14 Structures and facilities

Tab photo: Built up foreshore of the Tamar Estuary, northern Tasmania. © Chris Rees.

This chapter deals with how to minimise environmental damage when constructing and maintaining buildings and other public amenities in coastal areas. Proper planning, design and maintenance of structures will improve longevity, minimise maintenance and save money.

Thorough investigation and planning before building is important to protect sensitive coastal or marine environments such as foredunes, wetlands and saltmarshes. Many coastal areas, especially soft or sandy sites, are prone to erosion, and low-lying areas are vulnerable to sea level rise. Structures may be at risk of damage from wind, waves or currents and erosion, and sedimentation can be a problem in marine areas.

The visual appearance of coastal structures and the needs of the community and users of the area must be considered in planning and design. When planning new facilities, upgrades or removal of old facilities, community consultation is essential, and is most effective when done in collaboration with local community groups.

The types of structures that are commonly built on shoreline areas include picnic facilities, toilets, shore-based aquaculture facilities, boating and surf club facilities. In some urban areas, coastal environments are dominated by ports and industry, whilst in other urban areas the coast is modified for recreational facilities and access. Often there are few spaces left where natural processes and systems can persist. ***Refer to Chapter 13 Access Management*** for information on access structures such as boardwalks and steps.

14.1 Legislation and approvals

In addition to the legislation and approvals set out in ***Chapter 1 and Appendices 1 and 2***, the following may apply.

Structures on the shoreline often cross over land and water that is governed by different authorities. The Crown owns the seabed and water, regardless of whether the landowner has a high water mark title. Structures below high water mark also require DPIPWE Crown Land Services approval and a Crown Land lease. Depending on the structure's size and nature, DPIPWE may require submission of a Development Proposal and Environmental Impact Statement.

Developments must comply with the *Tasmanian Building Act 2002* and the *Building Code of Australia* (Australian Building Codes Board) as well as council planning schemes. Obtain a building or plumbing permit (usually from the local council) for all building and plumbing before work is commenced. The *Building Code of Australia* includes requirements for access to buildings for people with disabilities.

Approvals may require appropriate site rehabilitation works.

14.2 Construction work in coastal areas

Designing coastal structures is not an exact science and innovative designs may be more appropriate than traditional approaches. The information in this manual does not preclude other approaches, as long as they are supported by specialist advice and a sound maintenance program, to ensure that structures have minimal impact on the coastal environment and are kept in good condition.

Specialist advice is essential to assess whether the design and placement of structures is suitable for the local conditions. Building structures on unstable landforms and in coastal waters is often not appropriate but is sometimes necessary for the provision of important services and access.

Structures will be more effective if their design, siting and construction are based on good technical advice from a coastal engineer and a coastal geomorphologist. Inappropriately designed or sited coastal structures can easily be destroyed by wind or waves or become a danger to the public. They can also damage coastal values such as important wildlife habitat and cause serious erosion or sand build-up in adjacent areas.

Construction work in coastal areas must minimise impacts on coastal processes such as sand movement; cultural values such as Aboriginal heritage sites; wildlife and vegetation values such as threatened species; wildlife habitat and important coastal vegetation communities. Consult with specialists and undertake any necessary assessments. ***Refer to Chapter 1 Working in coastal environments.***

It is essential to ensure all works staff and contractors are briefed on minimising environmental impacts during construction work and that adequate supervision is provided to ensure best practice

environmental standards are being implemented. ***Refer also to Chapter 11 Soil Management and earthworks.***

14.2.1 Climate change and coastal infrastructure

Constructions in marine and estuarine waters and on or near the shoreline are highly susceptible to the impacts of sea level rise and coastal inundation.

Design and construction of structures (or upgrading existing facilities) should take into account such changes to the coastline within the life span of the structure, employing the best construction methods and materials for the situation and intended life span of the asset, and ensuring that maintenance over the structure's life span is feasible and affordable. Specialist advice from engineers will be needed.

Appropriate building setbacks, minimum floor levels, appropriate engineering assessments and appropriate construction techniques will all be part of adapting to predicted sea level rise and coastal inundation.

In view of predicted climate change and sea level rise, existing infrastructure that is low-lying or built on erodible shorelines should be assessed for the risk of erosion or inundation.

Coastal vulnerability maps are available on the LIST as part of the Smartline project. Specialist advice from a coastal geomorphogist will help with decisions about the best place to site structures.

The *Coastal risk management plan* (DPIW 2009) can assist in determining the likely risks to a structure and strategies to reduce risk. ***Refer to Chapter 3 Coastal hazards.***

It might be that the asset planned is itself an adaptive management structure, such as a seawall or groyne. ***Refer to Chapter 15 Shoreline modification.***

14.2.2 Designing and planning coastal infrastructure

Before works start, thorough investigation and planning are essential. This may take some time.

Obtain technical advice from an experienced coastal geomorphologist and an engineer before works are planned. Proposed works and structures that would extend below high water mark or on unstable coastal landforms should be checked by a suitably qualified person (e.g. engineer, building surveyor, architect, landscape architect or environmental health officer).

Obtain all relevant planning and building approvals for the works. Structures below high water mark or on other Crown lands require approval under the *Crown Lands Act 1975.*

Have designs and plans for built structures assessed and approved by a qualified building surveyor. Adhere to all relevant Australian and Tasmanian Acts, regulations, codes, strategies, management plans and standards including occupational health and safety standards.

When considering the location of coastal structures, take into account:

- the level of hazard or risk for the site or for adjoining or nearby properties or infrastructure – ensure it is not increased by the new structure
- the risk of water pollution from inundation of any materials, substances or wastes on the site – avoid or minimise
- the need for minimising future engineering or remediation works to ensure likely costs do not exceed the public benefit of the development.

