Ephemeral and Terrestrial Plant Installation Standard

Melbourne Water is owned by the Victorian Government. We manage Melbourne's water supply catchments, remove and treat most of Melbourne's sewage, and manage rivers and creeks and major drainage systems throughout the Port Phillip and Westernport region.

Melbourne Water
Enhancing Life and Liveability

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Executive Summary

The purpose of this document is to provide Melbourne Water's stakeholders with a clear set of standards for the effective installation of ephemeral and terrestrial plants. This standard applies to tube-stock and Hiko plantings.

The success of projects is strongly influenced by a number factors including but not limited to:

- site preparation
- seedling and seed quality
- planting technique
- species suitability
- species location and niche requirements
- seasonal conditions/moisture availability
- And the level of ongoing maintenance.

Factors such as operator skill and experience are a variable which are managed by training and competency auditing. The aim of this standard is to clearly specify Melbourne Waters requirements so that operator error is mitigated; ensuring the quality of ephemeral and terrestrial planting is of the highest standard.

Introduction

Melbourne Water invests substantial resources annually into the construction and management of Water Quality treatment Systems (constructed wetlands) across its operating area.

The quality of plants installed within these wetlands is a key determinant of plant establishment and survival and ultimately project success. Given the scope of these works and the amount of money invested, it is critical that Melbourne Water has clear standards articulating the organisation's needs, also adhering to the highest industry standards.

Ephemeral& terrestrial plants installed on Melbourne Water projects will adhere to the requirements of this standard and also the *Wetland Design Manual. Part A2: Deemed to comply design criteria*. (See Appendix A for info).

Overview

Constructed wetland plantings are natural filters used to treat stormwater. The planting contractor is to establish planting outcomes to the requirements of this document for the entire ephemeral and terrestrial zones.

The ephemeral and terrestrial plant installation standard provides a framework to manage the challenges to wetland plant establishment which need to be considered and managed by the planting contractor.

Key constraints to establishing wetland vegetation include:

- Top soil quality and depth
- Weed competition
- Site preparation.
- Weed control post planting
- Availability of water
- Depth of water in planting zones
- Frequency and duration of inundation
- Post planting wetland depth management
- Season of planting
- Plant selection and provenance
- Quality of plants
- Installation technique.

Pre-planting Site Preparation:

Of critical importance is ensuring enough pre-planting preparation time is available. Truncating preparation time in order to satisfy tight timelines inevitably leads to unsatisfactory outcomes.

Weed control prior to planting

Weed species compete with desirable plant species for light, water and nutrients which greatly impacts on the success of the project. Good quality site preparation will provide developing plants with the best possible conditions for growth and make ongoing maintenance easier and more cost effective.

Optimal requirements for site preparation are the establishment of a planting niche 12 months prior to plant installation. Preparation may include slashing, burning and/or herbicide application and ensures that root competition has been eliminated.

Soil preparation

The specification for soils and landscaping of constructed Melbourne Water assets must be utilised for appropriate soil preparation standards. Large scale soil preparation methods rely on machinery which cause significant disturbance, increased likelihood of weed invasion and significant changes in compaction and soil profile mixing which all need to be managed.

Poor quality topsoil will not support healthy plant growth. Insufficient depth will mean the plants will not have adequate material to be bedded into and leave the plant root-ball exposed.

The planting consultant and contractor are to review the quality of topsoil present and ensure there is adequate depth and quality for planting prior to installation occurring. While the planting contractor may not be tasked with laying the topsoil they take control of the site in the planting phase and should ensure they have received a site suitable to plant into as they are responsible for plant establishment. Should the topsoil not be acceptable, the planting consultant and contractor must notify Melbourne Water immediately so that it can be rectified prior to installation occurring.

Soil used on Melbourne Water sites must be rated as clean fill under EPA-VIC IWRG621, be free of building debris, contain no more than 5% by weight of particles >20mm and no particle size >50mm and be free of living plant propagules (weed seeds) with the exception of utilising site won material.

The prepared area must be sprayed for weeds prior to any imported or site won topsoil being placed. The sub base preparation for the ephemeral and terrestrial zones will be ripped to a depth of not less than 100mm; Ripped to a minimum of 200mm spacing's in a 'cross hatched' fashion (preference is for vibrating type cultivation tines to be used); the moisture content of the sub base will be conducive to the sub base shattering rather than being moulded by the ripping action; topsoil within the ephemeral and terrestrial zones must be placed in 100mm layers followed by ripping to incorporate this layer through the sub-base interface. Ripping will be done so as to mix the interface to a 100mm depth. Once the 200mm depth is reached the surface will be lightly compacted and left in a friable tilth. Topsoil must be spread in a 200mm thick layer across the entire ephemeral

and terrestrial zones. *Note:* Ripping is undertaken to avoid topsoil shearing and to encourage anchorage of roots in the soil/substrate interface.

Climatic Conditions and soil moisture levels

Soil moisture is an extremely important determinant for the success of plantings and direct seeding. The establishment of vegetation should be timed to maximise the likelihood of adequate soil moisture being available.

Contractors must be aware of the most appropriate time for planting based on the annual soil moisture conditions and seasonal factors of their region/location.

As a rule of thumb, the planting window for ephemeral and terrestrial planting is approximately April to September. Planting outside of these times may lead to a poor outcome, top up planting, extension of establishment and defects period or rejection of the asset by Melbourne Water. Any proposal to install and establish planting outside of the optimal times should be discussed with Melbourne Water.

Plant Selection

All plant material must meet Melbourne Waters standards. Standards are in place for ephemeral and terrestrial Plant supply and plant selection and provenance. These standards are based on Florabank guidelines and relevant state guidelines developed in collaboration with various agencies and Catchment Management Authorities.

