Wetland Ways

11

Interim Guidelines for
Wetland Protection and Conservation in British Columbia

March 2009

Chapter Eleven

Wetland Enhancement and Restoration

Wetland Stewardship Partnership

These interim guidelines will be updated using experience from pilot testing and feedback from user groups. If you would like to comment on these guidelines, please send your comments to wsp@gov.bc.ca

Cover photos: Judith Cullington, Claire de la Salle

CHAPTER 11: ENHANCEMENT, RESTORATION AND CREATION

11.1. INTRODUCTION

This chapter provides guidelines for the *enhancement*[1], *restoration* and *creation* of wetland ecological features and functions. It is intended to be read in conjunction with CHAPTER 2: GENERAL GUIDELINES.

Given the significant loss of wetlands in British Columbia, the ultimate aim of any enhancement, restoration or wetland creation activities should be to increase the number, area, and quality of wetlands, particularly in locations where wetland destruction and loss has been the greatest. This in effect would create a "net gain" policy similar to the Department of Fisheries and Oceans (DFO)'s fish habitat compensation program. Where wetlands are to be created and restored as part of a mitigation program the preferred approach is to develop in-kind compensation within the same sub-drainage. When creating or restoring wetlands, the amount of area restored or created will generally be greater than the areas lost in order to achieve equivalent functionality.

The goal is to increase the number, area, and quality of wetlands.
PHOTO: ROBERT COX

There is no overall standardized approach to increasing wetland area as wetlands are highly diverse and impacts vary widely with location. Each project should be developed on a case by case basis. While costs for creating or enhancing wetlands can be significant, many agencies, landowners and organizations are restoring wetlands for less than $1,000 per hectare.[2]

This chapter is not intended to be a technical 'how to' document, but focuses on the key elements and understandings that are required to determine whether wetland enhancement, restoration, or creation is appropriate and the major considerations that need to be understood to be successful.

[1] *Definitions* can be found in the GLOSSARY

[2] T. Biebighauser, pers. comm. 2008

11.1.1. General Concepts and Considerations

A wetlands restoration glossary can be found at: http://www.ramsar.org/strp/strp_rest_glossary.htm.

Definitions

ENHANCEMENT

Enhancement activities involve the modification of one or more physical, chemical, or biological features of wetlands to achieve specific goals within a *degraded* wetland. Typical enhancements include improvement of water quality and vegetation management. Care must be taken to ensure that enhancement does not adversely affect other parts of the wetland that are functioning as intended, including upstream and downstream habitats.

RESTORATION

Restoration is the art and science of returning physical, chemical, and biological characteristics of a degraded wetland to a more original condition. The objective is to restore naturally appearing and functioning wetlands that do not require maintenance. Restoration requires an understanding of historic actions that have been taken to destroy and modify wetlands. Wetlands in urban areas can be the most difficult and costly to restore because of all the changes that have been made to the landscape.

A study has shown that construction of new wetland habitat in boreal eastern Ontario, especially marsh, can significantly increase the numbers of breeding-season birds, including rare species. Total species richness increased 55% from 56 to 87 species, with obligate wetland birds increasing from 3 to 26 species. (Locky et al. 2005)

CREATION

Creation is the construction of a wetland in an area where it cannot be proven there was a wetland there before or has long ago lost its wetland characteristics. *Created wetlands* are designed to look and function similar to natural wetlands. They may range from large areas designed to compensate for wetland loss elsewhere, to small vernal pools or wetlands at schools. Fully functioning created wetlands can be difficult to achieve and are often expensive to implement

Constructed wetlands (or naturalized stormwater detention ponds) are wetlands built for a specific purpose, such as managing stormwater runoff or treating wastewater. These are discussed further in SECTION 11.7 CONSTRUCTED WETLANDS.

VIADUCT FLATS

Viaduct Flats in Saanich B.C. was a seasonal wetland that had been used for agricultural production. In the early 1990s the outlet was dammed by beavers increasing the flooded area and extending the wetted period. The beaver dam was replaced with a permanent rock weir in 2004 resulting in the creation of a permanent wetland. The intended purpose was to enhance local cutthroat trout populations. While there is considerable waterfowl use, water levels now preclude the feeding use of late summer mud shores by shorebirds (e.g., yellowlegs, dowitchers and killdeer).