Aim to minimise infrastructure in the coastal zone. Consolidate structures in high-use areas with existing facilities wherever possible.

Structures that provide access for disabled people

should be considered where required or appropriate, particularly at coastal access points such as viewing points and beaches.

Assess the environmental damage that could result from the construction works and develop measures to minimise the damage. An Environmental Management Plan may be required for larger projects. For smaller projects, prepare a specific site plan for all works, outlining the works to be conducted and measures to reduce environmental damage.

Identify all natural coastal and marine values and develop procedures to protect and minimise disturbance of these values. Seek specialist advice.

Minimising environmental damage might include procedures like controlling sediment and erosion; avoiding works near shorebird breeding sites during the nesting season (September to March); developing an oil spill plan or ensuring that all machinery, vehicles and vessels are free from weeds, pests and diseases before and after works; conserving soil and rehabilitating disturbance to the site as soon as practicable. ***Refer to Chapter 11 Soil management and earthworks.***

Seek advice from Aboriginal Heritage Tasmania about the potential to disturb Aboriginal heritage sites. An Aboriginal Heritage Assessment and permits may be required.

Seek public input to proposals for new developments and upgrades of existing facilities. Consult with local Coastcare groups even for very small projects. Local volunteers have a strong connection to the coast they have been caring for and should be included in coastal management decisions. Notify all neighbours and users likely to be affected by the works. Keep in mind that, if they are not consulted, annoyed beach-users may remove unwanted structures.

Provide facilities that look attractive, with a quality of design and materials that complement adjacent structures and landscapes and does not detract from the character of the area. Even a toilet building can have aesthetic appeal. The colours should generally fit with the colours of the landscape and vegetation, but brightly coloured structures may be appropriate in some situations (e.g. to make facilities easier to find among vegetation).

Position and design structures so that they will not

Figure 14.1 Structures in recreational areas of coastal landscapes are a necessary part of providing services and their visual appearance can be improved by the use of murals. This is also a great way to involve the local community.
© Leah Page

cause nuisance or hazard from excessive noise, odours, overlooking or overshadowing, visual intrusion or an altered microclimate.

Buildings should be consistent with the scale of the built character of the surrounding area, unless the existing development detracts from the natural setting. Confine developments, as far as practicable, to areas that have already been disturbed. Establish a limited site disturbance zone (e.g. to 1m) beyond the wall of the structure.

Ensure the building design and location includes measures to survive bushfires. Refer to *Building in bushfire prone areas* (Ramsay & Dawkins 1993) and *Landscape and building design for bushfire areas* (Ramsay & Rudolph 2003).

Design structures to minimise maintenance requirements for the duration of their service life. Where the life span of a structure is likely to be less than 25 years, plan for its eventual removal. Favour design and construction methods that allow the removal of the structure without major new impacts on environmental and conservation values.

14.2.3 Works guidelines for maintaining coastal infrastructure

Coastal structures and facilities must be inspected regularly to identify any hazards or maintenance required. Small-scale works to undertake minor repairs often do not require approval processes but still have the potential to impact on coastal values. It is important to identify and protect coastal values during all work activities. Specialist advice may be required.

Any works or modifications outside of the original footprint of the site will require consultation with Aboriginal Heritage Tasmania.

Assess existing structures for susceptibility to climate change impacts such as erosion and inundation caused by sea level rise. Use the latest Intergovernmental Panel on Climate Change (IPCC) projections of sea level rise and coastal vulnerability maps (Sharples 2006) to identify vulnerable locations. Use the *Coastal risk assessment tool* (DPIW 2009) to assess likelihood of risk and to establish mitigation or adaptation processes for particular assets.

All staff and contractors should be briefed on the environmental considerations of the site and any restrictions or specific work practices that must be implemented to meet those considerations. Appropriate supervision is required to ensure environmental standards are being met.

Ensure all machinery and vehicles are free from weeds and diseases prior to bringing them on site; if weeds and disease are present at the site then ensure that tools, boots, vehicles and machinery are cleaned at a suitable location before leaving the site. Only import material from sites that are free from disease and weeds. ***Refer to Chapter 8 Weed and disease management.***

Control sediment and erosion from work sites by applying sound soil management.

Investigate the incidence of acid sulfate soils (ASS) and if necessary take precautions to minimise their disturbance. A rotten-egg smell or yellow deposits when digging are likely indicators of ASS. Minimise the potential for causing sedimentation of watercourses in track design, construction and maintenance. ***Refer to Chapter 11 Soil management and earthworks.***

Identify coastal values such as important wildlife habitat, vegetation communities and threatened species. Consult specialists and undertake any necessary assessments. Put practices in place to minimise impacts on these values, such as timing the

construction works to avoid bird breeding seasons in areas where shorebirds, penguins or seabirds are present. ***Refer to Chapter 7 Vegetation management and Chapter 10 Wildlife and pest management.***

Plan for ongoing future maintenance by establishing a maintenance regime to ensure structures are inspected regularly.

14.2.4 Ongoing maintenance of structures and facilities on the coast

All buildings should be maintained regularly to minimise the risk of them becoming a public hazard. Conduct regular safety inspections as specified in the Australian Standards and after heavy rain, storms or unusually high tides.

Boating facilities require regular maintenance to make sure they are safe and in good condition and to monitor any erosion or sedimentation associated with the structure.

Inspection and maintenance should include the following.

