



# **LANDSCAPE DESIGN GUIDELINES**

**March 2015**

## EXECUTIVE SUMMARY

This guideline provides advice and guidance on how to ensure the adequate level of landscaping detail is prepared and presented for all forms of development in accordance with Council's current Development Control Plan (DCP). The Guideline provides information on:

- Landscape Documentation and Plans:
  - Landscape Site Analysis
  - Landscape Concept Plans
  - Landscape Master Plans
  - Landscape Design Reports
  - Landscape Construction Plan and Specifications
  - Landscape Compliance, Rectification and Maintenance Reports
- Landscape Design considerations for:
  - Public Reserves
  - Road Reserves
  - Car Parks
  - Stormwater Quality Improvement Devices
  - Lake Foreshore
  - Planting Design
  - Bushland Protection
- Landscape Units of Lake Macquarie
- Preferred species selections for street trees
- Native species lists for foreshore areas
- Species to protect against fire
- Native species lists for use in SQIDs
- Typical Landscape Specifications

**For landscape elements proposed on public land owned or managed by Council, undertake design and detailing in accordance with Council's Landscape Standard Drawings.**

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## 1 INTRODUCTION – THE LAKE MACQUARIE VISION

Lake Macquarie is one of Australia's largest coastal lakes or estuaries and is the predominant feature in the landscape of the Lake Macquarie area. The ecological, visual and recreational characteristics of the lake are extremely important to the Lake Macquarie community.

Lake Macquarie City Council (LMCC) is committed to preserving and improving the lifestyle opportunities offered in the Lake Macquarie area. Council is aiming to enhance urban development by preserving the quality of the natural environment, emphasising Lake Macquarie's bushland qualities and maintaining a quality lifestyle for the Lake Macquarie community.

With increasing population and expansion of the built environment, the very qualities that attract people to the lake could disappear as the quality of the environment is eroded. This decline can be avoided if the environment is treated as a highly valuable resource and given due consideration through quality landscape planning, design and construction. Landscape design is an important part of the planning process and should be addressed at the initial stages and demonstrate an integrated approach to all planning issues for the development.

These guidelines are a tool to achieve these aims and has been developed to assist applicants with the preparation of landscape plans for submission with development applications (DA). It outlines landscape standards required as part of the development process and clarifies the responsibilities of developers and landscape consultants in providing landscape documentation.

For the purpose of these guidelines, **landscape** refers to all areas outside the building. It encompasses all disturbed and undisturbed areas on the site. Landscape analysis and planning is an important part of the site planning process.

These landscape standards apply to all land in the Lake Macquarie City Council area on which development is permitted. These standards advise developers and consultants of the minimum requirements for granting consent in the Development Application (DA) process and work in conjunction with Council's DCP.

### 1.1 LANDSCAPE OBJECTIVES

Design in the landscape is about achieving a physically and visually acceptable alliance between human habitation and the environment. The consideration of these aspects is extremely important to the overall success of a proposal, its long term establishment and maturation in the landscape.

## 2 LANDSCAPE DOCUMENTATION

The category of the development will determine what level of Landscape Plans are required to be included in a development application. Landscape categories are determined in accordance with the nature and scale of the development proposal. Each category of development requires a level of landscape documentation by a landscape consultant with qualifications and experience appropriate to the scale and significance of the proposed development. The requirements for the differing categories are outlined in the controls within Council's DCP.

Landscape consultants will need to work closely with other sub-consultants such as surveyors, engineers, and architects and need to be fully briefed on relevant documentation such as survey, civil and services drawings.

For more complex or significant developments including proposals for which Council will have management of in the future (parks, streetscape) it is highly recommended that pre-DA consultation is undertaken with Council officers. Site analysis and concept plans should be produced for this purpose.

### 2.1 LANDSCAPE SITE ANALYSIS

Preparation of a Landscape Site Analysis is critical in providing a foundation for the thorough investigation of landscape opportunities and constraints for both the site and its context. The Landscape Site Analysis should be based on the initial Site Analysis prepared at the beginning of the development process with additional information as required.

For further details see Council's [Site Analysis Guidelines](#).

For Category 2 or 3 development the following items must be included in the Landscape Site Analysis:

<b>Checklist for Landscape Site Analysis Plan</b>	<b>Y</b>	<b>N</b>	<b>N/A</b>
<ul style="list-style-type: none"> <li>• Drawings at a scale that is appropriate for all detail to be clear and legible.</li> <li>• Details of surrounding land use</li> <li>• Existing open space adjoining or opposite the site,</li> <li>• Existing and proposed underground and above ground utilities including on-site wastewater system areas</li> <li>• Existing street services and proposed utilities including hydrant and substation locations.</li> <li>• Any natural drainage lines located within the site</li> <li>• The movement pattern of the sun in Summer and Winter and the prevailing seasonal wind conditions,</li> <li>• Vehicle access and roads adjacent to and near the site,</li> <li>• Pedestrian or cycling pathways adjacent to and near to the site,</li> <li>• All trees and vegetation on the site and on adjoining lots, and within the street, including actual canopy width, and heights of trees, and species particularly for local indigenous vegetation.</li> <li>• Any trees listed on the Significant Tree Register.</li> <li>• A preliminary arborist assessment of tree value (size, health, species) and recommendation for removal or retention</li> <li>• Tree protection zones for trees to be retained.</li> <li>• Existing cleared areas,</li> <li>• Mine Subsidence areas,</li> <li>• Proposed areas for construction purposes eg, temporary site access and</li> </ul>			

<b>Checklist for Landscape Site Analysis Plan</b>	<b>Y</b>	<b>N</b>	<b>N/A</b>
driveways, stockpile areas, site compounds, tree protection zones or any areas for control during construction and rehabilitation. <ul style="list-style-type: none"> <li>Identify areas with poor natural surveillance or potential entrapment issues to be addressed through the Crime Prevention Through Environmental Design assessment.</li> <li>Existing and proposed road layouts,</li> </ul>			

## 2.2 LANDSCAPE CONCEPT PLAN

For more complex or significant developments including proposals for which Council may manage in the future (e.g. parks, streetscape) it is recommended that concept plans are used for pre-DA consultation with Council Officers.

Landscape Concept Plans should be provided in the form of a drawing or series of drawings. These drawings document the preliminary site planning alternatives and landscape design concept for the site. The Concept Plans should reflect opportunities and constraints identified in the Site Analysis. The Concept Plan should clearly express the design intent and ideas. These drawings form the basis for the preparation of a comprehensive Landscape Master Plan. The checklist below indicates the issues to be addressed in a Landscape Concept Plan.

<b>Checklist for Landscape Concept Plan</b>	<b>Y</b>	<b>N</b>	<b>N/A</b>
<ul style="list-style-type: none"> <li>All items contained in Checklist for Landscape Site Analysis Plan should be included.</li> <li>The scale should be appropriate to the size of the site and complexity of the proposed design,</li> <li>Proposed road layouts, bus stops, slip lanes, taxi areas and street parking that may impact on landscape proposals,</li> <li>Car parking areas, parking space numbers and parking for people with disabilities,</li> <li>Surrounding land uses as well as existing and proposed utilities,</li> <li>Proposed and existing lot boundaries,</li> <li>Vegetation to be removed and retained including notable trees on adjoining properties as well as areas of ecological value and/or ecological corridors,</li> <li>Tree protection zones</li> <li>Broad planting theme,</li> <li>Broad distribution of paving and soft landscaping treatments,</li> <li>Indication of site grading, site retaining and opportunities with preliminary cross sections where relevant to demonstrate proposals balance cut and fill,</li> <li>Indicative location of proposed recreation facilities and/or infrastructure,</li> <li>Drainage and open space corridors and links to open spaces,</li> <li>Existing and proposed structures and important openings (windows, doors)</li> <li>Bushfire hazard zones and fire trails if relevant,</li> <li>Pedestrian and cyclist linkages,</li> <li>Signage theme and location,</li> </ul>			

<b>Checklist for Landscape Concept Plan</b>	<b>Y</b>	<b>N</b>	<b>N/A</b>
<ul style="list-style-type: none"> <li>• Lighting,</li> <li>• Awnings and overhead structures affecting proposals.</li> <li>• Locations of key services such as waste collection areas, hydrants and substations.</li> <li>• Landscape consultant's declaration.</li> </ul>			

## 2.3 LANDSCAPE MASTER PLAN

The Landscape Master Plan describes the ultimate proposal for the site including all stages of development.

The landscape proposal should demonstrate appropriate responses to issues identified in the Site Analysis and Landscape Design Report.

<b>Checklist for Landscape Master Plan</b>	<b>Y</b>	<b>N</b>	<b>N/A</b>
<ul style="list-style-type: none"> <li>• All items contained in Checklist for Landscape Site Analysis Plan and Checklist for Landscape Concept Plan should be included.</li> <li>• The scale should be appropriate to the size of the site and complexity of the proposed design</li> <li>• Existing site information (boundaries, contours, underground/overhead services, easements, drainage lines) as outlined in the Site Analysis Plan Checklist,</li> <li>• Existing and proposed structures including those that overshadow the site,</li> <li>• Trees covered by Tree Preservation and Management, Significant Trees, trees to be retained and trees proposed to be removed due to the development including those identified in the Arborist report.,</li> <li>• The outline of any major tree or building on adjoining property which the proposed development may affect in any way,</li> <li>• Proposed location of buildings/structures including finished floor levels,</li> <li>• Roadways, car parks, footpaths, driveways with description of materials and finishes,</li> <li>• Proposed tree planting and soft landscaping and their proposed treatment (planting arrangement, planting schedule (including botanical names), quantities, pot size, staking and planting details),</li> <li>• Sub-surface and surface drainage,</li> <li>• Fences and screens (materials and heights),</li> <li>• Location of site furniture, fixtures and lighting,</li> <li>• Indicative cross-sections of important features or areas of the site (entrances, watercourses, retaining walls),</li> <li>• Site protection works,</li> <li>• Fire mitigation works where necessary,</li> <li>• Entrance/s to subdivision or development,</li> <li>• Proposed water quality control devices,</li> <li>• The proposed location of all infrastructure servicing the site,</li> <li>• The proposed location of all free-standing signage structures,</li> <li>• Landscape consultant's declaration.</li> </ul>			



## 2.4 LANDSCAPE DESIGN REPORT

The Landscape Design Report supports the Master Plan and outlines the overall landscape design objectives proposed for the site. It should briefly address how the proposal responds to issues identified in the site and functional analysis for the proposed development, how it relates to the surrounding urban and landscape setting and how the proposed development meets the objectives and controls of Council's DCP.

<b>Checklist for Landscape Design Report</b>	<b>Y</b>	<b>N</b>
<ul style="list-style-type: none"> <li>• Project name and location, applicant's name and address, consultants name &amp; contact details,</li> <li>• Proposed site use and key functional issues for the landscape design proposal,</li> <li>• Social and cultural issues,</li> <li>• Key issues identified in the site analysis,</li> <li>• Summary of the surrounding setting,</li> <li>• Summary of relevant issues identified in other reports and documentation, such as the aborist's report, scenic analysis, stormwater</li> <li>• How the landscape proposal responds to key issues,</li> <li>• How the landscape proposal meets the objectives and controls in Council's DCP,</li> <li>• Other options considered advantages &amp; disadvantages.</li> <li>• Landscape consultant's declaration.</li> </ul>		

## 2.5 LANDSCAPE CONSTRUCTION PLAN AND SPECIFICATIONS

These documents need to be read in conjunction with the Landscape Master Plan and should include final detailed and documented landscape plans and specifications to enable construction. This documentation should cover the matters detailed in the following checklist.

Note: for landscape planting works associated with Stormwater Quality improvement Devices, refer also to **LMCC SQID Design Guidelines** for detailed checklists covering the design, installation, maintenance and asset handover of SQIDs.

<b>Checklist for Landscape Construction Plan and Specifications</b>	<b>Y</b>	<b>N</b>	<b>N/A</b>
<ul style="list-style-type: none"> <li>• Proposed design levels and original ground levels/contours,</li> <li>• Design details and materials of all surfaces, retaining walls, edging, embankments, furniture, planting, lighting and other structures,</li> <li>• Typical cross sections through the site,</li> <li>• Details of tree/bushland protection and erosion control measures,</li> <li>• Construction details for planting, paving and concrete jointing, edging and retaining walls,</li> <li>• Hose-cocks and irrigation systems,</li> <li>• Specification notes either on the drawings or in an associated report that adequately outline the quality of construction materials and contractual arrangements.</li> <li>• Specification notes for maintenance works required during the planting establishment period.</li> <li>• Specification notes outlining requirements for submissions, approvals and hold points for quality control, e.g. tree stock, soil testing and amelioration methods, maintenance log.</li> </ul>			

Checklist for Landscape Construction Plan and Specifications	Y	N	N/A
<ul style="list-style-type: none"> <li>For trees to be installed in the public domain, ensure specifications reflect Councils standard specification LSD-SPEC-01 Typical Tree Planting, including Dispatch Tree Stock Inspection Checklists in accordance with AS2303-2015 Appendix C- Example A.</li> <li>Consultant's declaration.</li> </ul>			

## 2.6 LANDSCAPE COMPLIANCE REPORT

At practical completion and prior to issue of the occupation certificate, the landscape consultant may be required to inspect the site and submit a report to council providing written certification that the landscape works comply with the Landscape documentation approved by Council.

The certification is to outline any minor defects which must be rectified and any specific landscape maintenance requirements during the maintenance period.

Note: for landscape planting works associated with Stormwater Quality improvement Devices, refer also to **LMCC SQID Design Guidelines** for detailed checklists covering the design, installation, maintenance and asset handover of SQIDs.

Checklist for Landscape Compliance Report	Y	N	Action Required
<ul style="list-style-type: none"> <li>Provide dates of inspections</li> <li>Have the works been installed in accordance with the design documentation?</li> <li>Have all the required submissions, written approvals, certificates of compliance and warranties been provided as specified?</li> <li>For trees installed in the public domain- have Dispatch Tree Inspection checklists in accordance with AS2303-2015 Appendix C- Example A been provided?</li> <li>Have copies of the above been included with this report?</li> <li>Has a maintenance plan and/or have maintenance logs been provided?</li> <li>Are there any signs of damage?</li> <li>Is any replanting required?</li> <li>Is any weed removal required?</li> <li>Is any mowing required?</li> <li>Are the drainage systems functioning?</li> <li>Have the landscaped areas been left tidy and free from litter/waste?</li> <li>What, if any, rectification works are required?</li> <li>Consultant's declaration.</li> </ul>			

## 2.7 LANDSCAPE RECTIFICATION REPORT

The landscape consultant may also be required to carry out an inspection 8 weeks after practical completion to ensure that any necessary rectification works are carried out in accordance with the Landscape Compliance Report, and that an appropriate level of landscape maintenance is being carried out.