Melbourne Water bases its ephemeral and terrestrial species lists on the Department of Environment, Land, Water and Planning (DELWP) Ecological Vegetation Class (EVC) templates and Melbourne Waters 20 year Vision templates for vegetation. Plant selection is made so that species are appropriate to the site, considering both ecological and functional requirements. For this reason any alteration to orders (species) must be discussed with Melbourne Water prior to plant supply and installation.

Every reasonable attempt must be made to supply the list of plants as specified in the design. In some circumstances numbers and/or species may need to be altered from that which was originally ordered. Where a substitution is required the landscape consultant must provide Melbourne Water with sufficient notice of and receive acceptance to any proposed change.

Vegetation & Landscape

Ephemeral batters (NWL to 350 mm above NWL) of the wetland macrophyte zone and sediment pond must be densely planted with plants at 6 plants per sq.m suited to intermittent wetting. The individual plants must be grown in individual pots or tray cells that are a minimum of 90 cm3 in volume (V93 hiko cell equivalent), however 200cm3 (forestry tubes) are preferred. 80% of the plants used in the ephemeral batters must be in accordance with the species and densities shown in Table 1.

Terrestrial plant species should align with Melbourne Waters 20 year vision templates for vegetation.

No mulch is to be placed below the Q100 flood line or frequently inundated areas. Jute mat is to be installed in planted areas above NWL for wetlands. Jute mat must be installed to the manufacturer's specifications, including fasteners.

Table 1 Ephemeral batter plant list (NWL to 350mm above NWL)

Botanical name	Common name	Minimum density (>90cm3 container/m2)
Baumea rubiginosa	Soft Twig-rush	6
Carex appressa	Tall Sedge	6
Carex tereticaulis	Basket Sedge	6
Cyperus lucidus	Leafy Flat-sedge	6
Juncus amabilis	Hollow Rush	6
Juncus flavidus	Yellow Rush	6
Juncus krausii	Sea Rush	6
Juncus pallidus	Pale Rush	6
Poa labillardierei	Common Tussock	6
Lomandra longifolia	Spiny-headed Matt-rush	6

Edge treatment

The edge of any deep open water should not be hidden or obscured by embankments or terrestrial planting unless measures are taken to preclude access. Public access to structures, the top of weirs, pits (grates or grilles) and outlet structures must be restricted by appropriate safety fences and other barriers. Permanent fencing is required adjacent to potentially unsafe structures (i.e. deep water zones, steep drops, top of weirs, outlet structures etc).

All wetland edges must have vegetated approach batters no steeper than 1:5, a 2.8 metre wide vegetated safety bench at 1:8 between NWL and 350 mm below NWL and a maximum 1:3 slope beyond 350 mm below NWL (refer to the Wetland Manual part A2 for additional information).

Plant Quality

Plant quality is an extremely important determinant of vegetation success. Good preparation and planting technique cannot make up for poor quality plants. Melbourne Water will not accept poor quality planting stock supplied to or installed on our assets.

Plant material supplied which does not comply with Melbourne Water's standard will be rejected at the expense of the supplier/contractor/developer. It is essential that nurseries familiarise themselves with Melbourne Water plant quality requirements and satisfy these standards.

Plant care and transport

Plant quality can be affected by the treatment and care of material at the nursery, on the way to a site and during the planting process. Taking basic measures to ensure plants are healthy and in good condition before they arrive to site is a prudent risk management strategy. Plants must be protected and appropriately covered on their way to a site. Recently propagated plants are not adapted to 80-100 km hour winds that may be experienced en route to site.

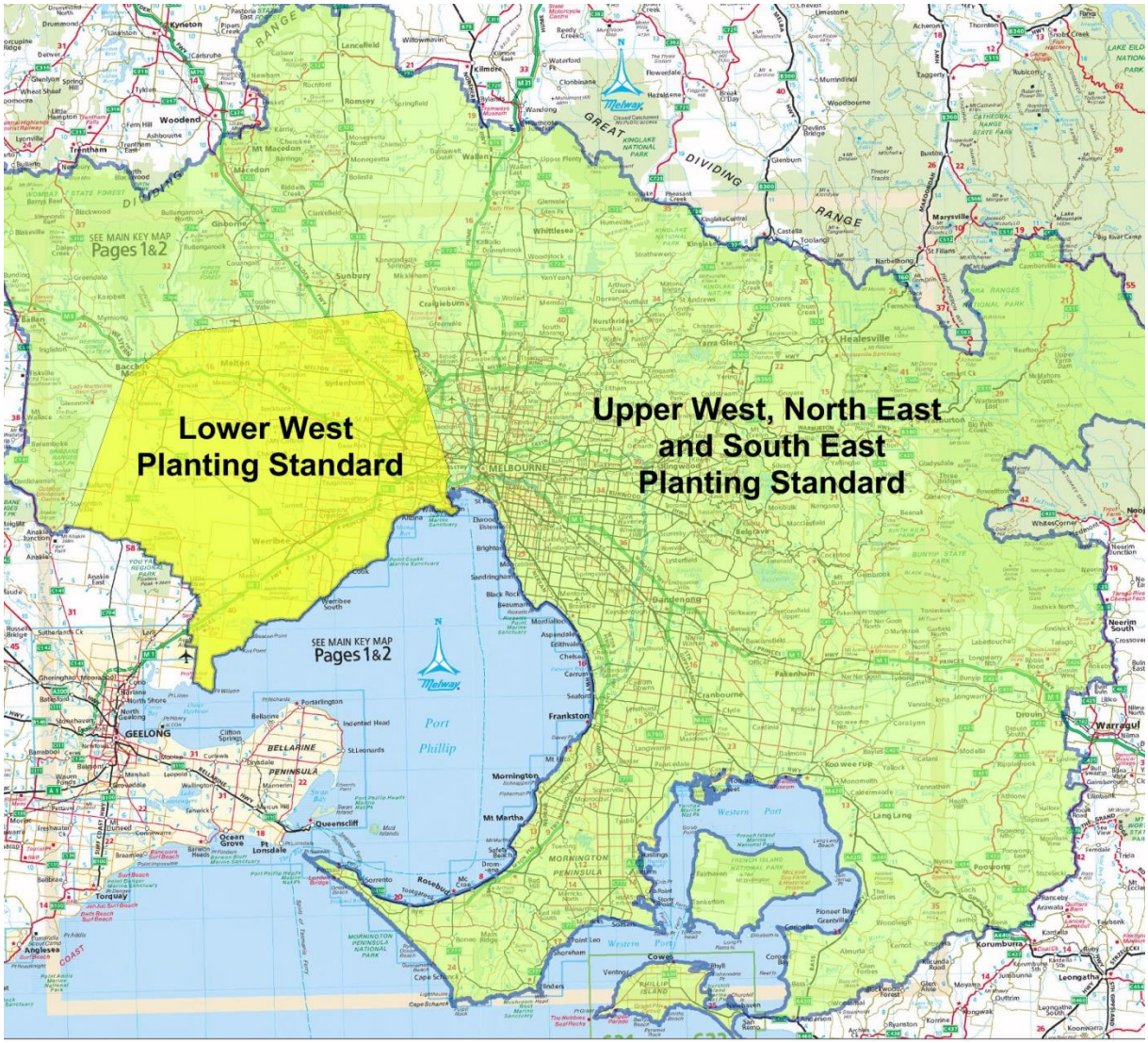
Melbourne Water reserves the right to reject material where stock arrives on site in poor condition due to inappropriate handling and transport methods.