The Wetland Stewardship Partnership is currently developing **policy guidance for wetlands compensation and mitigation** in British Columbia. When implemented, this policy will outline broad policy goals and objectives for wetland protection, restoration and creation in B.C. It is anticipated the policy will be completed in 2010. For more information contact Ted.Pobran@gov.bc.ca

MITIGATION AND COMPENSATION

Wetland enhancement, restoration or creation is often undertaken to offset impacts to existing wetlands. These activities can result from government mitigation or required compensation requirements. Mitigation and compensation activities should only be undertaken after all efforts have been made to avoid and/or minimize potential impacts to wetlands from development activities.

- **Mitigation** refers to actions taken in or near a given wetland to alleviate potential adverse effects on the productivity of that wetland habitat.
- **Compensation** refers to the replacement of a given wetland with wetland enhancement, restoration or creation in other locations. This will occur where mitigation is not adequate to maintain the existing wetland habitat.
- **In-kind** (or like for like) means replacing a wetland that is being impacted with a wetland of the same type. The functions and benefits are assumed to be consistent.
- **Out-of-kind** means replacement of one wetland type with another type usually when the impacted wetland cannot be recreated or another type of wetland is desired to improve regional biodiversity
- **On-site** is normally interpreted as being in the same sub-catchment basin where wetland disturbance has occurred; **off-site** can be within the larger watershed or different geographic area.

Compensation and mitigation approaches generally require the enhancement, restoration or creation of an area of wetland larger than the area that has been eliminated or impacted. Compensation ratios are also often related to issues such as like-for-like and on-site vs. off-site compensation, or displaced site sensitivity including endangered species and specific land development activities. Suggested ratios range from 1:1[3] to 8:1 but can be as high as 20:1 where critical habitat for species at risk is involved. Ratios are usually determined on a site-by-site basis. In-kind

THE SCIENCE OF WETLAND CREATION

J. Zedler (1996) and M. S. Race and M. S. Fonseca (1996) provide an overview of the ability to create specific wetland ecosystems, their predictability, limiting factors and landscape issues, as well as examining the continued use of compensatory mitigation as a wetlands management tool. Ecological Applications, http://www.esajournals.org/toc/ecap/6/1

[3] In other words, one new unit of wetland for every one existing wetland unit damaged.

Workshop on construction of groundwater wetlands.
PHOTO: SARMA LIEPENS

and on-site is the preferred approach to wetland development and compensation ratios vary from 1:1 to 2:1 in these circumstances.

No data appear to be available that assess whether the compensatory ratios suggested in fact achieve the desired results.

Costs

Wetland enhancement, restoration, and creation costs can be quite low (US$1,000 per ha) for voluntary projects and quite high (US$124,000/ha) for required mitigation.[4] U.S. studies evaluating the costs associated with wetland restoration and creation show that costs vary substantially in different areas of the country and on specific parcels of land, ranging from $10 per ha to nearly $3 million per ha, excluding the cost of land acquisition. A variety of factors influence the cost of wetland compensation projects including overall size of the project, project goals, site selection, the engineering and construction costs, and any unique or unusual site characteristics. These studies found that project costs did not vary much in relation to the type of wetland being restored or replaced; however they did note that wetland creation and restoration projects benefit from economies of scale.

Major costs associated with wetland enhancement, restoration, and creation include:

- Land purchase;
- Project planning, design, and construction monitoring, including professional expertise;
- Heavy equipment for moving soil;
- Labour; and,
- Materials (seed, straw, potted plants, liners, drainpipes etc.).

The Environmental Law Institute has prepared a study of compensatory mitigation programs.

Mitigation of Impacts to Fish and Wildlife Habitat: Estimating Costs and Identifying Opportunities
http://www.elistore.org/Data/products/d17_16.pdf

Wetlands should be designed and constructed to require little, if any maintenance. This can be accomplished by placing gradual slopes on dams (5% or less), selecting small watersheds that drain into wetlands, avoiding the use of pipes and water control structures, and by planting native species.

[4] Biebighauser, 2008. pers comm..

11.2. LEGISLATION

Legislative requirements for enhancement, restoration, or creation of wetlands will vary with the type of work being proposed (e.g., surface water versus groundwater, excavation, revegetation), habitat/species impacts (e.g., endangered species), and location. Proponents will need to be aware of and obtain necessary permits or approvals prior to carrying out their works. Approvals and authorizations may be required at the federal, provincial, First Nations and local levels. Also, be sure you are aware of the location of underground services and utilities before you begin any excavations.

