Transport Roads & Maritime Services

NSW Boat Ramp Facility Guidelines

September 2015

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- *The information in the Guidelines is intended only to provide general guidance on the design of boat ramp facilities for small recreational crafts. Whether these Guidelines are applicable and how they should be applied will depend on the specific facility, including site specific environmental conditions, the anticipated level and type of boat ramp usage and the requirements of local authorities. These Guidelines (including any illustrations) should not be used for any type of final construction project drawings or specifications. You should obtain advice from engineers with appropriate expertise.*
- *These Guidelines are designed to be used alongside the relevant Australian standards. You should always refer to the most current version of the relevant standards and should not rely on these Guidelines in place of considering the relevant standards.*
- *Compliance with these Guidelines does not mean that a facility meets the applicable legal and regulatory requirements or will receive the necessary approvals. You should obtain independent advice on these matters.*
- *Roads and Maritime developed these Guidelines by updating the NSW Boat Launching Ramps Guidelines 1985 prepared by the NSW Public Works Department and in consultation with a number of stakeholder groups. While all reasonable care has been taken to ensure the accuracy of the materials in these Guidelines, Roads and Maritime makes no representations or warranties of any kind about the accuracy, reliability, completeness or suitability or fitness for purpose in relation to these Guidelines. Roads and Maritime does not accept and expressly disclaims any liability or responsibility for any loss, damage or costs howsoever incurred by any person as a result of or in connection with reliance upon any part of these Guidelines.*

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FOREWORD

The original NSW Boat Launching Ramps Guidelines were prepared by the NSW Public Works Department (PWD) in 1978 and a revised edition was later released in 1985. This concise document has stood the test of time and it remains largely relevant. For the past 30 years it has been an industry guideline for the design and upgrade of boat ramps in NSW.

The NSW Marina Guidelines were prepared by PWD in 1987 and were followed by Australian Standard AS 3962 Guidelines for Design of Marinas, finalised in 2001. Both documents incorporated boat ramps, with the Australian Standard drawing from, but superseding, the earlier NSW Marina Guidelines. There are some minor differences in the treatment of boat ramps in the 1985 Guidelines and AS 3962-2001.

Various changes have emerged in recent decades with recreational boating activities in NSW. The capacity and power of tow vehicles is improving with technology such as traction control now common place and trailerable boats increasing in size and being fitted with more powerful engines. Both of these factors influence the loading on ramps and alter the design requirements of ramps and associated facilities. Changes to boat ramp facilities and amenities have also occurred. Pontoons are now more common, particularly use of on-ramp pontoons, and a facility which includes pontoon access attracts a higher level of usage.

This document, which was prepared with the assistance of Royal Haskoning DHV, replaces the NSW Boat Launching Ramp Guidelines. It is a result of a review of the previous guideline with the objective to update and refresh its content to reflect modern day boating requirements. In addition, the new Guidelines aim to be consistent with relevant Australian Standards and modern day usage and expectations of boat ramp users. This Guideline has been prepared in consultation with key representatives from NSW Roads & Maritime Services (RMS), The Boat Owners' Association of NSW, Recreational Fishing Alliance of NSW, NSW Maritime Advisory Council, NSW Recreational Vessels Advisory Group, Marine Rescue, selected recreational fishing clubs and local Councils.

1 GENERAL

1.1 Objectives and Scope

The objectives of these Guidelines, intended to be used alongside the relevant Australian Standards, are:

- to identify the main functional and design aspects that should be considered when planning the layout and components to be included within a new boat ramp facility or incorporated in an upgrade to an existing boat ramp facility; and,
- to provide best practice technical and operational advice to assist with the design of the facility.

The content of this document is intended to provide guidance only. Application of these Guidelines would be subject to site specific environmental conditions, and should account for anticipated level and type of boat ramp usage and the requirements of local authorities. It is recommended that as part of the planning and design process advice is sought from engineers with specific expertise in the design of small craft facilities.

The design parameters provided in this document are drawn from a number of relevant standards that exist at the time of writing. These should be checked for currency by the engineer as part of the design process.

1.2 Relevant Standards

Relevant Australian Standards that are referenced within these Guidelines include:

- AS 1170 Structural design actions;
- AS 1379-2007 Specification and supply of concrete;
- AS 1428-2010 Design for access and mobility set;
- AS 1657-2013 Fixed platforms, walkways, stairways and ladders – Design, construction and installation;
- AS 1742-2014 Manual of uniform control traffic devices set;
- AS 1743-2001 Road signs – specifications;
- AS 1744:2014 Standard alphabets for road signs;
- AS 2758.1:2014 Aggregates and rock for engineering purposes – Concrete aggregates;
- AS 2890.1:2004 Part 1: Off-street car parking;
- AS 2890.6:2004 Part 6: Off-street parking for people with disabilities;
- AS 3600-2009 Concrete structures;
- AS 3962-2001 Guidelines for design of marinas; and,
- AS 4997-2005 Guidelines for design of maritime structures.

Reference should also be made to Australian Standard supplements published by RMS including:

- RMS Australian Standard Supplements: Australian Standard – AS1742 Manual of Uniform Traffic Control Devices Parts 1 – 15 (July 2013); and,
- RMS Australian Standard Supplements: Australian Standard – AS1743 Road Sign – Specifications (July 2013).

Information on the use of fibre reinforced polymers within concrete has been obtained from relevant Canadian design codes and manuals:

- CAN/CSA-S806-12 Design and Construction of Building Components with Fibre-Reinforced Polymers; and,
- Reinforcing Concrete Structures with Fibre Reinforced Polymers, Design Manual No.3 (ISIS Canada, 2007).

Guidance is also provided in Austroads publications for pavement design aspects and turning path templates for specific design vehicles, and RMS Engineering Standards and Guidelines for Maritime Structures.

Reference should be made to the Safe Design of Structures, Code of Practice (Safe Work Australia, 2012) for safety in design requirements.

1.3 Preliminary Planning Considerations

There are a number of preliminary considerations that should be taken into account as part of the initial planning and design process for a boat ramp facility. These include:

- agreement on the scale and type of the facility with local authorities;
- identification of stakeholders for consultation, which may include the asset owner(s), local authorities, State Government agencies, waterway user groups and the general public;
- review of existing facilities in the area and their current level of usage;
- prediction of the level and nature (e.g. commercial/recreational powered craft, PWCs, non-powered craft) of usage of the proposed boat ramp facility in consultation with stakeholders, taking into consideration peak holiday periods and special events;
- identification of any particular usage requirements of emergency services, including Police, Water Police, Marine Rescue, State Emergency Service and Ambulance;
- review of vessel and boat licence registrations in the catchment area for the proposed boat ramp;
- consideration of providing a separate access facility for non-powered craft (e.g. canoes, kayaks) if usage by these user groups is expected to be high;
- consideration of the use of the boat ramp for purposes other than boat launching;

- proximity of the proposed ramp location to population centres and consideration should also be given to the assessment of surrounding land use i.e. potential impact on adjoining developments;
- identification of environmental (e.g. physical, ecological), heritage or native title issues that may affect the feasibility of the facility or represent design or construction constraints;
- identification of land-based supporting infrastructure (e.g. road access, power/water supply, sewer connection); and,
- determining the planning approvals required, including permits and licences.

1.4 Overview of Approvals Process

The *Environmental Planning and Assessment Act 1979* (EP&A Act) provides the statutory basis for planning and environmental assessment in NSW. The Minister, statutory authorities and local councils are all responsible for implementing this Act. Environmental Planning Instruments (EPIs) prepared under the EP&A Act include Regional Environmental Plans (REPs), State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs). The EPI's list the types of development/activities which:

- require development consent;
- do not require development consent; and,
- are prohibited.

The approvals pathway for boat ramps in NSW is dependent on whether the proponent is a public authority or not, the land ownership, zoning and applicable EPI's.