Step by Step guide to installing a plant

Given the quite different conditions in some areas of Port Phillip and Western Port Region, a step by step guide has been developed for two separate areas (see map below) based on rainfall and predominant soil type. These areas are the

(i) Upper West, North East and South East, and

(ii) The Lower West



Standard for the Upper West, North-East and South-East

Well-watered plants - the essential first step

Immediately prior to planting, all plants must be well watered so that the root ball is entirely moistened. Soak plants in a bucket of water or in the waterbody (wetland) before planting. If plants have not been well watered prior to installing there is high chance of plant mortality.

Dig the hole

Plant holes should be a quarter to a third deeper than the plants root ball or container. There are a variety of tools available for this task. A Hamilton planter is shown in the images below and is suitable for friable soils. Cracking clay or rocky ground may call for other tools such as mattocks and picks. The tool used in digging the hole should be similar to the plant format e.g. square Hamilton planter for tubestock and round for hiko.

Note: The below image highlights excellent pre-planting weed control. Weed competition will not hinder early establishment as it has been managed appropriately prior to planting. Dead foliage and grassy material must be removed, unless it is agreed that the material can stay as a weed suppressant, in some cases the scalping of 50 mm of soil around the plant location can assist the removal of weed seed as well as live root completion.

Note: Hole is deeper than the maximum depth of this Hamilton planter. This extra depth is very important and should enable the top of the potting mix in the tube to be covered with soil from the planting site and allow for a bowl to be created which allows water to pool. Where mattocks are used the hole must be deeper than the tube with sufficient depth for potting mix to be covered and a shallow bowl created.

Note: It is far better to be a little bit deeper than a little bit too shallow. The site must be well prepared and organic matter moved aside not pushed into the base of the hole. I.e. do not drive in weed seeds with the Hamilton planter.

Plant Removal

Note: Carefully remove the plant from its pot. Plants should not be squeezed. Do not force the plant out, and do not pull the stem.

Support the plant at all times.

Note: The plant is being cradled at all times to prevent soil collapse and root damage. A number of methods can be employed but the key point is that the root ball is adequately supported. Root and soil material is supported at all times. Furthermore this plant complies with Melbourne Water's plant supply standard.

Plant to ground contact

Note: Place the plant gently in the hole. Do not tease out the roots. Ensure that the top of the root ball is slightly below the top of the hole. Aim for at least 10mm. If the bottom of the hole is too deep crumble the removed soil material to lift the plant slightly. But never above the surrounding ground level. Begin to break up soil clods. Where soils are compacted effort must go into crumbling soil to a light tilth.

Note: The tube is placed neatly against the back and side of the hole. Complete contact with soil is essential. Large gaps between the potting medium and the soil must be avoided.

Note: Break up soil clods so that no large pieces remain and so that all loose soil can be placed to contact the plant roots entirely. Never put large clods in, always ensure soil is crumbled. Filling the planting hole with large clods of compacted soil is not acceptable.

Note: Break and crumble soil around the top of the tube and fill any air gaps at the side of the hole. Firmly but carefully press soil around the tube to ensure soil contact with the root ball. Potting mix must not be exposed to the air. It must be covered with several millimetres of soil. Failure to achieve complete soil contact with the potting medium is one of the leading causes of plant death during the first few months of plant establishment and especially over summer periods. A small amount of water saving crystals can be added at this stage. Large amounts cause soil swelling and may pop plants out of their hole.

Note: Ensure that soil adequately fills the hole and air gaps. The edge of the potting medium is still visible. This must be covered. Loose organic material should also be removed so that complete soil covering can be achieved.

Note: Fine soil has been gently placed around the plant and covers the potting mix. No edges of the original potting mix are visible. Organic matter has been removed and the plant is being firmly bedded down but not compacted.

Note: Organic matter has been removed and the plant is in total contact with the surrounding soil. In drier locations it is essential that a shallow bowl is created around the plant to allow watering to pool and seep to the root zone. Aim for the bowl to be 30 mm lower than the surrounding soil level. Plants in dry conditions must not be mounded. Mounding is generally unnecessary except in waterlogged conditions.