See CHAPTER 2 for some of the legislation that applies to wetland creation and management.

11.3. OBJECTIVES

The major objectives for the enhancement, restoration, and creation of wetlands are:

- Increase the number, area, and quality of wetlands;
- Create wetlands to make up for past or future losses of wetlands;
- Restore natural functions to drained, infilled or other degraded wetlands; and
- Manage wetlands where possible to assist species at risk.

Following the guidelines in this document will help landowners and land managers demonstrate that they have applied due diligence. Monitoring the impacts of activities will assist in meeting the objectives. For more information, see CHAPTER 12: MONITORING AND REPORTING.

Develop partnerships for wetland restoration. PHOTO: ROBERT COX

For more information on restoration, see the *Ecological Restoration Guidebook for B.C.* http://www.env.gov.bc.ca/wld/fia/TERP_eco_rest_guidelines/intro/index.html

11.4. GUIDELINES FOR WETLAND ENHANCEMENT AND RESTORATION

Enhancing and restoring wetlands involves identifying the factors impacting the wetlands, determining which factors are having the greatest impact on the wetland, and where possible working to reverse these effects. Publications and wetland restoration specialists can help you with this process. In general, projects follow these steps:

- Gather information;
- Develop partnerships ;
- Set goals;
- Develop a plan;
- Obtain approvals, permits and funding;
- Implement the plan; and,
- Monitor results, and adapt as necessary.

11.4.1. Information

Your goals and plan will depend on the individual circumstance. This means it helps to know as much as possible the area before proceeding.

GATHER AVAILABLE INFORMATION

Obtain all the information that you can get for your site. There are many available sources of data, including:

- The B.C. Wetlands Atlas;
- Aerial photographs and topographic mapping (check with your local government);
- Local government mapping (flood plain mapping, habitat atlases, etc.);
- The Community Mapping Network, which includes information gathered by many local and provincial groups;
- Conservation organizations (e.g., Ducks Unlimited Canada);
- Local natural history groups; and,
- Local landowners—ask if the wetland had ever gone dry and if actions were taken to dry it with ditches or tiles.

CONDUCT ADDITIONAL INVENTORIES

- ☐ Carry out a bio-inventory and site assessment (see CHAPTER 2) of the wetland.
- ☐ Walk around the wetland and examine:
  - ◊ How water enters the wetland, look for ditches that divert run-off before it can reach the wetland;
  - ◊ How water leaves the wetland, look for ditches and buried pipe, wood, and rocks that are draining the wetland;
  - ◊ Presence of fill, including soil, rock, and construction waste;
  - ◊ Soil, by digging a small hole to test for clay or gravel;
  - ◊ Fields, fences, young trees, and shrubs that indicate farming;
  - ◊ Evidence of trampling or compaction by livestock or vehicles;
  - ◊ Erosion sources; and,
  - ◊ Presence of trees and branches in and around the water.
- ☐ Test for soil compaction in and around the site. You should be able to dig a small hole in and around the wetland like in a garden if soils are not compacted.

LOOK AT THE BIGGER PICTURE

Consider the role of this wetland within its watershed.

Consider the impact of other activities within the watershed.
PHOTO: JUDITH CULLINGTON

- ☐ Determine the natural capacity of the watershed based on regional climate, hydrology and geology and biological factors. These factors ultimately determine what features and functions can be supported by the wetland.
- ☐ Consider the activities occurring within the watershed that have the potential to impact the project. On-site restoration works may need to be designed and constructed in a manner that will accommodate off-site impacts (e.g., non-point pollution sources, impervious surfaces impacts on hydrology) and potentially contribute to their management such as flood abatement and water quality.
- ☐ Consider the potential for longer term changes in watershed activities and land use that may impact the viability of the wetland, as well as existing impacts.
- ☐ If you anticipate that a large amount of sediment or pollutants will flow into the wetland, look for ways to clean them up before you enhance or restore the actual wetland.

IDENTIFY LOCAL PRIORITIES

- ☐ Contact federal and provincial agencies and local stewardship groups for information and advice on broader regional and local priorities for wetland enhancement and restoration.
- ☐ Plan and implement your project to support priority species and habitats. This should also improve your chances for funding.

