

SLOANE'S FROGLET STORMWATER WETLAND DESIGN GUIDELINES

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PREPARED FOR ALBURY CITY COUNCIL AND THE NSW OFFICE OF
ENVIRONMENT AND HERITAGE

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1. VISION AND PURPOSE

The Sloane's Froglet Stormwater Wetland Design Guidelines (the "Guidelines") detail key design considerations and hold points associated with the creation of Sloane's froglet breeding habitat and stormwater treatment wetlands in urban development projects in the Local Area Management Plan (LAMP) zone, defined in Figure 1.

These Guidelines are supplemented by existing planning, design, maintenance and construction documents (referenced throughout the document). These Guidelines provide a common understanding of and consistency in requirements for development approvals for proponents. These Guidelines are dynamic – they will be refined over time to incorporate new knowledge and considerations, as required.

Vision: a viable Sloane's froglet (*Crinia sloanei*) population is secured in the Albury area in the long-term.

Primary aims of the guideline is to ensure for all future development within the LAMP (where stormwater management is required) achieve:

1. Habitat outcomes - Sloane's froglet breeding habitat requirements are incorporated into all new stormwater wetlands irrespective of the presence of existing habitat.
2. Stormwater quality outcomes - Stormwater design delivers water quality outcomes in accordance with current state regulations.

2. CONTEXT

2.1 BACKGROUND

Sloane's froglet is a small threatened (Vulnerable in NSW) frog restricted to a few localities in southern NSW. Recent surveys (2012 to 2016) demonstrated an estimated decline in the species' range of over 90%. Ongoing habitat loss and degradation, including loss of connectivity between wetlands, landscape fragmentation, and recent severe drought, are causing an ongoing decline. One of the largest known population of Sloane's froglet in NSW occurs in Albury, in an area undergoing rapid urban expansion. Securing a viable population of Sloane's froglet in Albury is critical to securing the species in NSW.

Important Sloane's froglet habitat occurs on land zoned for development and on land zoned for environmental management in the Albury area. On its own, land zoned for environmental management is insufficient to ensure the species' future. Populations at many of these sites are relatively small, and breeding habitat may not be present in all years.

The persistence of Sloane's froglet in Albury will depend on the presence of sufficient connected habitat across the local area to support a viable population. Consequently, maintaining or creating connected breeding habitat on developable lands is necessary. This is achievable through the incorporation of breeding habitat into open space and its integration in the stormwater management system.

These Guidelines have been developed with staff from Albury City Council's (ACC) Town Planning, Engineering and Design, Environmental Planning, and Asset Management teams and the NSW Office of Environment and Heritage (OEH) Planning, and Ecosystems and Threatened Species teams. These Guidelines outline the key planning, design, habitat management and construction criteria that proponents must consider for any proposed development in the LAMP area (Figure 1). All development in this area that requires stormwater management must consider Sloane's froglet breeding habitat requirements, including the management of existing habitat on site and/or the creation of new breeding habitat (irrespective of whether existing habitat is present or not).



Figure 1: Sloane's froglet Local Area Management Plan area.

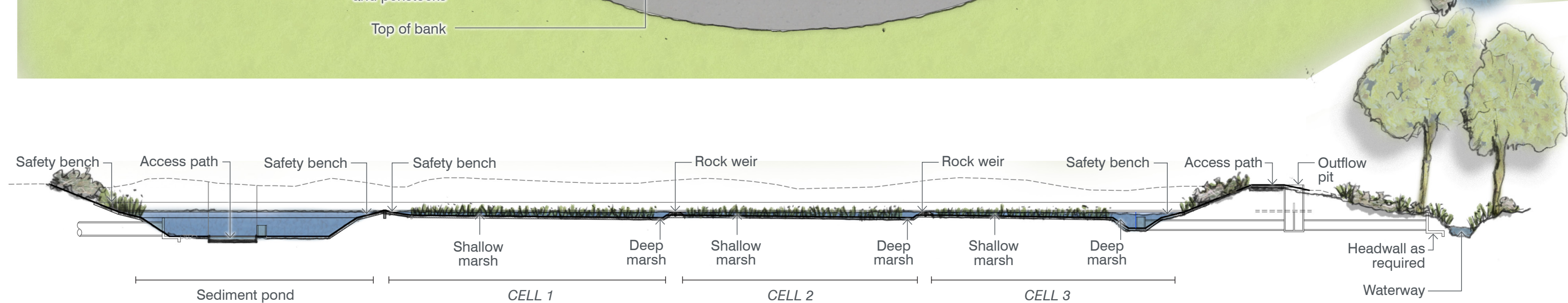
All development in this area must consider the need for creating or maintaining Sloane's froglet breeding habitat. Effectively, where a development requires a stormwater management system, Sloane's froglet breeding habitat must be created or maintained in line with these Guidelines. Stormwater management is a requirement for most new developments. These Guidelines detail how stormwater management should occur to benefit Sloane's froglet.

2.2 CRITICAL HABITAT REQUIREMENTS FOR SLOANE'S FROGLET

Sloane's froglet breeding habitat requirements are to be incorporated into combined stormwater quality treatment wetlands and flood retarding basins by ensuring that wetland construction adheres to the following key habitat design principles:

- ▶ **Habitat water depth** Calling male Sloane's froglets are typically found in areas of shallow water ranging from depths of 10 to 310 mm.
- ▶ **Habitat hydrology - length and season of inundation** Waterbodies need to contain water from mid- to late-autumn, and for at least 3 months after the winter breeding period finishes (i.e., at least until the end of October).
- ▶ **Habitat accessibility** Movement of Sloane's froglet into and out of wetlands can be helped by ensuring that batter slopes to water level are typically 1 to 4%, with a maximum acceptable slope of 18%.
- ▶ **Habitat size** Large robust colonies of Sloane's froglet are typically found in wetlands greater than 3000 m² in area.
- ▶ **Habitat vegetation** Ideal Sloane's froglet breeding habitat includes emergent wetland species that have a stem diameter of less than 5 mm (e.g., common spike rush, *Eleocharis acuta*). Plant species with a larger stem diameter (e.g., *Typha* and *Phragmites* species) should not be planted.

Each of these habitat characteristics have been considered in the steps defined in these Guidelines. Figure 2 outlines a schematic Sloane's froglet wetland, including breeding habitat. Standard designs are included in Appendix A.



SLOANE'S FROGLET WETLAND DESIGN GUIDELINES INDICATIVE WETLAND



DRG NO.
302992LASK

REV
A

DATE
25.09.2017

DES/DOC
SE/SM

0 2.5 5 7.5 10 12.5m
SCALE 1:500@A3

2.3 HOW TO USE THE GUIDELINES AND KEY REFERENCE MATERIAL

The Development Approval Process is outlined in Figure 3. Common terms are defined in the glossary (Appendix J).

Hold points are associated with each step. Proponents must ensure that they have received written approval from the relevant party or parties to demonstrate in-principle approval before proceeding to the next step. Approval will not be granted until each output has been provided. Upon submission of information at key hold points, both OEH and ACC will respond with initial feedback within 21 working days.

These Guidelines are not intended to provide a detailed process for the development of a stormwater wetland design. Other guidelines on detailed design processes are available, including the Melbourne Water Constructed Wetland Guidelines, which are referenced throughout this document.

The Sloane's Froglet Stormwater Wetland Design Guidelines provide a local context and specific design criteria for the incorporation of Sloane's froglet breeding habitat requirements into stormwater wetlands.

The Melbourne Water Constructed Wetland Guidelines have been selected as the key guiding document because:

- ▶ It is the most comprehensive design guideline for constructed wetlands available in Australia
- ▶ It is a proven and tested document that has evolved over the last decade
- ▶ Its content is general and can be applied to most areas in south-east Australia

Additional supporting information that should be considered when applying the Guidelines includes the following documents:

- ▶ Thurgoona Wirlinga Precinct Structure Plan
- ▶ Sloane's Froglet Interim Habitat Guide and Management Recommendations
- ▶ Threatened Species Profile – Sloane's Froglet
- ▶ Engineering Guidelines for Subdivisions and Development Standards for Stormwater Drainage Design
- ▶ Albury Local Environmental Plan (2010)
- ▶ Development Control Plan (DCP)
- ▶ Thurgoona Wirlinga Drainage Strategy (in development)
- ▶ Floodplain Risk Management Study and Plan
- ▶ Rural Lands Strategy for Table Top and Splitters Creek
- ▶ Albury Industrial Hub Master Plan
- ▶ East Albury Industrial Precinct – Masterplan

This document updates and supersedes guidelines previously distributed by ACC and OEH titled “*Sloane's Froglet Stormwater Management Guidelines – Working Draft V1*”.

ACC engineering standards that should be considered include:

- ▶ Guidelines for stormwater drainage and design
- ▶ Guidelines for design of roads
- ▶ Guidelines for landscaping (under review in 2017)
- ▶ Standard specifications for subdivisions
- ▶ Engineering standard drawings

These documents are readily available online, but can also be requested from ACC or OEH.

Where inconsistencies are identified between any of the documents mentioned above, ACC and OEH should be consulted.

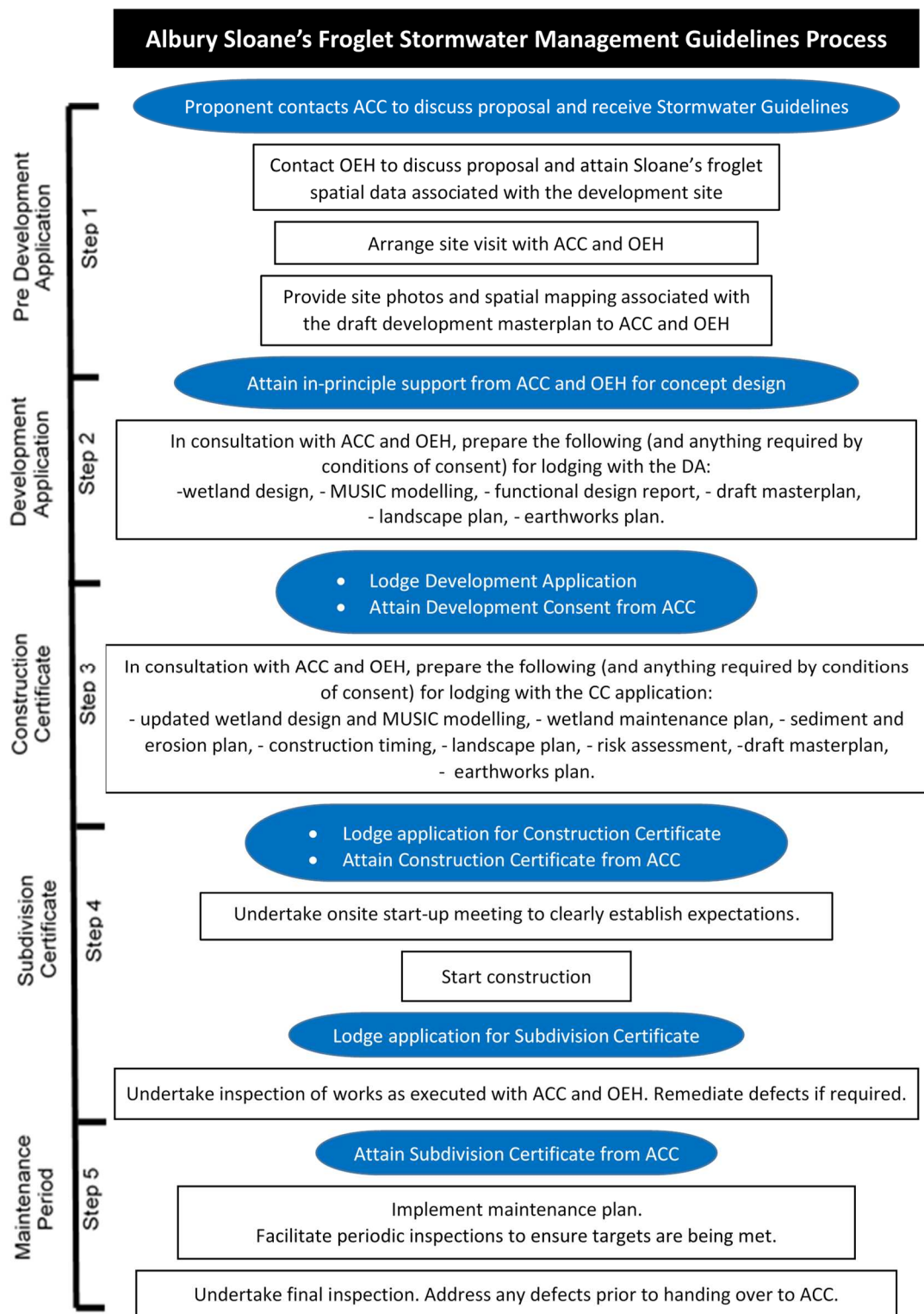


Figure 3: Overview of development approval process for developments in the Sloane's froglet Local Area Management Plan area. Detailed process provided in Appendix B

3. PROCESS

Section 3 details the requirements and critical hold points associated with each step in the development approval process.

STEP 1 PRE DEVELOPMENT APPLICATION

STEP 1.1 EARLY PLANNING

The intent of this step is for all parties to attend the proposed development site and understand key background information.

OEH and ACC encourage early engagement by proponents to ensure clarity around expectations for the management of existing Sloane's froglet habitat, and incorporation of new breeding habitat into the stormwater management system.

Step 1 requires proponents to:

- ▶ Undertake due diligence prior to purchase of a land parcel.
- ▶ Complete an early masterplan for the development area.

Specifically, Step 1 requires the proponent to complete the following:

- ▶ Organise and attend a visit of the development site with OEH and ACC.
- ▶ Review and understand:
 - These Guidelines, including key hold points and deliverables.
 - The content of other key reference documents (see section 2.2).
 - Map existing Sloane's froglet habitat on the site (a spatial layer of existing Sloane's froglet habitat can be obtained from OEH).
 - That a stormwater wetland area for Sloane's froglet will need to be proportional to the contributing catchment at a ratio of 3000 m² of breeding habitat per 10 ha of developed catchment.
- ▶ Provide a draft masterplan of the development to ACC and OEH

Site Visit

As early as practicable during Step 1, the proponent and their appointed consulting advisors should meet ACC and OEH representatives on site, in a joint meeting. These representatives include staff from:

- ▶ OEH – Planning and Ecosystems and Threatened Species
- ▶ ACC – Planning and Environment (Town Planner & Environmental Planner and Engineering - Development Engineer or representative)

The intent of this initial site visit is to begin the transfer of information between the proponent and key authorities, including:

- ▶ Proposed scale, land uses and spatial layout for the proposed development.
- ▶ Key site characteristics that will affect the creation and/or management of Sloane's froglet breeding habitat, including significant land on site relating to environmental or stormwater management (e.g., major drainage lines, shallow depressions, existing dams and waterways, surrounding catchment, catchment on-site, movement corridors and catchment post-development).
- ▶ Understanding the current and future site catchments as well as external catchments.
- ▶ Considerations for construction staging and sediment management over the duration of the catchment build out and potential impacts on constructed stormwater wetlands.
- ▶ Understanding existing and future habitat requirements for Sloane's froglet.
- ▶ Confirming the proponent's understanding of the requirements detailed in key information defined below.