- Check structures are secure and not becoming hazardous to the public.
- Check that surface- and groundwaters are not being polluted.
- Make sure erosion is not a problem.

Figure 14.2 The boat ramp at Ulverstone has a floating pontoon to minimise impacts on the sea floor and interference with sand transport along the shoreline. © Jocelyn Phillips

All built structures require maintenance regularly, and immediately after storms, to ensure they remain serviceable. They can be quickly damaged or destroyed by wind and waves and result in broken timbers, missing steps, sharp edges, dislodged nails and fastenings, and debris that can become a hazard to the public.

Structures built on sandy coasts are subject to the problem of sand accumulation at certain times of the year. It is not possible to keep them continually clear without major works (which disrupt the natural coastal processes) or by installing an expensive permanent sand bypass system (e.g. trapping the sand and pumping it elsewhere, as used at the Tweed River entrance in Queensland).

Carry out preventative maintenance at regular intervals or as required, to minimise further impacts.

- Prepare an inspection and maintenance plan.
- Ensure regular preventative or necessary maintenance is carried out.

Figure 14.3 Small private skids and boat sheds are common on many of Tasmania's beaches. Whilst some are well cared for, others are in need of repair and could be considered hazardous. © Leah Page

14.3 Launching ramps and other boating facilities

Piers, jetties and other boating facilities provide for recreational boating and fishing and commercial fishing operations. Marine structures can obstruct currents and waves and are likely to affect the transportation of sediment. Structures may be susceptible to wave erosion, loss of beach sand or sand build-up and managing these impacts can become expensive.

Detailed site investigations are an essential part of planning and designing marine structures. Site investigations should include an examination of the geotechnical characteristics of the proposed site and the likely effects of structures on coastal and marine ecosystems.

Choosing the appropriate site and design is critical for launching ramps and other boating facilities that extend across the shore and into the water. It is also important to investigate the likely effects of wind and storm surge on the structure and its use, particularly in light of climate change and sea level rise predictions. This will ensure that the structure will stand up to the local conditions and be safe to use during all weather and tide conditions.

Matters of public safety and the location of existing support infrastructure, such as road or rail access and channel depth, may sometimes override other considerations, making it necessary to place structures in locations where they will interfere with coastal processes (e.g. to provide a safe harbour). In such cases aim to keep interference with coastal processes and values to the minimum required for the desired effect and plan for ongoing management of adverse environmental impacts (e.g. by replenishing lost beach sand).

14.3.1 Types of boating facilities

A **boat launching ramp** is designed mainly for launching trailer-borne recreational vessels and small commercial vessels and includes associated car parking facilities.

A **jetty** or **pier** is a horizontal decked walkway, built on piers or piles, which provides access from the shore to a waterway.

A **pontoon** is a floating structure used for access to the water or a vessel.

A **skid** is an inclined ramp used for the manual launching of small craft but does not include a slipway. Skids permit small boats to be drawn out of the water without the use of winches, trolleys or cradles. A skid may also be used for rigging and launching small vessels and providing access to a boatshed.

A **small slipway** is a structure (usually two supported parallel rails on which a wheeled cradle is run) to draw a vessel out of the water for maintenance and repair. A larger slipway is part of a boating industry facility or a commercial marina.

14.3.2 Approvals for marine structures

Structures on the shoreline often cross over land and water that is governed by different authorities.

Structures below high water mark require Crown Land Services approval and a Crown Land lease. Depending on the structure's size and nature, submission of a Development Proposal and Environmental Impact Statement may also be required. Local council planning approvals and building approvals and permits are also necessary.

If the works cross land managed by the Parks and Wildlife Service (PWS) under the *National Parks and Reserves Management Act 2002*, then approval

of PWS will be required. This is necessary before submission of council planning applications.

All structures should comply with the *Building Act 2000* and *AS4997-2005 Guidelines for maritime structures* and the design and engineering guidelines in *AS3962-2001, Guidelines for design of marinas and ramp construction.*

These guidelines cover the design of near shore coastal and estuarine structures such as jetties, wharves, berthing dolphins, floating berths, seawalls, breakwaters, boat ramps laterally restrained, floating structures and building substructures over water. These standards can be used to determine the desirable position of structures within a harbour, based on the predominant wave conditions.

14.3.3 Role of Marine and Safety Tasmania (MAST)

Major commercial ports are owned and managed by Tasmanian Ports Corporation Pty Ltd. Marine and Safety Tasmania (MAST) manages some commercial and recreational facilities, but the majority of facilities are owned and managed by local councils, PWS, Hydro Tasmania and Crown Land Services. Details regarding ownership of marine facilities are available on the MAST website.

MAST oversees the construction process for its structures and also oversees some construction of facilities not owned by MAST through the Recreational Boating Fund (RBF). In these cases, after completion of a project and MAST managing for a warranty period of 12 months, the management is transferred to the owner.

When a facility is being constructed and it is not owned by MAST or has not occurred under the RBF process, then the only time MAST will be required to comment on the construction is if the new structure interferes with safe navigation or moorings in the area. This is picked up in the planning process, with the council forwarding a referral letter to MAST.

In sensitive ecosystems, engineering and design criteria that meet Australian Standards may not be enough to minimise environmental impacts. As a result, in some situations and environments (e.g. offshore from national parks and near marine reserves) stricter, novel or more 'environmentally friendly' alternative designs may be required. The criteria for such developments should be evaluated case by case.

14.3.4 Potential impacts of ramps and marine facilities

Structures that extend into the water can interfere with the transport of sand by tides, waves and currents. All marine structures, especially solid structures such as launching ramps, should be designed and suitably sited to avoid redirecting waves and sand where they are not wanted. This can lead to erosion or deposition of sand and erosion of soft-sediment cliffs nearby. Even a well-designed structure put in the wrong place can be damaged by wind or waves.