11.4.2. Partners

IDENTIFY PARTNERS

- ☐ Look for partners who share your goals for wetland improvement. Potential partners can provide:
  - ◊ Funding,
  - ◊ In-kind support and ideas;
  - ◊ Volunteer labour;
  - ◊ Professional advice; and,
  - ◊ Land for wetland improvement.

11.4.3. Goals

IDENTIFY PROJECT GOALS

- ☐ Identify your main reasons for undertaking wetland enhancement or restoration, and articulate your vision of 'success'.
- ☐ Set up clear, measurable and achievable goals for the project. A clear understanding of expected outcomes will determine how the project is implemented and forms the basis for follow-up monitoring. You may find that you need to revise your goals as you proceed.

  Typical goals for wetland enhancement and restoration include:
  - ◊ To restore a wetland to its original size and depth;
  - ◊ To protect and maintain habitat for species at risk or locally important species;
  - ◊ To protect waterfowl nesting habitat;
  - ◊ To provide turtle nesting habitat and shorebird feeding areas;
  - ◊ To restore the wetland's capacity to absorb flood events; and/or,
  - ◊ To reduce erosion.

Identify project goals.
PHOTO: SARMA LIEPENS

11.4.4. Project Plan

An important step to successful wetland enhancement and restoration is careful planning prior to proceeding with the project.

DEVELOP A PLAN

- ☐ Prepare a plan that outlines how you are going to achieve your goals. This plan will be important for getting regulatory approvals as well as funding support for your project. The level of detail will vary according to the nature of your project.
- ☐ Plans should include a site map as well as plans and profiles for the development area.
- ☐ Design for a self-sustaining ecological system to minimize the requirement for ongoing maintenance and reduce costs.
- ☐ Consider the option of using passive restoration techniques (e.g., fencing, plugging drainage ditches). Controlling or eliminating the degrading impacts and 'letting nature take its course' may be adequate.

IDENTIFY WHO IS RESPONSIBLE FOR IMPLEMENTING THE PLAN

- ☐ Establish a multi-disciplinary team that integrates the wide range of disciplines required to carry out the required mitigation projects. Participants may come from universities, government, and private organizations.

HAVE YOUR PLAN REVIEWED

- ☐ Seek out local expertise to review your plan. This can be a key element in the success of the project.
- ☐ Designate a project manager to coordinate funding, permitting and other project requirements.

Make a plan for restoration. PHOTO: ROBERT COX

11.4.5. Approvals and Funding

- ☐ Obtain necessary permits and approvals.
- ☐ Follow legislative requirements (federal, provincial, and local) and obtain appropriate permits for activities you propose.
- ☐ Ensure funding is in place to complete the project.
- ☐ Obtain adequate funding to carry out all planned works and any ongoing maintenance and monitoring programs. Funding may need to be obtained from multiple sources.
- ☐ Obtain letters of support from your partners to accompany funding applications.

11.4.6. Implementation

BE PREPARED

- ☐ Make sure personnel who will be working in and around the wetland are trained to recognize hazards including working around heavy equipment.
- ☐ Select heavy equipment operators based on a combination of factors that include experience operating heavy equipment, experience building wetlands, and price.
- ☐ Select the right type and size of equipment needed for the job, i.e. a dozer for pushing, compacting, and levelling soil for building a surface water wetland or an excavator for digging moist soils for a groundwater wetland.
- ☐ Ensure that equipment brought to the worksite is clean and weed free.
- ☐ Be involved with the implementation of the project by visiting the worksite daily. Expect plans to change once you start digging in the ground and decide what changes need to be made in partnership with the contractor.

Ensure that worksite equipment is clean and weed-free.
PHOTO: JUDITH CULLINGTON

TIME RESTORATION ACTIVITIES CAREFULLY

- ☐ Ensure that invasive species removal and planting of native species takes place at the time of year when this is most effective.
- ☐ Schedule activities to periods of least risk to wildlife and habitat (e.g., avoid breeding seasons).
- ☐ Take advantage of periods when the ground is dry to restore wetlands in wet places.