Submit a report to council providing written certification of compliance.

Note: for landscape planting works associated with Stormwater Quality improvement Devices, refer also to the **LMCC SQID Design Guidelines** for detailed checklists covering the design, installation, maintenance and asset handover of SQIDs.

<b>Checklist for Landscape Rectification Report</b>	<b>Y</b>	<b>N</b>
<ul style="list-style-type: none"> <li>• Provide dates of inspections</li> <li>• Have all matters raised in the Compliance report been actioned?</li> <li>• Does it appear that maintenance is being carried out in accordance with the Maintenance Plan?</li> <li>• Have inspection and maintenance logs been provided and attached with this report?</li> <li>• Consultant's declaration.</li> </ul>		

## 2.8 LANDSCAPE ASSET HANDOVER REPORT

For works installed in the public domain, the landscape consultant may be required to inspect the site with a representative of Council and submit a Handover Report to prior to Council accepting responsibility of the assets.

Note: for landscape planting works associated with Stormwater Quality improvement Devices, refer also to the **LMCC SQID Design Guidelines** for detailed checklists covering the design, installation, maintenance and asset handover of SQIDs.

<b>Checklist for Landscape Asset Handover Report</b>	<b>Y</b>	<b>N</b>	<b>Asset Owner Sign-off*</b>
<ul style="list-style-type: none"> <li>• Do the works appear to be functioning in accordance with the design – ie, vegetation is established; drains are operational.</li> <li>• No obvious signs of under-performance?</li> <li>• Is the plant establishment period complete?</li> <li>• Have the inspection and maintenance logs been provided and attached with this report?</li> <li>• Have the assets been inspected for defects and inspection dates and logs been provided?</li> <li>• Have WAEX plans been provided and attached with this report?</li> <li>• Has a street tree register (excel spread sheet) been returned to Council, identifying numbers and locations of Street Trees, which remain following the maintenance period?</li> <li>• For trees installed in the public domain- have Dispatch Tree Inspection checklists in accordance with AS2303-2015 Appendix C- Example A been provided?</li> <li>• Has all proprietary information and warranties been provided and attached with this report?</li> <li>• Have copies of the Landscape Compliance Report and the</li> </ul>			

<b>Checklist for Landscape Asset Handover Report</b>	<b>Y</b>	<b>N</b>	<b>Asset Owner Sign-off*</b>
Landscape Rectification Report been provided and attached? • Consultant's declaration.			

\*Asset owner before acceptance by LMCC

## 2.9 CONSULTANT'S DECLARATION

I (name in full) .....

have prepared this documentation and hold qualifications to meet the requirements of Lake Macquarie City Council for this category of development as outlined in Council's DCP. I have familiarised myself with all sections of Council's DCP and this guideline relevant to the landscape proposal for this development.

Category of proposal: .....

Qualification: .....

Institute obtained from: .....

Year of graduation: .....

Years of relevant post graduate work experience:

Signature: .....

### 3 LANDSCAPE DESIGN FOR PUBLIC RESERVES

#### ***Design Considerations:***

1. Identify landscape assets and include or link these into public reserve e.g. open space network, bushland, drainage corridors.
2. Any street frontages in the design of public reserves are to have a minimum of 50 metres street frontage to allow the reserve to be easily accessed and allow unobscured public observation and supervision of the reserve
3. Where Stormwater Quality Improvement Devices are proposed on public reserves they are to be designed to:
  - Comply with LMCC SQID Design Guidelines
  - Comply with LMCC Water Cycle Management Guidelines
  - Contribute to the aesthetics and amenity of the area.
  - Restrict access to open water using dense vegetative barriers or fencing. Where fencing is required, the layout and design of fencing needs to respond to the contextual setting of the area, and comply with relevant Australian standards and Building Code of Australia requirements.
  - Provide a variety of habitats for wildlife specific to the area.
  - Utilise species suitable to their placement and function within the SQID design- refer to Appendices.
4. Ensure that car parks, roads, buildings and other structures do not encroach upon public reserves or contribute to the fragmentation of open space. Provide for vehicle control.
5. Provide for the movement of pedestrians and cyclists through public reserves to link with open space network and neighbourhood facilities e.g. Schools, community halls, playing fields. Pedestrian pathways to be a minimum 1500mm wide and where necessary cyclist/pedestrian pathways. Consider the safety of users through avoidance of hidden spaces.
6. Provide a 4000mm (minimum) access point to all parts of public reserves for maintenance/emergency purposes.
7. Identify measures to avoid erosion and compaction, protect and retain existing vegetation communities and topsoil, and include these in the overall design of the reserve.
8. In accordance with recommendations of the Australian Pesticides and Veterinary Medicines Authority (APVMA), avoid the use of Copper Chrome Arsenate (CCA) treated timber for play equipment, picnic tables, decking, handrails and the like.
9. Turf design for parks and sporting venues are required to be suitable for the intended use. Design to include sub soil profile and soil characteristics, drainage and irrigation. Irrigation systems must be designed by an Irrigation Australia certified designer. Designs to be reviewed to ensure they are able to be maintained to a reasonable standard.
10. Refer to the Landscape Standard Drawings for further guidance on the design and installation of landscape elements in Public Reserves.

#### ***Playground Specific Considerations:***

1. All playgrounds (equipment and soft-fall) and accompanying seating must comply with Australian Standards and be discussed with Council at an early stage to determine Council requirements for each site.
2. Avoid the use of known branch dropping species in areas of high use such as playgrounds and park furniture, where falling branches may present an increased risk to people and property (refer to Section 8 of this document).

3. Shade must be provided for the playground and seating by locating facilities where they will benefit from existing shade or by planting shade trees suitable to the site.
4. For larger playgrounds with more equipment and where children and carers may stay for longer periods, a shade structure may be required over play equipment and furniture.
5. In locating and sizing shade planting and structures the pattern of solar movement and sun-shade patterns should be considered. Avoid locating structures under known branch dropping species (refer to Section 8 of this document).
6. Seating to be provided at each playground site. Style of seating must conform to Council's range or be approved by Council landscape architects.
7. Water (tap or bubbler) must be provided at each playground site unless stated otherwise.
8. All playgrounds built by developers must be certified following installation by an independent playground auditor for compliance with Australian Standards. The developer is responsible for obtaining the audit and certification.

## 4 LANDSCAPE DESIGN FOR ROAD RESERVES

### *Design Considerations:*

1. Conserve significant landscape features and include in site design.
2. Consider street and site factors when selecting tree species for streets. Provide compatible landscape types in streetscapes with heritage considerations.
3. Integrate with open space networks and natural drainage lines and ensure drainage meets Councils stormwater treatment requirements.
4. Where Stormwater Quality Improvement Devices are proposed with the road reserve, ensure compliance with LMCC SQID Design Guidelines and LMCC Water Cycle Management Guidelines, using species suitable to their placement and function within the SQID design- refer to Appendices.
5. Position street trees to maximise shade opportunities for pedestrians and car parking and minimise disturbance to service lines.
6. Ensure that public landscapes are easily and economically maintained and create no liabilities for Council.
7. Use or reinstate native grasses or ground covers where possible to minimise maintenance and reduce sediment runoff. Where roads are being used as a hard barrier to bushland, use of weed free mulch and local indigenous species is required on the bushland side of the road.(Refer to Section 9 of this document for Bushland Protection Measures)
8. Where roads dissect wildlife corridors, plant species should be of a type to narrow gaps between roadside vegetation and facilitate arboreal wildlife movements.
9. Refer to the Landscape Standard Drawings for further guidance on the design and installation of landscape elements in Road Reserves.

### 5 LANDSCAPE DESIGN FOR CAR PARKS

#### **Design Considerations:**

1. Include any existing significant landscape elements in the landscape design e.g. mature trees, and where possible incorporate these into the design.
2. Plant hardy domed tree species which will provide shade. Evergreen tree species are to form the basis of planting, with shrub planting to screen where necessary.
3. Ensure clear sightlines at entry/exit points to roads.
4. Use line marking, kerbs and wheel restraints to define parking areas rather than upright timber vehicle barriers.
5. Consider the use of contrasting pavement materials to define pedestrian and vehicular movement.
6. Ensure car park design meets Councils stormwater treatment requirements.
7. Where Stormwater Quality Improvement Devices are proposed within car parks, ensure compliance with LMCC SQID Design Guidelines and LMCC Water Cycle Management Guidelines, using species suitable to their placement and function within the SQID design- refer to Appendices.
8. Comply with the requirements for *Landscaping and Tree Planting in Car parks* for relevant Parts of the LMCC DCP.
9. Refer to Landscape Standard Drawings for detailed planting and pavement guidelines for car park areas.

### 6 LANDSCAPE DESIGN FOR STORMWATER QUALITY IMPROVEMENT DEVICES

The key objectives of landscape design for Stormwater Quality Improvement Devices (SQIDs) are:

- To ensure the selection of appropriate plant species for stormwater treatment whilst enhancing the overall natural landscape.
- To integrate the design of SQIDs within urban and open space environments.
- To create landscape amenity opportunities that enhance community and environmental needs.

Vegetation is a critical factor in the success of most Stormwater Quality Improvement Devices. Well-considered planting design contributes to the aesthetic, physical, chemical, biological and ecological functioning of the SQID.

As a general principle, Council requires SQID landscaping to be designed in accordance with the current Water by Design WSUD Technical Guidelines and Bioretention Technical Design Guidelines. These guidelines can be downloaded from <http://waterbydesign.com.au/>

#### **Design Considerations:**

##### 1. **CPTED:**

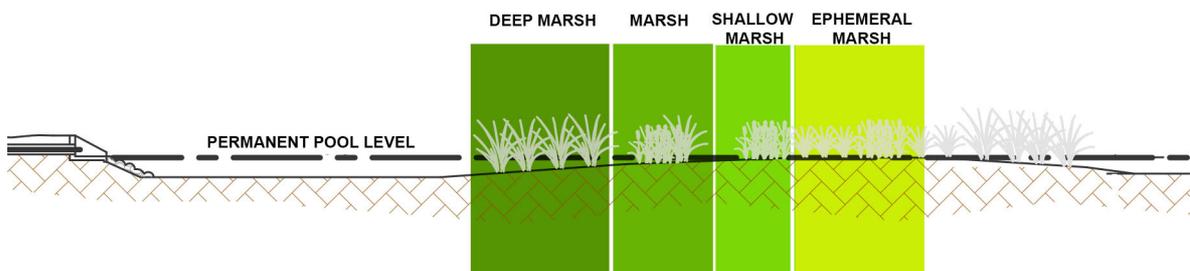
Landscape design of SQIDs need to accommodate the principles of informal surveillance, reducing concealment by providing open visible areas as required. Clear sight lines between roads, footpaths, activity areas and properties need to be maintained, where groundcovers and shrubs should not exceed 1m in height, and trees with a clear trunk height of 1.6m. Refer to the LMCC Crime Prevention

Through Environmental Design (CPTED) Guidelines for guidance on CPTED issues that need to be addressed.

## 2. APPROPRIATE PLANT SELECTION:

Planting for Stormwater Quality Improvement Devices (SQIDs) may consist of the following vegetation types:

- **Macrophytes**- consisting of:
  - Deep Marsh – from 0.5-0.35 below the permanent pool water level.
  - Marsh – from 0.35-0.2m below the permanent pool water level,
  - Shallow Marsh – from 0.2m to 0m below the permanent pool water level, this is typically where seasonal water level changes occur, planting should aid in stormwater quality improvement and provide aquatic habitat.
  - Ephemeral Marsh - from 0 to 0.2m above the permanent pool water level, this is typically where seasonal water level changes occur, planting should aid in stormwater quality improvement and provide aquatic habitat.



- **Turf** – for stormwater treatment and erosion protection, and where trafficable areas are required.
- **Groundcovers** - for stormwater treatment and erosion protection. Can form part of a littoral (embankment) zone on basins. Requires a dense and uniform distribution to prevent preferred flow paths, prevent scour and create a uniform root zone.
- **Shrubbery** - for screening, glare reduction and character and habitat values. Can form part of a littoral (embankment) zone on basins
- **Trees** - for shading, character and habitat values.
- **Existing vegetation**- retention of existing trees may require diversion of flow paths to avoid the critical root zone of trees to be retained.

NOTE: Where the planting design contains canopy layers, shade tolerant species should be selected for the groundcover layer. Trees and shrubs should also be managed so that the groundcover layer is not out-competed. If this does occur, replacement planting and possible thinning of the upper vegetation layers may be required to ensure the pollutant removal capacity of the groundcover is maintained.

## 3. SPECIES:

While the Tables in Appendix E provide guidance on plant species selection suitable for the Lake Macquarie area, it is not intended as an exhaustive list and designers should ensure that the proposed planting schedule is suitable for each specific site and soil conditions, SQID functioning and broader landscape objectives.

#### 4. **SOURCING VEGETATION AND LEAD TIMES:**

To ensure a planting specification can be accommodated, the minimum recommended lead time for ordering is 3-6months. The following sizes are recommended:

- Macrophytes- Viro- Tube or Strips- similar to a Flora edge or border strip system. Note: systems where several plants are grown together will maximise protection from water bird damage as the birds find it difficult to lift the interlocking plants out of the substrate unlike single plants grown in tubes.
- Groundcovers – Viro-Tube, Forestry Tube or 140mm (2.5L) pots.
- Shrubs - Viro-Tube, Forestry Tube or 140mm (2.5L) pots.
- Trees – to suit design – Note: Lake Macquarie Council requires street trees to be installed at a min. 75L size; trees in Parks and Reserves are required to be installed at a min. 45L size. Mass planting of trees in revegetation projects or adjacent existing bushland may be installed at smaller sizes.

NOTE: Pot size selection may affect planting density requirements for SQIDS. Refer to Appendix E – Suitable Species for SQIDS for further details.

#### 5. **TIMING FOR PLANTING:**

October and November are considered the ideal time to plant vegetation in treatment elements. This allows for adequate establishment/root growth before the heavy summer rainfall period but also allows the plants to go through a growth period soon after planting resulting in quicker establishment. Planting late in the year also avoids the dry winter months, reducing maintenance costs associated with watering.

