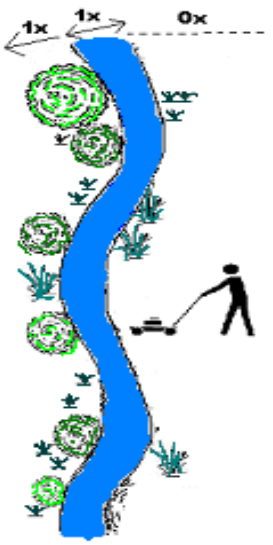
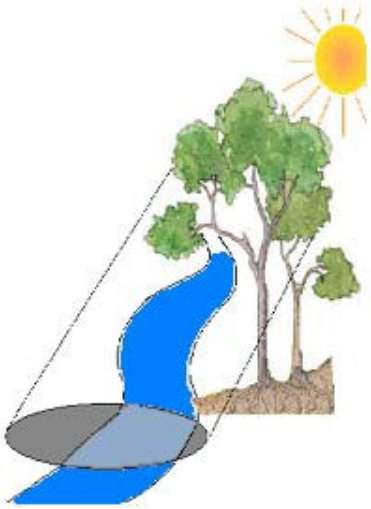
1. The student has effectively applied the creek health rating system to Chippewa Creek.
2. The student has accurately described his/her reasoning behind their rating score for each characteristic using field observations.
3. The student has applied his/her understanding of ecosystems and human impact to explain field observations.
4. The student has created a feasible remediation plan to address health concerns for Chippewa Creek.

References

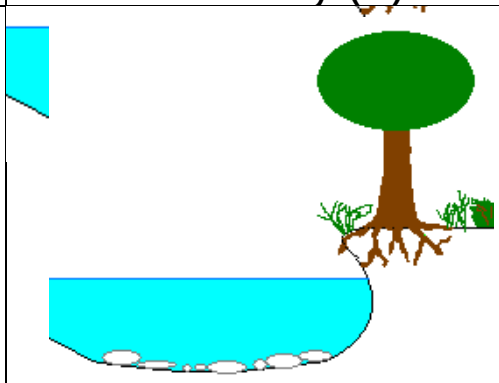
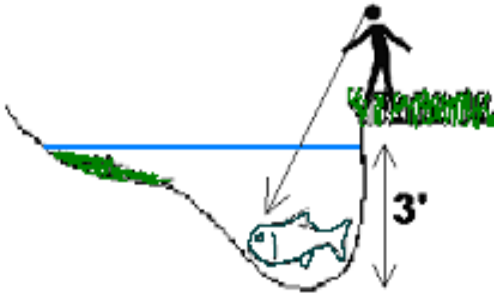
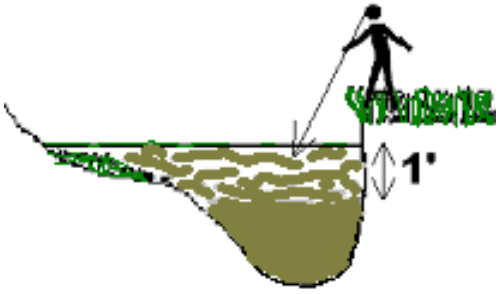
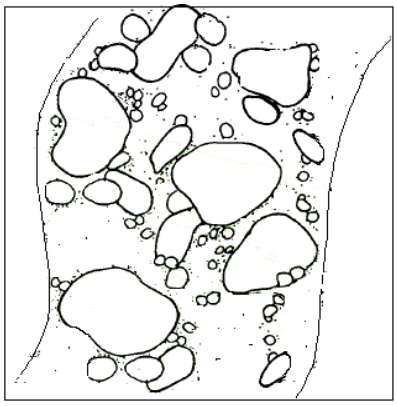
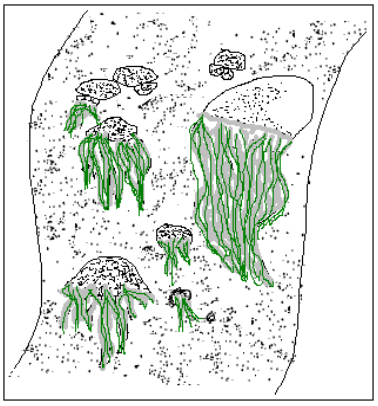
Community Stream Partnership Program. (n.d.) Stream *Health Checklist.*