RESTORE VEGETATION AND PREVENT EROSION

- ☐ Aim to have at least 75% of the surface of replacement area re-established with native wetland plant species within two growing seasons.
- ☐ Provide temporary stabilization of exposed soils to prevent erosion, for example by mulching with non-invasive species such as clean wheat straw.
- ☐ Place vegetation such as branches and logs in the wetland to provide habitat (e.g., cover and resting areas) for birds, turtles, amphibians, and invertebrates.

MAINTAIN A RECORD OF CHANGES

- ☐ Assess as the project proceeds and make in course corrections as required. Unforeseen issues may require adjustment of goals which is normal for these types of projects.
- ☐ For required mitigation make 'as-built' drawings of the final project. In-course corrections incorporated into the construction should be noted to ensure that ongoing monitoring activities accurately reflect the finished project.

Consider where you will get native vegetation for restoration planting.
PHOTO: JUDITH CULLINGTON

11.4.7. Maintenance and Monitoring

DEVELOP AND IMPLEMENT A MONITORING PLAN

- ☐ Create and implement a written monitoring plan for required mitigation. See CHAPTER 12: WETLAND MONITORING AND REPORTING for more details on monitoring.
- ☐ Continue monitoring until goals are achieved. Monitoring efforts may be reduced as the system matures.