The proponents for the majority of boat ramps in NSW are public authorities. Under *State Environmental Planning Policy (Infrastructure) 2007*, activities undertaken by public authorities relating to wharf or boating facilities are permitted without consent. However, approval under Part 5 of the EP&A Act is still required and an environmental assessment must be undertaken that examines and takes into account to the fullest extent possible, all matters affecting or likely to affect the environment. The environmental assessment would generally take the form of a Review of Environmental Factors (REF) unless significant impact to the environment is expected, in which case, an Environmental Impact Statement (EIS) would be required.

In addition to approval under the EP&A Act, other legislation that is likely to be relevant to the construction of boat ramps in NSW is listed below. A number of permits and licences may be required under this legislation:

- *Crown Lands Act 1989*;
- *Roads Act 1993*;
- *Maritime Safety Act 1998*;
- *Fisheries Management Act 1994*;
- *Coastal Protection Act 1979*;

- *Threatened Species Conservation Act 1995*;
- *Protection of the Environment Operations Act 1997*;
- *Water Management Act 2000*;
- *National Parks and Wildlife Act 1974*;
- *Native Vegetation Act 2003*;
- *Heritage Act 1977*;
- *Native Title Act 1994*;
- *Marine Parks Act 1977*; and,
- *Environment Protection and Biodiversity Conservation Act 1999*.

2 BOATS AND TRAILERS

Approximately 84% of boats registered in NSW are 6 metres or less in length[1] and are generally stored on trailers for transport to a waterway for launching at boat ramps. It is estimated that approximately 82% of boat trailers registered in NSW are used for storage of boats up to 6 metres in length[2]. 93% of boats registered in NSW are 8 metres or less in length[1].

When boats are more than 7 metres in length, boat trailer storage becomes more problematic and costs increase rapidly. This is due to a number of practical and legislative factors including:

- increased size and technical complexity of trailers to accommodate larger boats;
- increased vehicle capacity specifications required to tow heavy trailer and boat combinations;
- 2.5 metre limit on vehicle width for transit on NSW roads without an oversize permit (which are usually accompanied by access restrictions)[1]; and,
- NSW Road Rules which prevent vehicles (including trailers) over 7.5 metres in length or with a gross vehicle mass of over 4.5 tonnes from stopping on a road in a built up area for longer than 1 hour, and effectively limit roadside storage of large boat trailers in urban areas[2].

For the purpose of these Guidelines, 7.5 metres has been adopted as the maximum 'trailerable' limit for boats. The dimensions of trailers that are able to transport this size of boat vary between manufacturers and have a typical overall length of 7 to 8 metres, width of up to 2.5 metres, and a gross vehicle mass (i.e. combined trailer and boat mass) up to 3.5 tonnes. Boat trailers are typically towed by vehicles with a length of approximately 5 metres, giving a total length of tow vehicle and trailer of approximately 12.5 metres (refer Figure 1).

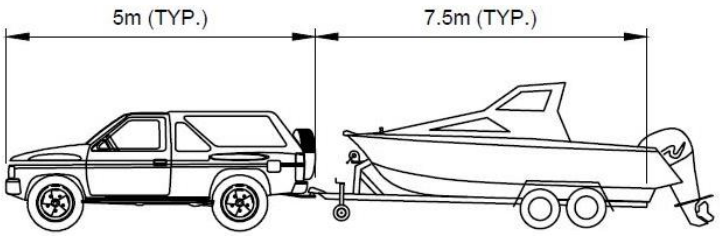


Figure 1: Typical tow vehicle and trailer combination

The Design Vessel for a particular boat ramp facility should be defined in the early planning stages of design in consultation with the local Council and RMS Boating Safety Officer.

[1] Based on registration data and information summarised within *NSW Boat Ownership and Storage: Growth Forecasts to 2026* (Roads & Maritime Services, July 2010).
[2] Based on registration data and information summarised within *Boat Trailer Working Group – Discussion report and options paper* (Transport NSW, March 2013).

3 FACILITY SCALE

The scale of a boat ramp facility is dependent on factors that affect the level of usage such as proximity to population centres and other launching facilities. The scale of a facility is also a means of managing boating activity on a waterway. The facility should provide no more capacity than the desired level for the type of use, user experience and user safety.

These factors are influenced by the siting of the ramp in an urban or rural area, and planning as a local or regional facility.

3.1 Regional and Local Facilities

The scale of a boat ramp as a regional or local facility is dependent on a number of factors and should be determined in consultation with Council and the local RMS Boating Safety Officer and with reference to the relevant regional boating plans as part of an initial planning phase.

A regional boat ramp would typically be a large scale facility designed to accommodate a high level of usage attracted from a boat user catchment area covering several different localities. It would typically comprise a wide boat ramp with multiple lanes and sufficient manoeuvring and parking areas to handle high traffic flow.

A local boat ramp would typically be a smaller scale facility with respect to number of launching lanes and parking capacity as its purpose is to service boat users from the local area only. These boat ramps may be located in close proximity to other boat ramps or at isolated townships.

3.2 Urban and Rural Facilities

The characteristics of a boat ramp facility are influenced by the scale of the facility and geographic setting, which can be within an urban or rural area. Typical characteristics of regional-urban (refer Figure 2) and local-rural (refer Figure 3) ramps are summarised below in Table 1.

Figure 2: Example regional-urban ramp at Foreshore Road, Port Botany

Figure 3: Example local-rural ramp at Dunns Swamp, Wollemi National Park

Table 1: Characteristics of regional and local ramps

Regional Boat Ramp	Local Boat Ramp
High usage by local and regional boat owners	Low usage by local boat owners only
Larger parking areas which may be limited by available land area and inhibit ramp usage	Small parking areas
Typically sealed parking areas with line markings, kerb and gutter, stormwater drainage and one-way flow of traffic and signage	Sealed, unsealed or informal parking areas
Multiple lanes	Single lane
Typically includes multiple boat holding structures such as jetties or pontoons	May include a small jetty or pontoon to assist with boat holding
Typically includes ancillary ramp amenities such as lighting, fish cleaning table, rigging and de-rigging bays (including washdown facilities), toilet and shower facilities and garbage facilities	May include limited ancillary ramp amenities such as lighting, fish cleaning table and a small washdown area (single bay)

(Note: This applies to both urban and rural settings)

4 FACILITY LOCATION AND EXPOSURE

4.1 General Considerations

There are a number of considerations that influence the siting of a boat ramp facility. These mainly relate to the safety of launching and retrieval operations under prevailing environmental conditions, including exposure to local coastal, estuarine and riverine processes.

Ideally, a boat ramp site should:

- have adequate water depths at the toe of the ramp at low water for launching and retrieval operations and still be usable at high water;
- be sheltered from excessive wave action;
- not be located where prevailing currents (e.g. from tides, waves or freshwater flows) run across the ramp;
- not be located in an area of active shoreline erosion or accretion;
- not be located in close proximity to sensitive ecological habitat (e.g. seagrass beds);
- have sufficient level cleared land area (or land that is able to be cleared in accordance with local Council requirements) on the foreshore immediately adjacent to the ramp for provision of accessways, manoeuvring areas, parking areas and ancillary ramp amenities;
- allow for land approaches that permit queuing without blocking other traffic;
- allow for water approaches of sufficient area to allow queuing and low speed manoeuvres without blocking existing fairways and channels used for local waterway navigation;
- have water approaches that are free from navigation hazards (e.g. rocky reef, seabed debris, mobile sand shoals); and,
- be located away from public swimming areas.

4.2 River Flow

It is recommended that local waterway user groups are consulted to determine suitable ramp locations within a river which may be subject to circulatory currents. Design features that may assist with launching and retrieval activities in river environments include:

- angling of the boat ramp in a downstream direction;
- installation of piles on the downstream side of the ramp to hold boats after launching;
- construction of rock mound structures on the upstream side of the ramp to reduce exposure to currents;
- provision of guide poles in the ramp approach area in high flow regions; and,
- creation of a sheltered basin behind the bank of the river.

