# Background Report: Rationale for Guidelines for ER Dedication for Wetlands and Other Water Bodies

## Introduction

To effectively conserve wetlands, riparian areas and their associated water bodies (eg. ponds, lakes, streams and rivers), it is essential to protect the functions and values of these lands. One of the most commonly used and most effective methods of protecting wetlands and riparian areas are buffer zones. According to Norman (1996), buffer zones are strips of vegetated land composed in many cases of natural ecotonal and upland plant communities which separate development from environmentally sensitive areas and lessen these adverse impacts of human disturbance. In other words, a wetland or riparian buffer zone is used to protect wetland and riparian functions and values from development and other human impacts. In general buffer zones are designed to address specific functions and the width of a buffer zone must be large enough to allow two conflicting land uses to co-exist without adverse impacts (City of Hamilton, 2005). Wetlands and riparian areas provide several functions such as flood control, water quality, habitat and recreational use. Ideally, a buffer zone can protect a multitude of functions.

Essential to the establishment of an appropriate buffer zone is boundary determination. There are three main boundaries that define a natural area containing a wetland or other water body - the wetland boundary, the buffer zone boundary and the boundary of the entire natural area. For the buffer zone, there are two aspects to consider - the environmental reserve (ER) dedication and the overall buffer zone of the wetland. The guidelines deal with establishing the wetland boundary and determining ER dedication for wetland and riparian buffer zones.

The Alberta Municipal Government Act Section 664 allows for the City of Edmonton (as a subdivision authority) to take "...part of that parcel of land as environmental reserve if it consists of
(a) a swamp, gully, ravine, coulee or natural drainage course
(b) land that is subject to flooding or is, in the opinion of the subdivision authority, unstable or
(c) a strip of land, not less than 6 metres in width, abutting the bed and shore of any lake, river, stream or other body of water for the purpose of
    (i) preventing pollution, or
    (ii) providing public access to and beside the bed and shore."

Therefore, ER dedication needs to address areas subject to flooding and areas required for pollution prevention and public access. These guidelines deal with each of these ER components individually with the intent that the overall ER dedication should be the greatest extent of all of the individual components. Please note that any area required for other wetland functions, in particular for habitat and biodiversity, should acquired through other means such as municipal reserve.

## Wetland Boundary Determination

The best boundary to use for wetland or riparian area delineation is the ecological boundary which includes all portions of the natural area that represent the transition between the aquatic and upland zones. The wetland should include areas where the predominant vegetation is hydrophytic (including emergent vegetation) and soils that are typically saturated and anaerobic (US Army Corps of Engineers, 1987). The

proper delineation of a wetland is a crucial step in determining the starting point for buffer zones (Sheldon et al. 2005).

If the Crown has claimed the bed and shore of a water body, a legal survey is required to determine the legal bank. Under Section 17(2) and (3) of the Alberta Survey Act, the legal bank should extend through the wetland vegetation and be located where distinct vegetation or soils exist (Kwasniak, 2001). In other words, if applied properly the legal bank should encompass the ecological boundary of the wetland. In addition, this survey will also establish ownership boundaries which are required to complete several components of the NSP. It is also recommended that when the legal survey is conducted by a certified Alberta Land Surveyor, representatives from both the landowners/developers and Alberta Public Lands be present.

If the Crown has not claimed the bed and shore of a water body, a legal survey is not required but would still be beneficial in determining buffer zones requirements. If a developer/landowner chooses not to obtain a legal survey of the bed and shore, a qualified environmental consultant should be retained to define the boundary of the wetland and/or water body.