Watering In

Note: All terrestrial plants must be watered at planting with a minimum of 2 litre of water immediately after a plant is installed and prior to the instalment of weed mat and guards. This is done primarily to ensure there are no air gaps between the plant roots and the surrounding soil. Watering must be done gently so as not to displace any soil gathered around the root ball and at the top of the tube/hiko. The photo illustrates that the water has remained in the 'bowl' around the stem and is not flowing away. The plant has not sunk deeper into the hole due to insufficient pressing in. The level of pressure in bedding this plant down was appropriate.

Weed mat installation

Note: Weed mat must be carefully placed over the plant to ensure that foliage is not damaged as the plant is pulled through. Weed mat must be secured to the ground with 4 pins. Ensure that the slot which the plant was pulled through is properly closed to prevent weed seeds emerging. This can be done by pulling the plant to one

Installing stakes

Note: Install two of the stakes through the pre-cut holes in the weed mat; ensure the stake is driven at 1/3 of the stake length on a 20 degree angle away from the plant. A wooden mallet or stake driving pole is an appropriate driving tool (assuming plastic sleeves are used for the protection of plants as opposed to corflute or black mesh). Hardwood or bamboo stakes are acceptable. Bamboo must be greater than 15mm diameter and are angled away from the plant. The angle of the stakes to provide tension and stability, this is critical to ensure that plastic sleeves stay put. The weed mat is in firm contact with the ground and the slot which the plant was pulled through has been completely closed. The stem is to one side of the slot. Hardwood stakes can be re-used, bamboo stakes are single use items.

Note: Pull the plastic sleeve over the first two stakes, note that the stakes are wider at the top (A) than at the base (B), as well as being angled away from the plant as shown in the previous image. Face the triangle upstream, so that they can better handle any flow events.

In areas which are prone to frost or inundation consider using black mesh guards instead or whether guards are even necessary.

If using corflute guards, rectangular stakes (in cross-section) or two square stakes should be used so that they don't spin around on themselves. You should also pin through the front of the corflutes to strengthen the assembly.

Note: The third stake is installed after placing the plastic sleeve over the plant. Once again the stake is angled away to place tension on the guard to direct the guards towards the ground. To ensure that plastic sleeves remain effective there may be the need to adjust stakes at maintenance points throughout a project. Tension at the top slightly greater than the base but not loose enough to allow browsers e.g. rabbits to reach the base of the plant.

Note: A well installed plant. Note the even tension on the guard and stakes that are well hammered in. No soil clods remain on the surface of the weed mat. Note pins placed at corners slightly bedded in as indicated by red arrows.