4.3 Wave Action

Exposure of the ramp area to wave action should be minimised to avoid waves pushing a boat sideways during launching and retrieval operations. This would also reduce the likelihood of damage caused by boats impacting on boat holding structures (such as jetties and pontoons) or collisions with other boats whilst queuing for ramp retrieval. Boat ramps should ideally be sheltered from waves[3] larger than 0.2m. However in exposed or coastal sites, this may not always be feasible and use of the boat ramp may be restricted under certain conditions.

4.4 Wind Exposure

Exposure to winds is determined by the geographical location of the ramp site and proximity to local topographic features (such as elevated land areas or prominent headlands or points within waterways) offering shelter from particular wind directions. The impact of exposure to strong cross winds can be minimised if the ramp is able to be aligned parallel to a dominant wind direction or located on the leeward side of topographic features.

4.5 Other Alignment Considerations

Other factors to be considered when optimising the alignment of a boat ramp include:

- alignment into the dominant incident wave direction from sea, swell or boat wash;
- orientation at an angle to the main approach road to reduce the likelihood of vehicles driving into the water; and,
- a typical 0 degrees to 15 degrees (up to 30 degrees maximum) downstream rotation (from shore-normal) to suit the flow line in rivers.

4.6 Sedimentation

Sedimentation at a boat ramp site can significantly affect its performance as a launching facility if shoaling occurs at the toe of the ramp or over the ramp itself (refer Figure 4). Sediment movement in waterway areas surrounding the boat ramp site can also limit or prevent boats from accessing navigable depths after launching. An initial appraisal of the potential for sedimentation should be undertaken as part of the feasibility assessment for boat ramp sites. This should include the following tasks:

- visual inspection of shoreline morphology;
- consultation with local waterway user groups;
- review of historical aerial photography; and,
- review of previous technical studies (e.g. coastal hazard assessments, estuary/coastal management plans, flood studies, bank condition assessments).

[3] Consistent with design guidance provided in AS 3962-2001.

Figure 4: Boat ramp affected by sedimentation

4.7 Open Coast Settings

Siting of a new boat ramp in open coast settings is generally not recommended for several reasons including:

- safety risks associated with launching and retrieving boats in adverse sea conditions;
- changes in beach levels may render the ramp unusable;
- potential impacts of the ramp structure on longshore sediment movement (e.g. acting as a groyne and causing updrift accretion and downdrift erosion);
- additional design provisions required to accommodate scour and wave action on the structure; and,
- additional challenges associated with construction in an exposed coastal environment.

5 BOAT RAMP

5.1 Configuration

5.1.1 Number of Lanes

The number of lanes allocated to the boat ramp should be sufficient to accommodate weekend demand during the boating season. As a guide, each lane of a ramp can accommodate 30 to 40 launchings and retrievals per day. This increases to 40 to 50 if boat holding structures are provided, and to 50 to 60 if separate rigging/de-rigging areas are provided. However, in the majority of cases the number of boat ramp lanes is dictated by the area available for car and trailer parking, particularly in space-constrained urban settings.

In special circumstances where a large number of boat ramp lanes are warranted, consideration may be given to splitting the ramp into two separate ramps rather than providing one large multiple lane ramp (i.e. more than four lanes). This may assist with reducing congestion and user conflict in the manoeuvring area.

The availability of ramp lanes can also be adversely affected by adjacent boat holding structures when they are occupied for extended periods by moored boats. When boat holding structures are provided, consideration should be given to providing an additional lane to improve ramp usage. Alternatively, boat holding structures can be positioned away from the ramp launching area.

5.1.2 Lane Width

Lane widths provided at boat ramps should accommodate the range of trailer reversing ability that is likely to be encountered within user groups from the general public to commercial operators.

It is recommended that a single lane boat ramp should be 4.5 metres wide[4] to accommodate a maximum permissible trailer width of 2.5 metres with 1 metre of manoeuvring space on each side. If kerbs are provided to guide reversing and reduce the risk of trailers running over the side of the ramp, AS 3962-2001 suggests that the single lane width can be reduced to 4 metres. Breaks should be provided within kerbs to facilitate drainage of the ramp surface.

The previous guidelines adopted 3.7 metre minimum lane widths for multiple lane facilities[4]. It has been found in practice that extra lane width speeds up the reversing process and thus improves ramp traffic flows. As such, it is recommended that lane widths of 4 metres are provided where practical for multiple lane ramps.

Lane demarcation is recommended to increase the efficiency of boat ramp usage. Line markings provided from the manoeuvring area to the crest of the ramp (refer Figure 5) can assist to define approach slots for each ramp lane and guide reversing drivers. However, painted line markings can become slippery when wet and are subject to wear. Retro-reflective raised pavement markers (i.e. ‘cats eyes’) should be used on the ramp surface. Alternatively, concrete joints can also be used to delineate lanes on the ramp. Low profile

[4] Consistent with design guidance provided in AS 3962-2001.

kerb divides may also be appropriate following consultation with local user groups. However, it is important to note that kerbs have the potential to be trip and navigation hazards when underwater.

Figure 5: Line markings delineating reversing lanes in manoeuvring area

5.1.3 Toe Depth

The ramp surface should be sealed down to a depth of 1.0 metre below the Design Low Water Level and the waterway bed should be continued at the ramp gradient to a minimum depth of 1.25 metres below the Design Low Water Level (refer Figure 6). This depth or greater should also be available beyond the ramp toe along the navigation route to the host waterway.

If a 1.0 metre depth below the Design Low Water Level cannot be practically achieved due to site constraints, a usability assessment should be undertaken to assess the viability of the boat ramp facility. This should involve comparison between the available toe depth at the site over a water level record and the depth required for safe launching[5] to determine the percentage of time that the boat ramp can be used for launching. A percentage of time of 80% is recommended as a practical minimum.

[5] Based on the expected distribution of the draft of boats using the facility plus an underkeel clearance from the bed of 300 mm.

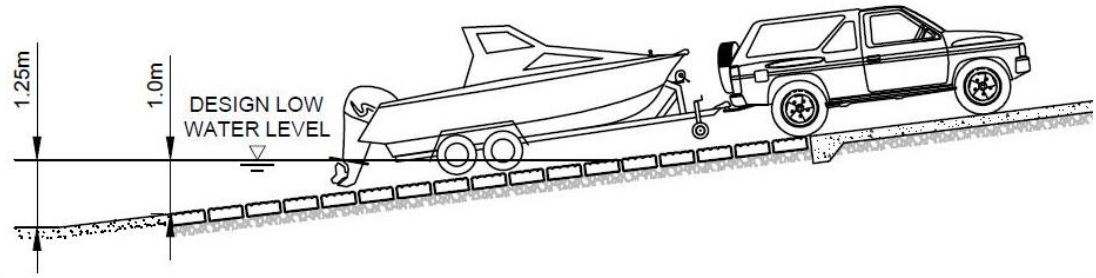


Figure 6: Ramp toe geometry

5.1.4 Ramp Slope

The slope of a boat ramp should be steep enough so that a tow vehicle does not need to enter the water to launch a boat (refer Figure 7) and not so steep that the tow vehicle is unable to pull the boat and trailer safely from the water. It is recommended that the ramp slope should be within the range of 1V:9H to 1V:7H (vertical to horizontal) with a preferred slope of 1V:8H.[6]

Figure 7: Boat launching on a ramp with insufficient slope with tow vehicle in the water

5.1.5 Ramp Crest Level

The crest of the ramp is the uppermost part of the ramp including the vertical curve. The crest of the ramp should not be submerged during Design High Water Level and wave runup conditions.

For preliminary design purposes, the following ramp crest levels can be adopted (with an additional allowance for predicted sea level rise[7] over the design life of the facility):

- in waterway areas influenced by tides, 500 mm above the level of Highest Astronomical Tide (HAT); or,

[6] Consistent with design guidance provided in AS 3962-2001.
[7] Based on projections that are widely accepted by competent scientific opinion, or as stipulated in local regulations.