The installation of these structures can impact on coastal vegetation, wildlife habitat and values, and marine communities. Construction activity can disturb toxic sediments or expose acid sulfate soils. ***Refer to Chapter 11 Soil management and excavation.***

Changes to drainage patterns on the shoreline can create or exacerbate shoreline erosion. The use of certain materials can be toxic to aquatic organisms.

Boat ramps and jetties can cause shadowing of marine plants and result in loss of biodiversity in the vicinity of the structure. Marine facilities can be sources of

pollution from fishing debris and chemical and oil spills.

Structures on soft and sandy shorelines are particularly vulnerable to rising sea level and increasing frequency of storm surges associated with global changes in climate. Refer to the maps of vulnerability to rising sea levels in *Indicative mapping of Tasmanian coastal vulnerability to climate change and sea-level rise* (Sharples 2006), and the *Guidelines for responding to the effects of climate change in coastal and ocean engineering* (National Committee on Coastal and Ocean Engineering 2004).

14.3.5 Planning for marine structures

Careful design and site selection of coastal structures is very important. New shore-based and marine structures should only be built where the structures meet a demonstrated need. Many structures on the coast were built long ago using methods and placed at sites that are now recognised as detrimental to coastal and marine environments. If community usage is established, it may be appropriate to maintain or improve existing facilities to best manage the impacts of human activities in the area.

Siting, design, construction and maintenance of structures should be sensitive to the natural, cultural and aesthetic qualities of the local coastal environment. As far as possible, structures should be concentrated at certain locations to reduce the visual and environmental impacts on the general area.

In more natural areas, structures should blend in as far as possible with the surrounding landscape (viewed from both the shore and the water). Locate the facilities where activities will have the least impact on existing amenities or views. Of course, public safety is also important (e.g. a breakwater may be needed to provide a safe harbour for fishing boats taking refuge from a heavy swell).

Minimise impact on: coastal processes such as sand movement; cultural values such as Aboriginal heritage sites; wildlife and vegetation values such as threatened species; wildlife habitat and important coastal vegetation communities. Consult specialists and undertake any necessary assessments.

Consult with local Coastcare groups and the community, who have useful local knowledge. Coastcare volunteers have a strong connection to the coast they have been caring for and should be included in coastal management decisions.

Site selection

If a new structure is needed and there is a choice of site, select a location that complies with the following requirements.

- Choose a safe site that minimises interference with natural ecosystems and the movement of water and sand, as far as possible.
- Avoid or minimise disturbance to sites with cultural heritage, geoconservation or other heritage values. A survey may be required to identify these values.
- Choose a site with no threatened species or ecosystems of high conservation value. Other habitat values should also be protected, wherever possible.
- Avoid areas where the works could mobilise contaminated sediments.
- Minimise visual and ecological disturbance by choosing less sensitive sites for these works and integrating them with other uses. Locate the facilities where boating activities will complement the area's existing amenities (e.g. roads) and where adequate car parking is available.
- Choose waters with adequate navigation depth and existing vehicular access.

- Avoid interfering with pedestrian access to and along the shoreline.
- Position marine structures to enable access at all tide levels.
- Consider the latest IPCC sea level rise predictions and the vulnerability of the site to erosion and inundation.

14.3.6 Design of marine structures

Obtain technical advice from an experienced geomorphologist and/or marine engineer before works are planned. Specialist advice is essential to identify the possible effects of marine structures on the natural coastal processes. This will include the factors that drive seasonal patterns of wind speeds, wind directions and tide and wave action.

Choose structures and materials that can survive the local conditions, such as saltwater, strong winds and wave action. In areas where there is a marked variation in tides, floating pontoon-style structures are a preferred option. Use non-slip surfaces for marine structures, to minimise hazards to pedestrians or vehicles.

Structures that are resilient or permeable (non-solid) may be preferable to rigid and impermeable structures that resist wind and wave and/or impede sediment movement. Permeable materials (e.g. slats or mesh) are preferable where solid materials will stop light reaching marine vegetation.

Marine structures built on piers are preferable to solid structures. The use of piers avoids altering water movement patterns and minimises changes in the natural patterns of erosion and deposition. Align marine structures to minimise changes to the patterns of movement and supply of marine sediment. It is critical to allow for full tidal flushing and passage of fish wherever possible. Piers will allow for the free movement of tides, and aquatic and terrestrial animals. ***Refer to Chapter 6 Coastal landscape management and Chapter 12 Stormwater and crossings.***

The IPCC Fourth Assessment Report (IPCC 2007) conservatively estimated a sea level rise of up to 79cm by 2100; ongoing research is predicting that sea level rise of over 1m and as high as 1.5m is possible, and sea levels will continue to rise long after 2100. It is anticipated that these higher projections will be reflected in the next IPCC report expected in 2014. Check the latest IPCC sea level rise predictions and use the most up-to-date estimates to ensure the works will function as intended for their life span.

14.3.7 Constructing and maintaining marine structures

Before constructing any boating facilities, approvals are required, which will probably specify any environmental management constraints. Maintenance of existing structures will most likely not require approvals but can still be very damaging to coastal values if not planned with those values in mind.

Before maintenance is undertaken a works plan should be prepared. It should outline the works to be undertaken and the measures that will be used to minimise the risk of causing environmental damage.

The following measures should be required of all contractors and others working in coastal areas.