## Wetland Buffer Width Determination

There are three approaches to implementing buffer zone widths - fixed widths, variable widths and a combination of fixed and variable widths. Applying fixed widths to buffer zones allows for easy enforcement, does not require specialized personnel, requires less expenditure in both time and money and provides greater predictability for land use planning. Most often, however, fixed width buffer zones are based on a single parameter or function and do not take site-specific details into consideration and therefore may provide not enough or too much protection (Castelle et al., 1994). More conservative widths, however, can be used to counteract this uncertainty. Variable width buffer zones are usually based on criteria that can use site-specific information and in general are thought to protect wetland functions with more confidence. Using variable widths requires a much greater expenditure of both time and money and can involve complex calculations. Also, there is much less predictability in land use planning when variable widths are applied (Castelle et al., 1994). Using the combined method of fixed and variable widths provides many of the benefits of both methods while removing much of the complications (Castelle et al. 1994). The Office of Natural Areas has chosen this approach for determining ER dedication for wetlands and other water bodies. For flood control a variable width is appropriate as it can be easily defined. For pollution prevention a minimum fixed width is recommended because of the complex process that would be required to assess all of the relevant site specific data. For emergency access, it is likely that a variable width approach is suitable but the Office of Natural Areas must rely on expertise from Emergency Response for this determination. Please refer to individual ER component sections for further explanation.

### Flood Protection

Wetlands, riparian areas and associated water bodies receive overland run-off from the naturally contributing area and direct input of water during precipitation. Wetlands in particular also experience a natural hydroperiod resulting in fluctuating water levels and periodic flooding. The floodplain for reasonably defined circumstances (a 100-year or other identified critical design storm with typical conditions and initial assumptions) needs to be identified and used to help determine ER dedication boundary. It is here that a variable width buffer zone is most appropriate as the high water level reflects site-specific features such as

elevation and slope. The Office of Natural Areas suggests providing a figure showing the floodplain boundary for the entire natural area.

In consultation with Drainage Services, we recommend that the following steps be taken to determine the appropriate floodplain:

1. Determine the legal bank/ bed and shore of the wetland.
2. Determine the extent of the natural drainage basin (pre-development).
3. Determine the critical (highest) storm water level (100-year) based on the following assumptions
    a. Normal antecedent moisture conditions
    b. Initial water level at the bed and shore line
    c. Pre-development land use runoff conditions (e.g. agricultural)
4. Plot this floodplain with respect to the wetland boundary (legal bank).

The wetland hydroperiod is defined as the pattern of fluctuating water levels due to the complex interaction of flow, topography, soils, geology and groundwater conditions in the wetland and important to consider for the conservation of wetlands (Technical Note 109 Watershed Protection Techniques). In fact, the hydroperiod is one of the most important determinants for wetland functions and processes (Mitsch and Gosselink, 1986). Therefore, for wetlands, the buffer zone should include as part of its determination consideration of hydroperiod dynamics under typical or normal water levels for the wetland, and allowable and desirable limits and frequencies for the fluctuation of the water level. The Office of Natural Areas recommends that the following criteria be considered to help mitigate the effects of development on the hydroperiod. These criteria have been established by the Puget Sound Wetland and Stormwater Guidelines and the Center for Watershed Protection. The wetland outlet should restrict:

- Mean monthly water level fluctuations to less than 8 inches (20 cm)
- No more than 6 excursions above 6 inches (15 cm) in an average year
- Duration of excursions should not exceed 3 days
- Total dry period in the wetland should not change by more than 2 weeks.

## Public Access

Public access includes access to the wetland by the Crown, public and municipal workers for purposes such as recreation, maintenance and emergency response. Our emphasis, however, is on ensuring that appropriate emergency access is available. The general assumption is that if emergency response needs are addressed, adequate access will be available for other types of public access.

The primary concern for emergency response with respect to wetlands and other water bodies is rescuing people and animals that have fallen through ice or are in trouble in deep water, particularly during high water events (Don Pilling, pers. comm.). The risk of fire is also important to consider. Ultimately, the Office of Natural Areas will rely on the expertise of Emergency Response (ERD) to assess the requirements for emergency access until more specific guidelines have been developed. Some of the elements ERD will likely consider include the amount of road frontage available, the location of adjacent parking lots and the frequency of access points. It is also important to account for the amount of space required for emergency crews to work and manoeuvre effectively and for heavy vehicles to access the natural area under high water conditions. The results of ERD's assessment may lead to a variable width recommendation or a fixed width recommendation. It is recommended that a figure be provided showing all of the proposed access points and where any road frontage exists.