Key information

The following is a list of key information that the proponent should be aware of before preparing a draft masterplan:

- ▶ Albury City Council
 - Information outlined in Section 2.3.
 - ACC can support the early design development step with high-level contour information (LIDAR). This information can be made available to proponents on request through ACC's Asset Team. It should be noted that LIDAR information is only valid up to "Step 3 - Concept Development Step". Following this step, the proponent is required to provide a detailed feature and level survey of the site completed by a licensed surveyor.
- ▶ Office of Environment and Heritage
 - Sloane's Froglet Interim Habitat Guide and Management Recommendations Booklet.
 - Spatial layer of existing breeding habitat (contact OEH to obtain access to this information).
- ▶ Other
 - At Step 1, the proponent should also consider educational/interpretive signage, open space requirements, landscape elements (boardwalks and structures).

Hold Point

The key outputs from Step 1.1 are:

- 1) A site visit with OEH and ACC key staff.
- 2) Photos and spatial mapping of key site characteristics provided to OEH and ACC.

STEP 1.2 SITE ASSESSMENT AND DRAFT MASTERPLAN

The intent of this step is for all parties to develop a comprehensive understanding of site-specific considerations and provide a draft masterplan.

Draft Masterplan

At the completion of this step a draft masterplan must be submitted by the proponent to ACC and OEH for review (see Appendix C for an example).

This masterplan should consider:

- ▶ Typical land uses and major access roads.
- ▶ Key land areas defined in preliminary investigations and the site visit.
- ▶ The proposed sub-division layout, including:
 - Stormwater assets
 - Indicative location and size of Sloane's froglet wetlands (i.e, constructed stormwater retarding basins).
 - Retained habitat
 - Movement corridors
- ▶ Catchments external to the site that drain into the site.
- ▶ Sub-catchments internal to the site.
- ▶ All waterways or waterbodies (natural and artificial) located on the site, or within 200 m of the site.
- ▶ Key development overlays, including the Environmental Conservation and Management Zones, defined in the LEP 2010 as E2 and E3 respectively.
- ▶ Existing utility easements.
- ▶ Existing Sloane's froglet habitat areas defined during the site visit or as provided by OEH.

The sizing ratio requirement for breeding habitat on site is 3000 m² for every 10 hectares of developed catchment. Created wetlands for developed catchments less than 10 hectares can be scaled accordingly. See Step 3 – wetland concept design for additional guidance.

Hold Point

The key output from step 1.2 is:

- 1) A draft masterplan supplied to ACC and OEH.

STEP 2 DEVELOPMENT APPLICATION

STEP 2.1 WETLAND DESIGN AND STORMWATER MANAGEMENT

This step aims to inform the completion of the development application, which includes; a stormwater management strategy and initial wetland concept design(s) that cater for the site's characteristics, Sloane's froglet breeding habitat requirements, and stormwater management.

Stormwater Management Strategy

Consideration of stormwater management is a standard requirement for any development irrespective of the presence of Sloane's froglet. The stormwater management strategy should consider key environmental requirements (including Sloane's froglet breeding habitat needs), the site masterplan, and the following:

- ▶ Hydrological analysis and flood mitigation:
 - Overview of 1% Annual Exceedance Probability (AEP) catchment hydrology (pre- and post- development), internal and external to the site.
 - Major drainage infrastructure required on-site to cater for the best-practice management of post-development flows.
 - Major drainage infrastructure sizing and spatial details for retarding basins, major drainage pipelines, road cross sections and constructed waterways, which should be supported by hydraulic computations and conceptual design information.
- ▶ Minor flows, environmental outcomes and stormwater quality treatment:
 - Overview of 20% AEP catchment hydrology (pre- and post-development), internal and external to the site.
 - Information on stormwater quality treatment infrastructure required to cater for the best-practice management of post-development flows, including how these flows will be integrated into the major drainage infrastructure for the site.
 - Sizing and spatial details for wetlands and minor drainage infrastructure, supported by hydrologic and hydraulic computations and conceptual design information (See Wetland Concept Design step for further details).
 - The habitat connecting the created Sloane's froglet breeding habitat to areas outside of the development, which will facilitate movement of Sloane's froglet throughout the landscape. This habitat may include non-breeding wetland areas (e.g., creeks; drainage lines; the existing stormwater network), and vegetated habitats (e.g. grasslands, woodlands).

Wetland Concept Design

The wetland designs must include the following parameters:

- ▶ The section of the wetland that constitutes breeding habitat maintains a water level of 300 mm.
- ▶ The extended detention depth in the wetland should not exceed 100 mm.
- ▶ A wetland with 2000 m² or more of breeding habitat should be divided into three separate wetland cells of similar size (i.e., a wetland of 3000 m² should have three cells of 1000 m² breeding habitat), separated by an impermeable wall with a concrete weir structure to allow movement of water from one cell to the next.

- ▶ Wetlands that will have breeding habitat from 1000 to 2000 m² in area can be divided into two cells of similar size; wetlands with breeding habitat of less than 1000 m² should only consist of one cell.
- ▶ Drawdown pipes connecting each wetland cell are provided for maintenance of water levels only and are to remain closed under normal operational conditions.

The design should also consider:

- ▶ Hydrological and stormwater quality analysis to confirm sizing, using MUSIC.
- ▶ How high sediment loads through stormwater runoff into the proposed wetland will be managed during the construction step of the development. For further detail on sediment management refer to Appendix E.
- ▶ Sizing must be validated against the topographical information available for the site.
- ▶ A treatment area that demonstrates the incorporation of the following criteria:
 - Maintenance of appropriate hydrological conditions for Sloane's froglet breeding habitat requirements, (see details on MUSIC modelling below).
 - A minimum size of 3,000 m² for the wetland per 10 ha or part thereof.
 - Best-practice standards for pollutant removal.

It should be noted that temporary sedimentation basins built during construction cannot be included as part of the ultimate wetland area.

- ▶ A layout that considers the required treatment area, flood retardation volume, high-flow bypass, provisions for maintenance and amenity values (see the Melbourne Water Constructed Wetlands Design Manual – Part A2 Deemed to Comply Design Criteria to guide key design aspects at Step 3).
- ▶ The treatment area, which must be supported by MUSIC modelling (see details on MUSIC modelling below).
- ▶ The total wetland footprint must consider the combined sedimentation and wetland treatment area defined from MUSIC, increased in size by a factor of 2 as a rule-of-thumb. This factor accommodates for the additional area required around the wetland for maintenance tracks and sediment dry-out areas, which will be included in future design steps. This factor must also be validated by the proponent.

MUSIC Modelling

The wetland concept design must apply the following MUSIC modelling parameters:

- ▶ Rainfall:
 - The average rainfall year to be used for MUSIC modelling is 1962 from Hume Reservoir. This MUSIC template is available from ACC and includes evapotranspiration data.
- ▶ Source node inputs (this is the catchment node), including:
 - Fraction imperviousness – See Appendix F for guidance on fraction impervious values. Press “Next” for Rainfall-runoff parameter inputs.

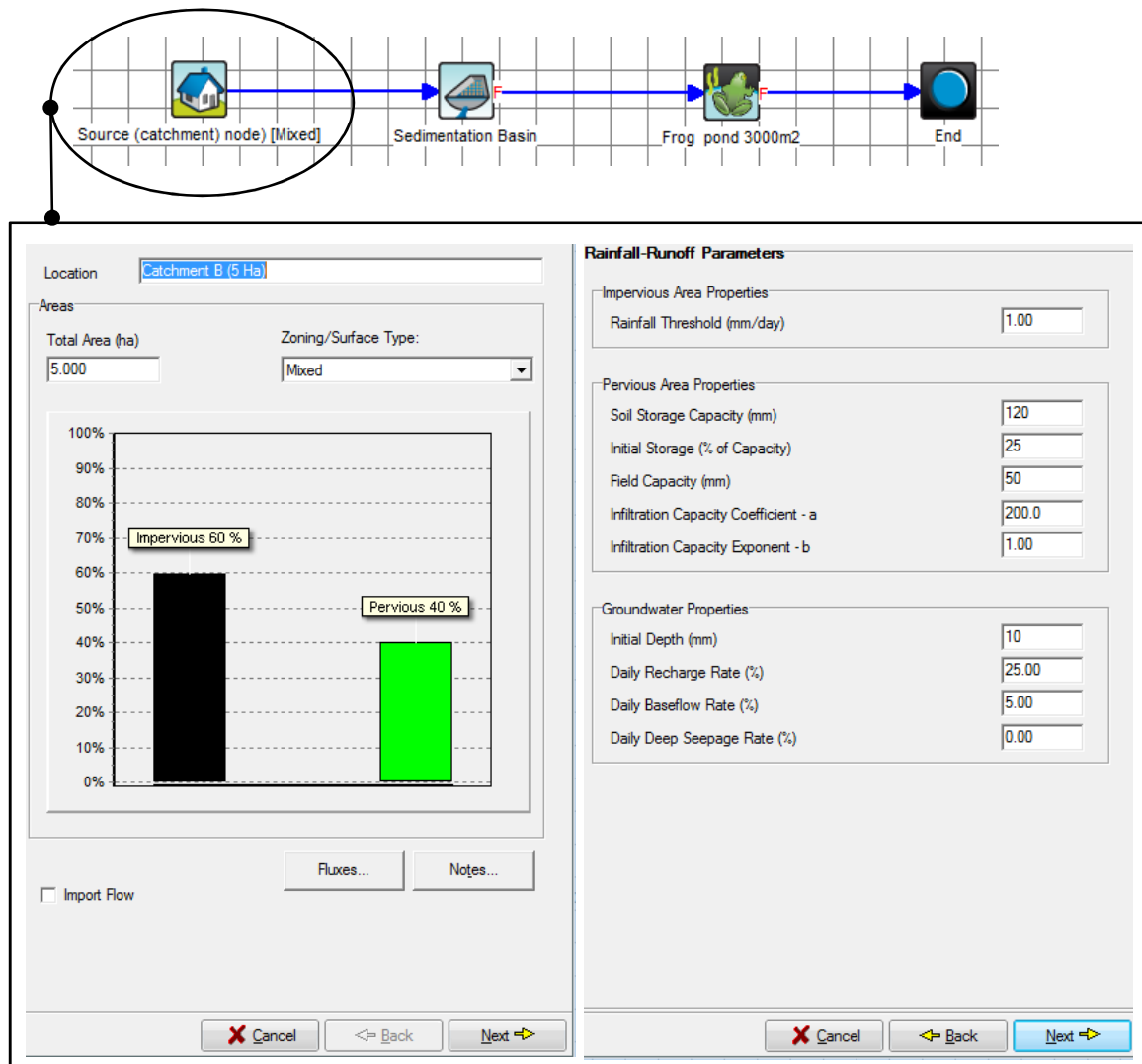


Figure 4: MUSIC screenshot showing input of key data into Source Node

- ▶ Rainfall and runoff parameters should be kept as default except for the below criteria, which should be entered as follows:
 - Soil storage capacity – 120 mm
 - Field capacity – 50 mm
 - These are reasonable parameter values to use where no other information is available. Where different values are used, justification must be supplied.
- ▶ Sedimentation basin parameters:
 - Sedimentation basin area and volume sizing is to be conducted in accordance with Melbourne Water's Constructed Wetland Guidelines.
 - The extended detention depth is to be determined on a case-by-case basis, but should not exceed 100 mm.
 - The sediment basins must be lined (exfiltration rate set to zero).
 - A 12-hour equivalent Notional Detention Time should be targeted (vary the Equivalent Pipe Diameter to achieve this outcome).

Location	Sedimentation Basin	
Inlet Properties		
Low Flow By-pass (cubic metres per sec)	0.00000	
High Flow By-pass (cubic metres per sec)	100.0000	
Storage Properties		
Surface Area (square metres)	180.0	
Extended Detention Depth (metres)	0.10	
Permanent Pool Volume (cubic metres)	180.0	
Initial Volume (cubic metres)	180.00	
Exfiltration Rate (mm/hr)	0.00	
Evaporative Loss as % of PET	75.00	
Estimate Parameters		
Outlet Properties		
Equivalent Pipe Diameter (mm)	24	
Overflow Weir Width (metres)	2.0	
Notional Detention Time (hrs)	11.8	
☐ Use Custom Outflow and Storage Relationship		
Define Custom Outflow and Storage		Not Defined
Re-use... Fluxes... Notes... More		
✖ Cancel ⏪ Back ✔ Finish		

Figure 5: MUSIC screenshot - input of key data into Sedimentation Basin Node

- ▶ Wetland parameters:
 - The pond volume and surface area should correspond to 300 mm permanent pool depth (e.g. 3000 m² equates to 900 m³ permanent pool volume). During the detailed design step a more accurate permanent pool volume should be applied based on 3D terrain modelling.
 - Inlet pond set to zero (sedimentation basin is a separate node).
 - 100 mm extended detention depth is typical.
 - Notional Detention Time should equate to of 24 to 72 hours (aiming to minimise flow rate). Vary the Equivalent Pipe Diameter to achieve this.
 - An overflow weir to minimise wave depth should be applied.
 - The exfiltration rate should be varied based on site specific soils. If the ponds are to be lined this should be set to zero, however, the ponds should allow some seepage typical of a clayey material. Refer to MUSIC in-built guidance.