- When using machinery, take particular care to avoid environmental damage, especially with large machines such as excavators and bulldozers operating on fragile and unstable coastal soils and in or near sensitive marine habitats, such as seagrass beds.

- Ensure that machinery does not introduce weeds or diseases into coastal areas, by cleaning soil and plant material from machinery before and after works.
- Maintain coastal structures to keep them in place and in good repair. This is a significant cost in areas that are unstable or vulnerable to strong winds and waves.
- Minimise excavation of shorelines and avoid works in important ecosystems and habitats, to reduce the impact of marine structures on the coastal environment.
- Ensure works are properly supervised by qualified people and that follow-up surveys are done. Ensure all site personnel are aware of operational constraints required to meet environmental standards and conditions.
- Minimise damage to nearby areas during works and rehabilitate the site soon after works are completed. Ensure follow-up surveys and monitoring are undertaken.
- Avoid fish nursery areas, seagrass beds, saltmarshes, intertidal flats, wetlands and other important ecosystems. Obtain specialist advice on the potential impacts on fisheries and wildlife, including threatened species (some migratory birds, spotted handfish, etc.).
- Time works to avoid the breeding seasons of nearby fish, birds or other wildlife.

Maintenance at slipways

For large slipways, additional maintenance may be required as recommended in *Environmental guidelines for boat repair and maintenance* (DEPHA 2009), which includes the following recommendations:

- Before slipping and during boat cleaning activities, inspect the waste management system sumps, filters, grates and grids and remove trapped solids.
- Clean and maintain oil/water separators and holding tanks/pits.

14.3.8 Design guidelines for small slipways and skids

Ensure all relevant assessments for natural and cultural values and all approvals have been undertaken.

Consult engineers and coastal geomorphologists before designing marine infrastructure.

For skid construction follow the natural shoreline profile.

The recommended slope is not steeper than 1: 2.7. Where the slope is more than 1:8 provide a safe foothold with spaced decking or cleats.

For skids, a slatted, mesh or perforated structure is preferable as this will allow light to penetrate to marine vegetation below.

For slipway construction, follow the natural shoreline profile. Do not cut or excavate the natural intertidal rock. Extend the slipway to allow storage of the vessel wholly above mean high water mark on the land.

Place work areas above the intertidal zone (at least 1m above the mean sea level or Australian Height Datum (AHD).

Use impervious work surfaces or other means to

minimise the amount of waste materials (including untreated washwater and biological material) entering the water. For instance, install traps at the lower end to collect wastes and regularly clean out the traps.

14.3.9 Design guidelines for moorings

Avoid moorings in seagrass beds or other sensitive habitat, wherever possible. Traditional chain-anchored moorings can disturb the bottom and damage seagrass when dragged across the sea floor during storms and at changes of tide. Moorings with a flexible connection between the mooring and the vessel are preferable.

A mooring must not be laid without a permit from Marine and Safety Tasmania (MAST). MAST requires that moorings are lifted and inspected every two years, more often in some areas.

Seagrass friendly mooring systems use a moveable arm raised off the sea floor which is attached to a fixed anchor. After a small amount of disturbance during installation, these moorings allow seagrasses and other marine plants, and soft-sediment animals to remain, live and grow uninhibited.

Seagrass Friendly Mooring System

Made of galvanised steel, the Seagrass Friendly Mooring System incorporates an anchor pole tipped with a screw helix (or auger). The pole is either 1500mm long (small 'marker buoy' version) or 3800mm long (mooring version). Fixed to the top of the screw-in anchor is a 280mm load spreader that sits underneath the seabed and can rotate about the screw-in pole, ensuring the anchor does not pull into the sea bed sideways under horizontal strain.

A 400mm swivel head on a nylon bearing is attached to the top of the screw anchor, to allow for easy 360° movement of a 1100mm seawater-driven spring-loaded shock absorber that gives 1m of shock absorption, chiefly from seawater being forced out of small gaps in the cylinder body (rather like a piston) but also from the spring itself. Future incarnations of this shock absorber for boats larger than 40ft would have a two spring.

A length of 24mm 'Aquatec' marine-grade rope is attached to the shock absorber and the surface buoy. This rope is buoyant, which keeps the shock absorber off the seabed even under extreme low tide conditions.

The Seagrass Friendly Mooring is installed and maintained from a boat fitted with a hydraulic auger drive. The moorings are currently being tested in several locations on coastal New South Wales and Queensland with encouraging results.

14.3.10 Design guidelines for launching ramps, jetties and pontoons

Ensure all relevant assessments for natural and cultural values have been undertaken and approvals obtained. Consult engineers and coastal geomorphologists before designing marine infrastructure.

Minimise the construction of protective structures, such as breakwaters, as these may affect natural patterns of coastal erosion and sediment movement in adjacent shoreline areas, and may look unattractive and detract from the visual and recreational values of the area.

To minimise shoreline alterations, consider using marine ways (dollies) or hoists (straddle carriers) instead of very large ramps. Hoists require a pier or quay. At sites with a gradual submarine slope, a marine way prevents the need for a pier, quay or dredging and allows vegetation to be preserved.

Jetties should be built only where excessive exposure to waves makes ramps and pontoons unacceptable. Jetties or wharves on piles are usually more appropriate than solid fill, to allow water to flow beneath the structure. Pile driven piles are preferred as they create less disturbance of the seabed. When piers made from solid fill are replaced, the material should be disposed of at an approved landfill site.