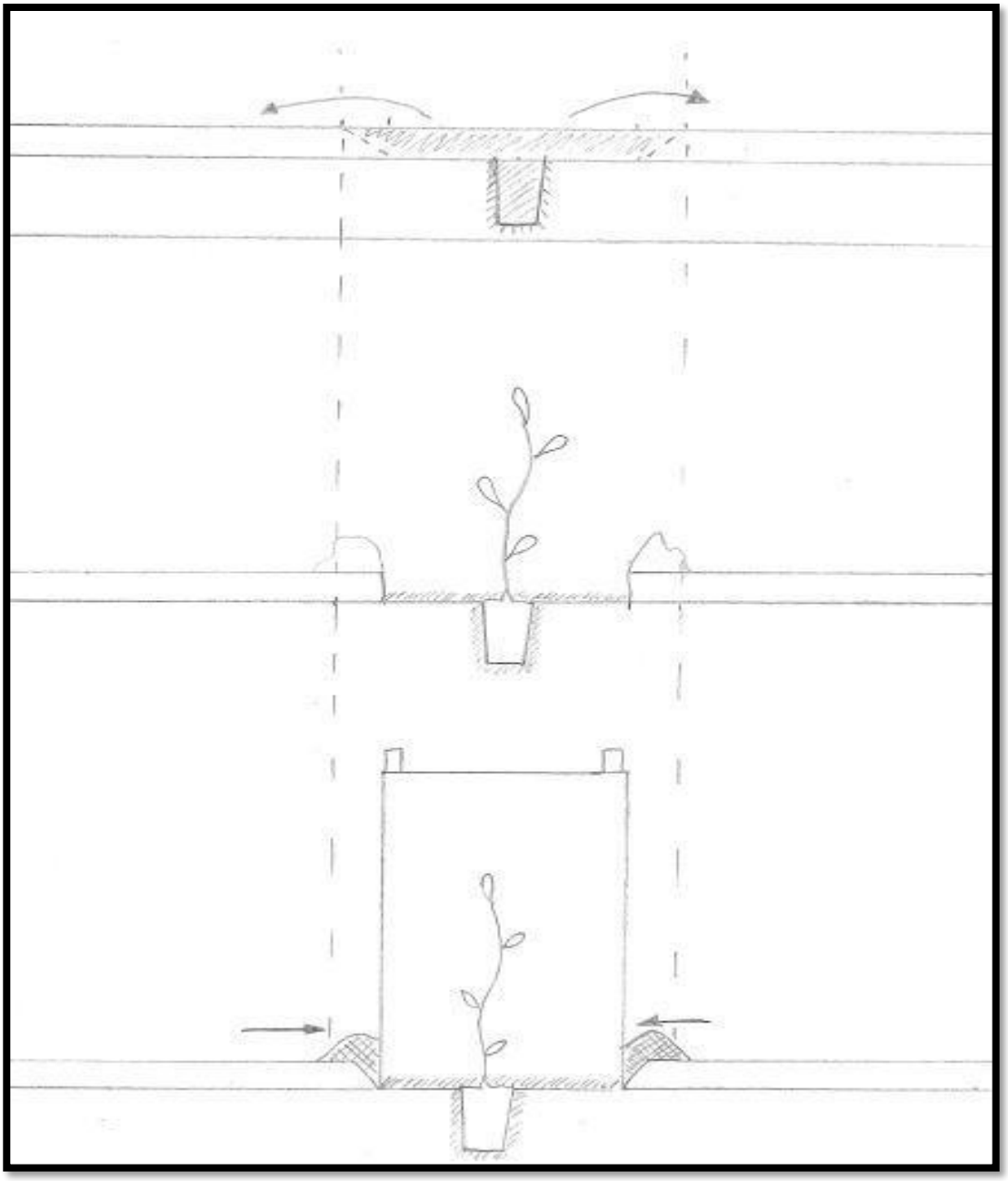
Standard for the Lower West

The lower west is an area which receives less than 600 mm of annual rainfall, has predominantly cracking clay soils and is located mostly within the Victorian Volcanic Plains Bioregion. Given the low rainfall and soil type, establishing plants in this area requires a different technique to maximise the chance of the plants successfully establishing. This area runs from the western edge of Port Phillip Bay to the eastern edge of the Brisbane Ranges, further to the north to Bacchus Marsh and Bulla. Lower rainfall areas include but are not limited to: Lower Werribee River, Lower Kororoit Creek, Little River, Lower Emu Creek and Konagaderra Creek.

Dig the hole

Using the below diagram as an example, remove 25 to 30 mm of top soil and place to the side. The hole should be dug slightly bigger than the plant root ball sizing. This removes nutrients and most of the weed seed and should therefore reduce maintenance effort. It also excavates a bowl that assists watering in and placement/embedding of the guard later.

The hole should be dug the day before planting and should be saturated with a bucket of water. The hole should be dug with a mattock rather than a tree planter. A mattock will break up the soil, increasing permeability and aiding root growth and plant establishment.



Well-watered plants

Immediately prior to planting, all plants must be well watered so that the root ball is entirely moistened. Soak plants in a bucket of water or in the waterbody (wetland) before planting.

Plant Removal

Carefully remove the plant from its pot by lightly squeezing the sides of the pot. Do not force the plant out, and do not pull the stem. The plant should be cradled at all times to prevent soil collapse and root damage. A number of methods can be employed but the key point is that the root ball is adequately supported (Refer Upper West, North-East and South-East section of this document for example photos).

Plant to Ground Contact

Place the plant gently in the hole. Do not tease out the roots. Ensure that the top of the root ball is slightly below the top of the hole. Install previously watered plant in to the hole and include a small amount of water retention product such as water crystals (applying too much can pop the plant out). Repack (removing air pockets) the soil firmly making sure to cover the root ball with a fine layer of excavated soil. When backfilling soil into the planting hole, leave a shallow depression (approx. 25-50 mm deep) around the plant to catch water. This will also make it easier to water in. Do not use the top 30 mm of soil for this as it will just re-introduce the weed seed. (Refer Upper West, North-East and South-East section of this document for example photos).

Watering In

All ephemeral and terrestrial plants must be watered at planting with a minimum of 2 litres of water immediately after a plant is installed and prior to the installation of guards. This is done primarily to ensure that there are no air gaps between the plants roots and the surrounding soil. Water must be done gently so as not to displace any soil gathered around the root ball and at the top of the tube/hiko. (Refer Upper West, North-East and South-East section of this document for example photos).

Installing Stakes and Guards

Install three stakes into the created soil bowl, ensure the stake is driven to 1/3 of the stake length on a 20 degree angle away from the plant. A wooden mallet or stake driving pole is an appropriate driving tool. Hardwood or bamboo stakes are acceptable. Bamboo must be greater than 15 mm diameter and are angled away from the plant. Hardwood stakes can be re-used, bamboo stakes are single use items. Face the triangle upstream, so that they can better handle any flow events. Once the guard is installed push in the remaining soil to seal the guard at the bottom (Refer Upper West, North-East and South-East section of this document for example photos). This protects the plant and guard from wind and helps to trap moisture during fog and rain.

This assumes plastic sleeves are used for the protection of plants as opposed to corflute or black mesh. In areas which are prone to **frost** or **inundation** consider using black mesh guards instead or whether guards are even necessary. If using corflutes guards, rectangular stakes (in cross-section) or two square stakes should be used so that they don’t spin around on themselves. (Refer Upper West, North-East and South-East section of this document for example photos).

Post-planting

The immediate three months after plants are installed is a critical time for plant survival. The level of maintenance should be greater in this period than normal and should include hand weeding inside the guard, fixing up guards and watering when no significant rainfall (>10mm) has occurred at the site.

Post planting maintenance for all areas

Planted sites will require differing levels of on-going maintenance post planting, however all sites will need at least the following actions completed.

1. **Weed control post planting**. The level of weed management required will be prescribed in the project specifications reflecting the conditions required in the vegetation vision templates. Weed control is required to enable plants to establish with multiple runs each year required to achieve a successful outcome. In the second year after planting the number of weed control maintenance runs may be reduced.
2. **Guard removal.** The removal of guards is required generally after a plant has reached X2 the height of the guard and/or where the stem of the plant is no longer flexible enough for browsing animals such as wallabies and rabbits to bend plant material over and browse upon it. Sprawling or creeping plants should have their guards removed before they start to come over the top of the guard or before plants reach a size where the guard must be cut to remove it from the plant.

3. **Ongoing maintenance of guards.** Any guards that have been dislodged must be removed or re-fitted.

Pest Animals

Browsing animals such as rabbits, hares, deer or native herbivores have the ability to severely impact upon revegetation project success. A thorough site investigation must be carried out prior to undertaking revegetation to assess the risks posed by browsing animals. If the risk of browsing animals has been identified as high, this can have substantial impact on plant establishment and must be managed accordingly. Further information on how to approach pest animal management may be found in the Pest Animal Strategy and Pest Animal Guidelines.

Hygiene Protocols

In order to reduce the spread of weed seed, plant (e.g. Phytophthora) and faunal diseases (Chytrid fungus) across sites, good hygiene practices must be demonstrated on all project sites. Vehicles, tools, boots, clothing, cuffs and pockets can be vectors for the spread of weed seeds, diseased plant material and soil and must be managed appropriately.