Construction planning and phasing should endeavour to correspond with suitable planting months wherever possible. In some circumstances it may be appropriate to leave temporary planting in place (if this is used to protect the swale during the building phase, e.g. turf over geofabric) and then remove this at a suitable time to allow the final swale planting to occur at the preferred time of year.

#### 6. **SOILS:**

SQID soils are required to support plant growth and provide a filtration function.

The installation of soils should follow environmental best practices and include:

- Stripping and stockpiling of existing site topsoils prior to commencement of civil works.
- Soil testing of stockpiles.
- Deep ripping of subsoils using a non-inversion plough.
- Reapplication of stockpiled topsoils and, based on site testing results, remedial works or additives.
- Addition where necessary of imported topsoils (certified to AS4419-2003)

Filter media for Biortention devices must also meet the following requirements:

- Characteristics for plant growth should be confirmed with soil analysis in consultation with a horticulturalist.
- Saturated hydraulic conductivity should be between 100mm/hr and 300mm/hr to maximise plant establishment and survival.
- Filter media must not be made from dispersive or erodible materials

- Must be tested in accordance with the *Guidelines for Soil Filter Media in Biofiltration Systems* (FAWB Guidelines) at the frequencies specified in the *Water By Design Bioretention Technical Design Guidelines*.
- The surface of the filter media must be lightly compacted prior to planting using a single pass of a drum lawn roller.

The following minimum topsoil depths are required:

- Min 400mm deep for Bioretention filter media
- 150mm for turf
- 300mm for ground covers and small shrubs
- 450mm for large shrubs
- 600mm for trees

### 7. MULCHING:

Conventional mulching is not recommended as most loose mulch floats and run-off causes this material to be washed away, causing blockages to outlet structures and potentially increasing nutrient concentrations and the risk of algal blooms.

Maximise weed control by adopting high planting density rates. To batters, lightweight or medium-weight biodegradable erosion control matting is preferred to facilitate plant growth, however heavy-weight matting may be required in some instances to ensure sufficient erosion control. Consult with the SQID design team to ensure any matting specified is suitable for both erosion control and plant growth functions.

For Bioretention systems, use an organic friable mulch such as fine sugar cane or tea tree mulch, pinned down with a loose-weave jute mesh at 500mm centres.

The following should not be used as mulch for SQIDs:

- Long lasting organic mulches such as hardwood or pine chips
- Organic mulch that is likely to contain weed seeds
- Heavy duty matting such as 800gsm jute mat- unless required to address specific erosion control issues.
- Inorganic matting such as filter cloth

### 8. VEGETATION ESTABLISHMENT AND MAINTENANCE

Council's Design Guidelines for SQIDs provide advice on the duration and maintenance requirements prior to asset handover. The Water By Design Guidelines provide assistance as to how these requirements can be achieved. The current Water by Design Guidelines can be downloaded from <http://waterbydesign.com.au/>

**Refer to LMCC SQID Design Guidelines for detailed checklists covering the design, installation, maintenance and asset handover of SQIDs.**

### 7 LANDSCAPE DESIGN FOR THE LAKE FORESHORE

1. Ensure planting is scheduled at higher densities with a broad range of species to enhance plant survival, increase the root mass and depth and allow a more diverse ecosystem to develop. Increased planting densities will improve the chance of establishment and to allow the new plants to out-compete weeds and provide each other with some support and shelter. For example, ground covers/grasses should be planted in the order of 10 plants per square metre.
2. Ensure that proper site preparation and use of appropriate fertilisers, soil modifiers, water absorbing materials, mulch (not deeper than 200mm) and in some cases shelter are considered to maximise the chances of plant establishment.
3. Maximise use of endemic species, many of which are identified in the Appendix B below, in foreshore planting.
4. Wholesale removal of existing vegetation, which is often introduced grasses, to plant native species may not be warranted in every situation. Introduced grasses can provide a stable transition from a beach to the land. Where an erosion scarp of up to 200mm has formed, grasses assist in holding the bank in place and may be adequate in limiting further erosion.
5. Where scarps are higher, such as greater than 250mm the shallower root depth and/or root mass of the grass does not hold the bank, undermining by wave action may continue and the bank collapses taking the grass cover with it. In this instance, native species with a longer root base may be more suitable.
6. Planting should occur as soon as possible after the construction of the foreshore stabilisation treatment. Delaying the planting leaves the foreshore vulnerable to erosion.
7. Planting in areas used for private land/water based recreation will require greater consideration to ensure damage through trampling does not result. Grouping or limiting planting areas and improving the growth of the grass component in active area will provide a better overall result.
8. Ongoing care of the plants, including replanting, watering, weed control, shelter control, restricting pedestrian access, is an essential factor in plant establishment.

### 8 PLANTING DESIGN

1. Give preference to local indigenous species (Refer to Appendices A and B for local landscape units and native species lists) and preference plant material of local provenance;
2. Exclude species that have the potential to invade local bushland, reduce bushland biodiversity and successfully compete to the detriment of local vegetation communities (e.g. by freely seeding, runner, shading, or be carried by watercourse into bushland);
3. Use, suitable native species selected from the species listed in a flora and fauna assessment that has been prepared to accompany a development proposal;
4. Maximise potential for healthy and vigorous plant growth by responding to specific site conditions (e.g. wind, soil types, solar-exposure, drainage, microclimate),
5. Respond to cultural requirements (e.g. non-local species may appropriate for some heritage applications) however, known environmental weeds should be avoided (refer to <http://www.lakemac.com.au> for a list of known environmental weeds);
6. Respond to aesthetic and amenity issues (e.g. visual impact when fully mature, scenic assessment issues, shading, appropriateness to landscape setting, screening, over-shadowing, dust control, solar access, drainage issues);
7. Respond to potential hazards (e.g. select and site trees to minimise property damage and personal injury – (refer Table 1 - Known Branch Dropping Species below), provide adequate shade, plant barriers to water bodies);

8. Respond to being in a bushfire prone area by meeting the requirements of Planning for Bushfire Protection and selecting species appropriate for the site that assist to guard against bushfire.(refer to Section 6 of this document for Bushfire protection measures);
9. Reduce future maintenance (e.g. plant dense understoreys, weed barrier species and multi-storeys to shade and compete out weeds, provide adequate mulch and natural drainage to optimise plant health);
10. Select plants with relevance to water-sensitive urban design principles;
11. Reduce turfed areas and replace with mulched garden beds, native ground covers and/or native grasses, to lower maintenance requirements, reduce use of fossil fuels for mowing, increase on-site harvesting of water, nutrients and sediments, and reduce reliance on soil additives such as fertilisers and herbicides;
12. Provide foraging sources and habitat for native fauna where appropriate (e.g. multi storeys, nectar, nut and fruit sources, trees overhanging water bodies);
13. Avoid species which produce fruit and attract Queensland fruit fly (owners or custodians of the land on which the plant is growing have a legal obligation to treat this pest or remove the tree).

Landscape Design should reflect the landscape character of the local area. This can be achieved by selecting local indigenous species preferably of local provenance, which have the following advantages:

14. General climatic suitability and tolerance of existing soil conditions;
15. Reinforcing and enhancing the unique landscape character of the Lake Macquarie area;
16. Maintaining scenic values of the Lake Macquarie region, particularly for highly visible locations and elements such as ridgelines, foreshore, headlands and major roadways, and highly visible buildings;
17. Reducing the likelihood of introducing bushland weeds to the area;
18. Maintaining natural nutrient balances (e.g. seasonal leaf drop by deciduous plants may impact on local watercourses, non-local species may increase the soil nutrient load by reliance on fertilisers and other additives);
19. Providing habitat and food source to maintain native fauna populations;
20. Maintaining genetic biodiversity;
21. Providing an incentive to nurseries to supply a wide range of local species suitable for cultivation;
22. Maximising the potential for healthy and vigorous landscapes by selecting local plant material responsive to local site conditions

### **KNOWN BRANCH DROPPING SPECIES**

The following species should not be planted in areas of high use where falling branches may present an increased risk to people and property. The list includes but is not excluded to the following:

Table 1: Known Branch Dropping Species.

<i>Acacia melanoxydon</i>	<i>Angophora costata</i>
<i>A. floribunda</i>	<i>A. subvelutina</i>
<i>Araucaria bidwillii</i> - cones	<i>Eucalyptus alba</i>
<i>E. botryoides</i>	<i>E. camaldulensis</i>
<i>E. citriodora</i>	<i>E. cornuta</i>

<i>E. grandis</i>	<i>E. haemastoma</i>
<i>E. maculata</i>	<i>E. mannifera</i>
<i>E. mannifera ssp. maculosa</i>	<i>E. megacornuta</i>
<i>E. obliqua</i>	<i>E. pilularis</i>
<i>E. regnans</i>	<i>E. rossii</i>
<i>E. rubida</i>	<i>E. viminalis</i>

(From: Australian Plant Study Group, 1990 *Grow What Where*, Viking O'Neal, Victoria, Australia )

## 9 LANDSCAPE DESIGN FOR BUSHLAND PROTECTION

Council views bushland as a valuable resource to be protected, retained and rehabilitated where possible. Bushland in good health minimises maintenance costs and maximises conservation of biodiversity. When proposing developments which impact on (large or small) areas of bushland the following is to be applied.

- depending on the size or type of development Council may require a flora study of the area documenting native communities and weeds
- do not use kikuyu or Rhodes grass in roadside rehabilitation or soil stabilisation works adjoining bushland. Native plants are preferred and are now available in turf and seed form.
- no site materials, green waste, plant or equipment is to be stockpiled, dumped or stored in bushland
- any material which has washed, blown or accidentally been placed into bushland is to be removed
- fire trails or roads are to be built on the perimeter within the boundary of the development and not encroach on remnant bushland areas
- the edge or interface of where the development meets bushland is to be addressed and measures preventing weed spread outlined
- do not remove scrub layer from bushland unless carrying out authorised fire mitigation works. Underscrubbing changes bushland ecology allowing weed invasion and eventually leads to tree layer decline and death
- erosion filter fencing is to be used during construction rather than hay bales which break down readily, spread weed seed and increase nutrient levels
- a buffer zone may be required which is in keeping with the Office of Environment and Heritage Guidelines.

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## APPENDIX A - LANDSCAPE UNITS OF LAKE MACQUARIE AREA

Figure 1 shows the broad vegetation communities of the Lake Macquarie area. This information is based on soil and topographic information and is taken from two reports produced by the NSW Department of Land and Water Conservation on soil landscapes of the Gosford-Lake Macquarie and Newcastle areas. The species listed provide a typical example of common species found in that particular area with variations depending on microclimatic effects.

Vegetation Types are:

### 1. WATAGAN MOUNTAINS

Tall open forest and closed forest in gullies.

Common species on slopes with southerly aspect: *Eucalyptus maculata*, *E. umbra* and *E. siderophloia*. On drier northern and western slopes *Angophora floribunda*, *Eucalyptus punctata*, *E. tereticornis*, *E. oblonga* and *Allocasuarina torulosa* with grassy understorey.

Closed forests in sheltered gullies: *Ceratopetalum apetalum* and *Doryphora sassafras*.

### 2. DORA CREEK

*Melaleuca linariifolia*, *M. styphelioides*, *Eucalyptus longifolia*, *E. robusta*, *E. saligna* and *Casuarina glauca* in tidal areas.

### 3. LAKE MACQUARIE LOWLANDS

Common tree species include *Angophora costata*, *Eucalyptus gummifera*, *E. haemastoma*, *E. capitellata*, *E. punctata* and *Allocasuarina torulosa*. Understorey species include *Lambertia formosa*, *Banksia spinulosa* var. *collina*, *B. oblongifolia*, *Leptospermum attenuatum*, *Isopogon anemonifolius*, *Melaleuca* spp. in poorly drained areas.

### 4. AWABA HILLS

Coastal heaths and woodlands with low open woodland along sheltered drainage lines.

Woodland species include: *Angophora costata*, *Eucalyptus haemastoma*, *E. maculata*, *E. capitellata*, *E. punctata* and *Allocasuarina littoralis*. Along sheltered drainage lines *Eucalyptus gummifera*, *E. capitellata* and *Allocasuarina littoralis*.

Common heathland species: *Melaleuca nodosa*, *Allocasuarina distyla*, *Banksia integrifolia*, *B. spinulosa* var. *spinulosa*, *B. oblongifolia*, *Lambertia formosa*, *Hakea teretifolia* and mallee *E. capitellata* and *E. umbra*. Catherine Hill Bay has extensive *Themeda triandra* grasslands. In poorly drained areas *Melaleuca quinquenervia* and *M. nodosa*.

### 5. WARNERS BAY

Tall open forest with *Eucalyptus maculata*, *E. punctata*, *E. gummifera*, *E. umbra*, *E. paniculata*, *E. glaucina* and *E. piperita*. On poorly drained sites *Melaleuca* spp. *E. robusta* and *Casuarina glauca*.

### 6. KILLINGWORTH

Open forest with some woodland. Common species include *Eucalyptus maculata*, *E. eugenioides*, *E. umbra*, *E. fibrosa*, *E. paniculata* with understorey of *Themeda triandra*, *Leptospermum* spp. and *Xanthorrhoea* spp. *Eucalyptus punctata*, *E. propinqua*, *E. globoidea* common on upper slopes. *Melaleuca styphelioides* occurs on poorly drained sites. *E. capitellata* and *E. haemastoma* occur in southern extent of landscape unit. *Syncarpia glomulifera* and *E. piperita* on sheltered upper slopes.

### 7. SUGAR LOAF RANGE

Tall open forest of *Eucalyptus piperita*, *E. umbra*, *E. paniculata*, *E. punctata* and *Allocasuarina torulosa*. Understorey of *Doranthus excelsa*, *Xanthorrhoea* spp. *Macrozamia communis*, *Imperata communis* and *Themeda triandra*. *Angophora costata* and *E. gummifera* on exposed sites.

### 8. COCKLE CREEK

Lower Cockle Creek woodlands of *Angophora costata*, *A. floribunda*, *E. gummifera* and *E. piperita* with *Casuarina glauca* along drainage banks. Upper Cockle Creek common species are *Eucalyptus robusta*, *E. umbra*, *E. amplifolia*, *E. deanei* with understorey of *Glochidion ferdinandi*, *Acacia parramattensis* and *Rapanea variabilis*. *Melaleuca* spp. occurs on poorly drained sites.