Design should consider the following:

- Provide sufficient area for car parking and turning for vehicles towing boat trailers onto the structure.
- Restrict size and length of structures to the minimum needed, yet ensure planning for future use.
- Use structures made with slats or mesh to allow light to penetrate to marine vegetation where practicable.
- Leave surfaces untreated, or stain or paint them in colours compatible with the character of the area (except as required for safety reasons).
- Use floating pontoons in preference to fixed ones, which require disturbance of the seabed during installation.

Protect public safety:

- Provide non-mountable kerbs on jetties and wharves in areas generally used by wheeled vehicles, including wheelchairs, where practicable. Handrails are recommended where this does not interfere with access to the water or boats.
- Provide a safety ladder on jetties and wharves where it would be difficult for someone who falls from the structure to get safely to shore.

14.3.11 Design guidelines for large slipways

Large slipways will be designed by an engineer and subject to a suite of approvals. Design should consider the following:

- Allow for pedestrian and boat access at all tides. Alteration of the shoreline may be reduced through using a boat lifting facility instead of rails.
- Ensure the paving design allows for very high loads (e.g. under fork lift trucks and hardstand cradles for boats).
- Provide collection and disposal facilities for solid and liquid wastes, including hazardous wastes (e.g. fuel, oil, cleaners, used sump oil, hull scrapings and paints) to prevent pollution of the ground and water. Provide pump-out or other facilities for wastewater disposal from boats.
- Construct a permanent catch drain above the high water level to collect and direct residues,

waste liquids and solids from the boat work area to a collection pit via a silt trap. Make the work areas slope slightly so wastewater will flow into the pit. Make the collection pit large enough to hold the first flush of contaminated stormwater and/or the expected volume of wastewater from wet cleaning processes.

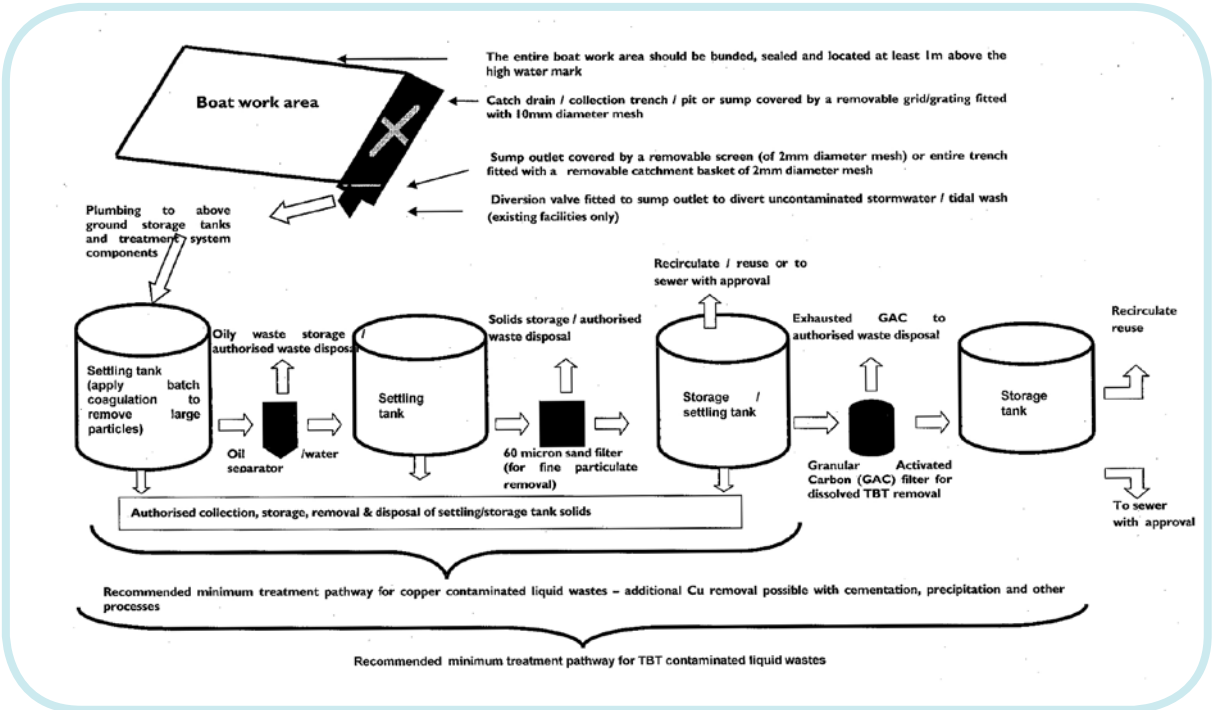
14.3.12 Waste management at slipways

Point source pollution generated during vessel maintenance can contaminate coastal waters and sediments, leading to negative impacts on the local community, the fishing and aquaculture industry, recreational users and the ecosystem itself. Maintaining good water and sediment quality is vital for all these uses and values (NRM South 2008b).

There are important measures that can be incorporated into slipway design to minimise impacts of waste pollution on the coastal and marine environment:

- Cover the work area, where possible, to minimise entry of rainwater and reduce contamination of stormwater.

Figure 14.4 Waste management and treatment of liquid wastes from slipways. Source: Environmental Guidelines for Boat Repair and Maintenance (Department of Environment, Parks, Heritage and the Arts 2009).



- Bund the boat work area and hardstand, where practicable, and construct drains to divert uncontaminated stormwater around the slipway site, contain the runoff from the boat work area and minimise the amount of stormwater requiring treatment.
- Regularly clean and maintain work areas and ensure that no litter or wastewater from cleaning or maintenance work falls or drains into stormwater.
- Do not allow water to run off or be released from the work areas without first being treated to remove toxic substances, turbidity and discolouration.
- Collect any contaminated stormwater in a holding tank and either dispose of it via a licensed waste transporter, or treat it on-site to an appropriate standard for discharge or reuse.