References

1. Anderson, G. (2003). *Site Preparation for Farm Forestry. Agriculture Notes AG0770.* Department of Primary Industries, Victorian Government, East Melbourne.

2. Corr, K. (2003). *Revegetation Techniques. A Guide for Establishing Native Vegetation in Victoria.*Greening Australia, Victoria.

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4. Perry, D. (2004). *Tree Planting and Aftercare. Landcare Notes LC0104.* Department of Primary Industries, Victorian Government, East Melbourne.

5. Peters, G. (2010). *Valuing Floodplains.*

6. TreeProject (2003). *Preparing and Planting your Revegetation Site.*

7. Melbourne Water, 2017. *Wetland Design Manual. Part A2: Deemed to comply design criteria*.

8. Melbourne Water, 2018. *Aquatic, Ephemeral, Terrestrial Plant Supply Audit form*

9. Melbourne Water, 2018. *Aquatic & Ephemeral Plant Supply standard*

APPENDIX A: Materials, Tools and Equipment

Hamilton Planter: Is a patented tool designed exclusively for digging holes for the installation of forestry tubes

Mattock: At certain locations due to soil type or slope a mattock may be a better choice for digging planting holes

Auger: Is a two stroke powered drill used to create holes for planting

Weed matting Jute squares or recycled fibre: Ensure the pre slotted weed matts are used as the holes will provide the optimum spacing for the stakes.

Matt pins: Where weed matts have been specified on a project, 4 matt pins must be installed

Water saving crystals: Certain projects may specify the use of this product, it is very important that manufacturer's label recommendations are followed precisely and they are never put into a hole dry.

Stakes: The predominant materials used for plant stakes is either hard wood or bamboo. Both materials are used on Melbourne Water revegetation projects. Bamboo stakes are round and useful only when medium and heavy gauge stakes are available. 15 mm must be used as a minimum. Light gauge bamboo stakes are inappropriate as they are too flexible and are not robust.

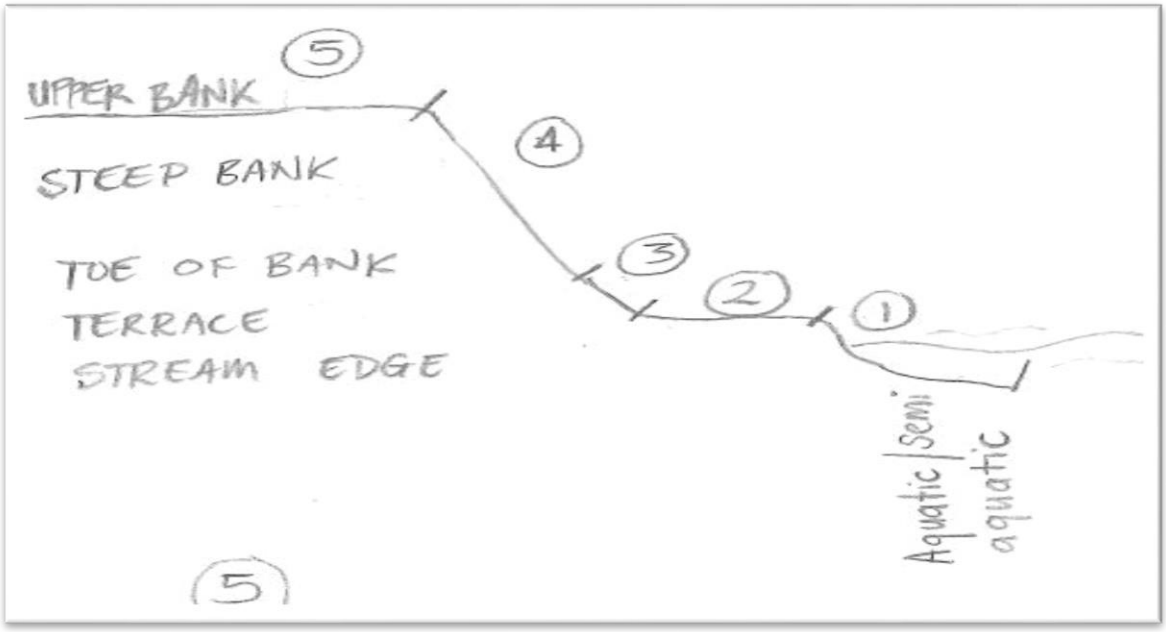
Guard Configurations: Corflute, plastic sleeve, milk carton, mesh

APPENDIX B: Planting Zones for specific situations

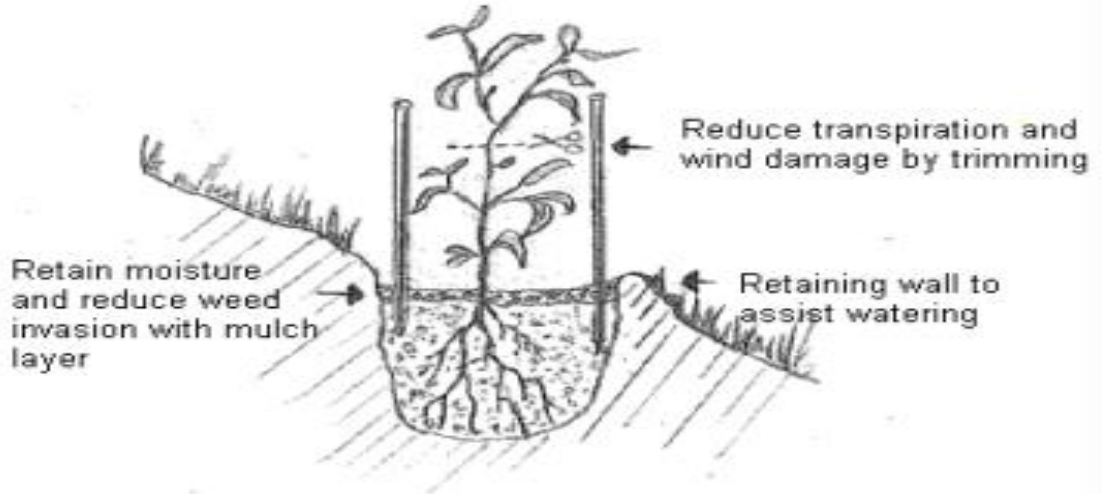
It is critical that the correct plants are planted in the correct zones, so that the plants are subject to conditions which are suitable to their requirements.