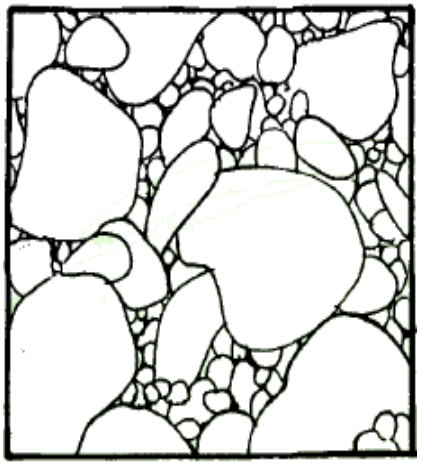
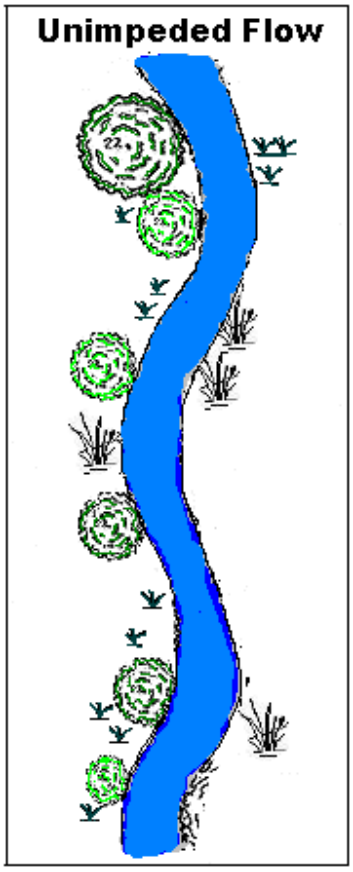
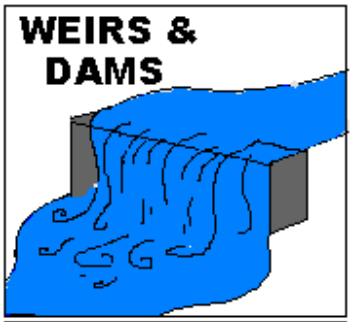
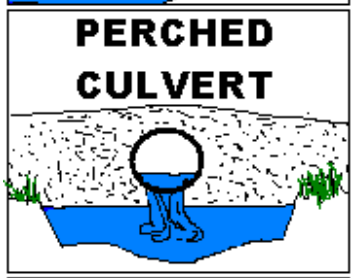
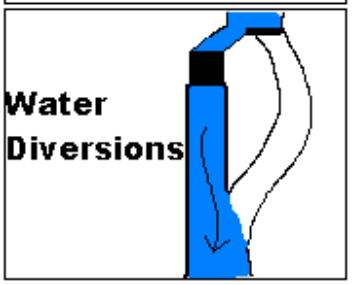
General Health Assessment Worksheet

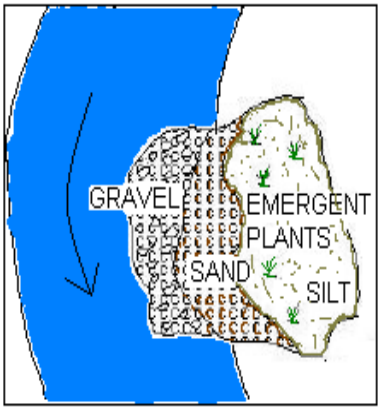
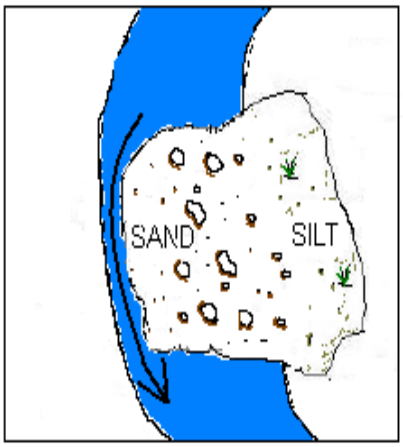
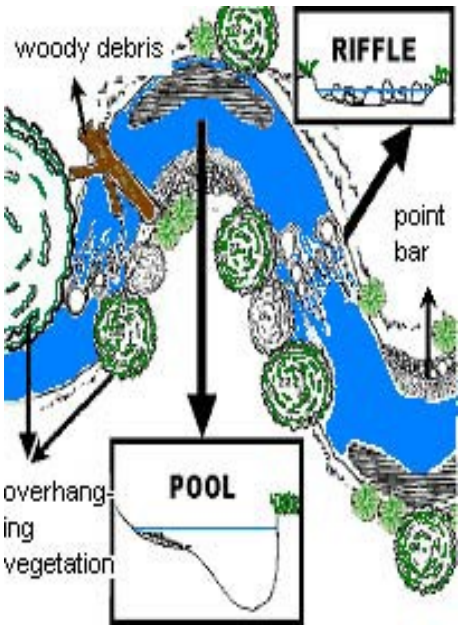
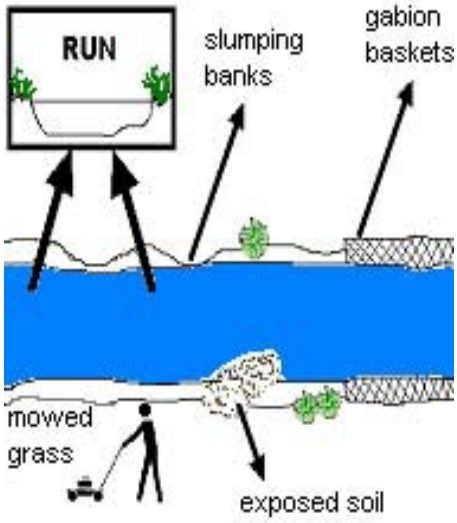
Based on field observations rate each characteristic from 3 (good) to 1(bad).
Record your scores in the boxes under each characteristic.