- in non-tidal areas or tidal areas where HAT is not defined, 500 mm above the 1 year Average Recurrence Interval (ARI) water level as determined by analysis of water level records.

A suitable vertical curve (refer Figure 8) should be provided between the ramp slope and the approach/manoeuvring area to prevent trailer hitches striking the ramp surface at the grade change. To accommodate a typical change in grade between the boat ramp and a flat approach/manoeuvring area a vertical curve should be provided over a minimum distance of 6 metres.

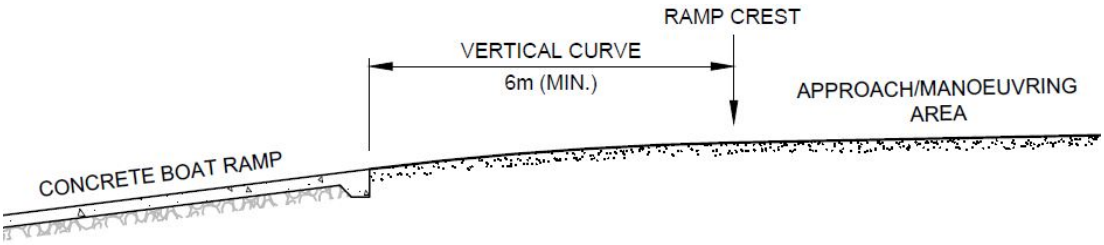


Figure 8: Vertical curve

5.1.6 Ramp Length

The desirable length of ramp below the ramp crest that is exposed at the Mean High Water Level is 10 metres to enable a tow vehicle and trailer to occupy the ramp whilst launching.

Ramps located in dams or lakes may extend over a considerable length to accommodate large water level fluctuations. Design features that may assist in these situations include:

- provision of turning points along the ramp to reduce the trailer reversing distance;
- provision of a compacted area alongside the ramp to facilitate parking at lower water levels;
- diversion and spreading (e.g. grooved surface) of stormwater runoff on the ramp and installation of scour protection measures (refer Section 5.3) to prevent scour adjacent to the ramp at low water levels; and,
- siting of the ramp to allow modification (e.g. lengthening) in response to future water level conditions (e.g. drought).

5.2 Boat Ramp Surface Finish and Construction Methods

5.2.1 General

The surface finish on a boat ramp should provide sufficient traction for tow vehicles and sound footing for pedestrians.

Typical details of surface finishes are provided on Drawing No. BRFG-002 and BRFG-003 in Appendix A.

5.2.2 Above Mean Water Level

Cast in situ concrete is the most economic material for construction of the boat ramp above the Mean Water Level. Concrete should be cast with deep grooves moulded into the surface to promote self-cleansing of the boat ramp surface by allowing drainage of excess water and debris (refer Figure 9). These should be 25 mm deep and 25 mm wide, square-shouldered grooves at an angle of 45 degrees to the ramp contours and at 100 mm centres.

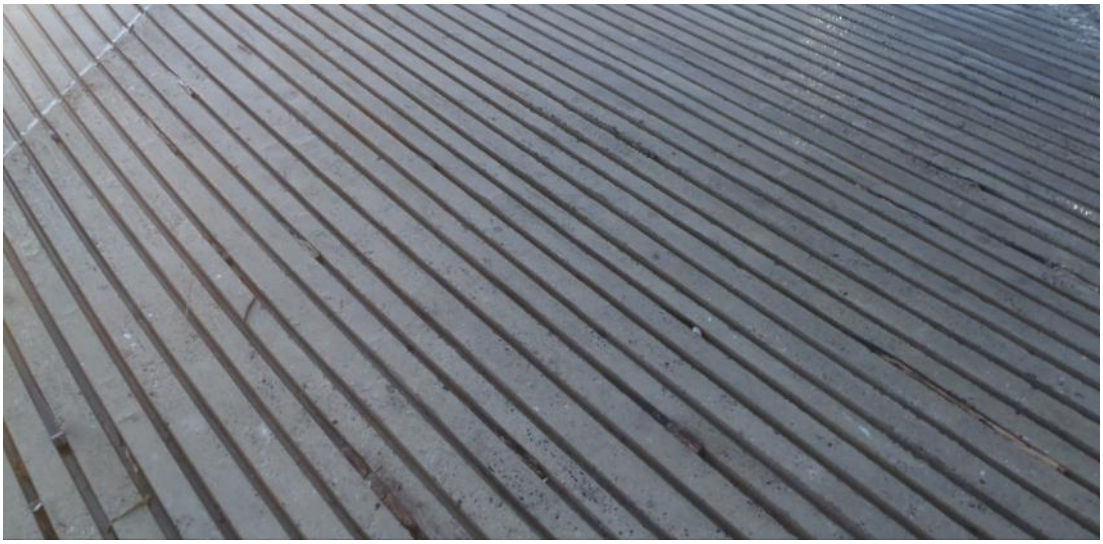


Figure 9: Moulded grooves in concrete

Raked, rough-broomed and other coarse-grained finishes without deep grooves are unsatisfactory as the coarse texture promotes marine growth and the surface may be smoothed by wear. A 'waffled' surface formed by intersection of deep grooves is not recommended as these surfaces are difficult to walk on.

Alternative non-slip coatings may be specified by the designer. These may include fixing or recessing aluminium mesh to the deck of the ramp. Any alternatives or additions must be suitable for safe pedestrian and vehicular usage.

5.2.3 Below Mean Water Level

Below the Mean Water Level, grooved (as per Section 5.2.2) precast concrete planks or precast slabs are recommended to extend the ramp surface to the design toe depth (refer Figure 10). Larger precast panels are an alternative, however these would require a larger lifting crane for installation (refer Figure 11). Generally, precast planks are laid at grade across the ramp and bedded on flexible foundations and connected with stainless steel straps and pins. Following the placement of precast planks and fixing of connections, it is recommended that the cavity formed at each connection point is filled with concrete. These areas can be sites for marine growth (refer Figure 12) and are hazardous for pedestrians.

At sites with greater exposure to environmental conditions a more robust and stiff structure would normally be required (e.g. planks fixed to underlying beams with dowels).

Alternate construction methods involve pumped placement of concrete underwater (e.g. tremie concrete). However, these methods require still water conditions or temporary works to protect the work area from environmental loadings (e.g. waves, currents etc.) and quality control of the concrete and surface finish is more difficult to achieve. Construction of a coffer dam, dewatering and construction in the dry is also possible but is generally more expensive in comparison to wet construction methods.

Figure 10: Precast planks installed below Mean Water Level

Figure 11: Installation of a large precast panel with a lifting crane

Figure 12: Oyster growth around precast plank connections

5.3 Foundation Design

It is recommended that a geotechnical investigation is undertaken to determine foundation conditions. The designer should prepare a foundation design that would:

- satisfy allowable and ultimate bearing capacities of the proposed base and sub-base course material; and,
- provide limited deflections under service loading.

Piling may be required for deflection control or support for suspended ramp structures. For suspended structures, steel or concrete piling is recommended. For deflection control of ground slabs, timber piling may be more suitable. The pile type and installation method should be determined by assessment of the existing ground conditions, availability of plant and materials, and durability considerations.

For sheltered boat ramps, piling is generally not required unless soft ground conditions necessitate additional deflection control. A compacted base course should typically be suitable to support the boat ramp. Foundations for sheltered boat ramps should comprise:

- a minimum 200 mm thick layer of compacted 50 mm to 100 mm sized igneous rock or equivalent; and,
- a suitably designed non-woven geotextile filter fabric underlay.