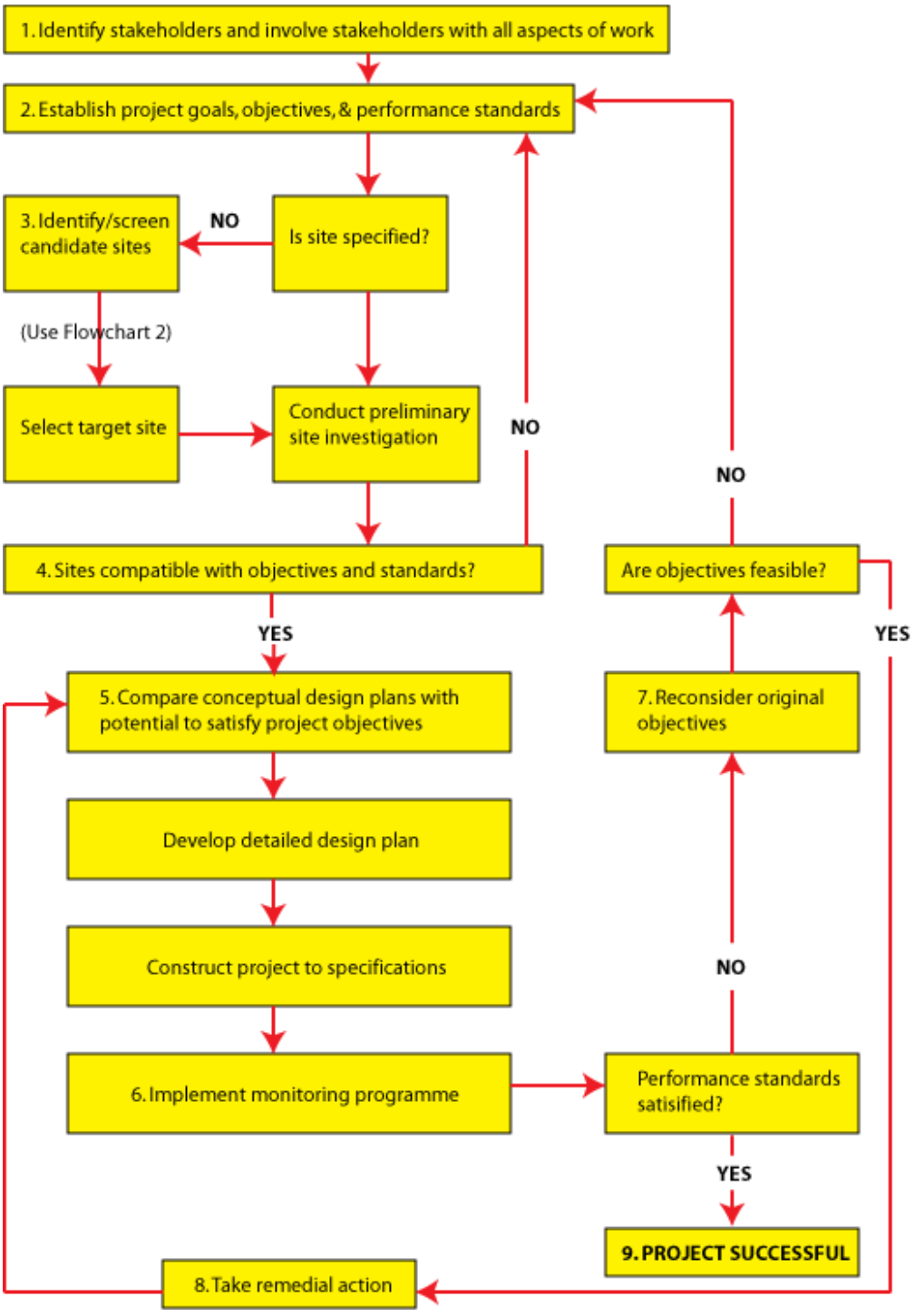
MAINTAIN STRUCTURES AND FEATURES

- ☐ Visit the project on a regular basis to make sure everything is operating as planned. Most problems show up within the first year after construction, which is why it is a good idea to reserve 15% of the project's original cost so that adjustments can be made when needed. Examine water control structures and spillways on a regular basis to make sure they are operating as planned.
- ☐ Remove invasive plants before they become a problem. Dispose of plants in a safe manner (i.e., so that they cannot spread to another area).

USE REFERENCE SITES TO CHECK ON PROGRESS

- ☐ Identify similar 'reference sites' to use as a basis of comparison when determining whether your goals have been met. Where possible use more than one site.

Remove invasive species (like Himalayan blackberry) before they become a problem.
PHOTO: JUDITH CULLINGTON



Guidelines for wetland restoration. FROM : RAMSAR CONVENTION ON WETLANDS PRINCIPLES AND GUIDELINES FOR WETLAND RESTORATION. http://www.ramsar.org/key_guide_restoration_e.htm

11.5. GUIDELINES FOR WETLAND CREATION

11.5.1. Created Wetlands

Wetland creation is a highly specialized activity and should only be undertaken with the assistance of professionals. For this document "created" wetlands do not include "constructed wetlands" built for the purpose of treating stormwater sediment and runoff management and sewage treatment. For more information on constructed wetlands see SECTION 11.7: CONSTRUCTED WETLANDS.

Wetland creation involves the shaping of dry land so it will become wetland. Techniques are now available for building a wetland just about anywhere on a landscape. Mountain ridge tops, benches, small bottomland fields, mined areas, and even transmission line right-of-ways can be turned into wetland.

Wetland creation involves the containment of water by excavating depressions or controlling water levels through the use of dykes or berms. Resultant water levels must also support development of *hydric* soils and wetland vegetation. Creation of a 'natural' wetland with proper functioning condition can be difficult to achieve and expensive to implement. Because of this difficulty, created wetlands are often unsuccessful in achieving their goals and objectives and should be a last resort for mitigation.

Wetland creation follows many of the same stages as enhancement or restoration, with some additional considerations.

Siting

SELECT A SITE THAT WILL WORK FOR YOU

- ☐ Select an appropriate site for your project. This will depend on logistics (e.g., accessibility of wetland area); project goals, funding and local support.

SITE THE FACILITY TO AVOID ENVIRONMENTAL CONFLICTS

- ☐ Maximize potential benefits from new wetlands, for example reducing habitat fragmentation or serving as buffers for other important conservation lands.
- ☐ Make sure the wetland you create does not impact a natural wetland or habitat for endangered species.

AVOID IMPACTS TO ADJACENT WATERWAYS

- STOP Do not divert or pump water from adjacent natural waterways, to protect their natural hydrological cycle (unless otherwise advised by an appropriately qualified professional).
- ☐ When using groundwater as a water supply, check water quality to ensure it is not toxic to plant species (e.g., high iron content is toxic to some species).

KEY CONSIDERATIONS

- ☐ When looking for a place to build a wetland search for land that appears level, whether in an open field, young forest, or canopy gap within an older forest. An area that is 25 m in diameter or larger will provide enough space for building a wetland that appears natural.
- ☐ Choose a location on higher ground to avoid the high costs and negative environmental impacts associated with damming a stream. Building a wetland on a dry ridge is a good idea, you'll supply much needed water to wildlife and can avoid problems associated with buried gravel often found along streams.
- ☐ Select an area that changes 1 m or less in elevation from upper to lower edge. If the ground looks flat enough to pitch a tent then its level enough to build a wetland.