### 9. CHARLESTOWN

*Angophora costata*, *E. haemastoma*, *E. gummifera*, *E. capitellata* and *Allocasuarina torulosa*. Understorey species include *Lambertia formosa*, *Banksia spinulosa* var. *collina*, *B. oblongifolia*, *Leptospermum attenuatum*, *Isopogon anemonifolius*, *Melaleuca* spp. in poorly drained areas.

### 10. WHITEBRIDGE ESCARPMENT

On exposed slopes *Eucalyptus maculata* and *E. umbra*. Tall open forest of *Eucalyptus saligna*, *E. maculata* and *E. umbra* with *Syncarpia glomulifera*. In sheltered gullies species include *Synoum glanulosum*, *Ceratopetalum apetalum*, *Doryphora sassafras*, *Backhousia myrtifolia*, *Choricarpia leptopetala* and *Acmena smithii*.

### 11. REDHEAD BEACH

Species include *Angophora costata*, *Banksia serrata*, *B. integrifolia*, *Leptospermum laevigatum*, *Acacia longifolia* var. *sophorae*, *Eucalyptus botryoides*, *Allocasuarina torulosa* with understorey species of *Dillwynia glaberrima*, *Macrozamia communis*, *Ricinocarpus pinifolius* and *Pimelia linifolia*. Sheltered closed forest species include *Livistonia australis* and *Acmena smithii*. On poorly drained sites *Melaleuca quinquenervia*.

### 12. SWANSEA

As a beach landscape unit, common vegetation includes *Eucalyptus gummifera*, *E. pilularis*, *E. robusta*, *Banksia integrifolia*, *B. serrata*, *B. aemula*, *Angophora costata*, *Leptospermum laevigatum*, *Acacia longifolia* var. *sophorae*, *Casuarina glauca* and *Melaleuca quinquenervia*. Understorey species include *Imperata cylindrica* and *Macrozamia communis*.



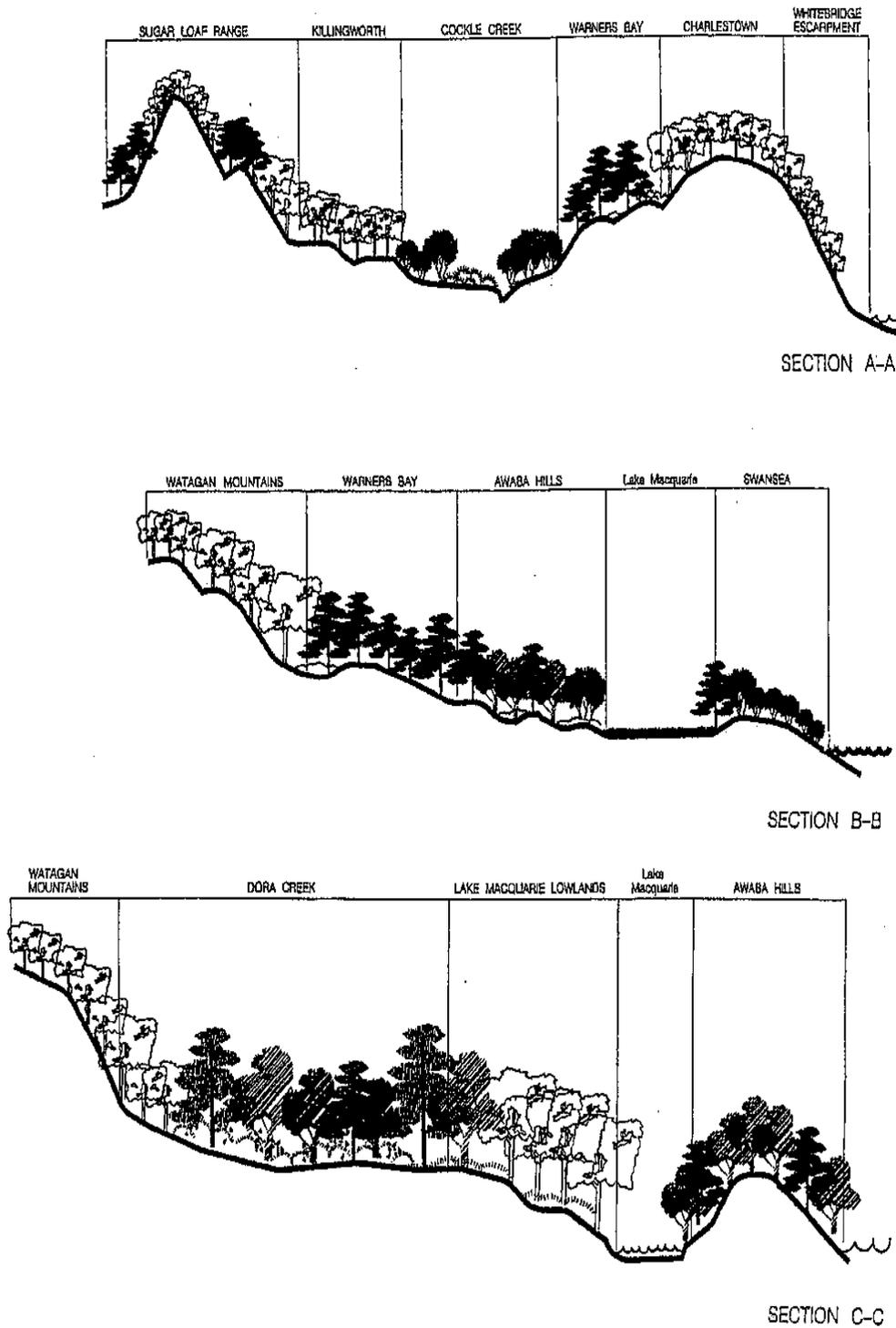


Figure 2 - Landscape Units of Lake Macquarie – typical profiles

## APPENDIX B – NATIVE SPECIES FOR FORESHORE AREAS

Table 1 - Local Native Species Suitable for Streambank Planting

	Common Name	Botanical Name	Growth Form	Conditions	Position	Notes
AQUATIC	Water Plantain	<i>Alisma plantago-aquatica</i>	Erect, emergent herb to 1 m tall	Wet-damp	In water - waters edge	Tubers are edible
		<i>Ludwigia peploides</i>	Herb with creeping or floating vegetative stems, and erect flowering stems to 50 cm tall	Wet, ponds and creeks	In water	Yellow flower
	Swamp Lily	<i>Ottelia ovalifolia</i>	Submerged plant with floating leaves	Wet, ponds and slow-moving water	In water	Attractive white flowers
	Water Ribbons	<i>Triglochin procerum</i>	Submerged, tufted herb	Wet, permanent creeks	In water	Widespread and common; small, green fruits are edible
	Tall Spike-rush	<i>Eleocharis sphacelata</i>	Large rush to 2 m tall	Wet, standing water	In water	Forms extensive colonies
	Leafy Twig-rush	<i>Cladium procerum</i>	Erect, leafy sedge 1-1.5 m high	Edge of freshwater swamps on the coast	In water	
	Jointed Twig-rush	<i>Baumea articulata</i>	Sedge 1-2 m tall	Swamps	In water	Attractive plant with large, drooping inflorescence
GROUND COVERS	Native Violet	<i>Viola hederacea</i>	Creeping herb forming carpets	Moist and shady	Bank slope to floodplain	
	River Buttercup	<i>Ranunculus inundatus</i>	Small herb	Marshy, periodically inundated	Waters edge	

	Common Name	Botanical Name	Growth Form	Conditions	Position	Notes
	Swamp Pennywort	<i>Centella asiatica</i>	Creeping herb	Marshy, clay or sandy soils	Top of bank to floodplain	
		<i>Hydrocotyle peduncularis</i>	Creeping herb	Sheltered, marshy	Top of bank to floodplain	
	Scurvyweed	<i>Commelina cyanea</i>	Creeping herb	Moist, shady	Top of bank to floodplain	
	Swamp Goodenia	<i>Goodenia paniculata</i>	Small, tufted herb to 30 cm	Marshy conditions	Top of bank to floodplain	

	Common Name	Botanical Name	Growth Form	Conditions	Position	Notes
TREES	Rasp Fern	<i>Doodia aspera</i>	Small, erect fern with harsh fronds 20-40 cm high	Moist, shady	Bank to floodplain	Forms extensive colonies
	Prickly-leaved Paperbark	<i>Melaleuca styphelioides</i>	Tree 6-15 m	Swampy places, fresh and brackish	Top of bank to floodplain	Lower catchment
	Narrow-leaf Paperbark	<i>Melaleuca linariifolia</i>	Small tree to 8 m	Marshy ground	Top of bank to floodplain	Lower catchment
	Node-fruited Paperbark	<i>Melaleuca nodosa</i>	Shrub or small tree to 6 m	Marshy ground	Top of bank to floodplain	Lower catchment
	Broad-leaved Paperbark	<i>Melaleuca quinquenervia</i>	Tree 8-12 m	Marshes	Top of bank to floodplain	Lower catchment
	Willow Bottlebrush	<i>Callistemon salignus</i>	Shrub 3-4 m	Moist and swampy ground	Top of bank to floodplain	Lower catchment
	Cabbage Tree Palm	<i>Livistona australis</i>	Tall palm	Rainforest gullies	Top of bank to floodplain	
	Water Gum	<i>Tristaniaopsis laurina</i>	Small, spreading tree 4-10 m	Moist	Top of bank to floodplain	Upper catchment

	Common Name	Botanical Name	Growth Form	Conditions	Position	Notes
	Grey Myrtle	<i>Backhousia myrtifolia</i>	Spreading shrub 3-4 m	Sheltered gullies	Top of bank to floodplain	Upper catchment
	Lilly Pilly	<i>Acmena smithii</i>	Shrub or tree	Moist	Top of bank to floodplain	Upper catchment
	Sandpaper Fig	<i>Ficus coronata</i>	Small tree 3-4 m	Moist	Top of bank to floodplain	Upper catchment
	Black Wattle	<i>Callicoma serratifolia</i>	Large shrub usually 4-5 m	Moist	Top of bank to floodplain	Upper catchment
	Cheese Tree	<i>Glochidion ferdinandi</i>	Shrub or tree usually 4-8 m	Moist	Top of bank to floodplain	Upper catchment
	Rough-barked Apple	<i>Angophora floribunda</i>	Small to medium tree	Moist valleys with deep, alluvial soils	Top of bank to floodplain	Upper western parts of catchment in valleys of Watagan mountains
	Sydney Blue Gum	<i>Eucalyptus saligna</i>	Tall tree 30-50 m	Moist	Top of bank	Upper catchment
	Swamp Mahogany	<i>Eucalyptus robusta</i>	Tree 20-30 m	Swampy ground, fresh and brackish	Floodplain (and steep foreshore land)	Lower catchment
	Swamp Oak	<i>Casuarina glauca</i>	Tree to 20 m	Along boundary between fresh and brackish waters	Top of bank to floodplain	Lower catchment
LOW UNDERSTOREY	Swamp Water Fern	<i>Blechnum indicum</i>	Erect fern 50-150 cm	Swampy ground near the coast	Floodplain	
	Common Maidenhair Fern	<i>Adiantum aethiopicum</i>	Delicate fern 15-40 cm high	Damp, shady places	Bank to floodplain	Occurs in dense colonies
	False Bracken Fern	<i>Calochlaena dubia</i>	Soft fern to 1.5 m	Moist, shady conditions on sandy soils	Top of bank to floodplain	Forms dense colonies
	Spiny Mat-rush	<i>Lomandra longifolia</i>	Grass-like herb to 1 m	Wide range of habitats	Bank slope to floodplain (above high tide on foreshores)	Flowers / bases of new leaves are edible

	Common Name	Botanical Name	Growth Form	Conditions	Position	Notes
	Tussock Rush	<i>Juncus usitatus</i>	Forms dense clumps to 1 m	Range of soils from moist to swampy sites	Bank slope and waters edge	
	Tussock Sedge	<i>Carex appressa</i>	Tussock to 1 m	Moist to waterlogged soils	Bank slope to floodplain	
	Saw-sedge	<i>Gahnia clarkei</i>	Forms dense thickets to 2.5 m	Damp and marshy sites	Bank slope to floodplain	
	Club-rush	<i>Bolboshoenus caldwellii</i>	Erect sedge 50-100 cm tall	Brackish water	Waters edge	
	Marsh Club-rush	<i>B. fluviatilis</i>	See above	Freshwater	Waters edge	
	River Club-rush	<i>Schoenoplectus validus</i>	Forms dense stands to 1.5 m or more	Freshwater	Waters edge	

Table 2 - Local Native Species Suitable for Foreshore Planting

	Common Name	Botanical Name	Growth form	Conditions	Position	Notes
<b>GROUNDCOVERS</b>	Sand Couch	<i>Sporobolus virginicus</i>	Creeping, perennial grass	Saline	From upper tidal range to above high tide	
	Coast Couch	<i>Zoysia macrantha</i>	Creeping, perennial grass	Saline-brackish	Above high tide	
	Samphire	<i>Sarcocornia quinqueflora</i>	Small herb to 30 cm	Saline, frequent inundation	Upper tidal range	Edible
	Austral Seablite	<i>Suaeda australis</i>	Spreading herb to 40 cm	Saline, frequent inundation	Upper tidal range	Edible
	Pigface	<i>Carpobrotus glaucescens</i>	Creeping herb	Saline	Above high tide	Succulent leaves and pink, daisy-like flowers
	Sesuvium	<i>Sesuvium portulacastrum</i>	Sprawling herb	Saline	Above high tide	Thick, glossy leaves and pink, star-shaped flowers
	Scurvyweed	<i>Commelina cyanea</i>	Creeping herb	Moist, shady, saline - fresh	Above high tide	
	New Zealand Spinach	<i>Tetragonia tetragonioides</i>	Robust, leafy, sprawling herb	Moist, saline	Above high tide	Leaves edible, preferably cooked
	Sea Celery	<i>Apium prostratum</i>	Scrambling herb	Saline, infrequent inundation	Above high tide	Superior substitute for parsley
	Creeping Brookweed	<i>Samolus repens</i>	Herb to 30 cm	Saline, infrequent inundation	Above high tide	
		<i>Lobelia alata</i>	Small herb with white to blue flowers	Marshy, brackish	Above high tide	Sharply angular stems, flowers white to sky blue
	Bacopa	<i>Bacopa monnieri</i>	Small, creeping herb	Marshy, brackish	Within tidal range	
		<i>Selliera radicans</i>	Creeping herb, forming dense carpets under Swamp Oak	Marshy, brackish	Above high tide	