Where exposed at the ramp edge, the ramp foundation material should be protected from scouring. Typical scour protection measures against wave, current and propeller action include:

- rock scour protection, which should be at least two armour rocks thick, extend down to a level of one design wave height below the Design Low Water Level and extend up to the level of maximum wave runup, and be underlaid with suitable filtration;
- reinforced cut-off walls installed along the edges of the cast in situ portion of the boat ramp to anchor the slab into the foundation material and provide protection against undermining if rock scour protection fails; and/or,
- dry concrete mix in hessian or geotextile fabric bags placed and then allowed to set by the application or natural ingress of water.

The provision of scour protection at the toe of the ramp assists to prevent ‘propeller dredging’. This occurs when boats are powered on to trailers rather than winched on. The action of strong propeller currents at the toe of the ramp causes scour of soft bed sediments and deposition as ridges within the launching area. This scour can undermine the ramp ground slab. Accumulation of sediments in the launching area can cause boats to bottom as they approach the ramp for retrieval.

5.4 Structural Design

5.4.1 General

Boat ramps should be designed as structures that have stability, strength, serviceability performance and durability performance in accordance with the relevant Australian Standards and applicable design guidelines. Local Councils may have specific development requirements that influence the design of boat ramps, which may be in the form of development control plans or guideline documents.

Typical structural details are provided on Drawing No. BRFG-003 in Appendix A (Note: Not all of these details may be applicable to local-rural ramps).

5.4.2 Design Life

The design life is the period of time for which a structure or structural element is able to perform its intended purpose. Structures or elements may or may not require maintenance actions in order to achieve their design lives.

Structural elements of boat ramps should be designed for a minimum 25 year design life[8] without any requirement for structural repairs (apart from that caused by unforeseeable damage). Ongoing maintenance would still be required over the design life of the structure. The required design life of boat ramps should be confirmed by the Proponent, with input and assistance provided by the designer regarding ongoing maintenance and associated lifecycle costs. Consideration should be given to specifying separate design life requirements for different structural ramp elements (e.g. concrete deck, precast concrete planks) and other launching facility elements (e.g. jetties or pontoons) depending on the difficulty, or associated hazards with repair or replacement of certain elements in the future.

Where appropriate, an allowance for predicted sea level rise[9] over the design life of the facility should be incorporated into the design.

5.4.3 Safety in Design

Safety in design is a requirement under the current Work Health and Safety (WHS) legislation. There are a range of legislative and regulatory requirements which are supported by the Safe Design of Structures, Code of Practice (Safe Work Australia, 2012). Designers are to ensure that requirements set out in the code of practice are achieved for the whole lifecycle of the structure, including construction, operation, maintenance and eventual decommissioning. Designers and proponents should seek to identify safety risks specifically associated with launching and retrieval of vessels and use by others of the site including trips, falls, gaps and issues associated with moving vessels, pontoons and wave action.

[8] Consistent with design guidance provided in AS 4997-2005.
[9] Based on projections that are widely accepted by competent scientific opinion, or as stipulated in local regulations.

5.4.4 Ramp Loading

Both dead loads (permanent actions) and live loads (imposed loads) should be considered by the designer. Dead loads include the self-weight of structural elements and other permanent loads that may be applied to the ramp surface (e.g. services and/or pontoons). Live loads include pedestrian and vehicular loads.

It is recommended that boat ramps should be capable of supporting a Uniformly Distributed Load (UDL) of 10 kPa or Point Loads of 45 kN, at spacing of 1.8 metres, each applied over an area of 300 mm x 150 mm[10]. Structures should be designed to satisfy stability, strength and service requirements for the potential application of imposed loads that would apply the most severe design action effects to the structure, or element being considered.

5.4.5 Environmental Loading

All applicable environmental loadings should be considered by the designer. These may include winds, waves, currents, debris, vessel mooring, vessel berthing, vessel wash, flood, hydrostatic and buoyancy forces, thermal effects and construction loads. Environmental loads may apply vertical and lateral forces to a ramp structure, including uplift and suction loads.

Ramps in exposed locations may be subject to wave and uplift forces that are likely to govern the structural design. The structural design of ramps located in estuaries or rivers is likely to be governed by ramp loading and foundation conditions.

5.4.6 Load Combinations

The ramp structure should be designed to support combined actions under serviceability and ultimate loading. Ramp loads and environmental loads may or may not act simultaneously. It is recommended that the load combinations outlined in AS 1170 are generally considered. Load combinations provided in AS 4997-2005 should also be considered for design actions experienced in a marine environment.

5.4.7 Materials

Reinforced concrete should be used to construct boat ramp decking consisting of beams, planks or slabs.

Where ramp elements are required to be suspended, or foundations are required to be piled, it is recommended that reinforced concrete and structural steel piles are used for the substructure members. Timber piling may also be suitable. The design life requirements of the facility may govern the choice of materials.

5.5 Reinforced Concrete Details

The durability of the concrete and reinforcement should be designed to satisfy the design life of the boat ramp. The designer may achieve this by selecting an appropriate combination of concrete strength, mix, admixtures (e.g. pore blockers, corrosion inhibitors), cover to

[10] Equivalent to a ‘Class 10’ loading within AS 4997-2005.

reinforcement, reinforcement coatings or embedded protection (cathodic protection), limiting reinforcement stresses or designing to minimise crack widths.

Reinforced concrete should be designed in accordance with AS 3600 for strength, serviceability and durability. AS 4997-2005 provides recommendations that should also be considered for durability design with regard to concrete mix characteristics, crack control and target design life of marine structures.

Alternatives to steel reinforcement may be incorporated into the structure (e.g. fibre reinforced polymers). In such cases, the structural design should be undertaken in accordance with a suitable industry accepted design code for that type of structure (e.g. for fibre reinforced polymers, relevant Canadian structural design codes and manuals should be applied, refer Section 1.2).

For boat ramps located in saltwater or brackish water environments, the structural design of reinforced concrete elements should incorporate the following:

- exposure classification of C2 as outlined in AS 3600;
- concrete mix design satisfying the recommendations provided within AS 4997-2005;
- concrete class of SC50 in accordance with AS 1379 (to satisfy recommendations provided within AS 4997-2005 for mix design, suppliers would need to provide a special class, 50 MPa concrete mix);
- the durability class of aggregates should be Class C in compliance with AS 2758.1;
- cover to reinforcement should be 65 mm or greater;
- galvanised reinforcement should be specified in combination with stainless steel or galvanised tie wire;
- black steel[11] reinforcement should be specified in combination with mild steel tie wire;
- design stresses for serviceability actions should remain less than or equal to 150 MPa to control crack widths;
- any cast-in fixtures, or doweled connections used should be stainless steel (Duplex Grade 2205) and electrically isolated from internal reinforcement[12]; and,
- expansion joints should be located in slabs at maximum 10 metre centres in both longitudinal and transverse directions.

For boat ramps located in fresh water environments, the above durability specifications may be reduced due to less severe exposure to chlorides.

[11] Cover to black steel reinforcement should be greater than for galvanised reinforcement to achieve the same design life.
[12] This is achieved by ensuring there is no contact between elements or use of a non-conductive barrier material between elements.

5.6 Inspections and Maintenance

Maintenance of boat ramps will always be required over their design life. The frequency and nature of routine maintenance would be subject to the local waterway and weather conditions, scale of the boat ramp facility and level of usage. The schedule of routine maintenance should be supported by an inspection program and should ensure that the facility is clean, safe and usable over the boating season. Regular maintenance extends the life of the facility, reduces the likelihood of major and costly repairs, and reduces or eliminates exposure to liability.

All boat ramps will require a cleaning regime to be implemented for removal of marine growth (refer Figure 13), and therefore the removal of slip hazards to allow the ramp to function safely for its users. This is generally undertaken by high pressure water blasting or by other mechanical means such as scrubbing with a hard brush. The Proponent should prepare a maintenance program and appropriate budget to allow for this periodic cleaning requirement.

The cleaning frequency required to prevent slip hazards will be site specific as the rate of marine growth is dependent on various environmental factors. Appropriate frequencies for ongoing maintenance should be confirmed following monitoring of the first few cleaning cycles.