For more details on building wetlands see: *Wetland Drainage, Restoration, and Repair (*Biebighauser, 2007).

- ☐ Use plastic flagging to mark the perimeter of a construction site that is at least twice as large as the surface area of water planned in the new wetland. The added space will be needed for piling woody debris, vegetation, and topsoil, and for building a dam with gradual slopes. Don't be afraid to remove some trees to create a wetland, in many cases they are now only growing on a site because it was historically drained.

ENSURE SUFFICIENT WATER SUPPLY

- ☐ Ensure that there is an adequate supply of water to maintain desired hydrologic functions even during drought periods and throughout the design period of the wetland.
- ☐ Determine if the wetland you are building will be supplied by surface water or by groundwater. A surface water wetland holds rainfall like a cereal bowl; within a depression of packed soils that are high in clay, and a dam that prevents water from flowing downhill. A groundwater wetland contains water like a large hand-dug well, exposing a high water table present near the surface.

  An indication of the type of wetland that can be built may be determined by using a post-hole digger to dig a hole at least 1 m deep

near the centre of the proposed worksite. Watch to see if water seeps into the hole from the bottom and sides. If the hole fills partially or completely with water, a high water table is present, and a wetland can be built that will fill with groundwater.

- ☐ Determine the amount of clay in the mineral soil when considering building a surface water wetland. Mineral soil is located below the topsoil layer, which is dark coloured and contains fine roots and organic material. Soils suitable for holding surface water are high in clay and silt. Soils with enough clay feel smooth and sticky like a mashed tootsie roll, while those with silt feel like wet flour, and soils that have too much sand and gravel feel gritty.
- ☐ A simple test can be used to determine if the clay and silt content is high enough to build a surface water wetland. Make a 4 cm ball of soil, add some water, and then form thin ribbon between thumb and forefinger. Measure the length of the ribbon that breaks off the edge of your finger. If it's 4 cm long or longer, then the soil has enough clay and silt to be shaped and packed to hold surface water. Both natural and restored wetlands maintained by surface water have dams consisting of compacted clay that prevent waters from flowing downhill to a stream or river.

Wetlands don't have to be large to help wildlife. One that is only 30-cm deep and 10-meters across can help wood ducks, salamanders, and frogs. Properly constructed, a wetland can be expected to last for thousands of years. Providing your land has soils that are high in clay, a wetland can be built for under $1,500.

Design

MIMIC NATURAL SITES

- ☐ Design wetlands to mimic natural wetlands and by avoiding straight edges and steep slopes.
- ☐ Aim to construct wetlands that imitate natural wetlands in the area.
- ☐ Design and manage water levels to avoid consolidation of wetlands and flooding of seasonal wetlands.
- ☐ Integrate buffers areas into the design and provide habitat connectivity where appropriate. Use native plant species to provide wildlife habitat.

For more information on creating vernal pools, see *A Guide to Creating Vernal Ponds*. The guide is intended for use by homeowners, educators, public land stewards, and private landowners. http://www.fs.fed.us/r8/boone/documents/resources/vernal.pdf

Monitoring and Maintenance

TIME MAINTENANCE ACTIVITIES TO MINIMIZE DISTURBANCE

- ☐ Ensure that maintenance activities minimize disturbance to aquatic and buffer areas. Conduct maintenance outside critical wildlife periods such as breeding and rearing.

MONITOR TO ENSURE HABITAT QUALITY

- ☐ Monitor water and sediment quality on a regular basis to ensure that contaminants do not pose a threat to wildlife.
- ☐ Manage and control invasive species that would impair habitat values.

Educational opportunities

PROVIDE EDUCATIONAL OPPORTUNITIES

- ☐ Consider using the wetland to provide educational opportunities for the general public and schools. Install interpretive signs and develop educational programs in partnership with local schools and stewardship groups.

11.6. BACKYARD AND SCHOOL WETLANDS

Constructing wetlands at schools or in a backyard can greatly increase opportunities for environmental education and provide a diversity of habitats. Educators in B.C. and elsewhere are discovering that incorporating the study of wetlands outdoors can boost science and mathematics scores.