Pollution Prevention (Water Quality)

The appropriate width for protecting the water quality of a wetland is the most complex and difficult issue to resolve. Several issues contribute to the complex nature of water quality buffer widths including the multiple parameters of water quality such as sediments, nutrients, metals, pathogens; the site-specific factors such as physical characteristics and proposed land use intensities; the complex and rigorous nature of some of the appropriate calculations; the wide range of suggested widths and the need to determine acceptable thresholds for pollutants. For this reason, the Office of Natural Areas feels that a minimum fixed width of 30 m from the wetland boundary is the most appropriate method of implementing a water quality buffer and determining ER dedication for pollution prevention. We will, however, consider variable widths providing sufficient evidence for the appropriateness of the proposed widths is provided.

It is true that each site is unique and that buffers of varying widths can be appropriate with respect to water quality but determining what is an appropriate width particularly with respect to the physical characteristics of the buffer and the predicted impacts of the surrounding land uses involves in-depth studies with rigorous calculations. Also, since water quality encompasses several different parameters including sediments, nutrients, water temperature, pathogens, metals, pesticides and other toxins, multiple widths would have to be calculated. Determining acceptable load thresholds for each parameter and determining the buffer width for each parameter at multiple locations is an extremely ambitious endeavour and not well suited for establishing ER dedication for the numerous wetlands and water bodies in Edmonton.

The decision to use a fixed minimum buffer width of 30 m for water quality is based on several sources of information including a review of literature and guidelines from other jurisdictions. There have been wide-ranging discussions about how much buffer is necessary to be effective in providing a particular level of function and there has been considerable research on the effectiveness of widths relative to percentage removal from various sources. The literature does not, however, address what level of pollutant removal is acceptable or desired, nor does it provide specific thresholds (Sheldon et al., 2005). These values would have to be established in order for a variable buffer width to be calculated.

In a 2005 literature review prepared by Alpine Environmental for the City of Calgary towards the development of a Draft Riparian Policy, it was found that a mean width of 47 m would likely mitigate loss of riparian (including wetland) functioning. Their overall recommendation from the literature was that a 30 m buffer would provide a reasonable level of protection for most wetland functions including water quality. From this review, the City of Calgary has drafted Environmental Reserve Setback Guidelines (City of Calgary, 2006) which identifies a base setback of 30 m for wetlands (Class III to VI and isolated wetlands) and allows for some adjustments with respect to slope, hydraulic connectivity and cover type. For example, no adjustments are required for slopes between 0 and 5% but for slopes >5% an additional 1.5 m is required for every % increase in slope.

In April 2006, the Municipal Government Board (MGB) ruled in favour of Lacombe County in a subdivision appeal where Lacombe County required a 30 m setback from the high water level of Sylvan Lake to be dedicated as ER primarily for pollution control. The Appellant in this case argued that the dedication should be solely based on a site-specific analysis while the Respondent (Lacombe County) referred to studies and policies that recommended a 30 m ER dedication for water quality. In general, adjacent and area landowners supported Lacombe County. It is important to note that the MGB ruled in favour of Lacombe County in part because the Appellant had failed to provide sufficient evidence that a lesser amount would

meet the objective of protecting water quality (MGB File: S05/LACO-CO-015).

In October 2005, the Natural Areas Policy Implementation Committee agreed to support (at the recommendation of the Study Team) the land use concept for the Schonsee Special Study Area which includes a 30 m buffer around the wetland. The rationale for this option (30 m buffer) includes increasing water quality and overland flow filtering. It was Stantec who prepared all of the land use options considered by the Schonsee Special Area Study Team. Some of the counties surrounding Edmonton also consider a minimum of 30 m buffer width for environmental reserve dedication as an appropriate recommendation. For example, Parkland County has applied a 30 m ER around lakes such as Jackfish Lake (Wayne Shanks, pers. comm.). Strathcona County uses a 30 m ER setback for any water bodies that the Crown has made bed and shore claims (Jocelyn Thrasher-Haug, pers. comm.).