Planting Zones are broken down into five categories.
Zone 1 – Moist or west soil, permanently or very frequently inundated
Zone 2 – Seasonally moist or wet, inundated during high flow events
Zone 3 – Better drainage, most soil
Zone 4 – Well drained and dry in summer
Zone 5 – very well drained, very dry and exposed

Example planting zones



Specific guidance for Planting on steep slopes



Appendix C: Plant supply formats.

Growing formats for species specified in the *Wetland Design Manual. Part A2: Deemed to comply design criteria*.
See the manual for the correct zonation information for each species.
Ephemeral species not on the list below can only be used if approved by Melbourne Water and the growing format suits their morphology.
(**Note:** Y = acceptable growing format)

Format	>90cm3 cell eg V93 Hiko	200cm3 Tube	Min. 550cm3 container	Minimum leaf height (mm)	Comments
Baumea rubiginosa	N	Y	Y	300mm in >90cm3 cells, 500mm in 200cm3 tubes or >550mm pots	V93 Hiko only suitable for Ephemeral zone Acceptable substitute Baumea arthrophylla
Carex appressa	Y	Y	N	200	
Carex fasicularis	Y	Y	N	200	
Carex tereticaulis	Y	Y	N	200	
Crassula helmsii	Y	Y	N	100	
Juncus species	Y	Y	N	200	*Juncus amabilis, J flavidus, J gregiflorus, J krausii, J pallidus, J procerus, sarophorus, J usitatus etc.*
Lomandra longifolia	Y	Y		200	
Persicaria decipiens	Y	Y	N	200	
Poa labillardierei	Y	Y	N	200	

Appendix D: Seasonal planting risk

The table below shows months where the conditions most suit the individual species.
Conditions during winter and spring for shallow and deep marsh plants have a higher risk and chance of plant mortality as they are likely to experience extended length of elevated water levels while in they are dormant (not emergent). The risk is also very high for young plants which are more susceptible to drowning.
Some aquatic species have lower growth productivity due to colder conditions with some species such as *Bolboschoenus* sp undergoing winter dormancy. These plants are at risk for longer periods of time if planted in winter as they are not able to take root and support themselves.
Installation of ephemeral species in summer has a higher risk for installation as they are more likely to experience desiccation.
Mitigation strategies must be in place if contractors want to install plants in the higher risk months shown in the table below.

Species	**Planting season**		**Preferred months**		**High risk months**							
	January	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
Baumea rubiginosa												
Carex appressa												
Carex fasicularis												
Carex tereticaulis												
Juncus species												
Lomandra longifolia												
Poa labillardierei												

Table 1: Seasonal planting risks for ephemeral & terrestrial species

Appendix E: Minimum information to be supplied with deliveries.

10. Nursery name and contact information
11. Project name
12. Date
13. Delivery number (if multiple deliveries to project)
14. Plant species name
15. Origin of genetic material (location)
16. Supply format (cell tray, container etc) quantities per species
17. Plant quantities (including container/cell tray #s) per species
18. Propagation date
19. Dates and details of hardening off/and or acclimatisation processes
20. Nursery QA sign off
21. Photos of nursery batches (to be supplied with final invoice)

Example below:

Delivery docket

Project name & section #		**Supplier**	
EPMS #		**Address**	
Estate name & stage		**Telephone #**	
Delivery Docket #		**Nursery manager**	
Date		**ABN**	
Melways ref:		**Council**	
Asset owner (Melbourne Water or Council)		**Melbourne Water surveillance officer**	
Nursery QA sign off representative		**Nursery QA sign off date**	
Photos of nursery batches (to be supplied			

Species Name	**Planting Zone**	**Propagation date**	**Hardening off/and or acclimatisation processess dates**	**Provenance (Origin of genetic material (location))**	**Quantity required**	**Quantity supplied**	**Format required**	**Format supplied**	**Minimum height requirement met (Y/N)**	**Substitutions**
Baumea articulata	Shallow marsh									
Bolboschoenus caldwellii	Shallow marsh									
Bolboschoenus fluviatilis	Shallow marsh									
Bolboschoenus medianus	Shallow marsh									
Cladium procerum	Shallow marsh									
Eleocharis acuta	Shallow marsh									
Schoenoplectus tabernaemon	Shallow marsh									
Cycnogeton procerum	Shallow marsh									
Baumea articulata	Deep marsh									
Bolboschoenus caldwellii	Deep marsh									
Bolboschoenus fluviatilis	Deep marsh									
Bolboschoenus medianus	Deep marsh									
Cladium procerum	Deep marsh									
Eleocharis sphacelata	Deep marsh									
Schoenoplectus tabernaemon	Deep marsh									
Cycnogeton procerum (syn. Triglochin procerum)	Deep marsh									
Myriophyllum crispatum	Submerged marsh									
Potamogeton ochreatus	Submerged marsh									
Vallisneria australis	Submerged marsh									

Appendix F: Landscape contractor requirements (Wetland Design Manual. Part A2: Deemed to comply design criteria.