Location		Frog pond 3000m2
Inlet Properties		
Low Flow By-pass (cubic metres per sec)		0.00000
High Flow By-pass (cubic metres per sec)		100.0000
Inlet Pond Volume (cubic metres)		135.0
		Estimate Inlet Volume
Storage Properties		
Surface Area (square metres)		3000.0
Extended Detention Depth (metres)		0.10
Permanent Pool Volume (cubic metres)		900.0
Initial Volume (cubic metres)		900.00
Vegetation Cover (% of surface area)		50.0
Exfiltration Rate (mm/hr)		0.36
Evaporative Loss as % of PET		125.00
Outlet Properties		
Equivalent Pipe Diameter (mm)		69
Overflow Weir Width (metres)		30.0
Notional Detention Time (hrs)		23.8
☐ Use Custom Outflow and Storage Relationship		
Define Custom Outflow and Storage		Not Defined
Re-use... Fluxes... Notes... More		
✗ Cancel ⬅ Back ✔ Finish		

Figure 6: MUSIC screenshot - input of key data into Wetland Node

Outputs from the MUSIC Model must demonstrate:

- ▶ A wetland size that ensures compliance with best practice standards with a total removal of the following pollutants for the site:
 - Total Suspended Solids – 80%
 - Total Phosphorus – 45%
 - Total Nitrogen – 45%
 - Gross Pollutants – 90%

- ▶ Compliance of the wetland hydrology to the breeding habitat requirements of the Sloane's froglet where:
 - Water levels in at least one wetland cell must remain above 300 mm in depth from 15 May to 31 October.
 - Modelling results show the wetland water level trace over this period. This result can be generated by creating a flux file from the wetland node as shown below:

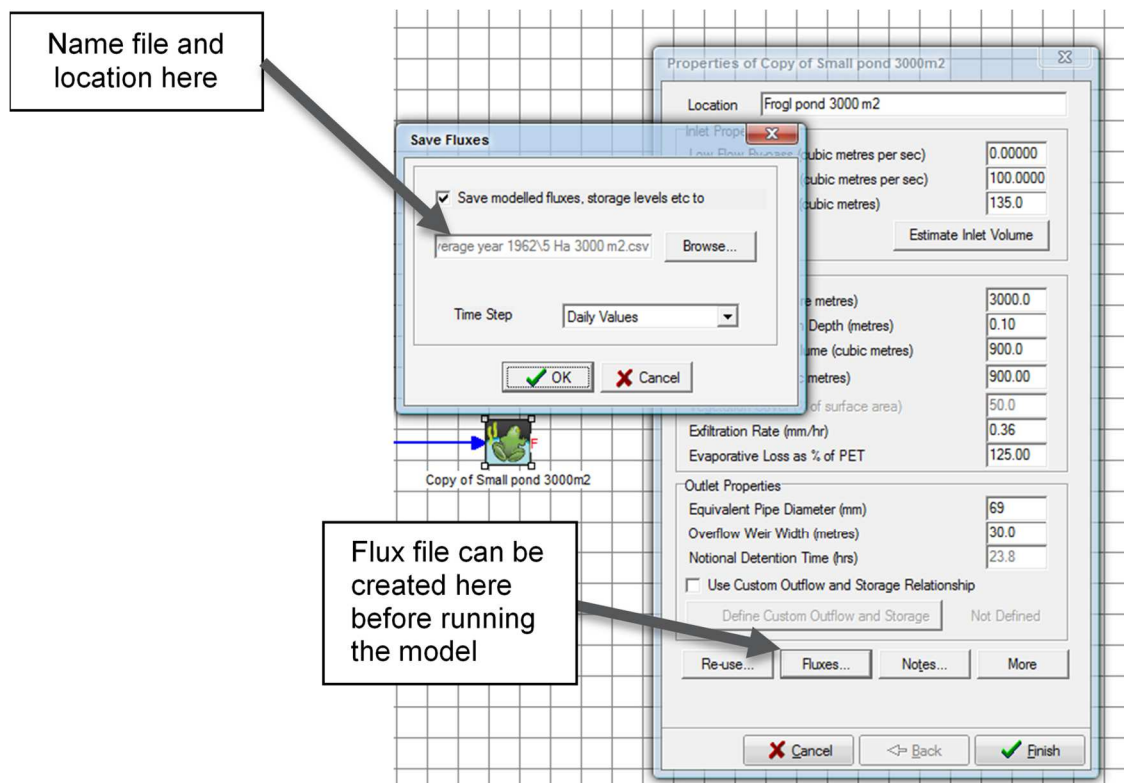


Figure 7: MUSIC screenshot - creating a flux file

- The flux file is created in Excel in the location specified. The relevant column is called 'Waterlevel (m)'. From here, a graph can be created of the storage level through time.
- Figure 8 outlines the MUSIC output and a compliant water level analysis:

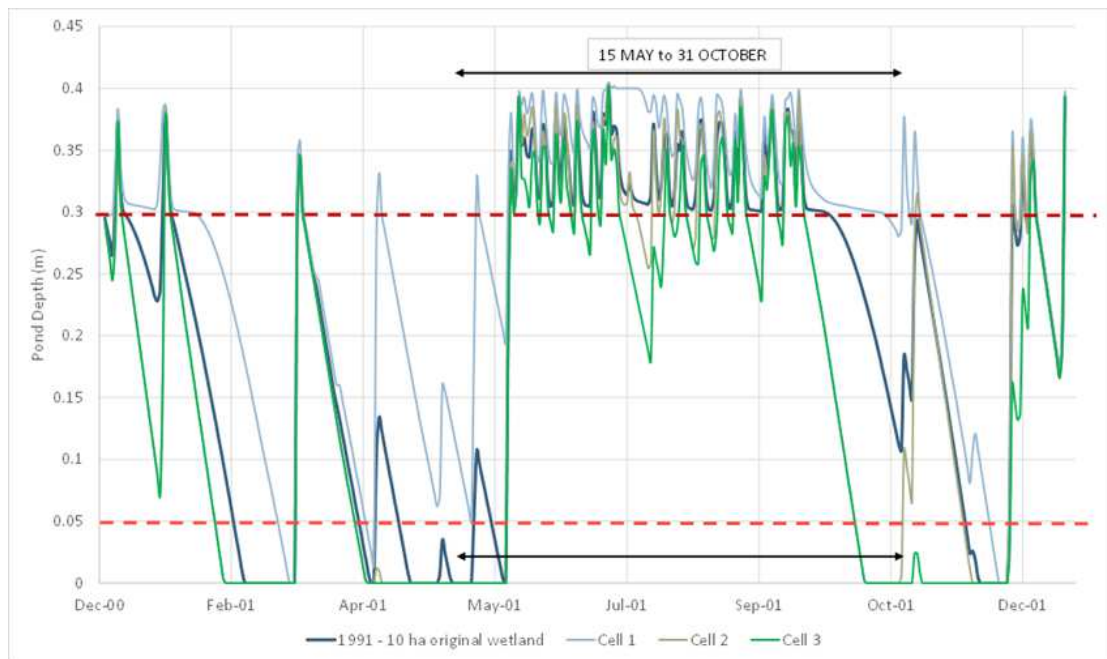


Figure 8: Example MUSIC modelling output demonstrating the water level analyses

Hold Point

The key outputs from step 2.1 are:

- A) A draft wetland design (see Appendix A), including drawing, dimensions, scale and typical sections
- B) The MUSIC model
- C) MUSIC modelling outputs – water level and stormwater quality treatment outcomes

STEP 2.2 FUNCTIONAL DESIGN, DRAFT MASTERPLAN AND EARTHWORKS

This step completes the information required for the development application, which is a progression of the concept design developed previously, based on feedback provided by ACC and OEH.

Where changes to the design have been created because of alternations to the project they must be documented. Step 4 requires the following to be considered:

- ▶ Masterplan or other design variables:
 - Changes must be rationalised with ACC and OEH.
 - The updated design must align with the design parameters defined in Step 3.
- ▶ Melbourne Water Constructed Wetlands Part A2
- ▶ On a case-by-case basis, stormwater harvesting and reuse may be considered for potential inclusion in the wetland. The inclusion of a stormwater harvesting and reuse system is subject to:
 - Available water for local reuse that doesn't affect the Sloane's froglet breeding habitat negatively.
 - The Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Step 2) Stormwater harvesting and reuse (July 2009) must be used to guide the design.
 - Other related permits from key NSW government stakeholders including Department of Primary Industries - Water.
 - Restricted to the non-breeding period for Sloane's froglet (November to April).
- ▶ Flood retarding basin hydrologic and hydraulic modelling must be completed in Runoff Routing Model (RORB) and Hydrologic Engineering Centres River Analysis System (HECRAS) (or an agreed alternative program). All inputs and outputs from this modelling must be approved by ACC.
- ▶ The following additional information must be submitted to ACC and OEH:
 - Updated MUSIC modelling for the functional design showing calculations for wetland hydrology and stormwater quality treatment performance.
 - A wetland design following the design principles and bathymetry defined in the standard drawing in Appendix A.
 - Preliminary planting plan for all aquatic and terrestrial planting, defining species and densities.
 - Completion of the risk assessment checklist in Appendix D.
 - A construction management plan detailing timing/project staging, including:
 - How Sloane's froglet breeding habitat will be managed over the duration of the project. This management plan must clearly demonstrate that the wetlands are established and functional prior to disturbance to existing defined habitat (see Appendix E for additional guidance on key habitat management requirements).
 - Evidence of how runoff from the site will be treated from the commencement of construction. ACC and OEH will not permit commencement of construction until this control is established on site.

- o Where the Step 1 outfall is located far from potential outfalls or potential Sloane's froglet breeding habitats, alternative sedimentation treatment needs to be approved by ACC and OEH.
- ▶ The detail provided on the construction management plan during the approvals steps must be discussed with ACC and OEH and finalised prior to the construction certification step.

Hold Point

The key outputs from step 2.2 are:

- A) Updated wetland design (see Appendix A) including plan, dimensions, scale and typical sections
- B) Functional design report detailing revised modelling rationale for environmental, stormwater quality and flood management functionality of the system.
- C) The updated MUSIC model
- D) Any revised MUSIC model outputs, including water level and stormwater quality treatment information.
- E) Landscape plan
- F) Draft earthworks and construction plan (demonstrating earthworks, project staging and timeline)
- G) Sloane's froglet habitat overlay

STEP 3 CONSTRUCTION CERTIFICATE

STEP 3.1 DETAILED DESIGN – DETAILED DESIGN DRAWINGS

This step aims to result in the production of a comprehensive design package that includes plans that show how the wetland will be constructed.

Two critical hold points are associated with the detailed design step:

- ▶ Provision of a preliminary detailed design package to ACC and OEH.
- ▶ Provision of an Issue for Construction design package to ACC and OEH.

The following step should be considered as a supplement to the Melbourne Water Constructed Wetlands Guidelines. The final detailed design plans must be completed to a level of detail outlined in the standard drawings provided in Appendix A and must include the following key design elements:

- ▶ Sediment pond, considering:
 - Sediment dewatering and storage locations.
 - Sedimentation basin access track and ramp.
 - Temporary sedimentation basins for construction step sediment loading (if required).
- ▶ Gross pollutant trap location and product type.
- ▶ Inlet and bypass details.
- ▶ Earthworks and contour levels relating to:
 - Wetland outline and bathymetry, with clearly defined normal water level and total extended detention depth.
 - Retarding basin, clearly defining the 1% AEP flood level.
 - High flow bypass channel.
- ▶ Maintenance/pedestrian paths
- ▶ Draw down pipes
- ▶ Outlet structures for the wetland and retarding basin, including wetland baffle pits and flood spillway.
- ▶ Proposed Landscape Plan defining all aquatic and terrestrial plantings (see Appendix G).

The detailed design should also consider:

- ▶ A risk assessment for the final design (undertaken in consultation with ACC and OEH using the template in Appendix D) to ensure that all community, council and environmental risks are managed during the design, construction and maintenance processes.
- ▶ Key ACC technical guidelines and standards, and particularly the Engineering Guidelines for Subdivisions and Development Standards Part 3 – Stormwater Drainage Design (July 2009).

- ▶ Preliminary investigations, completed during the functional design step, to inform the wetland design, including:
 - A detailed geotechnical assessment to define the nature of the *in-situ* material, clay liner, topsoiling and embankment requirements.
 - A detailed feature and level survey completed by a licensed surveyor.

At this step, it is also important to consider how the local community can use the wetland for educational, amenity and environmental opportunities. These opportunities may include:

- ▶ Educational signage that increases awareness of the wetland and its broader environmental and social benefits.
- ▶ Landscape architectural elements that enhance the wetland.
- ▶ Boardwalks and structures over the wetland to attract the local community to the wetland (made from appropriate materials that will not contaminate the wetland).

Gross Pollutant Trap

ACC requires the installation of a gross pollutant trap (GPT) upstream of all wetlands. GPT must consider the following:

- ▶ Provision for easy maintenance access via education trucks. GPT with lifting baskets cannot be used.
- ▶ Location of GPT must ensure provision for safe maintenance with off-road, all-weather access for education trucks.
- ▶ GPT nominated in design need to consider:
 - Nominated manufacturer
 - Proof of installation of the GPT product in ACC jurisdiction or within a major city or town, with client references validating its performance.
 - Proven treatment capability, ideally with test results or *in-situ* operational results.
 - If an alternative product is nominated by a contractor during the tender step of a project, the alternative nominated unit must complete the nominated approval process above.

Sedimentation basin

Sedimentation basins are a critical aspect of stormwater quality treatment as they minimise sediment loading in the vegetated area of wetland. Excessive loading of sediment entering the wetland zone ultimately affects the health of aquatic plants, and therefore, the quality of Sloane's froglet breeding habitat.

The design and management of sediments entering the wetland through the sedimentation basin must consider the following ACC specific design requirements:

- ▶ Maintenance access into the sedimentation basin must demonstrate how an excavator and haulage truck can manage the removal of sediment from the sedimentation pond. Typical details of the access track are provided in the Melbourne Water Constructed Wetlands Guidelines.
- ▶ All sedimentation basins require a concrete base that extends from the base of the pond to 0.5 m above. Consideration must be given to the interface of the concrete base with surrounding rock work and vegetation.

- ▶ Given the increase in sediment loading during the construction step of the subdivision, the detailed design step must also consider:
 - The management of loading in the catchment, including construction practices that increase the likelihood of excessive sediment load entering the sedimentation pond and the Sloane's froglet breeding habitat.
 - The sizing of the temporary sedimentation basin (or a detailed sediment control plan for the catchment) that manages increased sediment loading.
 - Ease of maintenance access and ability to estimate the extent of loading in the sedimentation basin.

Note: considerations for sedimentation management during the construction step are detailed in Step 6.

Inlet/outlet, rockwork and bypass details

All inlet, outlet, rockwork and bypass details must be designed in accordance with the Melbourne Water Constructed Wetlands Guidelines.

Pits, Valves, headwalls, markers and signs

Pits and headwalls used to ensure wetland and retarding basin functionality must comply with Council Engineering Development Standards – Part 3 – Stormwater Drainage Design. The following are key design considerations when nominating/designing pits and headwalls for the detailed design step:

- ▶ Council standard junction pit detail must be applied for the wetland draw down pipes and outlet.
- ▶ Councils concrete headwall – STD-D-70 or rock headwall detail must be applied for all pipes.
- ▶ All nominated valves and gates must comply with Water Services Association Australia (WSAA) or ISO standards or ensure compliance with the following:
 - Nominated manufacturer
 - Proof of installation of the valve or gate product in ACC jurisdiction or in a major city or town, with client references validating its performance.
- ▶ Where customised pits (that are not within ACC's standard drawings) are required the detailed design package must include supporting structural calculations and drawings.
- ▶ All pits and headwalls located within the vegetated areas or below water level, must be identified by a bollard located no more than 0.2 m from its defined location. The bollards nominated must be no more than 1.5 m high and specified on the landscape plan.

Earthworks – wetland and retarding basin

The earthworks defined in the detailed design step of the wetland and flood retarding basin must ensure the following:

- ▶ The final wetland area (not including the sedimentation pond) is no less than that defined in the functional design step (i.e., ensuring it meets habitat and stormwater quality requirements, whilst incorporating key maintenance requirements including access tracks and sediment dry out areas).
- ▶ Flood storage requirements are met and substantiated with hydrological modelling (RORB or equivalent).

- ▶ Retarding basin embankments must consider downstream risks in the event of failure.
- ▶ The detailed design step is the final step to consider construction timing for the wetland and managing existing Sloane's froglet habitat areas. The detailed design step must consider appropriate engagement with ACC and OEH to clearly demonstrate timing of construction and how these sequencing will take place.

Maintenance and pedestrian tracks

Maintenance of and access to the wetland must be confirmed at the detailed design step. The design should consider the following:

- ▶ Maintenance access (pedestrian or vehicle) with reference to:
 - All pits (inlet, outlet and draw down pits)
 - Sedimentation basin
 - Clearly defined boundaries outlined by OEH
- ▶ Limiting access of non ACC or OEH vehicles onto access paths using planting and bollards.
- ▶ Locks limiting access should ensure dual access by OEH and ACC.
- ▶ Pedestrian access through the wetland area to adjoining destinations.
- ▶ ACC Standards for maintenance and pedestrian/shared paths.