	Common Name	Botanical Name	Growth form	Conditions	Position	Notes
LOW UNDERSTOREY	Swamp Lily	<i>Crinum pedunculatum</i>	Large perennial herb with thick leaves to 2 m long and large white flowers	Marshy, brackish	Above high tide	Crushed leaves rubbed on skin are antidote to marine stings
	Sea Rush	<i>Juncus kraussii</i>	Forms dense clumps 1-2 m high	Saline water	Above high tide	
		<i>Isolepis nodosa</i>	Erect sedge, forming clumps to 70 cm	Moist, saline - brackish	Above high tide	Spikelets form dense globular clusters near top of stem
		<i>Baumea juncea</i>	Slender, erect sedge to 1 m	Slightly saline	Above high tide	
		<i>Cyperus laevigatus</i>	Erect sedge 40-60 cm tall	Saline	Within tidal range	
		<i>Bolboschoenus caldwellii</i>	Erect sedge 50-100 cm tall	Brackish	Within tidal range	
	Streaked Arrow-grass	<i>Triglochin striata</i>	Small, erect, grass-like herb	Brackish, with strong flow	Within tidal range	
	Kangaroo Grass	<i>Themeda australis</i>	Tufted grass to 1 m high	Steep foreshore land	Above high tide	
	Boobialla	<i>Myoporum insulare</i>	Scrambling shrub 50-150 cm high	Saline	Above high tide	
Sydney Golden Wattle	<i>Acacia longifolia</i>	Shrub 3-4 m high	Steep foreshore land	Above high tide	Golden yellow flowers	
TREES	Grey Mangrove	<i>Avicennia marina</i>	Small tree 2-5 m	Saline water	Within tidal range	Fruit fall in December and are dispersed by the tide
	Swamp Oak	<i>Casuarina glauca</i>	Tree to 12 m	Along boundary between fresh and brackish waters	Above high tide	Leaves are reduced to rows of small teeth on branchlets
	Coastal Banksia	<i>Banksia integrifolia</i>	Shrub or tree 6-16 m high	Saline	Above high tide	Underside of leaves is white
	Tuckeroo	<i>Cupaniopsis anacardioides</i>	Small to medium tree 3-10 m tall	Saline, from coastal headlands to littoral rainforest	Above high tide	
	Spotted Gum	<i>Corymbia maculata</i>	Tree to 30 m high	Steep foreshore land	Above high tide	Smooth, spotted bark

## APPENDIX C – PREFERRED STREET TREES

### Introduction

This list is for preferred street trees and is intended to guide the selection of tree species for use in streets throughout the Lake Macquarie Local Government Area. For the purpose of this list, a tree is defined as “a perennial woody plant with secondary branches supported by a primary stem and usually having a distinct crown”.

This list is not intended to guide the selection of park and bush land trees, nor does it include shrubs and other non-tree vegetation.

### Plant names

As name changes occur frequently in the botanic world, proper naming of species is important to prevent misunderstandings and the use of inappropriate species.

Proposals for street tree plantings must provide a current, complete, botanical name, a recognised common name and if applicable cultivar, hybrid, subspecies, other derivative names and recent or well known synonyms. An outdated name is referred to as a synonym and is usually indicated as “syn.”.

Eg: *Triadica sebifera* syn. *Sapium sebiferum*

The abbreviation spp. is used to indicate a group of species. A name written as *Populus* spp. includes all species, varieties and hybrids of the genus *Populus*.

### Preferred street tree species

The preferred street tree list includes forty species from 17 families. Thirty-five of the forty species are native. The following ranges of attributes have been considered in selecting these species;

- Attractive appearance- size, colour, texture
- Reliable form and shape
- No excessive shedding of fruits, foliage, stems or leaves
- Moderate mature size
- Non-invasive roots
- Unlikely to become an environmental weed
- Availability
- Soundness and stability
- Low maintenance
- Expected safe useful life

### Using tree species not on the preferred list

The preferred species list is not exclusive. Selecting species from outside of the preferred list for street tree use is permitted but requires justification, taking into account all of the factors relevant to street tree selection for a particular site. Species on the banned list will not be allowed for use.

Applicants intending to plant species other than those on the preferred list must provide documented evidence in support of the proposal. Council reserves the right to accept or reject any such proposals.

For every site, the prevailing conditions must be considered during tree species selection. These conditions include but are not limited to soil types, drainage, aspect, local climatic conditions, available space, existing species in the area and the character of the area.

### **Banned or undesirable tree species**

Not all tree species are suitable for use as street trees. This list nominates some species or groups of species that have been determined to be unacceptable for use as street trees in Lake Macquarie. The reasons for species being undesirable include;

- self pruning of larger limbs
- massive size
- invasive root systems
- susceptibility to insect and pathogen infestation
- aggressive self seeding or known environmental weeds
- suckering or adventitious growth patterns
- hazardous spines, thorns or appendages
- toxic, allergenic or irritant properties
- producing large fruits, or numerous small hard fruits
- producing large amounts of shed bark, leaves, fruit or flowers
- being a declared noxious weed
- high management costs

The website <http://www.weeds.org.au/> contains a PDF document accessed from the noxious weed tab that contains all of the species of plants declared noxious throughout Australia. This list should be checked before proposing to use a plant species in the Lake Macquarie Council area as any plant listed as noxious in any jurisdiction in Australia will not be accepted.

### Preferred Street Tree Species

BOTANICAL NAME	Family	COMMON NAME	COMMENTS	For use in narrow footpath areas <3.5m	For use in median strips	For use under powerlines	For use in salt air conditions	Expected height	deciduous (Y/N/semi)
<i>Acmena smithii</i>	Myrtaceae	Lilly pilly	Medium size tree, hardy versatile use, bird attractive fruits	n	y	y	n	20	n
<i>Acronychia oblongifolia</i>	Rutaceae	White Aspen	Usually small tree, local native, fruit crop usually light	y	y	y	n	15	n
<i>Alectryon subcinereus</i>	Sapindaceae	Native Quince	Medium sized local native tree	n	y	y	n	10	n
<i>Alloxylon flammeum</i>	Proteaceae	Tree Waratah	Large Australian tree	n	y	n	n	15	n
<i>Angophora hispida</i>	Myrtaceae	Dwarf apple	Small to medium size local native tree, may require pruning of lateral branches	y	y	y	y	4	n
<i>Archontophoenix cunninghamiana</i>	Arecaceae	Bangalow Palm	Single stem local native palm, self cleaning, grows to a predictable size and shape, leaf drop potential problem above high use areas	y	y	n	n	20	n
<i>Backhousia citriodora</i>	Myrtaceae	Lemon Scented Myrtle	Large Australian tree, lemon scented leaves	n	y	n	n	20	n
<i>Backhousia myrtifolia</i>	Myrtaceae	Grey Myrtle	Local native, medium/small tree, hardy	y	y	y	n	15	n
<i>Banksia integrifolia</i>	Proteaceae	Coast Banksia	Medium sized local native, hardy, prefers sandy or well drained soils	y	y	n	y	12	n
<i>Buckinghamia celcissima</i>	Proteaceae	Ivory Curl	Medium sized Australian tree, showy fragrant flowers bird attractive, hardy	n	y	y	n	10	n
<i>Caesalpinia ferrea</i>	Fabaceae	Leopard Tree	Slow growing, hardy, fine leaved	y	y	n	n	20	s
<i>Callistemon citrinus</i>	Myrtaceae	Crimson Bottlebrush	Medium sized evergreen, can be shrubby and may require pruning of low branches	y	y	y	y	8	n
<i>Callistemon salignus</i>	Myrtaceae	Willow Bottlebrush	Medium sized evergreen, can be shrubby and may require pruning of low branches	y	y	y	y	10	n

<i>Callistemon</i> species and cultivars	Myrtaceae	Bottlebrush	Small/ medium sized evergreen, can be shrubby and may require pruning of low branches	y	y	y	y	12	n
<i>Calodendrum capense</i>	Rutaceae	Cape Chestnut	A native of south-eastern Africa. Spectacular summer flowering, large pink flowers, dense dark green foliage	n	n	y	n	10	n
<i>Ceratopetalum gummiferum</i>	Cunoniaceae	NSW Christmas Bush	Showy flowers/bracts and new leaf growth, local native	y	y	n	y	10	n
<i>Elaeocarpus eumundii</i>	Elaeocarpaceae	Eumundi Quandong	Medium sized, Australian tree, evergreen, colourful foliage, will tolerate shading	n	y	y	n	10	n
<i>Elaeocarpus reticulatus</i>	Elaeocarpaceae	Blueberry ash	Medium size Australian tree, with showy flowers and bird attractive fruit, colourful foliage, will tolerate shading	n	y	y	n	12	n
<i>Eucalyptus</i> spp.	Myrtaceae	Grafted Flowering gums	Grafted varieties only, small tree, flowers profusely, large woody fruits but not excessively produced, relatively short life span	y	n	y	n	6	n
<i>Flindersia australis</i>	Rutaceae	Australian teak	Medium to large native Australian tree, dense foliage, large fruits not for near footpaths	n	y	n	n	40	n
<i>Geijera parviflora</i>	Rutaceae	Wilga	Small local native tree, very hardy, small leaved, slow growing but of excellent habit and appearance	y	y	y	y	8	n
<i>Glochidion ferdinandi</i>	Euphorbiaceae	cheese tree	Local native, dense foliage, suits coastal areas	n	y	y	y	10	n
<i>Guioa semiglauca</i>	Sapindaceae	Guioa	Local native tree, medium size, hardy	n	y	y	y	6	n
<i>Harpullia pendula</i>	Sapindaceae	Tulipwood	Medium/large size native Australian tree, fruit large, heavy crop	n	n	n	n	25	n
<i>Hibiscus tiliaceus</i>	Malvaceae	Cottonwood	Coastal conditions, medium Australian tree, with spreading crown, deciduous if droughted, suitable replacement for coral trees	n	n	y	y	15	n
<i>Leptospermum petersonii</i>	Myrtaceae	Lemon scented tea tree	Medium size, often shrubby, fine lemon scented foliage	y	y	y	y	4	n
<i>Leptospermum polygalifolium</i>	Myrtaceae	Tea tree, Tantoon	Medium size, often shrubby, fine foliage	y	y	y	y	4	n

<i>Magnolia 'Little Gem'</i>	Magnoliaceae	Dwarf Magnolia	Large white flowers, slow growing but long lived, dislikes root damage and very dry conditions	y	y	y	n	5	n
<i>Myrsine variabilis</i>	Myrsinaceae	Muttonwood	Small dense local native tree, glossy leaves, new leaves coloured	y	y	y	y	15	n
<i>Pistacio chinensis</i>	Anacardiaceae	Chinese Pistachio	Medium size deciduous tree, colourful autumn foliage, very hardy, requires well drained soil, preferably only male plants	y	y	y	y	10	y
<i>Polyscias elegans</i>	Araliaceae	Celerywood	Medium size native tree, fast growing	n	y	n	n	15	n
<i>Rodamnia rubesens</i>	Myrtaceae	Scrub turpentine	Local native, fragrant flowers spring/summer, bird attractive fruit, medium/large size tree	n	y	n	n	25	n
<i>Stenocarpus salignus</i>	Proteaceae	Scrub beefwood	Medium size native tree, evergreen, showy red flowers	n	y	y	n	15	n
<i>Stenocarpus sinuatus</i>	Proteaceae	Firewheel Tree	Medium size Australian tree, evergreen, showy red flowers	y	y	y	n	12	n
<i>Streblus brunonianus</i>	Moraceae	Whalebone Tree	Small local native tree, can become large under ideal conditions, bird attracting	y	y	y	n	10	n
<i>Synoum glandulosum</i>	Meliaceae	Scentless Rosewood	Small local native evergreen tree, can be shrubby	y	y	y	n	5	n
<i>Syzygium cultivars</i>	Myrtaceae	Lillypilly	horticultural dwarf varieties such as "Cascade"	y	y	y	n	10	n
<i>Tristaniopsis laurina</i>	Myrtaceae	Water Gum	Local native small evergreen tree fits under powerlines unless planted in wet areas where it grows much larger	y	y	y	n	15	n
<i>Ulmus parvifolia</i>	Ulmaceae	Chinese Elm	Small tree, hardy, semi-deciduous, fine leaved, attractive mottled bark	y	y	y	n	15	s
<i>Xanthostemon chrysanthus</i>	Myrtaceae	Golden Penda	An evergreen, medium sized Australian tree, noted for its red new tips, clusters of bright yellow flowers in spring, autumn and winter. Non invasive root system.	y	y	n	n	15	n

### Banned or undesirable tree species

BOTANICAL NAME	COMMON NAME	COMMENTS
<i>Acacia saligna</i>	Golden Wreath Wattle	Invasive in bushland, poor growth form
<i>Casuarina</i> spp. including <i>Allocasuarina</i> spp.	various	Problems with surface root systems and suckering, hard dry fruits problem on paved and lawn areas
<i>Cinnamomum camphora</i>	Camphor laurel	invasive in bushland, excessive growth/size, allergenic, eco-toxin properties
<i>Erythrina</i> spp.	Coral tree	Excessive growth, prone to windfall, deciduous with large leaves, environmental weed
<i>Ficus</i> spp.	Fig Trees	Most species too large for street use, invasive root systems, excessive leaf and fruit drop
<i>Grevillea robusta</i>	Silky Oak	Known to be allergenic particularly for tree workers
<i>Lagunaria patersonii</i>	Norfolk Island Hibiscus	Hazardous/ irritant fruits, invasive in bushland
<i>Liquidambar styraciflua</i>	Liquidambar, Sweetgum	Grow too large for normal street use, deciduous with large leaf drop, invasive root system
<i>Melia azedarach</i>	White Cedar	Deciduous, problems with caterpillars each autumn, heavy fruit drop
<i>Phoenix canariensis</i>	Canary Date Palm	Spiny fronds hazardous, provides rat harbourage, invasive in bushland, massive size
<i>Phoenix senegalensis</i>	Clustered Date Palm	Spiny fronds hazardous, provides rat harbourage, invasive in bushland
<i>Platanus</i> spp.	Plane Trees	Excessive growth, known for invasive root systems, known allergenic
<i>Populus</i> spp.	Poplars	Suckering species, excessive leaf drop
<i>Robinia psuedoacacia</i>	Black Locust	Thorny, root suckers, environmental weed
<i>Salix</i> spp.	Willows	Most species are declared noxious, invasive root systems, weeping willows require frequent pruning
<i>Schefflera actinophylla</i>	Umbrella Tree	Invasive root system, invasive in bushland
<i>Syagrus romanzoffianum</i>	Cocos Palm	Large fleshy fruit and hard seed, provides rat harbourage, invasive in bushland, difficult to maintain clean appearance
<i>Tecoma stans</i> syn. <i>Stenolobium stans</i>	Yellow Bells	Invasive in bushland
<i>Toxicodendron</i> spp.	Rhus Tree	All species - hazardous sap causes skin irritation, invasive in bushland
<i>Triadica sebifera</i> syn. <i>Sapium sebiferum</i>	Chinese Tallow Tree	Invasive surface roots and invasive in bushland
Various	Pine trees	large growth, large falling cones, large roots damaging infrastructure, invasive in bushland
Various	various	All plants listed as noxious weeds anywhere in Australia

### APPENDIX D - VEGETATION SELECTION TO GUARD AGAINST FIRE

**There is no such thing as a non-flammable plant, all plants will burn when exposed to enough heat.**

Look for these features in plants when choosing vegetation for areas that may be susceptible to fire

- High salt content in leaves
- High moisture content in leaves
- Low volatile oil content in leaves
- Tall trees with full canopies and fine leaves for wind breaks or filter traps are better to stop smoke and catch sparks.