Other maintenance tasks such as removal and application of protective coatings (on steel, concrete etc.), removal of accumulated debris/rubbish/sediment (refer Figure 14), or regular washing of metal elements (e.g. aluminium or stainless steel) may also be required over the life of the structure depending on site specific characteristics.

The inspection program for components of the boat ramp facility on the waters edge should be carried out by persons suitably qualified in the design and construction of maritime structures, and include an assessment of the following mechanisms for deterioration:

- Boat Ramp:
    - marine growth on the ramp surface;
    - movement or undermining of rock scour protection along the edges and toe of the ramp;
    - trip hazards or wheel hazards;
    - loss of ramp foundation material;
    - formation of a ‘drop-off’ or hole at the toe of the ramp;
    - visual evidence of reinforcement corrosion within concrete elements (signs include cracking, spalling, white salt encrustation, rust stains and exposed reinforcement);
    - settling of the ramp deck and separation at joints and connections; and,
    - deterioration or detachment of lane demarcation elements (line markings or raised pavement markers).
- Pontoons and Jetties:
    - freeboard, tilting/listing or instability of pontoon units;

- damaged decking materials and potential trip hazards;
- visual evidence of reinforcement corrosion within concrete elements (signs include cracking, spalling, white salt encrustation, rust stains and exposed reinforcement);
- wear of non-slip surfacing;
- deterioration of timber elements;
- damaged, loose or detached rubbing strips;
- damaged, loose or detached mooring cleats;
- hinges that are damaged, missing components (e.g. pins) or rusted;
- marine growth on the pontoon units;
- damage to underside of pontoons caused by impact on the boat ramp from wave action;
- loss of section, corrosion, marine borer and termite attack and changes in alignment or movement of piles; and,
- wear, corrosion or fracture of pile guides and fastenings.

- Gangways:
  - cracking, settling or damage to concrete abutments;
  - damage, missing components (e.g. pins) or rusting of the shore hinge connections of safety chains;
  - cracks or breaks in gangway welds;
  - pontoon landing area, including wear on the pontoon surface, missing rollers and damage to the transition plate; and,
  - damage to decking materials and any trip hazards.

Maintenance and inspection regimes should also address the deterioration of signage and other safety equipment around the boat ramp facility (e.g. lifebuoys or fire safety equipment).

A provisional inspection program is outlined in Table 2, which includes inspection intervals that are subject to environmental and operational conditions experienced at the facility. Inspections should be performed at more frequent intervals if the facility is located in an extreme environment or subjected to a severe loading event.

Table 2: Provisional inspection program for a boat ramp facility

Inspection Interval	Boat Ramp Component	Type of Inspection
6 months	Boat ramp	Visual inspection at low water for surface fracture, cracking and other signs of environmental degradation.
	Pontoons	Visual inspection above water with attention to damage from vessels, freeboard and connections.
	Piles and pile guides	Visual inspection above water at low tide (if applicable) and checking of pile guides.
1 year	Timber structures	Visual check on condition of framing and the connections between members. Alignment of timbers and the fastenings and hardware should be inspected. Check for decay. Annual pest inspections and treatment as required.
	Steel structures and components	Visual inspection for wear, abrasion and corrosion of the elements and protective coatings. Distortions due to overstress should be noted.
	Rock scour protection	Visual inspection at low water, looking for movement or undermining of rock protection, loss of ramp foundation material or formation of scour holes.
	Services (power and water supply)	Visual inspection for wear or fracture, deterioration of plastic components and corrosion of metal components. Particularly deteriorated conduits and water leakages should be noted.
3 years	Pontoons	Full investigation including an underwater inspection and the removal of excessive marine growth. Check for corrosion on all parts.
	Piles and pile guides	Detailed inspection using divers to check for any deterioration and the removal of excessive marine growth. Remaining section sizes at critical levels should be recorded.
5 years	Timber structures	Detailed above and below water inspection of structural elements. Attention to rot, decay and marine borer attack. Assessment of structure performance.
	Steel structures and components	Detailed inspection of structural elements. Attention to fatigue, wear, deterioration of protective coatings and overall structure performance.
	Concrete structures	Detailed inspection of concrete surfaces and check for visual signs of reinforcement corrosion (cracks, spalling, white salt encrustation, rust stains and exposed reinforcement).

Figure 13: Marine growth on a boat ramp

Figure 14: Accumulation of debris and rubbish on a boat ramp

6 ACCESSWAYS, MANOEUVRING AND PARKING AREAS

6.1 Car and Trailer Parking Numbers

A sufficient number of car and trailer spaces should be provided to meet the demand of normal weekend usage during the boating season. Provision for overflow parking at peak times may be considered at regional facilities. Car and trailer parking is influenced by:

- number of boat ramp lanes required (refer Section 5.1.1);
- available parking area; and,
- demand for parking based on present usage and proximity of alternative boat ramps.

An initial assessment and general recommendation (based on previous guidelines and RMS experience) is that 25 to 30 spaces should be provided per boat ramp lane. In high use areas, and in combination with associated support facilities, additional car and trailer parking may be considered as outlined in Table 3 (although the upper bound numbers are unlikely to be achieved except for a major facility).

The available land area for parking may also be used to determine the size of the boat ramp provided (i.e. number of lanes) as the amenity of the facility would be significantly impacted if the parking capacity is inadequate to cater for the launching and retrieval potential supported by the ramp. In this instance the number of lanes provided (by reverse calculation) may be increased to ensure ease of launch and retrieval, rather than the number of lanes determining the number of car and trailer spaces.

Car and trailer parking provisions for urban and rural facilities reproduced from AS 3962-2001 are provided in Table 3. However, consideration needs to be given to local and regional settings when interpreting the table.

Table 3: Number of car and trailer parking spaces for boat ramp facilities

Area	Number of car and trailer spaces per boat ramp lane		
	Ramp only	With boat holding structures	With separate rigging and de-rigging areas
Urban	30 – 40	40 – 50	50 – 60
Rural	20 – 30	30 – 40	40 – 50

Failure to provide adequate car only parking would result in cars occupying car and trailer spaces, which limits the capacity of the ramp facility particularly at sites that also support non-boating user groups (e.g. swimmers, picnicking). Separate car only parking areas should be provided at a rate of 1 car park per 5 car and trailer spaces[13]. In addition to this, at least one car only parking space should be provided for disabled access. In large car parking areas, 2% of car only parking spaces should be allocated for disabled access[14].

[13] Consistent with design guidance provided in South Australian Boating Facility Advisory Committee (1997).
[14] Consistent with design guidance provided in the Building Code of Australia (BCA).

Where practicable, the boat ramp parking area may also be considered as a multi-use facility. For example, a section of the parking area could be designated for commuter use as a 'park and ride' facility during weekdays and returned to boat ramp users during weekends, school holidays and special events when demand is higher.

6.2 Car and Trailer Parking Arrangements

Car and trailer parking spaces should be angled for reversing entry and to optimise the use of available space. A parking space angle of 45 degrees is preferred with 60 degree and 90 degree parking also possible. Car and trailer spaces should be a minimum of 3.0 metres wide and 12.5 metres long to accommodate typical tow vehicle and trailer combinations. While a 12.5 metre length is the adopted car and trailer combination for design purposes in these Guidelines, it is recommended in regional facilities that a number of longer car and trailer parking spaces (up to 14 metres, refer Figure 15) be provided to accommodate oversized vehicle arrangements. Conversely, a small number of shorter car and trailer parking spaces may also be considered to maximise car and trailer parking opportunities at a site.

It should be noted that trailers are legally able to have a rear overhang of up to 3.7 metres, measured from the centre of wheel axle(s). As such, overhang of the trailer beyond the rear wheelstop can be accommodated in the design of car and trailer spaces.