Planting

The final detailed plant list must be submitted with the detailed design drawings. A sample of suggested species are provided in Appendix G. Key considerations include:

- ▶ Plants nominated must be tube stock; hydroseeding can be used if approved by ACC.
- ▶ If jute matting is proposed to be used then it should be non-toxic and biodegradable.
- ▶ Lawn used in proximity to the wetland should avoid Kikuyu (*Cenchrus clandestinus*) and lawn cultivars of Couch (*Cynodon dactylon*).
- ▶ Deciduous trees should not be planted within 20 m of the top water level of a wetland to avoid excessive leaf litter dropping into wetlands during winter (when Sloane's froglet is breeding).
- ▶ For the eastern, western, and northern sides of wetlands, shrubs and trees must not be planted closer than 3 to 5 metres from the top of the bank; grasses and some sedges (e.g., *Lomandra* spp.) can be planted closer to the wetland.
- ▶ For the eastern, western, and northern sides of wetlands, only those shrub and tree species that do not exceed 3 m at mature height can be planted.
- ▶ For the southern side of the wetland, tree and shrub species of any height can be planted, but still should not be planted closer than 3 to 5 metres from the top of the bank.
- ▶ Where practicable, all planted trees and shrubs should be species that are listed in the South West Slopes Revegetation Guide (a copy of suitable species can be requested from Council).

Signage

Appropriate signage is critical to highlight environmental and safety aspects of the wetland and flood retarding basin. Signage serves two functions:

- ▶ A mechanism to manage risk
- ▶ Information and interpretation

Signage is important for communicating risks associated with the area. ACC has adopted the signs as remote supervision principles as outlined in the Albury City Signs as Remote Supervision Policy. The steps involved in developing appropriate signage are outlined in Figure 9. This flow chart should be used together with ACC's Signage as Remote Supervision Signage Assessment toolkit.

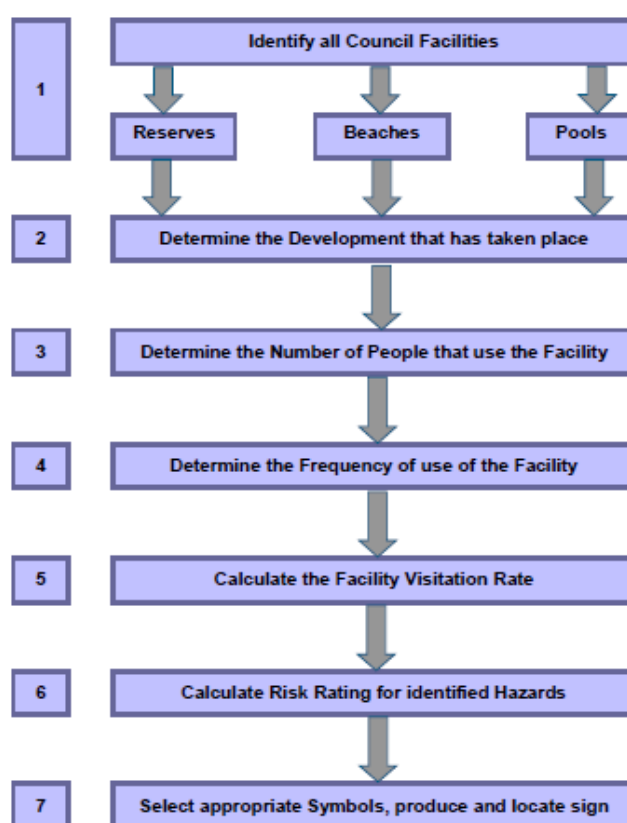


Figure 9 Signage development flowchart

The proponent is encouraged to contact ACC to assist with the risk signage process and to ensure an appropriate sign is erected prior to construction completion. A sample of the form used to document the assessment process is attached in Appendix H. Figure 10 provides some examples of signs for consideration.

Information and interpretive signage should be developed at key habitat locations (to be discussed with OEH and ACC). The purpose is to provide the community with background to Sloane's froglet and outline how the area is constructed/maintained and why. The proponent is encouraged to work with ACC and OEH in the development of information or interpretive signage.



Figure 10 Example Sign

Hold Point

The key outputs from section 3.1 are:

- A) Detailed design plans (see Appendix A) including plan, dimensions, scale, detailed sections, detailed landscape plans (showing aquatic and terrestrial planting)
- B) Final earthworks and construction plan
- C) A design report to support all detailed modelling and design rationale
- D) Detailed design risk assessment

STEP 3.2 DETAILED DESIGN – CONSTRUCTION SPECIFICATION AND MAINTENANCE MANUAL

The aim of this step is to produce construction specification that will support the detailed design plans. The construction specification must include key information to set expectations for contractors during subdivision construction and maintenance (defects) period.

Key inclusions in the specification are:

- ▶ Specific construction requirements that are outside the detail provided in the design plans
- ▶ Key hold points defined by ACC or OEH relating to construction and environmental approvals
- ▶ Key construction considerations relating to Sloane's froglet breeding habitat requirements including:
 - A final Environmental Management Plan
 - A final Erosion and Sediment Management plan
 - A final Earthworks and Construction Plan

Key inclusions for the maintenance manual are:

- ▶ A plan locating and labelling all assets in the wetland and flood retarding basin, including nominated markers.
- ▶ Key assets that require operation or maintenance.
- ▶ Regularity of maintenance and renewal for all assets in the wetland and flood retarding basin with respect to Sloane's froglet's requirements.
- ▶ Completed checklists by the contractor from the defects liability period (refer to Appendix I).

Other considerations for the maintenance manual include:

- ▶ If occupied Sloane's froglet breeding habitat will be destroyed as part of the development process, it is important to ensure the created habitat is established prior to the start of the breeding season (start of May) following the commencement of construction. If construction commences during the breeding season (start of May to end of October – not the preferred option), then constructed Sloane's froglet habitat should be established by the start of the following breeding season.
- ▶ While a temporary sedimentation basin may be required during construction, a proportion of the permanent sedimentation basin could be established as Sloane's froglet breeding habitat at the commencement of the construction.
- ▶ If habitat establishment fails at any point from construction to hand over, the proponent will be required to re-establish the Sloane's froglet breeding habitat. This process may include de-silting and re-planting the entire area of constructed habitat.

Refer to Appendix E for an overview of the recommended format of the Habitat and Sedimentation Manual. These documents will form part of the detailed design package submitted to ACC and OEH.

Hold Point

The key outputs from step 3.2 are:

- A) A Sloane's froglet habitat management plan (See Appendix E)
- B) Environmental management plan
- C) Final Erosion and Sediment Management plan
- D) Final Earthworks and Construction Plan
- E) Construction specification
- F) Maintenance Manual

Note: All key information relating to the Sloane's froglet should be consistent across all the documents mentioned above

STEP 3.3 REPORTING AND MODELLING

This step aims to result in the production of final detailed design report. This report must be included in the detailed design package submitted to ACC and OEH. This report will summarise all steps of design.

This report must include:

- ▶ Key background information, including geotechnical reports and the detailed feature and level survey
- ▶ All hydrologic modelling inputs and outputs relating to the retarding basin design
- ▶ All hydrologic modelling inputs and outputs relating to the wetland environmental functionality
- ▶ Water quality modelling for the wetland design
- ▶ Design calculations demonstrating the sizing of the sedimentation basin and provisions for sediment loading during the estate construction and home building
- ▶ Hydraulic modelling and computations relating to the inlet and outlet pits from the wetland and retarding basin

The report must demonstrate how the above design features and considerations fulfil Sloane's froglet breeding habitat requirements by making specific reference to the criteria listed in Section 2.1. This document will form part of the detailed design package submitted to ACC and OEH.

Hold Point

The key output from step 3.3 is:

- A) A detailed design report incorporating outputs.

STEP 4 SUBDIVISION CERTIFICATE

STEP 4.1 CONSTRUCTION

This step aims to ensure the construction considers implementation of the design and management plans to protect the Sloane's froglet habitat area.

Key construction step considerations include the following:

- ▶ Key hold points that require review and signoff from ACC and OEH (where nominated), including the following:
 - Project commencement meeting, which must include ACC and OEH representatives. This meeting will ensure all site staff:
 - Are inducted into key site practices relating to the protection and management of Sloane's froglet habitat.
 - Are clear on expectations relating to key construction hold points and attendance of OEH and ACC at each.
 - Documentation of the levels being used for pipes and pits.
 - Documentation of the type of rockwork being used.
 - Results from key materials tests, including concrete, embankment compaction and clay liner tests.
 - A final works as executed validation of earthworks in the form of construction drawings.
 - Works as executed reviewed by OEH and ACC, and signed off by ACC.
 - At the end of the defects liability period, an inspection with ACC and OEH.
- ▶ Clear site signage and no-go zones in Sloane's froglet existing or established habitat.
- ▶ Legal and educational information relating to Sloane's froglet must be included in the Sloane's froglet habitat management plan. All site inductions must consider the commitments made in this management plan. Key educational information must also be clearly displayed at site sheds and the proponent is responsible for ensuring that all contractors on site are aware of the requirement to incorporate and manage Sloane's froglet habitat on-site.

Hold Point

The key outputs from step 4.1 are:

- A) An inspection of works as executed by OEH and ACC and formal approval by ACC

STEP 5 MAINTENANCE PERIOD

STEP 5.1 OPERATION AND MAINTENANCE

This aim of this step is for the contractor to ensure that the following operational and maintenance conditions are met.

These operational and maintenance conditions include:

- ▶ Maintenance of plants (Appendix G)
- ▶ Civil assets must be fully functional and free from sediment.
- ▶ Rockwork and concreting must be free of structural faults.
- ▶ Sedimentation basins and gross pollutant traps must be cleaned and free of sediment and gross pollutants.
- ▶ Log books outlining all maintenance operations over the duration of the defects period must be handed to ACC at final inspection (see Appendix I).
- ▶ Plant survival (based on number of plantings) is at least 60% in each wetland cell as assessed by OEH.
- ▶ The depth of the first wetland cell must not drop below 200 mm (based on an average of 12 measurements) as assessed by OEH in the summer preceding handover.
- ▶ All valves in draw down pits must remain closed unless directed by OEH.

The following are ACC's mandatory defects periods:

- ▶ Civil assets – 12 months
- ▶ Landscape assets – 36 months

At the completion of the defects period, ACC and OEH will complete a final inspection with the contractor to review all aspects of the wetland and confirm that the above operation and maintenance considerations have been met.

Hold Point

The key outputs from step 5.1 are:

- A – An inspection of the works by ACC at the completion of the maintenance period.
- B – An inspection of the wetland breeding habitat (cells) by OEH.

APPENDIX A – STANDARD DRAWINGS

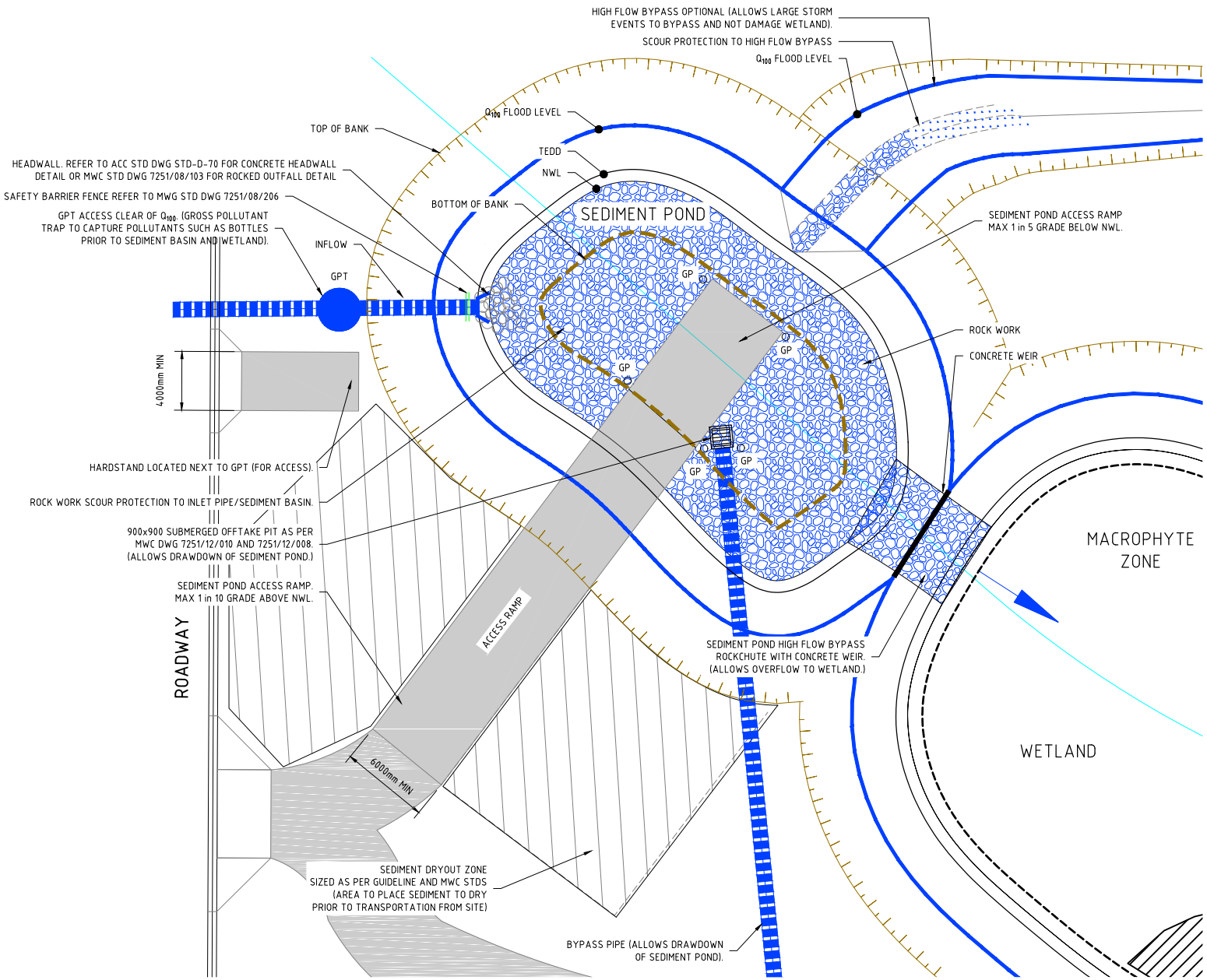


NOTES:

- RAMP
 - TO BE DESIGNED FOR GEOTECHNICAL CONSTRAINTS AND TO NSW BOAT RAMP FACILITY GUIDELINES
 - 200mm MIN THICK CONCRETE PAVEMENT WITH SUITABLE REINFORCEMENT.
 - 100mm MINIMUM THICK FCR BASE.
 - PAVEMENT TO BE PLACED UPON GEOTEXTURE AND SUITABLY PREPARED SUBGRADE.
 - RAMP TO HAVE CORRUGATED OR ROUGH SURFACE FOR FRICTION/TRACTION PURPOSES.
- GP DENOTES: GUIDE POST WITH EXTENSION 500mm PAST NWL.
- OWNERSHIP OF THE LAND INCLUDING THE WETLAND AREA IS GENERALLY COUNCIL'S.
- ANY COUNCIL ROAD RESERVE WITH A SUBDIVISION RUNNING ADJACENT TO THE WETLAND RESERVE SHOULD BE FITTED WITH BOLLARDS (NON REMOVABLE) TO PREVENT UNAUTHORISED VEHICLE ACCESS THUS MINIMISING DUMPING OF RUBBISH ETC WITHIN THE RESERVE OR UNWANTED ACCESS.
- DESIGN MANUAL PROCEDURES AND SIZING REQUIREMENTS TAKE PRECEDENCE OVER DRAWINGS.
- DIMENSIONS AND DETAILS ON DRAWINGS TAKE PRECEDENCE OVER MELBOURNE WATER DETAILS.
- ALL PITS TO BE LOCATED WITHIN 0.5m OF AN ACCESS PATH.