KNOW HOW TO PROCEED

- ☐ Seek additional advice and information from local stewardship groups or government agencies.
- ☐ Ensure you have any necessary permits or approvals.

Schoolyard wetland–two years after construction.PHOTO: SARMA LIEPENS

Get everyone involved!
PHOTO: CLAIRE DE LA SALLE

USE NATURALLY WET AREAS

- ☐ Look for level areas with heavy (clay) soils. A natural low lying area or depression that stays wet is an ideal place to develop a wetland.
- ☐ Use aquatic-safe liners on construction fill and where soils are low in clay.
- STOP Avoid altering naturally occurring wetlands. Vernal pools are seasonally wet and may be difficult to identify when dry. If in doubt, look for another site.

IDENTIFY AVAILABLE WATER SOURCES

- ☐ Ensure that you have an adequate supply of water. Roof drainage may be diverted to the wetland and make-up water for small areas can be provided from the domestic water supply. Make sure chlorination will not cause a problem for plants or animals.
- STOP Don't locate the wetland where it will damage foundations, outbuildings or other structures.

PROTECT OTHER LANDOWNERS

- ☐ Make sure that proposed wetlands will not cause erosion or flooding on adjoining properties.

Remove invasive species, such as this spartina.
PHOTO: CLAIRE DE LA SALLE

Revegetation

PREVENT EROSION AND SITE DEGRADATION

- ☐ Seed and mulch exposed soils with wheat and wheat straw to prevent erosion. Preventing erosion will maintain water quality in adjacent water bodies and maintain site productivity while vegetation re-establishes.
- ☐ Choose native plants that are adapted to your particular geographic area and site conditions. Consult local suppliers specializing in native plants.

MANAGE INVASIVE PLANTS

- ☐ Remove invasive species from the site. Invasive species can seriously degrade the site and are most easily dealt with before they become well established. Seek expert advice as improper removal can encourage the spread of invasives.

11.7. CONSTRUCTED WETLANDS

Constructed wetlands include stormwater detention ponds and wastewater treatment systems. Stormwater detention ponds are primarily constructed to reduce downstream flooding and erosion and trap and settle much of the suspended solids in urban stormwater. Constructed wetlands should not be considered as a replacement for 'naturally' occurring wetlands and are not always desirable from a species or habitat perspective.

Wetlands can develop in stormwater ponds as a result of natural seeding and succession or can be incorporated as part of the design process. Some features and functions that may be provided by constructed wetlands include:

- Provision of amphibian habitat if species needs and water quality issues are addressed during design and construction;
- Riparian habitat for birds and other species;
- Reduction of downstream flooding and erosion; and,
- Providing filtered cooler groundwater base flows to downstream surface waters.

Dry detention ponds do not generally provide wetland features and functions.

Raingarden built to manage stormwater—at construction.
PHOTO: FAYE SMITH

Raingarden—following two days of heavy rain
PHOTO: FAYE SMITH

Constructed wetlands may also be created to treat home or municipal sewage. Treatment of wastes in constructed wetland can be significantly cheaper than traditional mechanical treatment processes that include the regular addition of chemicals.

Table 1: Water treatment costs

Type of System	Cost range (1997)
Ecological	$170 to $410 per m3/day
Traditional	$800 to $1,000 per m3/day
m3/day = cubic metres treated per day	

From http://www.flemingcollege.com/cawt/pages/conwet/benefits.html

- ☐ Locate constructed wetlands on the upland away from natural watercourses.
- ☐ Involve appropriately qualified professionals (e.g., engineer, biologist) in the design, construction, and maintenance of constructed wetlands. Requirements for each site will be unique.
- ☐ In the planning, design, construction, operation, and maintenance, aim to:
  - ◊ Avoid environmental conflicts;
  - ◊ Mimic natural sites by creating gradual slopes, saving and spreading topsoil, adding logs and branches, and planting native species;
  - ◊ Monitor to determine if environmental goals and objectives are being achieved; and.
  - ◊ Use the site to provide educational opportunities where appropriate.

Labrador tea. PHOTO: JUDITH CULLINGTON

11.8. REFERENCES AND FURTHER READING

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USEPA. Constructed wetlands. http://www.epa.gov/owow/wetlands/watersheds/cwetlands.html

USEPA. River Corridor and Wetland Restoration. http://www.epa.gov/owow/wetlands/restore/

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