BATTER AND FENCING GUIDELINES FOR SQIDS AND DETENTION BASINS

December 2013

TABLE OF CONTENTS

1. Introduction

Stormwater quality arising from urbanised catchments is a major problem affecting Lake Macquarie. To address some of the impacts Lake Macquarie City Council is constructing a number of wetland projects and requiring developers to install constructed wetlands as part of the development process.

There are great opportunities for wetlands, in particular, to be more than water quality structures. Additional values can include variety to areas of public open space, increasing aesthetic appeal and creating aquatic habitat and places for environmental education and awareness. This mixed use can raises the risk exposure of the wetlands in public areas.

Levels of risks (especially for constructed wetlands) can be determined by the: location of the wetland, type of inflow, ease of access, wetland objectives, nature of adjoining land uses or activity and context of the site (DLWC 1998). Added to this list are the risks associated with any maintenance activities and general management of the wetland.

The objective of these Guidelines is to provide a consistent approach to the treatment of batter slopes and the installation of fencing near constructed wetlands and detention basins.

The Guidelines incorporate a risk management approach to the decision making process. Appendix 1 allows the designer to select the most appropriate batter or fence treatments for a particular site.

2. Public Safety Considerations

Public safety is an important consideration near stormwater management devices. The following points may need to be considered when designing a constructed wetland or detention basin:

- To achieve greater community acceptance and integration of the wetland on a site it may be desirable to allow people to have access to specific areas around the wetland. In such areas above and below water batter slopes need to be gentle (1V:6H to 1V:8H).

- Dense planting of vegetation and/or fencing should be provided where access is to be restricted.

- The incorporation of features like boardwalks and viewing platforms into the wetland can control public access, allow the public to view wetland components (with possible interpretive information), but not access those components.

- Densely planted vegetation can be used in a number of situations to discourage public access to parts of a site. Species with particularly spikey leaves (that could cause serious eye damage), such as *Eleocharis acuta,* should not be used where there is easy access to the wetland area.

- Where dense vegetation is to be used as part of the risk minimisation strategy several factors need to be considered.

    - Water levels in the wetland need to be manipulated to allow the establishment of macrophytes and to minimise water depths until terrestrial plant controls are well established.

    - Advanced plants should be used adjacent to accidental entry fencing and along the planting/ public interface to provide a quick barrier whilst the remainder of the planting establishes.

    - Temporary fencing in the form of paraweb fencing (or similar) may be required until plantings are well established.

- Steeper underwater batter slopes (1V:3H or steeper) are ideal for mosquito control.

- Slopes of 1V:4H (above water) are usually considered as a maximum especially where machinery is used for maintenance. Appropriate barriers such as fencing or dense vegetation may be required to discourage public access on steeper batters.

- The Institution of Engineers Australia (Rainfall & Runoff 1998) outlines some criteria for detention basins that includes :

    - Rails or fences should be provided at the most dangerous sections of drainage systems especially near schools, or upstream of culverts or closed conduits.

    - Preferred slopes should not be steeper than 1V:6H and areas steeper than 1V:4H may require fencing or rails. These requirements are more important where water areas are deeper than 1.2m.

    - Fences should be 1.0 to 1.2m in height and should not impede potential rescuers.

    - Where signs are used, signs should inform the public of the function of the facility as well as giving a warning. In some situations gauge boards could

be used in channels or ponds to give tacit warnings as well as for recording flood information. Warning picturegram signs, noting it as a water treatment and/or floodway area, and swimming not permitted, placed prominently upon the area.

LMCC Note: Standard signage should be used. Other information signage should promote positive public relations and convey the message of protecting the waterways of Lake Macquarie City. For example:

"This is a Water Quality Device Maintained by Lake Macquarie City Council to Protect our Waterways."

- Exclusion fencing should be provided where vertical drops occur adjacent to permanent water. This should also apply where water is retained during the construction phase.

- Consideration should be given to providing egress points where there is danger of a person, particularly children, not being able to escape from the water should they fall in.