LEGEND

- Q₁₀₀ FLOOD LEVEL (1% AEP RETARDATION WATER LEVEL AND/OR HIGH FLOW BYPASS LEVEL)
- NORMAL WATER LEVEL (NWL)
- TOP OF EXTENDED DETENTION DEPTH (TEDD)
- BATTER LINE
- SEDIMENT DRYOUT AREA
- ROCK WORK - ROCK WORK AS PER MWC DWG 7251/12/004. CONCRETE ALTERNATIVE ACCEPTABLE AS PER MWC DWG 7251/12/004.
- HEADWALL (ROCK OR CONCRETE)
- PIT



TYPICAL SEDIMENT POND LAYOUT
SCALE: 1:200

H 1:200
SCALE @ A1



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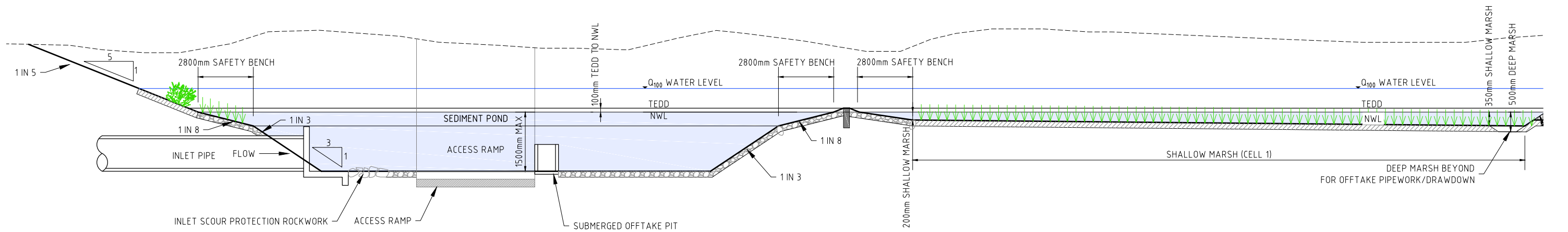
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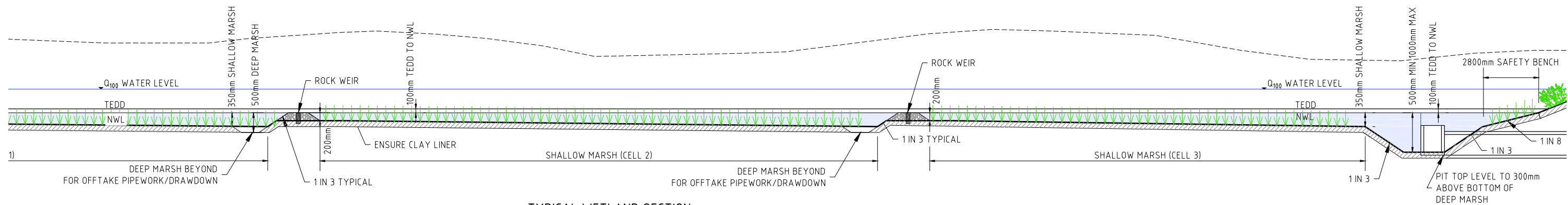
**SLOANES FROGLET WETLAND DESIGN
GUIDELINES - DRAWINGS**
**TYPICAL WETLAND
TYPICAL SEDIMENT POND LAYOUT**
ALBURY CITY COUNCIL
NSW OFFICE OF ENVIRONMENT AND HERITAGE

PRELIMINARY Drg No **302992CG200** Rev **D**



TYPICAL SECTION - SEDIMENT POND

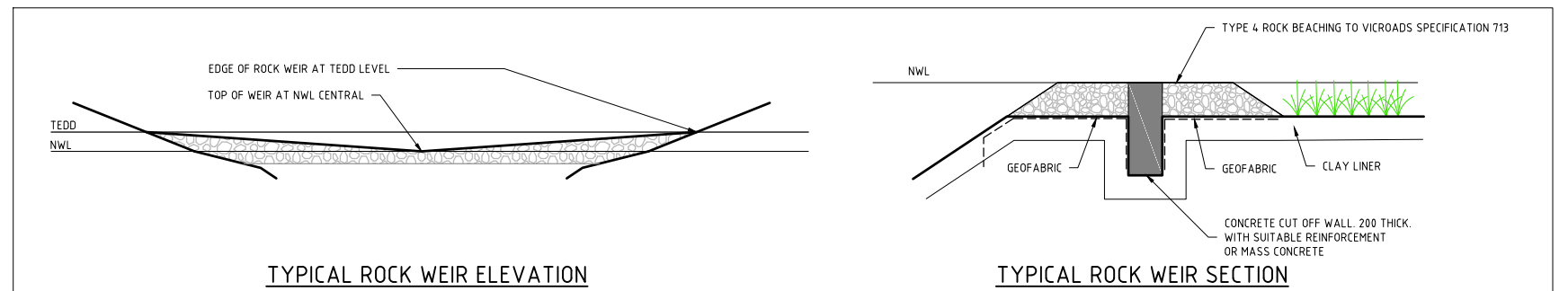
TYPICAL SECTION - WETLAND



TYPICAL WETLAND SECTION

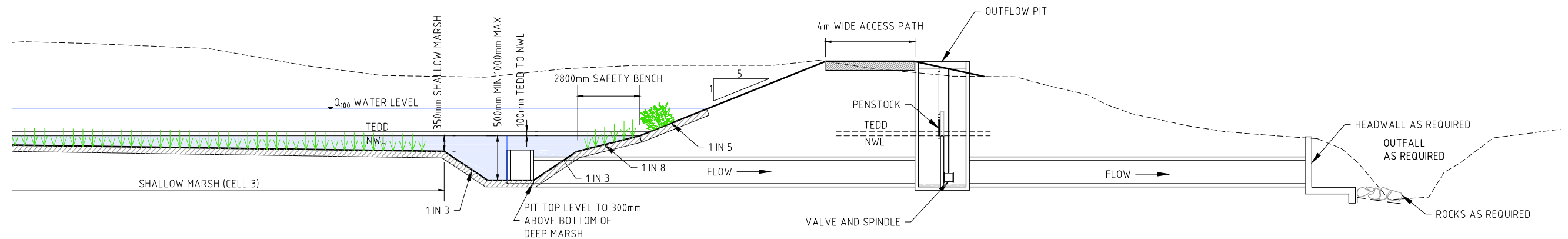
LEGEND

- Q₁₀₀ FLOOD LEVEL (1% AEP RETARDATION WATER LEVEL AND/OR HIGH FLOW BYPASS LEVEL)
- NORMAL WATER LEVEL (NWL)
- TOP OF EXTENDED DETENTION DEPTH (TEDD)
- ROCK WEIR



TYPICAL ROCK WEIR ELEVATION

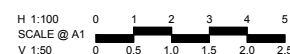
TYPICAL ROCK WEIR SECTION



TYPICAL SECTION - WETLAND AND OUTFALL

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Rev	Amendments	Approved	Date
D	PRELIMINARY	DDA	17-08-17
C	PRELIMINARY FOR DISCUSSION PURPOSES	JDH	05-07-17
B	PRELIMINARY FOR DISCUSSION PURPOSES	JDH	04-07-17
A	PRELIMINARY FOR DISCUSSION PURPOSES	DDA	27-06-17



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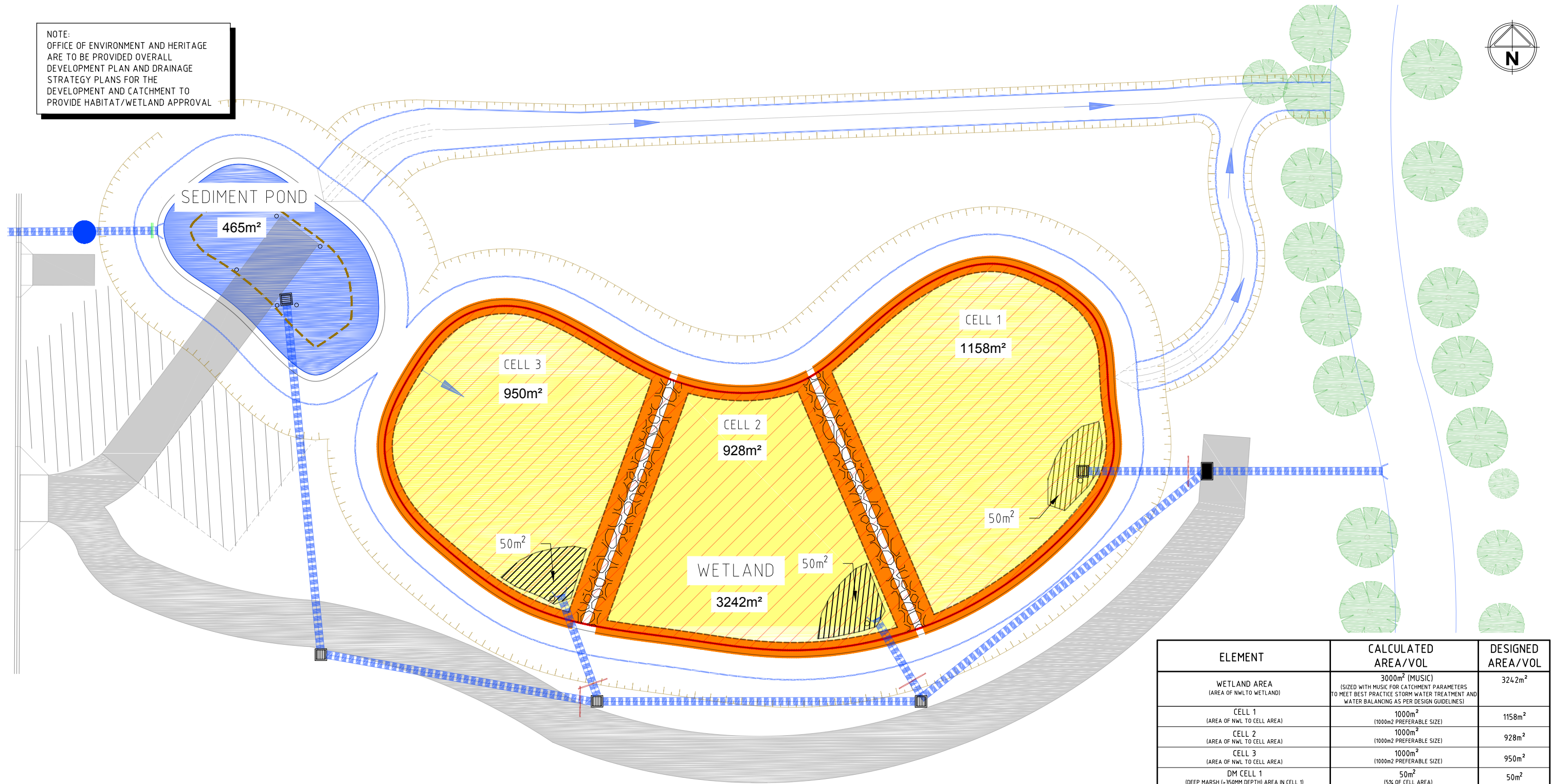
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**SLOANES FROGLET WETLAND DESIGN
GUIDELINES - DRAWINGS**
**TYPICAL WETLAND
SECTIONS**
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NSW OFFICE OF ENVIRONMENT AND HERITAGE
PRELIMINARY Drg No **302992CG202** Rev **D**

NOTE:
OFFICE OF ENVIRONMENT AND HERITAGE
ARE TO BE PROVIDED OVERALL
DEVELOPMENT PLAN AND DRAINAGE
STRATEGY PLANS FOR THE
DEVELOPMENT AND CATCHMENT TO
PROVIDE HABITAT/WETLAND APPROVAL



WETLAND AREA PLAN

SCALE: 1:250

ELEMENT	CALCULATED AREA/VOL	DESIGNED AREA/VOL
WETLAND AREA (AREA OF NWL TO WETLAND)	3000m ² (MUSIC) (SIZED WITH MUSIC FOR CATCHMENT PARAMETERS TO MEET BEST PRACTICE STORM WATER TREATMENT AND WATER BALANCING AS PER DESIGN GUIDELINES)	3242m ²
CELL 1 (AREA OF NWL TO CELL AREA)	1000m ² (1000m ² PREFERABLE SIZE)	1158m ²
CELL 2 (AREA OF NWL TO CELL AREA)	1000m ² (1000m ² PREFERABLE SIZE)	928m ²
CELL 3 (AREA OF NWL TO CELL AREA)	1000m ² (1000m ² PREFERABLE SIZE)	950m ²
DM CELL 1 (DEEP MARSH (-350MM DEPTH) AREA IN CELL 1)	50m ² (5% OF CELL AREA)	50m ²
DM CELL 2 (DEEP MARSH (-350MM DEPTH) AREA IN CELL 2)	50m ² (5% OF CELL AREA)	50m ²
DM CELL 3 (DEEP MARSH (-350MM DEPTH) AREA IN CELL 3)	50m ² (5% OF CELL AREA)	50m ²
SEDIMENT POND (AREA AT NWL)	465m ² (SIZED WITH TO MEET BEST PRACTICE STORM WATER TREATMENT AS PER DESIGN GUIDELINES)	465m ²
SEDIMENT POND STORAGE VOL (VOLUME OF SEDIMENT POND WITH BATTERS CONSIDERED)	480m ³ (DESIGNED TO GUIDELINES WITH 5 YEAR STORAGE VOLUME CONSIDERED TO NWL)	511m ³
SEDIMENT POND DRY OUT AREA (SLIGHTLY GRADED LAND AREA CLEAR FOR SEDIMENT STORAGE)	960m ² (0.5m DEEP SEDIMENT STORAGE DEPTH BASED ON POND STORAGE VOL)	1000m ²
UPSTREAM CATCHMENT (CONSIDERS CATCHMENT DRAINAGE STRATEGY, DEVELOPMENT AREA AND ULTIMATE DEVELOPMENT AREA)	10 Ha, 100,000m ²	10 Ha, 100,000m ²
UPSTREAM CATCHMENT RUNOFF CO-EFFICIENT (AVERAGE CATCHMENT RUNOFF CO-EFFICIENT)	0.7 (CALCULATED FACTOR IN LINE WITH DESIGN GUIDELINES)	0.7

NOTE: APPROXIMATE FIGURES ONLY DETAILED DESIGN/MODELING TO OCCUR TO PROVE THE ABOVE FIGURES

Rev	Amendments	Approved	Date
C	PRELIMINARY	DDA	17-08-17
B	PRELIMINARY FOR DISCUSSION PURPOSES	JDH	5-07-17
A	PRELIMINARY FOR DISCUSSION PURPOSES	JDH	05-07-17

H 1:250
SCALE @ A1



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**SLOANES FROGLET WETLAND DESIGN
GUIDELINES - DRAWINGS
TYPICAL WETLAND
WETLAND AREA**
ALBURY CITY COUNCIL
NSW OFFICE OF ENVIRONMENT AND HERITAGE