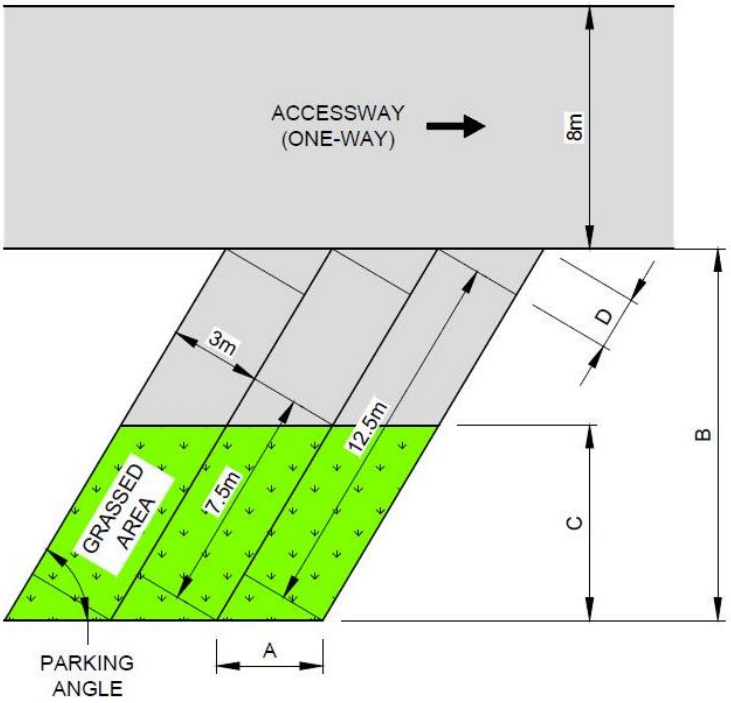
The portion of the car and trailer space that is occupied by trailers may be sealed in high use or poor drainage areas or ideally grassed (refer Figure 16) to minimise impervious areas and facilitate infiltration of surface runoff. The width of car and trailer spaces and grassed area (measured perpendicular to the alignment of the parking space) will vary according to the adopted parking angle as shown in Figure 17.

The size and arrangement of car only parking spaces should be provided in accordance with AS 2890.1. Car spaces for disabled access and associated shared areas, bollards, kerb ramps and pavement markings should be provided in accordance with AS 2890.6 and AS 1428.

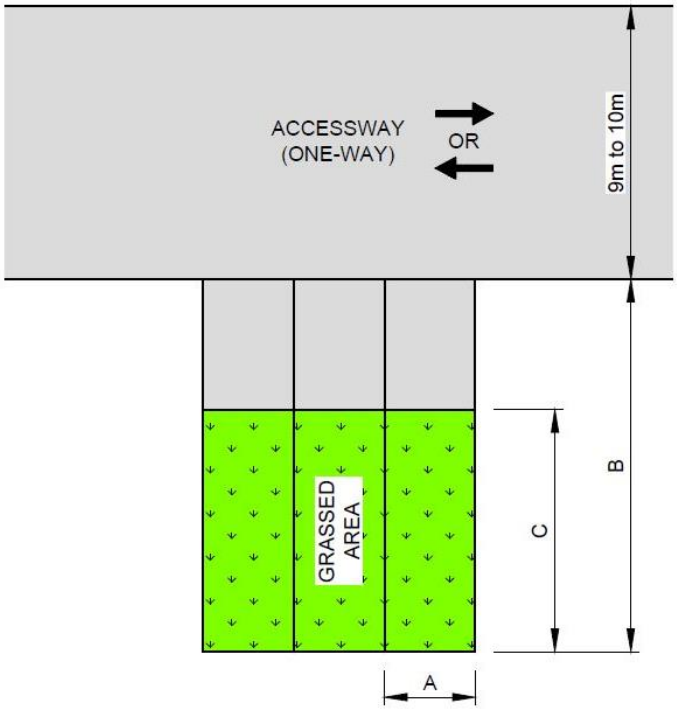
Accessway widths should be in accordance with Section 6.4.

Figure 15: Longer car and trailer spaces to accommodate oversized vehicle arrangements

Figure 16: Grassed car and trailer spaces



Angled Parking



90 Degree Parking

Parking Angle	Dimension (metres)			
	'A'	'B'	'C'	'D'
90 degrees	3.5	12.5	7.5	-
60 degrees	3.5	12.3	6.5	1.7
45 degrees	4.2	11.0	5.3	3.0

Figure 17: Typical car and trailer parking space geometry dimensions

6.3 Rigging, Manoeuvring Area and De-Rigging

To reduce the time that vehicles occupy the manoeuvring area and boat ramp a designated rigging area (refer Figure 18) should be provided along the accessway approaching the manoeuvring area. The rigging area should comprise a 3.5 metre wide and 20 metre long parking bay with tapered entry and exit points that allow traffic to pass alongside it. One bay per boat ramp lane may be considered.

A clear manoeuvring area should be provided behind the crest of the boat ramp to allow for turning and reversing of vehicles. The manoeuvring area should:

- be as wide as the boat ramp;
- be orientated to permit straight line reversing to the boat ramp launching position;
- provide a land approach 20 metres long[15];
- be free of obstructions (e.g. overhead lines, lane dividing barriers, kerbs etc.); and,
- have a longitudinal grade of 1% to 5% towards the boat ramp and 0% to 2% crossfall (0% crossfall is preferred).

To reduce congestion a de-rigging and tie-down area should be provided along the exit accessway from the manoeuvring area (refer Figure 19). The number of bays and size of this area should be similar to the rigging area. Boat washdown facilities and garbage bins should ideally be provided to service each bay of the de-rigging area. Due to potential noise issues, washdown areas should be positioned away from residential dwellings where possible. Time restrictions on the use of washdown facilities should be considered if the boat ramp is located in a residential setting.

Figure 18: Rigging area provided along left hand side of ramp approach accessway

[15] Consistent with design guidance provided in AS 3962-2001.

Figure 19: Boat washdown bay alongside ramp exit accessway

6.4 Accessways

Entrance driveways into boat ramp facilities from public roads should be positioned to minimise adverse effects on existing traffic flows from entry/exit of vehicles. The width of entrance driveways should be in accordance with AS 2890.1.

As a minimum, accessways provided within the boat ramp facility should:

- be 5 metres wide for one-way access along entry and exit accessways to the boat ramp or parking areas;
- be 8 metres wide to provide one-way access between opposing angled (45 or 60 degree) car and trailer parking spaces;
- be 9 to 10 metres wide to provide one-way access between opposing 90 degree car and trailer spaces;
- accommodate car and trailer turning paths in accordance with the template provided as Figure 7.1 within AS 3962-2001;
- include ground markings (e.g. arrows) to direct traffic into different areas of the facility and to indicate the direction of traffic flow;
- provide sufficient length for boat/trailer queuing along the approach accessway from the entrance to the rigging and manoeuvring areas; and,
- be clear of overhead lines at the rigging and manoeuvring areas.

6.5 Surface Treatments and Water Management

The sealing of surfaces within a boat ramp facility should be minimised to improve visual amenity and reduce the generation and management of runoff. In addition to the provision of grassed areas for trailer parking, consideration should be given to the sealing of the number of car and trailer and car only spaces required for average weekend use and the allocation of grassed or gravel mulched areas as overflow for peak usage periods. At low use facilities, sealing may not be necessary and the delineation of parking spaces and other areas can be achieved with landscaping features (e.g. timber fencing, logs, plantings etc.) and appropriate signage. The use of permeable paving systems could also be considered to improve the durability of unsealed areas.

If the manoeuvring area is not sealed, the concrete surface of the ramp should be extended to form a flat area beyond the ramp crest (refer Figure 20). This would reduce the occurrence of rutting at the transition between the ramp and unsealed areas caused by vehicles spinning their wheels as they transit over the vertical curve at the ramp crest.

Figure 20: Extension of concrete surface beyond ramp crest

Sealed surfaces should be graded to direct sheet flow into adjacent grassed or landscaped areas. Preference should be given to the use of dish drains and swales to collect and distribute stormwater runoff to vegetated areas rather than concentration of runoff in kerb and gutter systems with piped drainage. Where kerbs are installed it is recommended that rollover kerbs are used.