Signs	Healthy (3)	Unhealthy (1)
Riparian Zone How wide is the Riparian Zone* ie. # of channel widths on each side of the stream? (ideally, the riparian zone should be at least twice the width of the stream channel ☐	 More than 2 channel widths	 0-1 channel widths.
Overhead Canopy % of water surface shaded by vegetation at least 0.5 m (16 Inches) tall at mid-day ☐	 Greater than 50% of water surface shaded	 less than 25% of water surface shaded

*What's a Riparian Zone? Terms highlighted are explained in the glossary.

Signs	Healthy (3)	Unhealthy (1)
Bank Stability Evidence of erosion or bank failure ☐	 Little or no evidence of bank erosion. Banks are covered with vegetation. (note: this does not include mowed grasses or crops)	 Most of the banks are slumping or collapsing. Banks are mostly bare of vegetation and/or they are mowed to the shore the edge
Nutrient Enrichment Water colour & clarity ☐	 Clear water, objects over 3' deep are visible	 Murky water, e.g. "pea soup"
Algae growth ☐	 Little or no algae evident, (no slime or only a thin film of slime on rocks)	 Thick algal mats (long filaments of algae or slimy film on rocks)

Sign	Healthy (3)	Unhealthy (1)
Riffle Substrate Composition Are the riffle areas made up of large particles (boulders, cobble, or gravel) or finer particles (sand, silt, or "muck") ☐	 Mostly large particles	 Mostly finer particles
Barriers Look for barriers that could impede the migration of fish and/or excessive woody debris & sediment *Note: Be sure to consider dams and other barriers upstream and downstream, especially within 5km of your site.* ☐		  

Signs	Healthy (3)	Unhealthy (1)
Sediment Deposition Check for deposits of fine sediment on point bars ☐	 Point bars few, small, stable, well vegetated and composed of gravel or cobble with little or no fresh sand	 Point bars moderate to large and unstable with high amount of fresh sand present at most stream bends
In-stream Habitat Woody debris (in the channel), a variety of bottom types (e.g. Gravel, cobble, boulders), and changing depth along its length (e.g. riffles and pools) ☐	 Natural variety observable along channel: woody debris, gravel, cobble, boulders, pools, riffles and native vegetation	 Little or no natural variety observable along channel: no woody debris, only silt/sand, no pools or riffles only straight runs

Glossary

Algae: photosynthetic organisms (use sunlight to produce energy) that can be found in most, if not all water systems. They often appear either as a slimy layer or as long stringy filaments, attached to rocks and other stream debris. Algae are at the bottom of the aquatic food chain and are consumed by several stream dwellers.

Armouring: engineered structures installed along stream banks to prevent erosion (examples: rip-rap, gabion baskets)

Point Bar: an accumulation of sediments that is usually seen on the inside of a meander (bend) in the stream. They are often made up of several types of sediment from sand and silt to gravel. The bigger the deposited material, the more stable the point bar (i.e. gravel is more stable than sand). When point bars are primarily sand and silt with no vegetation, there is probably bank erosion occurring at some point upstream.

Pool: a deep, slow moving stretch of stream. Typically an area of erosion or scouring during the spring or other high flow periods. Fish use pools to rear their young and feed.

Riffle: Shallow section of a stream or river with a fast current and a broken surface (look like miniature rapids). Fish, like trout and salmon, use the riffles in streams to lay their eggs. The fast moving waters supply the eggs with plenty of oxygen to develop properly.

Riparian Zone: the area immediately adjacent to a watercourse; serves as a transition between aquatic and terrestrial environments. A healthy, well- vegetated riparian zone (also referred to as a **riparian buffer**) acts as filter, preventing excess sediment and other pollutants from entering the watercourse. Riparian vegetation also provides shade and shelter for stream dwellers.

Substrate: In the context of this checklist, the **substrate** is a term describing the streambed and its make-up (sand, gravel, silt). Generally speaking, a substrate is any surface on which an organism lives.