- Lake Macquarie Council has agreed to abide by the Crime Prevention Through Environmental Design (CPTED) protocols. Councils must (by legislation) consider the CPTED principals when assessing all development applications and fencing and landscaping in public areas must address these issues. The guidelines, and checklist, are available on the Police website. http:www.police.nsw.gov.au/sbd/index.cfm

3. Maintenance Considerations

Safe, practical and efficient maintenance is a primary consideration in the selection and layout of batters and fencing. Considerations should include:

- Access and manoeuvring areas for vehicles and equipment. Gateways should preferably be located away from high pedestrian use areas and gates should be 4.3m wide and lockable.
- Material handling and de-watering areas.
- Mowing operations. Exclusion fencing should have a mower strip 300mm wide laid at its base and the layout should facilitate tractor mowing.
- Use of standard products and module lengths. Limit the number of products used at any given site.

4. Factors for Determining Batter Slope and Fence Treatments

Appendix 1 shows each of the factors; batter slope angle, vertical drop height, water depth, and site context, that are to be used to determine the internal batter slope treatments and fencing requirements around constructed wetlands and detention basins in the Lake Macquarie City Council area.

As a general principle, the designer should aim to minimise the use of exclusion fencing by selecting design elements with lower risk factors.

Where a site requires special considerations Council may approve alternative treatments based on their merits.

5. Major Storm Events

In the design of wetland layouts, particularly where dense planting, viewing platforms and exclusion fencing is used, consideration should be given to the major event stormwater flows. Depth, velocity and debris load can impart significant forces that can destroy fencing. If resisted, flows can also be diverted from their intended path and may have potentially serious effects, for example, causing the main wall to overtop rather than an overflow weir.

6. Fencing and Gates Styles

Where the risk assessment suggests a fence treatment is required, there are two that are used in Lake Macquarie. One is a post and cable fence for lower risk situations and the other is an exclusion fence for higher risk situations.

6.1 Post and Cable Fence Style

The preferred style is the Council's standard cable fencing design with 20mm diameter galvanised steel cable threaded through 100mm ID galvanised steel posts spaced at 2.5m intervals. Refer to Drawing EGSD-601 for details of the panel adjoining a gate or pedestrian opening.

A custom made fence, being a public art commission to an approved design and finish will also be considered.

6.2 Exclusion Fence Style

Council's standard exclusion fence design is shown in Drawing EGSD-602, however an approved equivalent (to AS 1926.1-1993) in a powder coated colour (preferably black or dark green) is also permitted. Any approved equivalent will include the LMCC badge shown in Drawing EGSD-602.

A custom made fence, being a public art commission to an approved design and finish, will be considered for high profile or showcase sites.

6.3 Gates

Gate ways are often required to provide access for machinery etc to maintain and clean out the facility. This is particularly the case for SQID treatments.

The gate ways should preferably be located away from high pedestrian use areas. They should be lockable and constructed to Drawing EGSD-603 for a single gate and EGSD-604 for a double gate.

7. References

Department of Land and Water Conservation, New South Wales, 1998. *"The Constructed Wetlands Manual".* Vol 1.

Lake Macquarie City Council, "Nutrient Ponds in Subdivisional Works – Design Guidelines". Subdivision and development Section.

Lake Macquarie City Council, 20/2/1998. "GPT's, Retention Basins & Nutrient Ponds – Design/Assessment Guidelines. Final Draft", (Nutrient.doc).

The Institution of Engineers Australia, 1998. "Australian Rainfall and Runoff – Book Eight, Urban stormwater management". Canberra.

Appendix 1: Risk Assessment for Batter and Fencing Treatments

The fencing treatment is determined through a four-step process involving an assessment of the risk associated with the shape and location of the proposed facility followed by an assessment of the type of fencing required based on the total assessed risk.

Step 1 – Establish location of water edge to be used for risk assessment

In constructed wetlands and detention basins the water level fluctuates which means that the location of the water's edge also changes. To undertake the following assessment, a civil designer must first establish the location of the "water edge" to be used.

In constructed wetlands and sediment basins the permanent water level is considered to be the level established by the low flow pipe/outlet structure and may be the design level. If the basin is designed to store up to a higher temporary level during storm events (eg capture of first flush that then draws down of a subsequent 72 hour period) then this higher temporary level will be the design level.