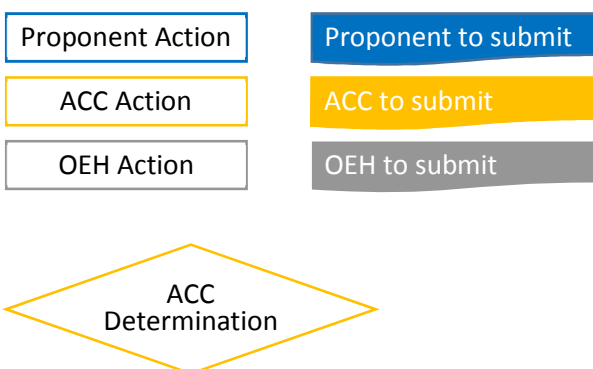
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APPENDIX B– DETAILED PROCESS FOR ALBURY SLOANE’S FROGLET STORMWATER MANAGEMENT GUIDELINES

LEGEND

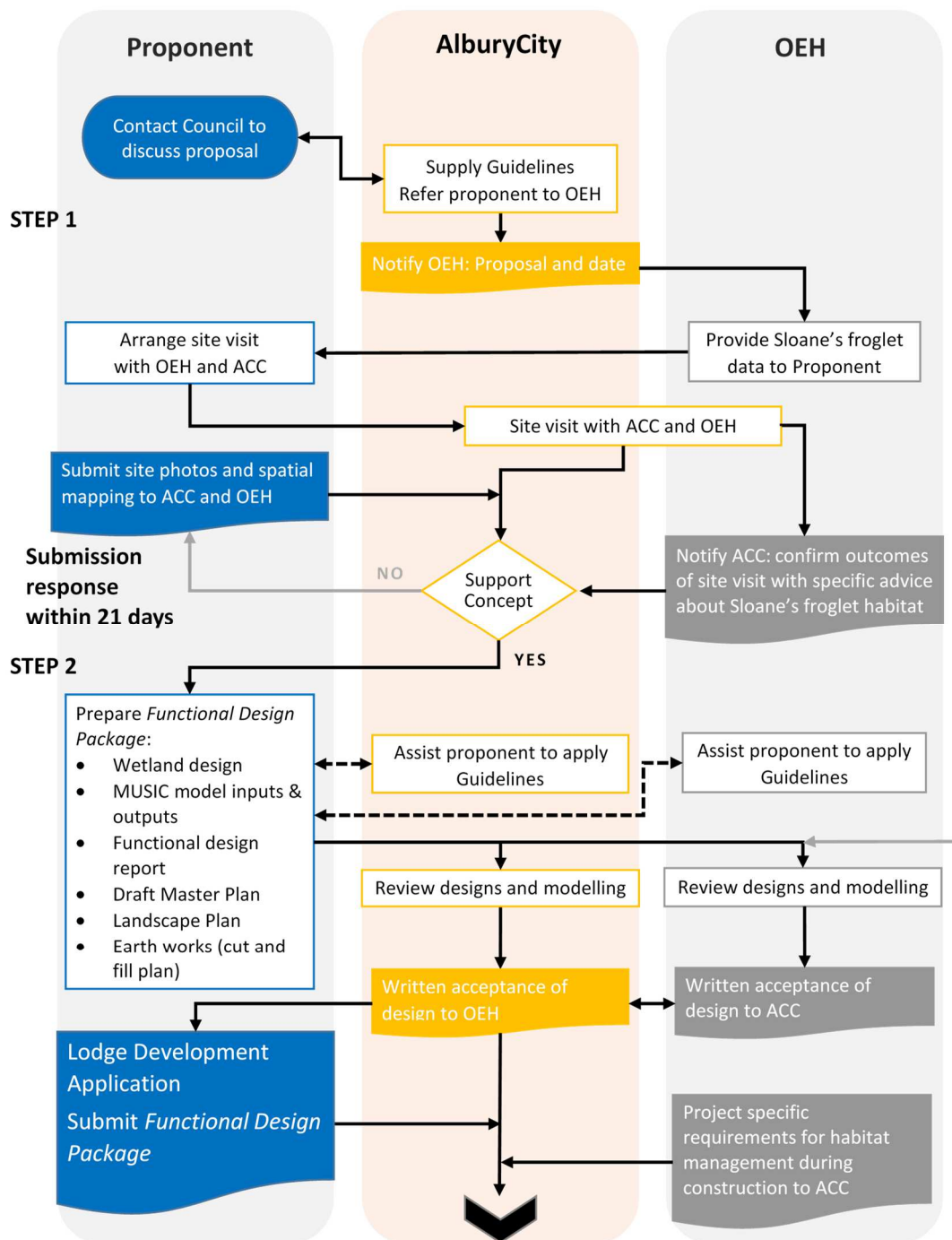
- Direction of activity
- Alternative path if action fails
- ↔ Action may need discussion and several iterations

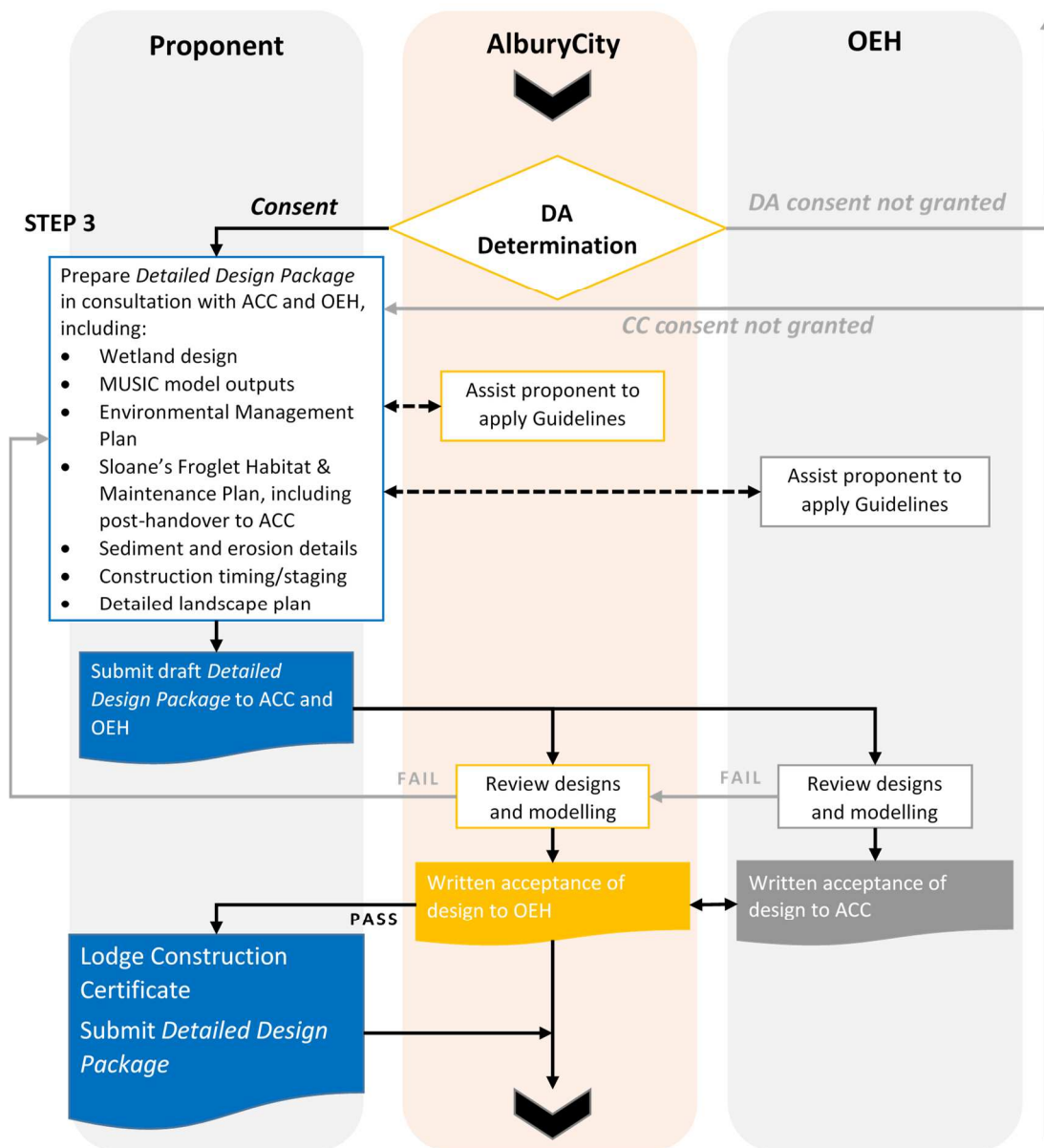


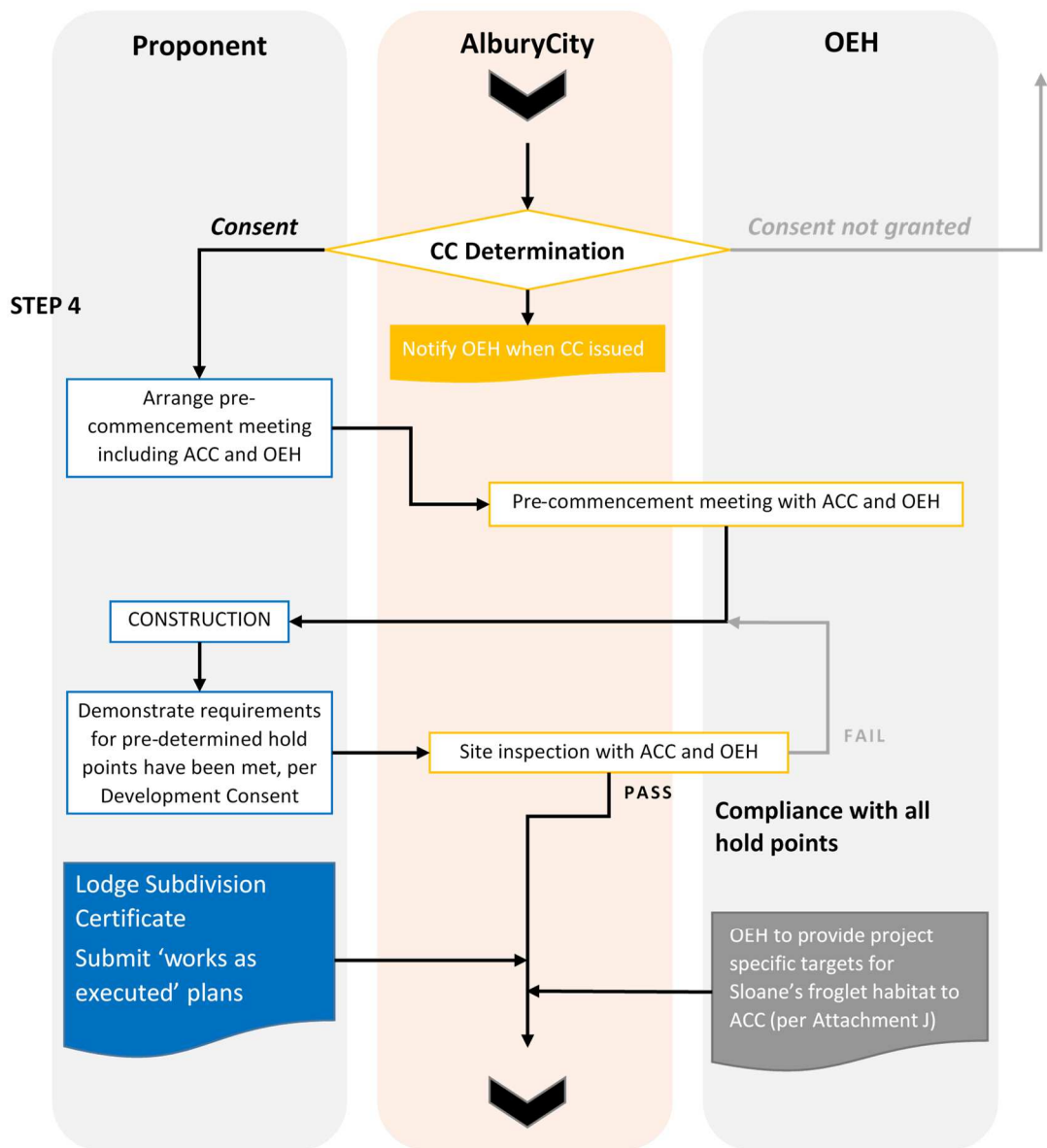
CONTACTS

ACC Albury City Council: info@alburycity.nsw.gov.au Ph (02) 6023 8111

OEH NSW Office of Environment and Heritage (South West Planning Mailbox):
rog.southwest@environment.nsw.gov.au Ph (02) 6022 0606









APPENDIX C – EXAMPLE MASTERPLAN



APPENDIX D – RISK ASSESSMENT CHECKLIST

HS-TL301 SAFETY IN DESIGN - HAZARD IDENTIFICATION & ASSESSMENT TOOL



PURPOSE:

THIS ASSESSMENT IS TO IDENTIFY THE KEY HAZARDS ASSOCIATED WITH THE PRELIMINARY/CONCEPT DESIGN, UTILISING THE HAZARD IDENTIFICATION PROMPTS IN ORDER TO PROVIDE FOCUS ON OPTIMISATION OF THE DESIGN TO MANAGE/MITIGATE IDENTIFIED HAZARDS.

SCOPE:

THIS "SAFETY IN DESIGN" RISK ASSESSMENT IS ONLY FOR HAZARDS IDENTIFIED RAMP DEVELOPMENT PHASE, WHICH ARE SPECIFIC HAZARDS TO WORKERS AND/OR THIRD PARTIES WHICH CAN BE PARTIALLY OR FULLY MITIGATED VIA ENGINEERING DESIGN.

I.E. THIS ASSUMES THAT LD&C PROJECT MANAGEMENT PLANS (INCLUDING SAFETY MANAGEMENT PLAN, ENVIRONMENTAL MANAGEMENT PLAN, QUALITY MANAGEMENT PLAN) AND ASSOCIATED SAFE WORKING METHODS, JSEAs, ITPs AND THE LIKE ARE PREPARED AND IMPLEMENTED FOR EACH PROJECT.