Points to remember when maintaining a fire retardant area around your property

- Plants may retain and accumulate dead leaves and twigs that will easily ignite. Ensure that dead plant matter is cleaned away from vegetation and stored or disposed in a safe way.
- Plants are less likely to burn if they have a high moisture content in their leaves, so ensure plants are kept well watered. However, take note of water restrictions, as water may be in short supply during a bad fire season.
- Long dead grass is a major fire hazard whilst short green grass can be used as a firebreak. Ensure grass is kept short, and watered well to prevent the travel of fire to your house.
- Gain extra information from Lake Macquarie City Council and the NSW Rural Fire Brigade about fire exclusion zones and other precautions that can be taken to ensure your house and property is fire safe.

The plant species list below are plants that are more fire retardant than others and are less likely to ignite during moderate intensity bushfires.

When purchasing plants, nurseries that specialise in native plants will be more likely to stock the plants contained within this list.

The plant species in the following list occur locally in the Lake Macquarie City Council region. The inclusion of the species in the list was determined from the following resources:

REMS vegetation survey (Lower Hunter & Central Coast Regional Environmental Management Strategy, <http://www.lhccrems.nsw.gov.au/projects/biodiversity/LakeMacquarieSpecies.xls>, 2002)

Species List from Cam's Wharf, Nesca Park, Green Point (Carl Fulton: Landcare vegetation officer, 2002),

Appendix 7: Regionally Significant Species (City of Lake Macquarie State of the Environment 1999-2000, 2000, p191-193)

Appendix 1: Green Point Estate flora list (Green Point Estate Bushland Park: Conservation and Management of Native Vegetation, June 1995, Urban Bushland Management Pty. Ltd.)

The fire tolerance of the species in the list were determined from the following resources:

Some Fire-retardant Plants for the Blue Mountains, Living Near the Bush: a voluntary code and information guide for Blue Mountains' residents and visitors, (Blue mountains Conservation Society)

Factsheet 5: Australian Plants for Fire Prone Central Coast Gardens (Australian Plants Society, Central Coast Group in conjunction with the Central Coast Waste Board, Gosford City Council and Wyong Shire Council)

Tree Selection for Fire Prone Areas (NSW Rural Fire Service, <http://www.bushfire.nsw.gov.au/communityfiresafety/fireguard03.htm,11/10/02>)

Using fire-retardant plants for fire protection (Queensland Natural resources and mines, <http://www.nrm.qld.gov.au/factsheets/pdf/tree/T51.pdf,9/12/02>)

Australian Plants for Fire Prone Areas (SGAP guide to Australian plants, <http://farrer.riv.csu.edu.au/ASGAP/fire.html,29/10/02>)

Legend for Vegetation Community:

W-Widespread, RF-Rainforest, F-Forest, OF-Open Forest, WL-Woodland, SL-Scrubland, HL-Heathland, GL-Grassland, SD-Sand dunes, B-River/Creek Banks, M-Marshes/Wetlands, E-Estuary, C-Coastal, m-moist, s-saline, r-rocky soil/rocky outcrops, f-freshwater, b-brackish, d-dry, ss-sandy soil, cs-slay soil.

Family	Scientific Name	Common Name	Vegetation Community	Habit	Found In Studies	Sold locally
Adiantaceae	<i>Adiantum aethiopicum</i>	Common Maidenhair Fern	RF,mB,	Fern, 15-40cm	y	
Adiantaceae	<i>Adiantum formosum</i>	Giant Maidenhair	RF, mF, mB	Herb, erect 1m	Y	
Adiantaceae	<i>Adiantum hispidulum</i>	Rough Maidenhair fern	RF,mF,mB,r	Fern, 50cm	y	
Agavaceae	<i>Doryanthes excelsa</i>	Gynea Lily/ Giant Lily	WL,r,ss	Herb, Stem:3-4m	y	Y
Aizoaceae	<i>Carpobrotus glaucescens</i>	Pigface	SD:C,ss	Herb, Creeping	y	Y
Anacardiaceae	<i>Euroschinus falcata</i>	Ribbonwood	RF	Tree, 10-20m	y	
Araceae	<i>Gymnostachys anceps</i>	Settler's Flax	RF	Herb, 2m	y	
Araliaceae	<i>Polyscias sambucifolia</i>	Elderberry Panax/ Celerywood	mF, ss	Tree, 3-8m	y	
Arecaceae	<i>Archontophoenix cunninghamiana</i>	Bangalow Palm	RF	Palm	y	Y
Arecaceae	<i>Livistona australis</i>	Cabbage-tree Palm	RF,C	Palm, 30m	y	Y
Asclepiadaceae	<i>Tylophora barbata</i>	Bearded Tylophora	RF, ss, mB	Herb, Creeper	y	
Asteraceae	<i>Brachycome multifida</i>	Cut-leaf Daisy	OF-GL	Herb, <40cm	y	Y
Asteraceae	<i>Chrysocephalum apiculatum</i>	Yellow Button/ Common Everlasting Daisy	F, GL, ss	Herb, 7-60cm	y	Y
Asteraceae	<i>Senecio lautus</i>	Coast Groundsel	SD:C,r	Herb, Ground Cover	y	
Atherospermataceae	<i>Doryphora sassafras</i>	Sassafras	RF	Tree, 20-40m	y	
Avicenniaceae	<i>Avicennia marina</i>	Grey Mangrove	sE,sM, C	Tree, 4-6m	y	
Bignoniaceae	<i>Pandorea pandorana</i>	Wonga-Wonga Vine	W, RF,ss	Climber, Woody	y	Y
Blechnaceae	<i>Doodia aspera</i>	Rasp fern	RF	Fern, 20-40cm	y	
Caesalpiniaceae	<i>Senna odorata</i>	Cassia/ Southern Cassia	WL, ss	Shrub, 1-2m	y	Y

Family	Scientific Name	Common Name	Vegetation Community	Habit	Found In Studies	Sold locally
Caprifoliaceae	<i>Sambucus australasica</i>	Yellow Elderberry/Native Elderberry	RF	Shrub, 2-4m	y	
Casuarinaceae	<i>Allocasuarina distyla</i>	Scrub She-oak	SL, HL, d,r	Shrub, dense, 4m	y	Y
Casuarinaceae	<i>Allocasuarina littoralis</i>	Black Sheoak	SL, WL, ss,r	Tree, 3-6m	y	Y
Casuarinaceae	<i>Allocasuarina torulosa</i>	Forest Oak	WL, F, m	Tree, 8m	y	Y
Casuarinaceae	<i>Casuarina glauca</i>	Swamp She-Oak	bM, bE, ss	Tree, 20m	y	Y
Celastraceae	<i>Cassine australis</i>	Red -fruited Olive Plum	RF	Tree, 6-10m	y	Y
Chenopodiaceae	<i>Atriplex australasica</i>	Saltbush	sE, sM	Herb, Sprawling annual	y	
Chenopodiaceae	<i>Atriplex cinerea</i>	Grey Saltbush	SD,C	Shrub, Erect 1m	y	
Chenopodiaceae	<i>Einadia nutans</i>	Native Seaberry/ Saloop-bush	C	Herb, Small weak 1m	Y	
Chenopodiaceae	<i>Sarcocornia quinqueflora</i>	Samphire/ Glasswort	sM, C	Herb, leafless 30cm	y	
Chenopodiaceae	<i>Suaeda australis</i>	Austral Seablite	sM, bE	Herb, 40cm	y	Y
Commelinaceae	<i>Aneilema acuminatum</i>		RF	Herb, 40cm	y	
Commelinaceae	<i>Commelina cyanea</i>	Native Wandering Jew	W	Herb	y	Y
Commelinaceae	<i>Pollia crispata</i>	Pollia	RF	Herb, 80cm	y	
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	RF, ss, m	Herb, Creeping	y	
Cunoniaceae	<i>Aphanopetalum resinosum</i>	Resin vine/ Gum vine	RF	Climber, woody	y	Y
Cunoniaceae	<i>Callicoma serratifolia</i>	Callicoma/ Black Wattle	RF, m,ss	Shrub, 4-5m	y	Y
Cunoniaceae	<i>Ceratopetalum apetalum</i>	Coachwood	RF,ss,mB	Tree, 15m	y	
Cunoniaceae	<i>Schizomeria australis</i>				y	

Family	Scientific Name	Common Name	Vegetation Community	Habit	Found In Studies	Sold locally
Cyperaceae	<i>Carex appressa</i>	Tall Sedge	W, RF, M, ss	Sedge, 70-100cm	y	Y
Cyperaceae	<i>Isolepis nodosus</i>	Knobby Clubrush	mC	Sedge, 70cm	y	Y
Dilleniaceae	<i>Hibbertia scandens</i>	Golden Guinea Flower	W	Climber	y	Y
Dioscoreaceae	<i>Dioscorea transversa</i>	Native Yam			y	
Ebenaceae	<i>Diospyros australis</i>	Black Plum	RF	Shrub, Small Tree	y	Y
Elaeocarpaceae	<i>Elaeocarpus obovatus</i>	Hard Quandong	RF	Tree, Medium	y	
Elaeocarpaceae	<i>Elaeocarpus reticulatus</i>	Blueberry Ash	WL, ss, mf,r	Tree, 4-10m	y	Y
Euphorbiaceae	<i>Baloghia inophylla</i>	Brush Bloodwood	RF	Tree, 6-10m	y	
Euphorbiaceae	<i>Breynia oblongifolia</i>	Coffee Bush	RF, ss, mB	Shrub, 2-3m	y	
Euphorbiaceae	<i>Glochidion ferdinandi</i>	Cheese Tree	RF,ss,mB	Tree, small	y	Y
Euphorbiaceae	<i>Omalanthus populifolius</i>	Bleeding Heart	RF	Shrub, 2-4m	y	Y
Eupomatiaceae	<i>Eupomatia laurina</i>	Bolwarra	RF	Shrub, Small Tree	y	Y
Fabaceae	<i>Jacksonia scoparia</i>	Dogwood	dF,ss,r	Shrub, 3m	y	
Fabaceae	<i>Kennedia prostrata</i>	Running Postman	HL,WL	Herb, Creeper	y	Y
Fabaceae (Faboideae)	<i>Hardenbergia violacea</i>	False Sarsaparilla	WL,W,r	Herb, Attractive scrambler	y	Y
Fabaceae (Faboideae)	<i>Kennedia rubicunda</i>	Red Kennedy Pea/ Dusky Coral Pea	W	Herb, Attractive scrambler	y	Y
Fabaceae (Mimosoideae)	<i>Acacia binervata</i>	Two-veined Hickory	mF, C, RF, ss	Tree, Dense 16m	y	
Fabaceae	<i>Acacia brownei</i>		WL, ss	Shrub, spiky 1m	y	

Family	Scientific Name	Common Name	Vegetation Community	Habit	Found In Studies	Sold locally
(Mimosoideae)						
Fabaceae (Mimosoideae)	<i>Acacia bynoeana</i>	Bynoe's Wattle	HL, WL	Shrub, low	y	
Fabaceae (Mimosoideae)	<i>Acacia cheelii</i>				y	
Fabaceae (Mimosoideae)	<i>Acacia decurrens</i>	Sydney Green Wattle	F	Tree, 10-16m	y	
Fabaceae (Mimosoideae)	<i>Acacia echinula</i>	Prickly Wattle	OF, HL	Shrub	y	
Fabaceae (Mimosoideae)	<i>Acacia elongata</i>	Swamp Wattle	HL,WL, m	Shrub, 3m	y	
Fabaceae (Mimosoideae)	<i>Acacia falcata</i>	Sickle Wattle	WL, cs,	Shrub, open 5m	y	Y
Fabaceae (Mimosoideae)	<i>Acacia filicifolia</i>	Fern-leaved Wattle	OF, WL	Tree, small	y	
Fabaceae (Mimosoideae)	<i>Acacia floribunda</i>	White Sally/White Sallow Wattle	B	Shrub, Dense 2-4m	y	Y
Fabaceae (Mimosoideae)	<i>Acacia howittii</i>	Sticky Wattle	m	Tree	Central Coast	Y
Fabaceae (Mimosoideae)	<i>Acacia implexa</i>	Hickory, Lightwood	me,cs	Shrub, Small tree, 4-10m	y	Y
Fabaceae (Mimosoideae)	<i>Acacia irrorata</i>	Green Wattle	mB, ss	Tree, 15m	y	Y
Fabaceae	<i>Acacia linifolia</i>	Flax-leaved Wattle	HL,WL	Shrub, 2m	y	