The landscape consultant must be engaged by the developer to supervise and approve the entire landscape construction process from the pre-commencement meeting through to achieving the end of defects period (a minimum of 27 months), ensuring the fellow requirements are met:

LC1	The landscape contractor awarded the wetland project is suitably qualified and experienced and has completed work on Melbourne Water wetlands historically and the work is of a high quality.	Construction
LC2	The landscape contractor awarded the wetland project must be the contractor undertaking the plant installation. Melbourne Water will not accept sub-contracting to another contractor without written approval to ensure the sub-contractor is suitably qualified, experienced and has completed work of this nature previously.	Construction
LC3	The landscape contractor awarded the wetland project must be the contractor maintaining the planting once installed. Subcontracting of the maintenance activity must be approved by Melbourne Water in writing to ensure the sub-contractor is suitably qualified and experienced and has completed work of this nature previously.	Construction
LC4	The landscape contractor awarded the wetland project	Construction

	must order stock from a nursery that grows plants to the specifications outlined within the wetland manual and this document (no wild stock or cutting up of planting clumps is to be installed).	
LC5	Check the planting contractor's delivery dockets to ensure the number of plants and format of plants ordered and delivered matches the landscape plan and requirements of the wetland manual and this document.	Construction
LC6	Audit the quality of stock delivered to site prior to the installation occurring accepting and/or rejecting any unacceptable stock that doesn't meet the requirements of the wetland manual or this document.	Construction
LC7	Ensure the contractor is undertaking regular weed runs (ephemeral & terrestrial) of the site to ensure a weed seed bank doesn't develop.	Construction
LC8	Undertake random audits of the nursery's they regularly source stock from to ensure the stock they are growing and supplying is of a high quality and meets the requirements of the wetland manual and this document.	Construction
LC9	Make Melbourne Water aware of any nursey's growing and supplying poor quality stock that doesn't meet the requirements of the wetland manual or this document.	Construction

LC10	Make Melbourne Water aware of any landscape contractor not sourcing, installing and maintain planting to the requirements of the wetland manual or this document.	Construction
LC11	Make Melbourne Water aware of any topsoil installation that doesn't meet the requirements of Melbourne Waters topsoil specification weather installed by the civil or planting contractor.	Construction
LC12	Make Melbourne Water aware of wetland bathymetry that doesn't meet the requirements of the wetland manual or this document resulting in reduced planting banding and wetland treatment.	Construction

Note: Should Melbourne Water feel the quality of sourced plants delivered to and installed on site don't meet the requirements of this manual, we reserve the right to engage an independent auditor to assess and make a recommendation as to the quality of the landscape planting. Any required rectification works resulting from this audit would be at the expense of the developer, not Melbourne Water.

Appendix G PRIORITY WEED SPECIES

The below is an indicative list of problem weed species, additional species may be required to be controlled depending on their impact.
State controlled and state prohibited weeds are not included however any contractor suspecting that these species are present must inform Melbourne Water and DELWP to ensure appropriate control is undertaken.

PRIMARY CONTROL USUALLY FOR SITE PREPARATION

Agrostis capillaris s.l.	Brown-top Bent
Anthoxanthum spp.	Vernal Grass
Crocosmia X crocosmiiflora	Montbretia
Cynodon dactylon var. dactylon	Couch
Cyperus eragrostis	Drain Flat-sedge
Dactylis glomerata	Cocksfoot
DOCK	Any genus eg Acetosa, Rumex etc.
Echium plantagineum	Paterson's Curse
Echinochloa spp.	Barnyard Grass
Ehrharta spp.	Veldt Grass
Galenia pubescens var. pubescens	Galenia
Genista spp.	Broom
Glyceria spp.	Eg Reed Sweet Grass
Holcus spp.	Fog Grass
Hordeum spp.	Barley Grass
Juncus spp.	Eg Jointed Rush
Leersia oryzoides	Rice Cut-grass
Myriophyllum aquaticum	Parrot's Feather
Nassella spp.	Eg Serrated Tussock, Chilean Neddle Grass etc
Nasturtium spp.	Watercress
Oxalis spp. (naturalised)	Wood Sorrel
Paspalum spp.	Eg Water Couch, Paspalum
Pennisetum spp.	Eg Kikuyu
Phalaris spp.	Canary Grass
Phytolacca octandra	Red-ink Weed
Plantago spp.	Eg Ribwort
Polygonum aviculare s.l.	Prostrate Knotweed
Polypogon spp.	Beard Grass
Ranunculus spp.	Eg Creeping Buttercup
Romulea spp.	Onion Grass
Rubus fruticosus spp. agg.	Blackberry
Sagittaria spp.	Sagittaria
Sparaxis spp.	Harlequin Flower
THISTLES	Any genus eg. Cirsium, Helminthotheca, Cynara
Typha spp.	Eg Lesser Reed Mace
Vinca spp.	Periwinkle
Watsonia spp.	Watsonia
Xanthium spp.	Eg Bathurst Burr

SECONDARY CONTROL USUALLY FOR MAINTENANCE

Allium triquetrum	Three-corner Garlic
Arctotheca calendula	Cape Weed
Aster spp.	Aster
Avena spp.	Oat
Brassica spp.	Turnip
Briza spp.	Quaking Grass
Bromus spp.	Bromus
Chenopodium spp.	Fat Hen
Conyza spp.	Fleabane
Echium spp.	Bugloss
Erodium spp.	Eg Common Herons Bill
Fumaria spp.	Fumitory
Galium aparine	Cleavers
Lactuca spp.	Lettuce
Lolium spp.	Rye Grass
Lotus spp. (naturalised)	Trefoil
Medicago spp.	Medic
Ornithopus spp.	Bird's Foot
Sisymbrium spp.	Mustard
Solanum spp.	Eg Black Nightshade
Sonchus sp	Eg Common Sow Thistle
Taraxacum species group 1	Garden Dandelion
THISTLES	Any genus eg. Cirsium, Helminthotheca, Cynara
Trifolium spp.	Clover

NB Species have designated into PRIMARY and SECONDARY as an indicatio of when control efforts are most likely to be required however individual sites may respond differently depending on management and external factors. Species may be present in one or both phases and control will be required at the discretion of Melbourne Water.