HAZARD IDENTIFICATION GUIDEWORDS / PROMPTS:		APPLIES? (Y/N/NA)
1	GROUND CONDITIONS (Topography, Previous & Present Use; Contaminated Ground; Ground Stability, Seismic Activity and Groundwater)	
2	HAZARDOUS ENVIRONMENT (Biological Hazard; Chemicals (liquid, gas, powder); Radioactivity; Dust Emissions; Discharges / Effluents)	
3	EXISTING WORKING ENVIRONMENT (Abnormal Hours; Climate/Weather; Vibration; Noise; Fire & Flammables; Restricted Working Area; Lighting; Working with Lead or Asbestos)	
4	EXISTING SERVICES (Underground and Overhead Services)	
5	PROXIMITY TO OTHER STRUCTURE(S) (Risks from Existing Structures e.g. Stability)	
6	WORKING NEAR BODY OF WATER (Risk of Flooding; Work over Water; Work near Reservoir / Aquifer, River etc.; Risk of Pollution; Waterborne Diseases)	
7	PROXIMITY TO OTHER ACTIVITIES (Existing Operations; Other Contracts; Adjacent Moving Plant/Machinery)	
8	SEQUENCE OF CONSTRUCTION (Consider Programme with regard to Health & Safety)	
9	ACCESS (Access and Egress from Site or Adjacent Properties; Weight, Height or Turning Restrictions; Traffic Management Requirements, plant access requirements)	
10	INTERFACES (Neighbours – Terrorist Activity, Riots, Political Unrest, Military Action etc.; Schools; Public Highway Traffic; Rail Traffic; Shared Scaffolds or Accesses; Liaison with Operational Staff; Client Emergency Procedures)	
11	CONFINED SPACE WORKING (Buildings; Excavations; Manholes; Tanks; Chambers; Pipes)	
12	OPERATION AND MAINTENANCE CONSIDERATIONS (Cleaning; Waste Disposal; Fragile Roofs; Confined Spaces; Ventilation; Signs or Notices, access/egress)	
13	WORKING AT HEIGHT (Falling Objects; Mechanical or Manual Lifting; Lifting Cranes; Work on Sloping Roofs / Slopes)	
14	DEMOLITION / REFURBISHMENT / REPAIR (Consider Health & Safety on Existing and Future Work)	
15	WELFARE (Provide Water, Power and Wastewater Connections where practicable)	
16	OCCUPATIONAL HEALTH (Noise; Vibration; Manual Handling; Hazardous Substances; Dust, Fire Explosion, Toxic Gases, Heat)	
17	ENVIRONMENTAL ISSUES (Surrounding Land Use, Planning Restrictions, Noise Pollution, Discharge to Air, Discharge to Soil, Visual Impact)	
18	END USER SAFETY STANDARDS (Design for access and mobility, Commonwealth Discrimination Act, parking facilities, playground safety standards, pool & water safety, pavements, earth retaining structures, lighting, slip resistance, indines, road guidelines, platforms, ladders and stairways)	
19	HAZOP (A hazard and operability study (HAZOP) is a structured and systematic examination of a complex planned or existing process or operation to identify and evaluate problems that may represent risks to personnel or equipment)	
20	OTHER SIGNIFICANT HAZARDS NOT IDENTIFIED ABOVE (e.g. Hot Works, Diving Operations, Non-Destructive Testing)	

Project Name:					Project Number:	
Component or Aspect:					Assessment No:	
Ref No	Nature of hazard	Component of Project (e.g. tank, pipeline, PS)	Possible effect of hazard	Phase where hazard may arise	Precautions or remedial action to be taken (mitigation if any)	Details of Residual Risks
Assessment by:					Approved by:	

APPENDIX E – SLOANE’S FROGLET HABITAT MANAGEMENT TEMPLATE

Note: this template is intended to provide guidance to the proponent on the type of information need to demonstrate how Sloane’s froglet habitat will be managed and maintained. The use of simplified tables/diagrams/flowcharts etc. is encouraged. Proponents will be required to provide separate Environmental Management, Erosion and Sedimentation Management, and Construction Timing and Staging plans. Proponents should contact AlburyCity Council for specific details to be included in these plans.

Purpose

A statement on the plan’s primary purpose and intent. E.g., ‘This Plan aims to ensure that stormwater wetlands for DEVELOPMENT NAME conform to Sloane’s froglet (Crinia sloanei) habitat and stormwater management requirements as detailed in the Thurgoona Stormwater Wetland Guidelines, to contribute the long-term viability of the Thurgoona Wirringa Sloane’s froglet population’.

Sloane’s Froglet Habitat Creation and Management

► General Methods

A statement on the general methods that will be used to create and/or maintain Sloane’s froglet habitat on the development site.

► Habitat Creation Timeline

Specific details on the planned timing of habitat creation and maintenance for Sloane’s froglet. This section should include details of when planting will occur and the contingency for failed plantings.

► Revegetation Details

Information on the plant species and densities to be planted in and around Sloane’s froglet stormwater wetlands. Diagrams demonstrating the location and depth (for aquatic plants) of plantings are encouraged. Species should be separated into the following categories: emergent plants (deep), emergent plants (shallow), fringing plants, and barrier plants. Contingency plans for re-planting where necessary.

► Water Management Regime and Methods

Details the methods and/or infrastructure that will be used to regulate water levels.

Sedimentation Management and Maintenance Methods

► General Methods

A statement on the general methods that will be used to manage sediment from pre- through to post-construction (i.e., includes the defects period). This section should also include information on infrastructure or plant used to remove/manage sediment (e.g., gross pollutant traps; education trucks).

► Sedimentation Maintenance Timeline

Specific details on the timing of sediment management from pre- through to post-construction. This section should also include details on how and when the proponent will monitor sediment inflow to the wetlands, and trigger points for revising the maintenance regime. A table or similar is recommended to clearly show the proposed timeline.

- ▶ Sediment Management and Control Methods

Details on the proposed sediment management and control methods. Should include information on any infrastructure (e.g., silt exclusion fencing).

Monitoring undertaken by OEH for presence of Sloane's froglet, sediment levels in habitat cells, and aquatic plant survival

The following sections associated with monitoring undertaken by OEH should be incorporated into the Sloane's froglet habitat management plan:

- ▶ Monitoring Sloane's froglet occupancy

OEH will be responsible for monitoring the colonisation of the wetlands by Sloane's froglet. This monitoring will commence immediately (first winter) following wetland construction.

- ▶ Sedimentation monitoring in the Sloane's froglet habitat cells

To assess whether the sedimentation management has effectively protected the habitat cells from excessive sediment deposits, OEH will monitor changes in the depth of the habitat cells over the duration of construction (prior to handing wetland basins over to ACC).

Measurements for each cell will be taken using a laser level from 12 evenly spaced points in summer when the cells are dry, with the water level being determined at the outlet.

Measurements will only be taken from sections of the cells initially set at 300 mm depth. If the average depth of the cell is less than 200 mm, the developer will be required to dig out and replant the habitat cells to the initially prescribed 300 mm prior to handover.

- ▶ Aquatic vegetation monitoring within the Sloane's froglet habitat cells

*OEH will assess the survivorship of aquatic plants in the habitat cells. This assessment will only be undertaken for emergent aquatic plants in the 300 mm depth zones (i.e., *Eleocharis acuta*). For each habitat cell, survivorship will be assessed in 12 evenly spaced quadrats (each quadrat will be 4- × 4-m) throughout the habitat cells. If average survivorship is less than 60%, the proponent will be required to undertake additional planting to achieve an overall coverage/survivorship of 60% in that cell.*

APPENDIX F – MUSIC SUPPORTING INFORMATION

Table 1: Guide for fraction impervious based on land type

Zone	Brief Description	Normal Range	Typical Value
Residential	Large Residential Allotment size 601-1000m ²	0.50-0.80	0.60
	Standard Density Allotment size 300-600m ²	0.70-0.80	0.75
	High Density Allotment size <300m ²	0.80-0.95	0.85
Mixed Use	Mix of residential, commercial, industrial and hospitals	0.60-0.90	0.75
Industrial	Typical industrial areas with large warehouses and large paved areas	0.70-0.90	0.90
	Garden Supplies/Nurseries	0.30-0.60	0.50
	Quarries	0.10-0.30	0.20
Commercial	Offices, manufacturing and broader commercial areas	0.70-0.95	0.90
Rural	Rural Areas	0.05-0.20	0.10
	Rural Living	0.10-0.30	0.20
Public Land	Education	0.60-0.80	0.70
	Powerlines, pipe tracks and drainage reserves	0.00-0.10	0.05
	Hospitals	0.80-0.90	0.85
	Railways	0.60-0.80	0.70
	Cemeteries	0.50-0.70	0.60
	Libraries, sports complexes and Depots	0.50-0.90	0.70
	Major Roads and Freeways	0.60-0.90	0.70
	Secondary and Local Roads	0.50-0.80	0.60

APPENDIX G - PLANT LIST

Potential plant species for each wetland zone are listed below. Where practical, all planted trees and shrubs should be species that are listed in the South West Slopes Revegetation Guide. Additional species may be proposed by the proponent, but should be discussed with ACC and OEH prior to planting.

Emergent vegetation zone:

- ▶ *Eleocharis acuta* (common spike rush); six to eight tubes per m² (this species is strongly recommended for planting)
- ▶ *Potamogeton ochreatus* (blunt pondweed); two per m²
- ▶ *Myriophyllum papillosum* (common water-milfoil); four to six tubes per m²

In the emergent vegetation zone, *Eleocharis acuta* should be planted in the area that will be 300 mm deep. *Potamogeton ochreatus* and *Myriophyllum papillosum* should be planted in the 450-mm deep zone.

Approximately 60% of the wetland should be 300 mm deep. The other 40% should be approximately 450 mm deep.

Fringing vegetation zone:

- ▶ *Poa labillardieri* (snow grass); four tubes per m²
- ▶ *Carex appressa* (tall sedge); four tubes per m²
- ▶ *Juncus usitatus* (common rush); one to two for every 1m²
- ▶ *Cynodon dactylon* (common couch); three tubes per m²
- ▶ *Paspalum distichum* (water couch); two to three per m²

Barrier shrubs zone:

Medium Shrubs – greater than 1m high (but not shading the breeding habitat)

- ▶ Fan Grevillea – *Grevillea ramosissima* subsp. *ramosissima*
- ▶ Urn Heath – *Melichrus urceolatus*

Small Shrubs – less than 1m high

- ▶ Heathy Bush-pea – *Pultenaea procumbens*
- ▶ Crimson Grevillea – *Grevillea polybractea*

Deciduous trees should not be planted within 20 m of the top water level of a wetland to avoid excessive leaf litter dropping into wetlands during winter (when Sloane's froglet is breeding). The wetland zones are defined in Appendix A.

APPENDIX H - SIGNAGE ASSESSMENT CHECKLIST

Signage as Remote Supervision Signage Assessment



1. OPEN SPACE IDENTIFICATION DETAILS			
Location Name:			
Park ID Number:		Property Number:	
2. INSPECTING COUNCIL OFFICER			
Name:		Date:	
Position:			
Signature:			
3. FACILITY VISITATION RATE (FVR)			
A. DEVELOPMENT RATING NATURAL	1 = No hazardous features 2 = Sloping ground, no natural water, walking track around reserve 3 = Reserve contains natural waterway that runs during wet weather, drops less than 1m 4 = Creeks, ponds and ledges between 1m and 3m 5 = Contains rivers, dams and cliffs greater than 3m		RATING:
A. DEVELOPMENT RATING INFRASTRUCTURE	1 = Virginal bush, cleared land, no infrastructure 2 = Cleared land, static infrastructure, eg grass area with tables and chairs, toilet block, lookout 3 = Cleared land with mobile infrastructure eg grassed area with play equipment, cycleway, market, leash free dog areas 4 = Council owned infrastructure with no artificial lighting eg golf course, football field, recreational ground, caravan park 5 = Extensively developed infrastructure with artificial lighting eg sporting complex, artificially lit courts		RATING:
B. POPULATION USING RESERVE	1 = Less than 5 people at a time 2 = 5 to 50 people at a time 3 = 50 to 100 people at a time 4 = 100 to 500 people at a time 5 = More than 500 people at a time		RATING:
C. FREQUENCY OF USE	1 = Annual Use 2 = Monthly use 3 = Weekly use 4 = Daily use 5 = Continuous use during day		RATING:
FACILITY VISITATION RATE		A (Highest) x B + C = RATING:	
4. HAZARD IDENTIFICATION AND RATING			
	Hazard	Risk Rating (VH/H/M/L)	
1.			7.
2.			8.
3.			9.
4.			10.
5.			11.
6.			12.

Signage as Remote Supervision Signage Assessment



5. SIGNAGE REQUIREMENTS		
☐	FVR = 2 to 3	Sign Details: No sign is required. Sign Location: No sign is required.
☐	FVR = 4 to 6	Sign Details: Name of facility. General warning message. All Council regulations as prohibition pictograms. Any information symbols relevant to facility. Does not require warning symbols. Sign Location: A prominent position within the reserve.
☐	FVR = 7 to 10	Sign Details: Name of facility. General warning message. All Council regulations as prohibition pictograms. Any information symbols relevant to facility. All Very High or High risk hazards as warning symbols or if none, the top hazard. Sign Location: All entrances to the facility.
☐	FVR = 11 to 15	Sign Details: Name of facility. General warning message. All Council regulations as prohibition pictograms. Any information symbols relevant to facility. All Very High or High risk hazards as warning symbols or if none, the top two hazards. Sign Location: All entrances to the facility.
☐	FVR = 16 to 20	Sign Details: Name of facility. General warning message. All Council regulations as prohibition pictograms. Any information symbols relevant to facility. All Very High or High risk hazards as warning symbols or if none, the top three hazards. Sign Location: All entrances to the facility. Consider placing in high use areas.
☐	FVR = 21 to 26	Sign Details: Name of facility. General warning message. All Council regulations as prohibition pictograms. Any information symbols relevant to facility. All Very High or High risk hazards as warning symbols or if none, the top four hazards. Sign Location: All entrances to the facility. Consider placing in high use areas.
☐	FVR = 27 to 30	Refer to Document: Signage as Remote Supervision - High Facility Visitation Rate Form DOC16/184500.

6. SIGNAGE SPECIFICATIONS			
Location Name:			
General Warning Message:	Warning: Use of this area may be hazardous. Please take reasonable care for your safety.		
Council Prohibitions:	1.	2.	3.
	4.	5.	6.
Information Symbols:	1. ☐ Keep children under active supervision at all times ☐ (Additional) in or around water.	2.	3.
Hazard Warning Symbols:	1.	2.	3.
	4.	5.	6.

APPENDIX I – PREI-INSPECTION CHECKLIST

A range of guidelines, checklists and case studies are available on the Melbourne Water Website. The checklists below are updates to the Melbourne Water (2005) *WSUD Engineering Procedures: Stormwater Manual* and are available for download in MS Word format from the Melbourne Water website:

www.melbournewater.com.au/planning-and-building/stormwater-management/case-studies-and-checklists

Constructed wetland handover checklist

This list has been developed by Melbourne Water for use as a guide by Councils in assessing constructed wetland projects at handover.

Location	
Inspected by	
Asset ID	
Date and time	
Asset designed by	
Asset constructed by	
Defects and liability period	

Item Inspected	Satisfactory (Y/N/NA)	Comments
Treatment		
1. System appears to be working as designed visually?		
2. No obvious signs of under-performance?		
Maintenance		
3. Operation and Maintenance plans provided for each asset?		
4. Inspection and maintenance undertaken as per maintenance plan?		
5. Inspection and maintenance checklist completed and provided including up to date inspection with no outstanding issues?		
6. Asset inspected for defects?		
Asset Information		
7. Design Assessment Checklist provided?		
8. As constructed plans provided?		
9. Copies of all required permits (both construction and operational) submitted?		
10. Proprietary information provided (if applicable)?		
11. Digital files (including drawings, survey, models) provided?		
12. Asset listed on asset register or database?		

Constructed wetland maintenance checklist

This list has been developed by Melbourne Water for use as a guide by Councils in maintaining constructed wetlands.

Location	
Inspected by	
Asset ID	
Date and time	

Item Inspected	Satisfactory (Y/N/NA)	Details of Action Required
Litter accumulation within Gross Pollutant Trap (cleanout required)?		
Sediment accumulation at inflow points?		
Sediment accumulation within inlet zone (record depth, remove if > 2/3 full)?		
Litter or debris within inlet structure?		
Litter within inlet or aquatic plant (macrophyte) zone?		
Overflow structure integrity satisfactory?		
Outlet structure free of debris?		
Maintenance drain operational?		
Settling or erosion of bunds or batters present?		
Terrestrial vegetation condition satisfactory? (density, weeds, disease, pest infection, stunted growth or dead plants)		
Aquatic vegetation condition satisfactory? (density, weeds, disease, pest infection, stunted growth or dead plants)		
Replanting required?		
Evidence of damage or vandalism?		
Evidence of dumping (building waste, oils etc.)		
Evidence of algal scums?		
Evidence of odours?		