Family	Scientific Name	Common Name	Vegetation Community	Habit	Found In Studies	Sold locally
(Mimosoideae)						
Fabaceae (Mimosoideae)	<i>Acacia longifolia</i>	Sydney Golden Wattle	F,m	Shrub, 3-4m	y	Y
Fabaceae (Mimosoideae)	<i>Acacia maidenii</i>	Maiden's Wattle	RF, C	Tree 12m	y	
Fabaceae (Mimosoideae)	<i>Acacia myrtifolia</i>	Red-stemmed Wattle	WL,ss	Shrub, erect .5-1m	y	Y
Fabaceae (Mimosoideae)	<i>Acacia obtusifolia</i>		WL	Shrub, erect 3m	y	
Fabaceae (Mimosoideae)	<i>Acacia parramattensis</i>				y	
Fabaceae (Mimosoideae)	<i>Acacia prominens</i>	Golden Rain Wattle/Gosford Wattle	WL	Shrub, erect 3-6m	Central Coast	
Fabaceae (Mimosoideae)	<i>Acacia quadrilateralis</i>				y	
Fabaceae (Mimosoideae)	<i>Acacia sophorae</i>	Coastal Wattle	SD,ss	Shrub, 3m	y	Y
Fabaceae (Mimosoideae)	<i>Acacia stricta</i>	Straight Wattle	OF	Shrub, 3m	y	
Fabaceae (Mimosoideae)	<i>Acacia suaveolens</i>	Sweet Wattle	HL, WL	Shrub, 1.5m	y	Y
Fabaceae (Mimosoideae)	<i>Acacia terminalis</i>	Cedar Wattle/ Sunshine Wattle	HL, WL,m	Shrub, 1.5m	y	Y
Fabaceae	<i>Acacia ulicifolia</i>	Prickly Moses	WL, d	Shrub, 1.5m	y	Y

Family	Scientific Name	Common Name	Vegetation Community	Habit	Found In Studies	Sold locally
(Mimosoideae)						
Fabaceae (Mimosoideae)	<i>Pararchidendron pruinoseum</i>	Snow Wood	RF	Tree 4-8	y	
Flacourtiaceae	<i>Scolopia braunii</i>	Scolopia/ Flintwood	RF	Tree 3-8m	y	
Goodeniaceae	<i>Scaevola aemula</i>	Fairy fan flower		20cm	y	Y
Goodeniaceae	<i>Scaevola albida</i>	Pale fan flower	OF, cs	Herb, 30-50cm	y	Y
Goodeniaceae	<i>Scaevola calendulacea</i>	Scented Fan Flower	SD,C	Herb	y	Y
Goodeniaceae	<i>Scaevola ramosissima</i>	Snake-flower	WL, ss	Herb, Scrambling .5-1m	y	Y
Juncaceae	<i>Juncus usitatus</i>	Common Rush	M,E,m	Sedge, <1m	y	Y
Lauraceae	<i>Cryptocarya glaucescens</i>	Brown Beech/ Jackwood	RF	Tree, 15-30m	y	
Lauraceae	<i>Cryptocarya microneura</i>	Murrogun	RF	Tree, 15-30m	y	
Lauraceae	<i>Cryptocarya rigida</i>	Forest Maple			y	
Lauraceae	<i>Endiandra discolor</i>	Rose Walnut	RF	Tree	y	
Lauraceae	<i>Endiandra sieberi</i>	Corkwood	RF, ss, mWL	Tree, 20-30m	y	
Lauraceae	<i>Neolitsea dealbata</i>	White Bolly Gum	RF	Tree, Tall	y	
Liliaceae	<i>Dianella caerulea</i>	Paroo Lily/ Blue Flax Lily	WL, ss	Herb, Tufted 50cm	y	Y
Lobeliaceae	<i>Lobelia alata</i>		CB,CE	Herb, 10-50cm	y	Y
Luzuriagaceae	<i>Geitenoplesium cymosum</i>	Scrambling Lily	RF, F	Climber, wiry	y	
Meliaceae	<i>Melia azedarach</i>	White Cedar	W	Tree, 3-8m, Deciduous in Winter	y	Y

Family	Scientific Name	Common Name	Vegetation Community	Habit	Found In Studies	Sold locally
Meliaceae	<i>Synoum glandulosum</i>	Scentless Rosewood	RF, m	Shrub, 1.5-3m	y	
Monimiaceae	<i>Wilkiea huegeliana</i>	Wilkiea	RF	Shrub, 2-4m	y	
Moraceae	<i>Ficus coronata</i>	Sand Paper Fig/Creek Sandpaper fig	RF,B	Tree, 3-4m,Straggly	y	Y
Moraceae	<i>Ficus fraseri</i>	Fraser's Sandpaper Fig		Tree, Small, fast growth	y	
Moraceae	<i>Ficus macrophylla</i>	Moreton Bay Fig	RF	Tree, 30-50m	y	Y
Moraceae	<i>Ficus obliqua</i>	Small-leaved Fig	RF	Tree, <40m	y	Y
Moraceae	<i>Ficus rubiginosa</i>	Port Jackson Fig/Rusty Fig	RF, B,r	Tree, 4-10m	y	Y
Moraceae	<i>Maclura cochinchinensis</i>	Cockspur Thorn	RF	Shrub, 2-3m	y	
Moraceae	<i>Streblus brunonianus</i>	Whalebone Tree	RF	Tree, 3-8m	y	
Myoporaceae	<i>Eremophila debilis</i>	Amulla	M,OF	Shrub, 1m	Central Coast	Y
Myoporaceae	<i>Myoporum acuminatum</i>	Mangrove boobialla	RF,E, C, F	Tree, 4-6m	y	
Myoporaceae	<i>Myoporum boninense</i>	Boobialla	rC, ss	Shrub, Scrambling .5-1.5m	y	
Myoporaceae	<i>Myoporum parvifolium</i>	Creeping boobialla			Central Coast	Y
Myrsinaceae	<i>Rapanea howittiana</i>	Turnipwood/ Brush Muttonwood	RF	Tree, 3-10m	y	Y
Myrsinaceae	<i>Rapanea variabilis</i>	Mutton Wood	F, ss	Shrub, 2-3m	y	Y
Myrtaceae	<i>Acmena smithii</i>	Lilly Pilly	RF	Tree, 20m, Fast growing	y	Y

Family	Scientific Name	Common Name	Vegetation Community	Habit	Found In Studies	Sold locally
Myrtaceae	<i>Angophora costata</i>	Sydney Red Gum/ Smooth-barked Apple	W	Tree	y	Y
Myrtaceae	<i>Angophora hispida</i>	Dwarf apple	CF	Shrub, <4m	Central Coast	Y
Myrtaceae	<i>Backhousia myrtifolia</i>	Grey Myrtle	RF, mB	Shrub, 3-4m	y	Y
Myrtaceae	<i>Choricarpia leptopetala</i>	Brush Turpentine			y	
Myrtaceae	<i>Eucalyptus maculata/ Corymbium maculata</i>	Spotted Gum	W, OF	Tree, <30m	y	Y
Myrtaceae	<i>Rhodamnia rubescens</i>	Scrub Turpentine	RF	Tree, 4-8m	y	
Myrtaceae	<i>Syzygium oleosum</i>	Blue Lilly Pilly	RF	Tree, 3-8m, fast growing	y	
Myrtaceae	<i>Syzygium paniculatum</i>	Magenta Lillypilly/ Scrub cherry	RF	Tree, 3-8m	y	Y
Myrtaceae	<i>Tristaniopsis laurina</i>	Water Gum	RF,rE	Tree, 4-10m	y	Y
Oleaceae	<i>Notalaea longifolia</i>	Mock Olive	mF	Shrub, 2-4m	y	
Oleaceae	<i>Notalaea venosa</i>		RF	Tree, 2.5-8m	y	
Pittosporaceae	<i>Bursaria spinosa</i>	Blackthorn/ Sweet Bursaria	F	Shrub, 2-3m	y	Y
Pittosporaceae	<i>Citriobatus pauciflorus</i>	Orange Thorn	RF	Shrub, 1-1.5m	y	
Pittosporaceae	<i>Hymenosporum flavum</i>	Native Frangipani	RF	Tree, Small	y	Y
Pittosporaceae	<i>Pittosporum revolutum</i>	Rough-fruit Pittosporum	mF, RF	Shrub, 1-3m	y	Y
Pittosporaceae	<i>Pittosporum undulatum</i>	Sweet Pittosporum	RF	Tree, 3-10m	y	Y
Poaceae	<i>Oplismenus aemulus</i>	Basket grass	RF, F,mWL	Herb, small weak grass	y	

Family	Scientific Name	Common Name	Vegetation Community	Habit	Found In Studies	Sold locally
Poaceae	<i>Oplismenus imbecillis</i>	Basket grass	RFT,F ,mWL	Herb, small weak grass	y	
Podocarpaceae	<i>Podocarpus elatus</i>	Brown pine	WL	Tree	y	Y
Proteaceae	<i>Banksia aemula</i>		C, ss	Shrub, 4m	y	
Proteaceae	<i>Banksia integrifolia</i>	Coastal Banksia	CSL,CF,CSD,E ,ss	Shrub,Tree 6-16m	y	Y
Proteaceae	<i>Banksia marginata</i>	Silver Banksia	HL, WL	Shrub,Tree 6m	y	Y
Proteaceae	<i>Banksia oblongifolia</i>	Rock Banksia	HL,WL,W	Shrub, Spreading .5-2m	y	Y
Proteaceae	<i>Banksia spinulosa</i>	Hair-pin Banksia	WL,m	Shrub, 2m	y	Y
Proteaceae	<i>Grevillea linearifolia</i>	White spider flower	HL,WL	Shrub, 2m	y	Y
Proteaceae	<i>Grevillea montana</i>				y	
Proteaceae	<i>Grevillea sericea</i>	Pink spider flower	HL	Shrub, 1-2m	y	Y
Proteaceae	<i>Grevillea x gaudichaudii</i>		m	<1m	Central Coast	Y
Proteaceae	<i>Hakea bakeriana</i>		HL,WL	Shrub, 2m	y	
Proteaceae	<i>Hakea dactyloides</i>	Finger Hakea/Broad-leaved Hakea	HL,dF,W, ss	Shrub, 1.5-4m	y	Y
Proteaceae	<i>Hakea salicifolia</i>	Willow-leaved Hakea	mWL,mF	Shrub, tree >2m	Central Coast	Y
Proteaceae	<i>Isopogon anemonifolius</i>	Drumstick	HL,SL	Shrub, 1-1.5m	y	
Proteaceae	<i>Lambertia formosa</i>	Mountain Devil	HL,SL,dF	Shrub, <1.5m	y	Y

Family	Scientific Name	Common Name	Vegetation Community	Habit	Found In Studies	Sold locally
Proteaceae	<i>Lomatia silaifolia</i>	Crinkle Bush	dF	Shrub, Low tufted ground	y	Y
Proteaceae	<i>Persoonia lanceolata</i>	Geebung	HL	Shrub, Erect 2m	y	
Proteaceae	<i>Persoonia laurina subsp laurina</i>	Golden Geebung	WL	Shrub, 1m, Spreading	y	
Proteaceae	<i>Persoonia levis</i>	Broad-leaved Geebung	HL,WL	Shrub, 4m	y	
Proteaceae	<i>Persoonia linearis</i>	Narrow-leaved Geebung	W	Shrub, 3m	y	
Proteaceae	<i>Stenocarpus sinuatus</i>	Firewheel tree	RF	Tree	Central Coast	Y
Proteaceae	<i>Xylomelum pyriforme</i>	Woody Pear	F, ss, W	Shrub, 2-4m	y	
Rhamnaceae	<i>Alphitonia excelsa</i>	Red Ash		Tree 6-10m	y	Y
Rutaceae	<i>Acronychia oblongifolia</i>	Acronychia/ Lemon Aspen	RF	Shrub, Tree 2-8m	y	Y
Rutaceae	<i>Eriostemon myoporoides ssp. Myoporoides</i>	Long leaf Wax Flower	mB	Shrub, 1-2m	Central Coast	Y
Rutaceae	<i>Melicope micrococca</i>	White Euodia/ Hairy-leaved Doughwood	RF	Shrub, tree 1-6m	y	
Rutaceae	<i>Sarcomelicope simplicifolia</i>	Yellow Lillypilly	RF	Tree, 8m	y	
Sapindaceae	<i>Alectryon subcinereus</i>	Native Quince/ Wild Quince	RF	Tree, 8m	y	Y
Sapindaceae	<i>Cupaniopsis anacardiodes</i>	Tuckeroo	C,m,RF	Tree, 3-10m	y	Y
Sapindaceae	<i>Diploglottis australis</i>	Native Tamarind	RF	Tree, 20m	y	Y
Sapindaceae	<i>Dodonaea triquetra</i>	Common Hop Bush	F	Shrub, 2m	y	Y

Family	Scientific Name	Common Name	Vegetation Community	Habit	Found In Studies	Sold locally
Sapindaceae	<i>Guioa semiglauca</i>	Guioa	RF	Tree, 8-15m	y	
Sapotaceae	<i>Planchonella australis</i>	Black Apple	RF	Tree, 8-20m	y	
Sinopteridaceae	<i>Pellaea falcata</i>	Sickle Fern	OF,RF	Fern, 60cm	y	
Solanaceae	<i>Duboisia myoporoides</i>	Corkwood	RF	Shrub, 3-6m	y	
Solanaceae	<i>Solanum lanceolatum</i>	Kangaroo apple			Central Coast	
Sterculiaceae	<i>Brachychiton populneum</i>	Kurrajong	W, dcs,r	Tree, 10-35m, deciduous in winter		
Sterculiaceae	<i>Commersonia fraseri</i>	Black-fellow's Hemp	mF,mB,RF	Tree, 3-6m	y	
Symplocaceae	<i>Symplocos stawellii</i>	Buff Hazelwood	RF	Tree, 4-8m	y	
Ulmaceae	<i>Trema aspera</i>	Native Peach	mF,mB,RF	Tree, 3-6m	y	Y
Verbenaceae	<i>Clerodendrum tomentosum</i>	Hairy Clerodendrum	mF	Shrub, 2-4m	y	
Violaceae	<i>Viola hederacea</i>	Native Violet	m, W	Herb, Creeping	y	Y
Vitaceae	<i>Cissus hypoglauca</i>	Water Vine	RF,mC	Climber, Woody Vine	y	
Xanthorrhoeaceae	<i>Lomandra longifolia</i>	Mat rush	W	Herb, tufted 50cm	y	Y
	<i>Dysoxylum fraserianum</i>	Rosewood	RF	Tree, Large	y	Y

## APPENDIX E - SUITABLE SPECIES FOR SQIDS

**Note: the following tables list local native species suitable for SQID planting. These are not exhaustive lists and do not preclude designers from using other species suitable to climatic, function and landscape design objectives.**

**Table 1 - Filter strips, Grassed and Planted Swales**

Note: Kikuyu grass is not to be specified in the vicinity of drainage infrastructure.