Encourage responsible boat maintenance.

- Slipway work (e.g. hull blasting) should be done above the catch drain so that any wastes drain into it.
- Hulls should not be cleaned within 50m of the shoreline, wherever possible, if the hardstand is not sealed and bunded, and the washdown waters and other wastes could enter estuarine or marine waters.
- Oil filtration devices should be fitted to bilge pumps; commercial oil absorption materials should be placed in bilges; and contaminated bilge water and other wastes should be discharged responsibly.

14.4 Buildings, toilets and other amenities

This section outlines considerations for building new structures and maintaining existing structures in the immediate coastal zone, including change rooms, huts, picnic shelters, outdoor furniture and rubbish bins.

As a general rule, buildings and amenities such as outdoor furniture and rubbish bins should be placed away from the shoreline wherever possible. The shoreline is a sensitive area, where unstable soils and sediments are prone to erosion and landslip and vulnerable to sea level rise. Consider not just the impact of installation but the ongoing impacts of accessing the facility for servicing (e.g. emptying rubbish bins) or maintenance. Some buildings and amenities, however, will need to be provided on or near the shoreline for recreation, work or safety purposes.

A new built structure should only be considered where the need for it can be clearly demonstrated, and its construction and use avoids or minimises damage to coastal processes (e.g. movement of sand between the dune-beach-shore system) and ecosystems.

Where possible, consolidate structures into areas of high use or existing facilities. Promote community use of shared structures such as public ramps rather than private boat sheds.

Choosing the appropriate site is critical for structures on or near the shore. These structures are susceptible to damage by wave erosion or sand or sediment build up. They can be expensive to maintain and can cause problems in adjacent shoreline areas by changing the sediment budget. Works in coastal sand dunes can funnel wind and increase wind erosion causing blowouts and mobility of the dune system.

Choose a site that avoids or minimises interference with coastal processes (e.g. wave actions, wind and cyclic beach sediment budgets).

Identify and protect natural and cultural values during construction and for the life of the structure.

The use of creative design, form, colour and siting will make buildings and amenities more attractive and this can deter vandalism. The style of the building design should be appropriate to its setting, e.g. in urban areas the style may be formal in character whereas in more natural settings the style may be informal.

Involve the local community wherever possible, as they are often the reason for the facility being provided. Work in collaboration with the local Coastcare or community group. Members often have valuable local knowledge and their own aspirations for the area they have been caring for.

14.4.1 Site selection

If a new structure is needed and there is a choice of site, select a site that complies with the following requirements.

- Avoid unstable areas such as dunes, slip-prone areas, very erodible soils, natural drainage channels and stream banks.
- Protect aesthetic values by concentrating structures at certain locations to reduce the visual and environmental impacts on the general area.
- Choose sites away from significant natural or cultural heritage values. Avoid building on natural vegetation, floodplains, wetlands and other ecologically sensitive sites.
- Avoid works in areas infected with phytophthora root rot.
- Avoid works in acid sulfate soils (ASS) wherever possible, as disturbing ASS can lead to environmental damage and corrosion and loss of structures.
- Consider the latest sea level rise predictions from the IPCC and the vulnerability of the site to inundation and erosion due to sea level rise.

14.4.2 Special considerations for outdoor furniture and amenities

Design outdoor furniture and amenities to be functional, suit the needs of the user and be adequate for the expected use levels. They should be safe, solid and constructed from durable materials that will stand up to salt spray, high winds, storms and sun. New, innovative designs may be more effective and attractive than conventional designs.

Use non-abrasive, non-splintering materials with all edges and corners rounded and avoid protruding bolts, screws, nails and similar items that might injure users.

Stainless steel can be substituted for galvanised fittings and fixings to greatly improve the life of these items. Stainless steel fittings (brackets etc.) will require stainless steel fixing, to avoid galvanic corrosion where metals come into contact.

Provide a range of table sizes and seating arrangements to cater for disabled visitors and various group sizes and ages. Sloping seat surfaces will allow water to run off.

Provide rubbish bins with secure lids (to prevent scavenging by possums or dogs) and ensure they are emptied regularly.

Consider the types of rubbish bins to be provided and ensure that their size and design are adequate to handle the amount and type of waste. Land managers should provide separate bins for waste/rubbish and recyclables. Consider where the bins are located and

how often they will be emptied.

The use of CCA (copper, chromium, arsenic) treated timber for seating and tables and other areas with which humans come into contact is no longer permitted. New treated timbers are being developed and there is a large range of prefabricated tables and seating that are made from recycled plastic.

Shelters provide shade and a focal point for recreational activities. In exposed locations it may be necessary to choose shelters with walls that provide protection against prevailing winds. In determining wind breaks, site aesthetics may need to be considered as well as the potential for making the most of views. Curved roofs can be used to soften the visual impact of structures.

14.4.3 Special considerations for toilets

Toilets and facilities to treat and dispose of wastewater require careful design and siting. Effluent from poorly designed toilets can travel a long way (down-slope and sideways and into the water table) and may pollute wetlands or sand where children play.

The appropriate type of toilet and wastewater treatment system will depend on the soil and other site conditions, water supply and costs (including maintenance) and projected public demand.

Details of approved commercially available wastewater treatment systems are available from councils and from the Building Standards and Regulation Section, Workplace Standards Tasmania, Department of Infrastructure, Energy and Resources.