From our literature review and internet search the following are examples of where a 30 m buffer zone is used:

- The Minnehaha Creek Watershed District (2001) has concluded that buffers less than 15 m (50 ft) are only marginally effective in protecting wetlands. Therefore their recommended buffer widths particularly for water quality range from 15 to 30 m minimums.
- The USDA – NRCS (National Resources Conservation Service) generally accepts a set buffer width of 30 m (CRWP Inc., 2006).
- The City of Everett in Washington State requires at least 30 m (100 ft) for sediment control and a range of widths from 13 to 600 ft for overall water quality (CRWP Inc., 2006).
- US LEED (Leadership in Energy and Environmental Design) Neighbourhood Design requirements include that wetlands should be protected in perpetuity from development by a 30 m (100 ft) buffer.
- The Center for Watershed Protection found that a minimum base width of 30 m is generally recommended and been demonstrated to provide adequate protection in urban areas (Alpine Environmental, 2005).
- The Connecticut River Joint Commission recommends that the basic minimal widths of a riparian buffer strip be 18 m from the top of bank but in order to protect specific functions related to water quality such as sediments and nutrients buffer widths should be expanded to at least 38 and 45 m, respectively. More specifically, for pesticide runoff, a minimum recommended width is 33 m (Alpine Environmental, 2005).
- The Chesapeake Bay Riparian Handbook suggests that a minimum width of 25 to 33 m be used for stream protection. More specifically for sediment removal and nitrogen removal, the handbook suggests widths of approximately 38 and 48 m respectively (Alpine Environmental, 2005).
- In the City of Hamilton, Ontario under their Natural Heritage System, a minimum vegetated protection zone for wetlands of 30 m is required (City of Hamilton, 2005).
- For new developments in Port Moody, British Columbia, the Zoning Bylaw supports 30 m setbacks from the top of bank (Alpine Environmental, 2005).
- Stoney Creek, Ontario policies included a 30 m setback (City of Hamilton, 2005).
- Pesticide regulations in the Canadian Environmental Protection and Enhancement Act pesticide prohibit the use of pesticides within 30 m of an open body of water unless a special permit is granted. Enforcing this legislation is difficult if homeowners' yards are within 30 m of a wetland (Alpine Environmental, 2005).
- The Wetland Office of the Department of Environmental Conservation (1999) in Vermont recommends that a 30 m (100ft) buffer be used for protecting water quality function of wetlands.

- The Government of Western Australia's Water and Rivers Commission (2000) uses the general guideline that a 50 m buffer for protecting wetland function should be established from the extent of the wetland vegetation.
- Carolinian Canada recommends a 30 m minimum buffer width for wetlands (City of Hamilton, 2005).
- The Stormwater Manager's Resource Center recommends a minimum base width of 30 m (100 ft) to provide adequate protection.
- The Tennessee Valley Authority recommends a minimum buffer width to maintain water quality ranging from 23 to 30 m (75 to 100 ft).

From this list, the Office of Natural Areas feels that its recommendation of a minimum buffer width for water quality of 30 m (as ER dedication) is well-supported.

## Summary

To determine the buffer zone for wetlands and other water bodies with respect to ER dedication, the Office of Natural Areas recommends the following:

- A legal survey be conducted to determine the legal bank/wetland boundary.
- The wetland buffer zone be measured from the legal bank.
- To determine the buffer zone width required for ER dedication:
    1. Each of the components of ER (flood control, public access and pollution prevention), including the water body boundary, be delineated separately and presented as overlays on a map.
    2. The greatest extent of all of the ER components be identified as the required area for ER with respect to Albany Wetland.
- For flood control, the 100-year floodplain or another design storm floodplain should be used. The methodology outlined above should be used.
- For public access, emergency access needs should be used. Please note that ERD (Emergency Response) should provide input into this determination.
- For pollution prevention and water quality a fixed minimum width of 30 m (from the wetland boundary) should be used. Please note that if sufficient evidence is provided supporting a more variable width is provided, this buffer will be considered.

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