Scientific Name	Common Name	Form	Height (mm)	Planting Density (min/m2)*	Comments
<i>Cynodon Dactylon</i>	Couch	Grass	50-150	Seeded or rolled	Mowing required to achieve smaller heights
<i>Digitaria didactyla</i>	Blue Couch	Grass	50-150	Seeded or rolled	Mowing required to achieve smaller heights
<i>Paspalum distichum</i>	Water Couch	Grass	To 500	Seeded or rolled	Not suitable for sandy soils with low water holding capacity
<i>Paspalum vaginatum cv. 'Saltene'</i>	Salt Water Couch	Grass	To 500	Seeded or rolled	Salt tolerant
<i>Sporobolus virginicus</i>	Marine Couch	Grass	To 400	Seeded or rolled	Salt tolerant
<i>Stenotaphrum secundatum</i>	Buffalo	Grass	50-150	Seeded or rolled	Mowing required to achieve smaller heights
<i>Bacopa monnieri</i>	Bacopa	Prostrate	100	6-8	
<i>Carpobrotus glaucescens</i>	Pigface	Prostrate	100	4-6	Suitable for infrequently flooded areas only
<i>Myoporum boobialla</i>	Boobialla	Prostrate	150	4-6	Suitable for infrequently flooded areas only
<i>Viola hederacea</i>	Native Violet	Prostrate	100	4-6	Shade tolerant. Suitable for infrequently flooded areas only
<i>Baumea juncea</i>	Bare twig-rush	Tufted	1500	4-6	

\*Planting densities shown are minimum requirements for Viro-tube planting. Decreased densities will only be accepted if pot sizes are increased accordingly.

<i>Carex appressa</i>	Tussock sedge	Tufted	1000	6-8	
<i>Crinum pendunculatum</i>	Swamp Lily	Tufted	1500	4-6	Suitable for infrequently flooded areas only
<i>Cyperus laevigatus</i>	-	Tufted	400-600	6-8	
<i>Dianella caerulea</i> cv 'Breeze'	Blue Flax Lily	Tufted	600	4-6	Suitable for infrequently flooded areas only
<i>Dianella caerulea</i> cv 'Little Jess'	Blue Flax Lily	Tufted	400	6-8	Shade tolerant. Suitable for infrequently flooded areas only
<i>Dianella longifolia</i> var. <i>longifolia</i>	Pale Flax Lily	Tufted	500	6-8	Shade tolerant. Suitable for infrequently flooded areas only
<i>Dianella tasmanica</i>	Tasman Flax Lily	Tufted	1000	4-6	Shade tolerant. Suitable for infrequently flooded areas only
<i>Dichelachne crinita</i>	Long Haired Plume Grass	Tufted	200	6-8	
<i>Gahnia clarkei</i>	Saw Sedge	Tufted	2500	4-6	Has moderate salt tolerance.
<i>Gahnia sieberiana</i>	Saw Sedge	Tufted	2500	4-6	Has moderate salt tolerance.
<i>Isolepis nodosa</i> (syn. <i>Ficinia nodosa</i> )	Knobby Clubrush	Tufted	700	6-8	Salt tolerant.
<i>Juncus kraussii</i>	Sea Rush	Tufted	600-2500	6-8	Salt tolerant.
<i>Juncus usitatus</i>	Common Rush	Tufted	500	8-10	
<i>Lomandra longifolia</i>	Spiny Mat Rush	Tufted	1000	4-6	Shade tolerant. Suitable for infrequently flooded areas only
<i>Lomandra longifolia</i> cv 'Katrinus'	Mat Rush	Tufted	1000	4-6	Shade tolerant. Suitable for infrequently flooded areas only

\*Planting densities shown are minimum requirements for Viro-tube planting. Decreased densities will only be accepted if pot sizes are increased accordingly.

<i>Lomandra longifolia</i> cv 'Tanika'	Mat Rush	Tufted	500-1000	4-6	Shade tolerant. Suitable for infrequently flooded areas only
<i>Poa labillardieri</i> cv 'Eskdale'	Eskdale	Tufted	450	6-8	Suitable for infrequently flooded areas only
<i>Themeda australis</i>	Kangaroo Grass	Tufted	500	6-8	Suitable for infrequently flooded areas only
<i>Themeda australis</i> cv 'Mingo'	Mingo	Tufted	200	8-10	Suitable for infrequently flooded areas only
<i>Callicoma serratifolia</i>	Black Wattle	Shrub	4.0m	N/A	
<i>Callistemon salignus</i>	White Bottlebrush	Tree	4.0m	N/A	
<i>Banksia integrifolia</i>	Coast Banksia	Tree	10.0m	N/A	
<i>Casuarina glauca</i>	Swamp Oak	Tree	15.0m	N/A	
<i>Eucalyptus robusta</i>	Swamp Mahogany	Tree	25.0m	N/A	
<i>Livistona australis</i>	Cabbage Tree palm	Tree	12.0m +	N/A	
<i>Melaleuca linariifolia</i>	Snow-in-Summer	Tree	8.0m	N/A	
<i>Melaleuca nodosa</i>	Prickly-leaved Paperbark	Tree	2.0m - 7.0m	N/A	
<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Tree	6.0 – 15.0m	N/A	
<i>Melaleuca quinquinervia</i>	Broad-leaved Paperbark	Tree	12.0m	N/A	

\*Planting densities shown are minimum requirements for Viro-tube planting. Decreased densities will only be accepted if pot sizes are increased accordingly.

**Table 2 - Biofiltration/Bioretenion Systems**

Note: the following list of core plant species has been derived from the *Water By Design Bioretention Technical Design Guidelines*. Using these core plant species ensures that a minimum level of bioretention performance will be achieved. At least 50% of the filter area should be planted with the core plant species, and the remainder of the filter media area should be planted with the supplemental species. Batter slopes and non-filter media areas should be planted with species suitable for the landscape objectives, anticipated wetting and drying regime, and local climatic conditions.

Scientific Name	Common Name	Form	Height (mm)	Planting Density (min/m <sup>2</sup> )*	Comments
<b>Core functional species</b>					
<i>Carex appressa</i>	Tussock sedge	Tufted	1000	6-8	Suitable for sporadically flooded areas.
<i>Isolepis nodosa</i> (syn. <i>Ficinia nodosa</i> )	Knobby Clubrush	Tufted	700	6-8	Salt tolerant.
<i>Imperata cylindrica</i>	Blady Grass	Tufted	500	6-8	
<i>Lepidosperma laterale</i>	Variable sword-sedge	Tufted	500-1000	6-8	
<i>Lomandra longifolia</i>	Spiny Mat Rush	Tufted	1000	4-6	Shade tolerant. Suitable for infrequently flooded areas only
<i>Poa labillardieri</i> cv 'Eskdale'	Eskdale	Tufted	450	6-8	Suitable for infrequently flooded areas only
<i>Themeda australis</i>	Kangaroo Grass	Tufted	500	6-8	Suitable for infrequently flooded areas only
<i>Banksia robur</i>	Swamp banksia	Shrub/Small tree	1.5m	One plant per 2-20sq.m. Min. pot size 140mm	
<i>Melaleuca thymifolia</i>	Thyme Honey Myrtle	Shrub	1000	One plant per 2-20sq.m. Min. pot size 140mm	
<i>Casuarina glauca</i>	Swamp Oak	Tree	15.0m	N/A	

\*Planting densities shown are minimum requirements for Viro-tube planting unless otherwise noted. Decreased densities will only be accepted if pot sizes are increased accordingly.

<i>Melaleuca quinquinervia</i>	Broad-leaved Paperbark	Tree	12.0m	N/A	
<b>Supplementary species</b>					
<i>Gahnia clarkei</i>	Saw Sedge	Tufted	2500	4-6	Has moderate salt tolerance.
<i>Gahnia sieberiana</i>	Saw Sedge	Tufted	2500	4-6	Has moderate salt tolerance.
<i>Juncus usitatus</i>	Common Rush	Tufted	500	8-10	
<i>Buckinghamia celsissima</i>	Ivory Curl Flower	Shrub	2.0m	One plant per 2-20sq.m. Min. pot size 140mm	
<i>Hibiscus heterophyllus</i>	Native Rosella	Shrub	1.5m	One plant per 2-20sq.m. Min. pot size 140mm	
<i>Cupaniopsis anacardioides</i>	Tuckeroo	Tree	7.5m	N/A	
<i>Tristaniopsis laurina</i>	Water Gum	Tree	7.5m	N/A	
<i>Waterhousia floribunda</i>	Weeping Lily-pilly	Tree	10.0m	N/A	
<i>Paspalum distichum</i>	Water Couch	Grass	To 500	Seeded or rolled	Not suitable for sandy soils with low water holding capacity
<i>Paspalum vaginatum</i> cv. 'Saltene'	Salt Water Couch	Grass	To 500	Seeded or rolled	Salt tolerant
<i>Sporobolus virginicus</i>	Marine Couch	Grass	To 400	Seeded or rolled	Salt tolerant
<i>Zoysia macrantha</i>	Zoysia	Grass	To 150mm	6-8	Suitable for infrequently flooded areas only

\*Planting densities shown are minimum requirements for Viro-tube planting unless otherwise noted. Decreased densities will only be accepted if pot sizes are increased accordingly.

**Table 3 - Constructed Wetlands and Sediment Basins**

Scientific Name	Common Name	Depth below permanent pool water level (mm)	Zone	Form	Height (mm)	Planting Density (min/m <sup>2</sup> )*	Comments
<i>Ludwigia peploides</i>	Water Primrose	1.5-0.5	Open Water	Submerged macrophyte	500	1	Rapid growth; yellow flowers.
<i>Ottelia ovalifolia</i>	Swamp Lily	0.5-0.35	Deep Marsh	Submerged macrophyte	1000	1	Attractive white flowers.
<i>Baumea articulata</i>	Jointed twig-rush	0.5-0.35	Deep Marsh	Emergent macrophyte	1000-2000	6-8	Slow growing
<i>Bolboschoenus fluviatilis</i>	Marsh Club-rush	0.5-0.35	Deep Marsh	Emergent macrophyte	1500	4-6	Flow resistant
<i>Eleocharis sphacelata</i>	Tall Spike-rush	0.5-0.35	Deep Marsh	Emergent macrophyte	1250	6-8	Slow establishment; rhizomes can restrict growth of other plants; flow resistant
<i>Schoenoplectus validus</i>	River Club-rush	0.5-0.35	Deep Marsh	Emergent macrophyte	1500	4-6	
<i>Triglochin procerum</i>	Water-ribbon	0.5-0.35	Deep Marsh	Emergent macrophyte	2000	4-6	Aesthetic; spreading
<i>Alisma plantago-aquatica</i>	Water Plantain	0.35-0.2	Marsh	Tufted	1000	4-6	Rapid establishment
<i>Bolboschoenus caldwellii</i>	Club-rush	0.35-0.2	Marsh	Emergent macrophyte	1000	4-6	Rapid establishment; salt tolerant
<i>Baumea juncea</i>	Bare twig-rush	0.2-0.0	Shallow Marsh	Tufted	1500	4-6	<i>Slow establishment</i>

\*Planting densities shown are minimum requirements for Viro-tube planting unless otherwise noted. Decreased densities will only be accepted if pot sizes are increased accordingly.

<i>Isolepis nodosa</i> (syn. <i>Ficinia nodosa</i> )	Knobby Clubrush	0.2-0.0	Shallow Marsh	Tufted	700	6-8	Salt tolerant.
<i>Juncus usitatus</i>	Common Rush	0.2-0.0	Shallow Marsh	Tufted	500	8-10	Rapid growth
<i>Carex appressa</i>	Tussock sedge	0.0-+0.2	Ephemeral Marsh	Tufted	1000	6-8	
<i>Ranunculus inundatus</i>	River Buttercup	0.0-+0.2	Ephemeral Marsh	Prostrate (groundcover)	300	4-6	Rapid growth, often forms large mats.
<i>Cyperus laevigatus</i>	-	+0.2-+0.5	Batters	Tufted	400-600	6-8	
<i>Dianella longifolia</i> var. <i>longifolia</i>	Pale Flax Lily	+0.2-+0.5	Batters	Tufted	500	6-8	Shade tolerant
<i>Gahnia clarkei</i>	Saw Sedge	+0.2-+0.5	Batters	Tufted	2500	4-6	Has moderate salt tolerance.
<i>Gahnia sieberiana</i>	Saw Sedge	+0.2-+0.5	Batters	Tufted	2500	4-6	Has moderate salt tolerance.
<i>Lomandra longifolia</i>	Spiny Mat Rush	+0.2-+0.5	Batters	Tufted	1000	4-6	Shade tolerant
<i>Triglochin striatum</i>	Streaked Arrow Grass	+0.2-+0.5	Batters	Emergent macrophyte	300	6-8	Salt tolerant
<i>Viola hederacea</i>	Native Violet	+0.2-+0.5	Batters	Prostrate (groundcover)	100	4-6. Min. pot size 140mm	Shade tolerant. Rapid growth. Prolific once established. Flowering.
<i>Callistemon salignus</i>	White Bottlebrush	+0.2-+0.5	Batters	Tree	4.0m	N/A	Moist sandy and alluvial soils-tolerates part shade.
<i>Eucalyptus robusta</i>	Swamp Mahogany	+0.2-+0.5	Batters	Tree	25.0m	N/A	Tolerates inundation
<i>Lophostemon confertus</i>	Brush Box	+0.2-+0.5	Batters	Tree	25m		Moist sandy or alluvial clay soils

\*Planting densities shown are minimum requirements for Viro-tube planting unless otherwise noted. Decreased densities will only be accepted if pot sizes are increased accordingly.

<i>Melaleuca linariifolia</i>	Snow-in-Summer	+0.2-+0.5	Batters	Tree	8.0m	N/A	Moist sandy soils and swampy areas
<i>Melaleuca nodosa</i>	Prickly-leaved Paperbark	+0.2-+0.5	Batters	Tree	2.0m - 7.0m	N/A	Moist sandy soils
<i>Melaleuca quinquinervia</i>	Broad-leaved Paperbark	+0.2-+0.5	Batters	Tree	12.0m	N/A	Tolerates inundation

\*Planting densities shown are minimum requirements for Viro-tube planting unless otherwise noted. Decreased densities will only be accepted if pot sizes are increased accordingly.