If the facility is a stand alone detention basin or a detention basin with a wetland in its invert then the design level is the highest level at which the basin fills to, and then holds water for more than one hour during any storm event, up to and including the 100 year storm. (Note that this will mean that longer duration storms 3 - 6 hours will need to be modelled). Where the facility is a combined basin / wetland facility the risk factor for each shall be assessed with the higher risk prevailing.

Once you have established the design water level you can then find the corresponding location for the water edge.

Step 2 – Assess the risk factor as a result of the shape and location of the facility

The Risk factors are determined for each of the four risks:

- Risk 1 – Batter slopes leading down to the waters edge
- Risk 2 – Vertical drop at the waters edge
- Risk 3 – Maximum water depth between water edge and 4m from the water edge
- Risk 4 – Site context

The total Risk Factor is then determined by summing the four individual risk factors. Where the terrain is not uniform, a Risk Factor needs to be established for each terrain type.

Risk 1 – Batter slopes leading down to the waters edge	**Risk Factor**
1:6 or shallower (1:8 ideal)	1
1:4 up to 1:6	2
Steeper than 1:4	6
Vertical Wall height adjacent to and/or above water edge 0.1m < wall height ≤ 0.5m	8
Vertical Wall height adjacent to and/or above water edge Wall height > 500mm and ≤ 1000mm	16
Vertical Wall height adjacent to and/or above water edge > 1000mm	21

Risk 2 – Vertical drop at water edge **i.e. Is there a vertical drop that is submerged at the waters edge (or within 4 m of the waters edge).**	**Risk Factor**
Vertical Drop 0 to ≤ 150mm ie no drop or minor drop	0
Vertical Drop >150mm and ≤ 300mm	4
Vertical Drop >300mm and ≤ 500mm	8
Vertical Drop >500mm and ≤ 1000mm	16
Vertical Drop > 1000mm	21

Risk 3 – Max water depth between water edge and 4m from the water edge	**Risk Factor**
≤ 500mm (1:8 underwater batters or flatter)	0
> 500mm and ≤ 670mm (1:6 to 1:8 underwater batter)	4
> 670mm and ≤ 1000mm (1:4 to 1:6 underwater batter)	8
> 1000mm (steeper than 1:4 batter)	16

Risk 4 – Site context (Select the site context that best fits the site being assessed)	Risk Factor
Low Risk Location • Reserve designed to incorporate a constructed wetland as a landscape feature integral to the open space. Adjacent areas may already contain other water bodies or watercourses. • Residences within 100m of site and there is good surveillance from overlooking houses. • Infant/primary schools are >250m from the site.	4
Medium Risk Location • Reserve, with potential high use including likely high pedestrian and cyclist numbers, playground, picnic/BBQ facilities and possible larger public events. • Infant/primary school >250m from the site. • Residential areas ≤ 150m from the site. • Moderate/good public surveillance.	6
High Risk Location • Reserve including parkland/natural areas, generally with low use. • Infant/primary school ≤ 250m from site and/or on a direct route to/from the school. • Residential areas >150m from the site. • Limited public surveillance.	8

Step 3 – Sum the risk factor scores

Risk 1 - Batter slopes	
Risk 2 - Vertical drop	
Risk 3 - Max water depth	
Risk 4 - Site context	
Total Risk Factor Score	

Step 4 – Determine batter treatment and fencing requirement

Total Score	Treatment Required
≤11	Mown grass and/or planting for aesthetic and shade purposes.
12 - 16	Dense planting and post and cable fencing. Planting is to have a minimum 2.5m (but ideally 4.0m) width. Plants are to be clumping preferably to approximately 0.75m height and at 0.5m maximum spacing.
≥17	Exclusion fencing which may be accompanied by planting for aesthetic and shade purposes.

Notes:

1. Any fencing is to be in accordance with Council's Engineering Guidelines Standard Drawings (Part 6 of the Engineering Guidelines).

2. The wetland or basin may have some portions that have steep batters or vertical walls and some areas that have flat batters. If the facility is not uniform in its batter slopes, depth etc then a Risk Factor assessment should be applied to each different area to determine the batter treatment applicable to the area. Each treatment shall extend around the whole of the area that generates the corresponding Total Risk Factor Score.