Sediment pond handover checklist

This list has been developed by Melbourne Water for use as a guide by Councils in assessing sediment pond construction handover projects.

Location	
Inspected by	
Asset ID	
Date and time	
Asset designed by:	
Asset constructed by	
Defects and liability period	

Item Inspected	Satisfactory (Y/N/NA)	Comments
Treatment		
1. System appears to be working as designed visually?		
2. No obvious signs of under-performance?		
Maintenance		
3. Operation and Maintenance plans provided for each asset?		
4. Inspection and maintenance undertaken as per maintenance plan?		
5. Inspection and maintenance checklist completed and provided including up to date inspection with no outstanding issues?		
6. Asset inspected for defects?		
Asset Information		
7. Design Assessment Checklist provided?		
8. As constructed plans provided?		
9. Copies of all required permits (both construction and operational) submitted?		
10. Proprietary information provided (if applicable)?		
11. Digital files (including drawings, survey, models) provided?		
12. Asset listed on asset register or database?		

Sediment pond maintenance checklist

This list has been developed by Melbourne Water for use as a guide by Councils in maintaining sediment ponds.

Location	
Inspected by	
Asset ID	
Date and time	

Item Inspected	Satisfactory (Y/N/NA)	Details of Action Required
Civil Components		
Safety fences, batters and other public safety features intact?		
Inlet erosion, damage or standing water?		
Sediment blocking inlet pipe?		
Outlet freely draining?		
Blocking of outlet pipe?		
Sediment level is more than 0.5 m below normal water level?		
Overflow structure integrity satisfactory?		
No isolated pools with presence of mosquito larvae?		
Maintenance drain operational?		
Landscape Components		
Terrestrial vegetation condition satisfactory and of adequate density?		
Less than 10% of the basin surface area and batters covered in weeds?		
Evidence of damage or vandalism?		
Evidence of algal scums?		
Evidence of odours?		

APPENDIX J - GLOSSARY

Breeding habitat

The environment where a species lives and can complete its life cycle.

Breeding habitat for Sloane's froglet (*Crinia sloanei*) has the following characteristics: permanent or ephemeral waterbodies; wet from mid-late autumn and for at least three months after the winter breeding period (at least until the end of October); dry during summer; emergent vegetation with a stem diameter of less than 5 mm; banks with a gentle slope from 1 – 4%; still water (apart from immediately after rainfall events) with a water depth ranging from 10 to 310 mm. Large robust colonies are typically found in wetlands greater than 3000 m² in area.

Catchment

A topographically defined area, drained by a stream such that all outflow is directed to a single point (WSUD Engineering Procedures Manual 2005).

Connectivity / Habitat corridor

A wildlife corridor, habitat corridor, or green corridor is an area of habitat connecting wildlife populations and people. In these corridors, passive transport means are encouraged to minimise potential impacts on the local environment

Construction Certificate (CC) for subdivision works

A CC is required as part of the development process if a subdivision requires civil construction works (e.g. roads, footpaths, drainage works). The CC is issued by Council and verifies that the detailed design of the works complies with the development consent. Work cannot commence until a CC has been issued.

Development Application (DA)

The *Environmental Planning Assessment Act 1979* requires consent to be granted for various forms of development. In many circumstances that consent is via the submission and assessment of a DA. Planning for the DA includes the preparation of supporting documentation known as a Statement of Environmental Effects (SEE) and lodgement with the Consent Authority (Albury City Council).

Drainage Strategy

A strategy (not yet in existence) that Albury City may seek to develop to further inform stormwater management in the Thurgoona-Wirlinga area.

Defects period

A defects liability period is a set period after a construction project has been completed during which a contractor has the right to return to the site to remedy defects.

Detention time

The time it takes for a 'parcel' of water to flow from the inlet of a wetland system to the outlet. Detention time is never a constant (see also Notional detention time) (WSUD Engineering Procedures Manual, 2005).

Ecological Community

Ecological communities are unique and naturally occurring groups of plants and animals. Their presence can be determined by factors such as soil type, position in the landscape, climate and water availability

Extended detention

Volume above wetland normal water level and the overflow weir height in a treatment element (e.g. wetland, sedimentation basin).

Fraction Impervious

A proportion that defines the percentage of area that does not permit permeability into natural soils.

Gilgai

Gilgai refer to surface micro-relief formed by the shrinking and swelling of clays during alternate drying and wetting cycles. The surface eventually becomes covered by a repeated pattern of small mounds and depressions that give the soil surface a 'pock-marked' appearance. Gilgai depressions are sometimes also called crabholes or melonholes.

Gilgai wetlands

Ephemeral wetlands that occur in gilgai soil formations. Wetlands in the Albury region called 'gilgai wetlands' may correspond to '*Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains*', listed as a critically endangered ecological community (CEEC) on the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (see Threatened Species).

The Seasonal Herbaceous Wetlands CEEC is characterised by a particular hydrology, geographical position and vegetation structure. These are isolated, freshwater wetlands that are usually inundated on a seasonal basis through rainfall, then dry out, so surface water is not permanently present. They occur on the lowland plains of temperate south-eastern Australia and have a vegetation structure that is open, i.e. woody cover is absent to sparse, and the ground layer is dominated by herbs (grasses, sedges and forbs) adapted to seasonally wet or waterlogged conditions. When standing water is present, wetland plants are clearly evident, however during drought or seasonal dry periods plants may not be visible above ground. In some cases (including around Albury), the terrain is characterised by gilgais with wetlands forming in the gilgai depressions. More information:

www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=97&status=Critically+Endangered

Gross Pollutant Trap (GPT)

A structure used to trap large pieces of debris (> 5 mm) transported through the stormwater system (WSUD Engineering Procedures Manual, 2005).

HECRAS

HEC-RAS is a computer program that models the hydraulics of water flow through natural rivers and other channels. The Hydrologic Engineering Center (HEC) in Davis, California developed the River Analysis System (RAS) to aid hydraulic engineers in channel flow analysis and floodplain determination

Life cycle

Relating to constructed wetland – the various steps of a constructed wetlands design development, construction, operation and maintenance.

Local population

A community (group) of animals, plants, or humans (in this case a population of Sloane's froglet) among whose members interbreeding occurs, which occurs near the point of interest. I.e., the Sloane's population in the Sloane's Local Area Management Plan area is a "local population". A population may consist of several smaller "meta-populations" that contribute to the size and viability of the overall populations.

Maintenance Period

The period usually commences upon practical completion of the works and runs for a specified time frame. Maintenance starts on date of issue of the Subdivision Certificate.

Melbourne Water's Constructed Wetlands Design Manual

Melbourne Water's Constructed Wetlands Design Manual is one of the most comprehensive design manuals currently available within industry. The content of this guideline is applicable to all cities and towns in South East Australia. Updated material is available from the Melbourne Water website www.melbournewater.com.au/planning-and-building/developer-guides-and-resources/standards-and-specifications/constructed-0.

MUSIC

A program designed to help urban stormwater professionals visualise possible strategies to tackle urban stormwater hydrology and pollution impacts. As an aid to decision-making, MUSIC – Model for Urban Stormwater Improvement Conceptualisation – predicts the performance of stormwater quality management systems.

OEH - NSW Office of Environment and Heritage

State government department with legislative responsibilities for the *National Parks and Wildlife Act 1974*, *Biodiversity Conservation Act 2016* and parts of the *Environmental Planning and Assessment Act 1979*. For biodiversity and Aboriginal cultural heritage planning matters in south-western NSW, OEH can be contacted at rog.southwest@environment.nsw.gov.au.

Pre-Development Application (or pre-lodgement)

Early planning, site visit and meetings with OEH and ACC in the period before lodging the DA. Allows OEH and ACC staff to see the proposal on the ground and provide site-specific advice about implementing the Guidelines.

RORB

RORB is a general runoff and streamflow routing program used to calculate flood hydrographs from rainfall and other channel inputs. It subtracts losses from rainfall to produce rainfall-excess and routes this through catchment storage to produce the hydrograph.

Sloane's Froglet Interim Habitat Guide and Management Recommendations

A document prepared by Dr Alexandra Knight, with support from the NSW Office of Environment and Heritage (OEH). Details existing knowledge of Sloane's Froglet habitat requirements. Information in the guide is drawn almost entirely on work done as part of Alex's Ph.D. research. http://www.alburyconservationco.org.au/wp-content/uploads/2015/02/Sloanes-Froglet_Office-of-Enviroment-Herritage-A5-Booklet-A4_reduced-size.pdf

Sedimentation Basin

Sediment basins are used to retain coarse sediments from runoff and are typically the first element in a treatment train. They are important in protecting downstream elements from becoming overloaded or smothered with sediments. They operate by reducing flow velocities and encouraging sediments to settle out of the water column.

They are frequently used for trapping sediment in runoff from construction sites and as pre-treatments for elements such as wetlands (e.g. an inlet pond). They can be designed to drain during periods without rainfall and then fill during runoff events or to have a permanent pool. Sediment basins can have various configurations including hard edges and base (e.g. concrete) or a more natural form with edge vegetation creating an attractive urban landscape element. They are, however, typically turbid and maintenance usually requires significant disturbance of the system (WSUD Engineering Procedures Manual, 2005)

Sloane's Froglet Local Area Management Plan (LAMP)

A strategic plan (in preparation) that details what work should happen where in the Thurgoona-Wirringa area to support the long-term viability of the local Sloane's Froglet population. Primarily map-based, the document will focus on a range of potential management actions, including where new wetlands could be created, where existing wetland or land management could be improved, and where critical connections need to be created or maintained to support movement of Sloane's Froglet across the landscape. The LAMP is currently being prepared by OEH and will be finalised in consultation with Albury City and other major stakeholders. The LAMP will take the form of an overarching Thurgoona-Wirringa strategic map, and also individual, "zoomed-in" maps for specific interested stakeholders (e.g., Albury Environmental Lands; Charles Sturt University; Albury Equestrian Centre).

Sloane's Froglet Habitat Management Plan

A document prepared during the detailed design stage for each development where the Sloane's Froglet Stormwater Management Guidelines are applied. This plan aims to ensure that stormwater wetlands conform to the Sloane's froglet (*Crinia sloanei*) breeding habitat and stormwater management requirements as detailed in the Guidelines. It specifies how Sloane's froglet breeding habitat will be managed and maintained to contribute to the long-term viability of the Thurgoona Wirringa Sloane's froglet population.

Small-stem diameter vegetation

Emergent wetland plants with a stem diameter of less than 5 mm, such as common spike rush (*Eleocharis acuta*). These types of plants are a common feature of good quality Sloane's froglet wetlands.

South West Slopes Revegetation Guide

Guide to identifying trees, shrubs and groundcover species that should be used in revegetation works in the NSW South West Slopes bioregion (Stelling 1998). The guide identified the species best suited to particular areas based on catchment (and sub-catchment) and landscape features of the site (valley, slope, hill top). The full guide can be downloaded from www.biodiversitygateway.com.au/SWSR_Guide/home.html

Stormwater Wetland Design Guidelines

This document. Guidelines currently being prepared by Spiire, in consultation with OEH and Albury City Council. These guidelines will provide developers with clear advice on processes, obligations, and technical requirements relating to the development of stormwater wetlands that will support the long-term viability of Sloane's Froglet in the Thurgoona-Wirlinga area.

Subdivision Certificate (SC)

A SC certifies that all engineering and landscape works (including works as executed plans) are completed and all other conditions of the development consent are satisfied. It is issued after completion of works inspections show that all works comply with DA conditions and have been completed in accordance with the construction certificate, and works as executed plans have been endorsed by Council. The SC authorises the lodgement of the plan of subdivision (or 'linen plan') with NSW Land & Property Information (LPI). It is required before LPI will register the new lot and deposited plan (DP) number and subsequently issue the new title. It is only after the issue of the new lot and DP number (title) that the new allotment or property legally exists and the land can be transferred to another party. Issue of the SC is sometimes referred to as linen plan release.

Temporary Sedimentation Basin

A temporary sediment basin is a temporary pond built on a construction site to capture eroded or disturbed soil that is washed off during rain storms, and protect the water quality of a nearby stream, river, lake, or bay. The sediment-laden soil settles in the pond before the runoff is discharged. A temporary sediment basin is considered applicable for the Sloane's Froglet Wetland system to ensure it protects the ultimate breeding habitat area of the froglet from large sediment loading.

Threatened Species

Plants and animals whose survival is threatened because of changes in the landscape and native habitat as a result of human activity. Species, populations and ecological communities are considered threatened (at risk of extinction) if there has been a reduction in population size, they have restricted geographical distribution or there are few mature individuals.

NSW legislation applying to threatened entities and threatened species programs is the *Biodiversity Conservation Act 2016*. It is administered by OEH and supersedes the *Threatened Species Conservation Act 1995* (TSC Act). More information about threatened species in NSW is on the OEH website www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species.

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is Commonwealth legislation to manage nationally and internationally threatened flora, fauna, ecological communities and heritage places — defined in the EPBC Act as matters of national environmental significance. More information is on the EPBC Act website www.environment.gov.au/epbc.

Threatened species records

Point locations where threatened species have been recorded are stored in BioNet (also known as the Atlas of NSW Wildlife). BioNet records include species sightings and the results of systematic flora and fauna survey and is accessed via the OEH website

www.environment.nsw.gov.au/wildlifeatlas/about.htm.

Thurgoona Wirlinga Precinct Structure Plan

The Thurgoona Wirlinga Precinct Structure Plan is a strategic planning document whose role is to deliver a framework for the future development of the Thurgoona Wirlinga area. It seeks to create an urban development structure/pattern that will facilitate the orderly development of land in the short, medium and long term and deliver practical outcomes in response to housing yields and density, employment areas land provision and location, activity centres land provision and location, community facilities land provision and location, transport and movement networks, open space and recreation facilities, natural systems, utilities and land use conflicts.

Viable population

A population of a species that has a high likelihood of still being present in 100 years.

Works as executed (WAE) Plans

Required for the Subdivision Certificate (SC). Following the completion of engineering works in a subdivision or development, "Works as Executed" plans are to be prepared by a registered surveyor professional engineer and forwarded to Council prior to the release of the final plan of subdivision.

Water regime

Frequency (how often), duration (how long) and timing or season of water inundation

Wetland

An area transitional between land and water systems, which is either permanently or periodically inundated with shallow water.

WSUD

Water-sensitive urban design (WSUD) is a land planning and engineering design approach which integrates the urban water cycle, including stormwater, groundwater and wastewater management and water supply, into urban design to minimise environmental degradation and improve aesthetic and recreational appeal.

WSUD Engineering Procedures Manual (Melbourne Water 2005)

Manual produced by Melbourne Water that features design and construction engineering practices to underpin strategic planning and concept designs for management of urban stormwater. It provides design and maintenance procedures, typical drawings, design checklists, landscape requirements, worked examples and case studies. Updates to sections of the manual are available on the Melbourne Water website:

www.melbournewater.com.au/planning-and-building/stormwater-management.