Protect nearby soil and water from contaminated effluent discharge. Seek advice from an engineer about the appropriate type of toilet, wastewater

Figure 14.5 An unsightly concrete toilet has become a mosaic work of art thanks to a local artist working with the local school community. © Leah Page

treatment and disposal systems to install.

Ensure that qualified professionals design and install all structures, including on-site wastewater treatment plants, rising mains and associated sewerage reticulation. The design plans for wastewater treatment systems should provide full details of the treatment system to be used.

The design and installation of on-site wastewater disposal systems (including absorption trenches, absorption beds, evapo-transpiration-assisted beds, absorption/seepage trenches or mounds and sub-surface irrigation areas) must be done in accordance with the relevant statutory requirements and Australian Standards.

Ensure sites for wastewater disposal are evaluated by a qualified geotechnical engineer or environmental health officer experienced in this field. A site evaluation report must be completed in accordance with the Australian Standard *AS/NZS 1547:2000 On-site domestic-wastewater management and the Code of Practice for On-Site Wastewater Disposal* (Australian Institute of Environmental Health, Tasmanian Division) and the *Tasmanian Plumbing Code* (DIER 1994).

Any on-site wastewater disposal must not create an unreasonable risk to public health or local surface- or groundwater quality. Systems should be designed to cater for peak flow conditions and should fully treat wastewater within the boundaries of the designated treatment site.

Avoid installing septic tanks on sandy sites. Where toilets are required, install systems that will not pollute groundwater (e.g. pump-out toilets) and arrange for disposal of sewage at approved facilities off-site.

Sewage generated from pump-out facilities must be disposed of by a licensed waste transport business, approved to collect, transport and dispose of waste at an approved facility.

Maintain all toilets regularly to minimise the risk of them causing pollution or becoming a health hazard or eyesore.

Types of toilet

Toilets are of three types:

Wet toilets are flush toilets connected to sewers, or to septic tanks. Flush toilets are preferred by users, but discharge larger volumes of effluent and are expensive to maintain.

Dry toilets include pit or composting toilets. These use much less water than conventional flush toilets, but require more regular maintenance.

Vault toilets have a holding tank that requires pumping out from time to time. Vault toilets avoid pollution on-site but require more site disturbance to install, and are expensive to pump out. They can be visually intrusive if the holding tank sits above the ground.

14.5 Tools and resources

Complete details of all printed publications listed here are provided in a reference list at the end of the Manual. Other tools and resources including websites are collated in ***Appendix 5***.

Aboriginal Heritage Tasmania

Desktop searches for Aboriginal heritage sites

www.aboriginalheritage.tas.gov.au

Australian Standards

Available from ASI Global

phone 1300 654 646

www.standards.com.au

- *AS3962-2001 Guidelines for design of marinas*
- *AS4997-2005 Guidelines for design of maritime structures*
- *AS/NZS ISO 31000:2009 Risk management - Principles and guidelines*

  Replaces *AS 4360-2004 Risk management* as the leading resource for risk management.

Climate change and coastal risk assessment project.

A suite of tools and documents including:

- *Coastal risk management plan: Template and guidelines* (DPIW 2009)
- *Coastal hazards in Tasmania: General information paper* (DPIW 2008c)
- *Climate change and coastal asset vulnerability: An audit of Tasmania's coastal assets potentially vulnerable to flooding and sea-level rise* (DPIW 2008b)
- *Sea-level extremes in Tasmania: Summary and practical guide for planners and managers* (DPIW 2008e)
- *Historical and projected sea-level extremes for Hobart and Burnie, Tasmania* (Hunter 2008)
- *Background report: Coastal flooding - Review of the use of exceedence statistics in Tasmania* (DPIW 2008a)

www.dpiw.tas.gov.au/climatechange

Coastal management specification manual: a guide for the construction of coastal management infrastructure (Green Skills Inc 2010)

Coastal Values data

Vegetation, species habitat and geomorphic values data for a 100m wide coastal strip of the northern, southern and north-western Tasmania NRM Regions. Available on the LIST

www.thelist.tas.gov.au

Environmental guidelines for boat repair and maintenance (Department of Environment, Parks, Heritage and the Arts 2009)

Environmental guidelines for marinas in the Great Barrier Reef Marine Park (Bugler 1994)

Foreshore values mapping

Provides baseline information on the condition of foreshores and identifies pressures for measuring impacts on key marine and coastal ecosystems. Available on the LIST.

www.thelist.tas.gov.au

Guide to best practice management of point source pollution at boat repair and maintenance facilities (NRM South 2008b)

Guidelines for responding to the effects of climate change in coastal engineering design (National Committee on Coastal and Ocean Engineering 2004)

Indicative mapping of Tasmanian coastal vulnerability to climate change and sea level rise (Sharples 2006)

MAST Mooring Factsheet

http://www.mast.tas.gov.au

Natural Values Atlas

The Natural Values Atlas provides authoritative, comprehensive information on Tasmania's natural values. Download a free registration form from the website to access.

https://www.naturalvaluesatlas.tas.gov.au

Occupational Health and Safety

www.wst.tas.gov.au

Seagrass friendly Mooring System

http://www.seagrassmooring.com.au/

Siting and design guidelines for structures on the Victorian coast (Victorian Coastal Council, 1998)

Smartline or coastal vulnerability maps

Maps of coastal landform types and their vulnerability to sea level rise can be found under 'Climate Change' layers on the LIST and the OzCoasts website. The data is presented as a 'smart line' following the coastline, with information on the geology of the coast readily interpreted for particular coastal areas.

www.thelist.tas.gov.au

www.ozcoasts.org.au

Tasmanian reserve management code of practice (Parks and Wildlife Service et al. 2003)