The collection of concentrated water runoff in areas utilised for washdown of boats or release of bilge water (i.e. manoeuvring areas and de-rigging bays) is likely to require the

use of kerb/gutter/pit systems. This may include the installation of a grated drainage trench along the crest of the boat ramp to capture runoff from the manoeuvring area.

Proprietary devices may also be required to improve the quality of captured water prior to discharge as it is likely to contain a combination of pollutants including oil and grease, hydrocarbons, heavy metals, fine particulates and other chemicals. Consultation with the EPA should be undertaken to determine the best practice for the management of drainage from these areas.

Figure 21: Dish drain used at rear of sealed portion of car and trailer space

The incorporation of Water Sensitive Urban Design (WSUD) within a boat ramp facility layout should also be considered to collect, attenuate, convey and treat stormwater runoff before discharge to receiving waterways. WSUD elements may include buffer strips, vegetated swales (refer Figure 22), permeable paving and bioretention systems and should be designed to prevent damage from vehicles (e.g. logs acting as wheelstops at the rear of car and trailer parking areas to protect vegetated swales). These elements are most effective when surface grades are limited to 1% to 4%. Useful guidance on the design and maintenance of WSUD elements has been published by the NSW Corporation, Landcom.

The feasibility of the above measures would be subject to the site topography and local Council requirements for stormwater management.

Figure 22: Vegetated swale in between car and trailer spaces

6.6 Typical Layout and Dimensions

A typical layout for a regional boat ramp facility is provided on Drawing BRFG-001 in Appendix A. Layouts for accessways, manoeuvring and parking areas should consider the following:

- provide one-way access throughout the facility with a preference for clockwise circulation;
- ideally have a single entry and exit point into the facility from public roads;
- have separate designated parking areas for car and trailer spaces and car only spaces, with car and trailer and disabled access spaces being located closest to the boat ramp and amenities (refer Figure 23);
- incorporate a hard surface path from disabled access car spaces to the boat ramp and amenities;
- have single entry and exit accessways to the boat ramp manoeuvring area;
- include accessways and signage to facilitate splitting of car park traffic from boat ramp traffic;
- incorporate landscaped areas to soften the visual impact of the facility without blocking any lighting or compromising the lines of sight required within parking and manoeuvring areas; and,
- include signage and line markings in accordance with AS 1742, AS 1743, AS 1744 and AS 2890.6 (including RMS Australian Standard Supplements).

Figure 23: Disabled access car space and shared area in close proximity to amenities block

7 PONTOONS, JETTIES AND HOLDING BEACHES

7.1 General

Jetties or pontoons should be considered at major urban and regional boat ramps. Jetties or pontoons may also be used at smaller rural and local ramps. They improve the safety and efficiency of launching and retrieval of boats. At smaller ramps in rivers, holding of vessels may be simply achieved with a pile installed on the downstream side of the ramp.

Holding beaches are desirable, particularly where beaches occur naturally and the maintenance commitment to clean and replenish sand is low. Equitable access to jetties, pontoons and holding beaches to all users should be provided where reasonable and cost-effective.

7.2 Pontoons, Jetties and Gangways

7.2.1 General

Jetty or pontoon facilities at boat ramps are desirable so that launched boats may move away from the ramp as quickly as possible and similarly to facilitate access to vehicles for quick boat retrieval. They are also used for holding, loading and boarding, and may facilitate the erection of masts and rigging of trailer sailers. Provision of life saving equipment (e.g. life saving rings) should be considered where appropriate with adequate measures to prevent or minimise theft and vandalism.

7.2.2 Pontoons

Pontoons are generally favoured by users for their easy access to and from boats and are preferred over jetties where possible. The popularity of the traditional rectangular pontoon and gangway (refer Figure 24) is today shared with linear on-ramp pontoons. Pontoons may not be required where sandy holding beaches are located adjacent to the boat ramp.

Figure 24: Gangway leading to rectangular pontoon

A single rectangular pontoon with mooring on both sides can service two ramp lanes. Typical single pontoons range from approximately 15 square metres in surface area for a small pontoon at a local rural boat ramp, to more than 50 square metres for a large pontoon at a major urban site.

Pontoons should be designed to float level with decks 350 mm to 450 mm above the water (i.e. freeboard). Where pontoons are accessed by non-powered craft and/or PWCs, consideration should be given to providing a lower freeboard for sections of the pontoon or vertical fendering to accommodate the low height of these craft.

An on-ramp pontoon (refer Figure 25) is preferably located along the vehicle driver-side of the boat ramp except in rivers where it should be placed on the upstream side. It is desirable that the pontoon is at least 1.5 metres wide and provides a Usable Berth Length at the Design Low Water Level that is at least 1.5 times the length of the Design Vessel (refer Figure 26) for a small facility. Larger boat ramp facilities require longer (at least 3 times the length of the design vessel) or multiple on-ramp pontoons.

Figure 25: On-ramp pontoon

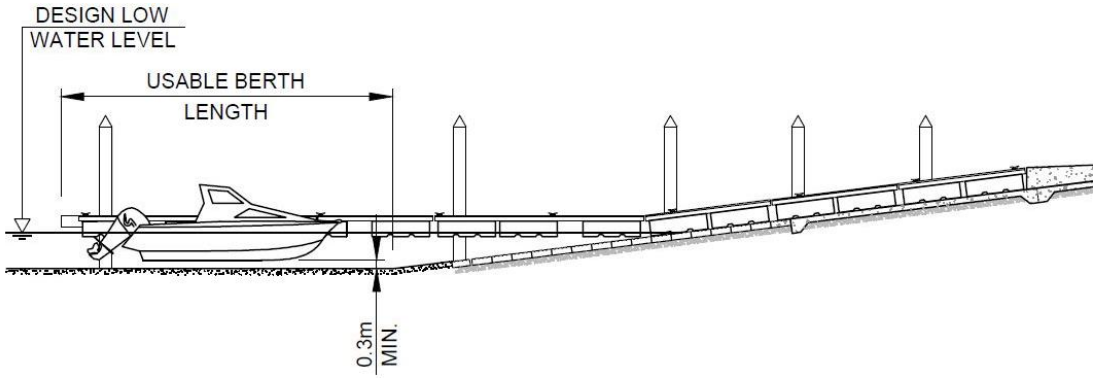


Figure 26: On-ramp pontoon profile showing Usable Berth Length at Design Low Water

Common construction materials for pontoons at boat ramps include high density polyethylene (HDPE) and concrete. Steel is also used, but is relatively expensive and less common. Slatted timber decks are occasionally incorporated for aesthetic reasons. A composite pontoon may comprise a HDPE shell and concrete deck. The draft of a pontoon controls wave transmission, and pontoon depth (draft plus freeboard) in relation to pontoon width dictates stability against rolling. While HDPE pontoons are UV tolerant and durable, these lightweight structures may not control wave transmission should this be required, or develop acceptable stability against rolling. Concrete on-ramp pontoons are generally more stable and provide superior wave attenuation, although can be susceptible to cracking due to slamming on the boat ramp from wave action.

Pontoons should have 50 mm reserve buoyancy when designed for any one of the following live loads, whichever produces the most adverse effect:[16]

- A uniformly distributed load of 3 kPa over all or part the deck, excluding the area under gangways.
- A concentrated load of 4.5 kN.
- The live load imposed by the gangways.

Fenders, cleats (preferably in-built) and rubbing strips should be provided on pontoons. Fenders should be long and wide enough to protect both the vessel and pontoon from damage, and prevent vessels from getting caught underneath the fender. Bolted fixings are preferred where possible.

It is desirable for pontoons to be accessible to all boat users and for travel paths along pontoons to be sufficiently wide for use by persons in wheelchairs or those using other mobility aids. These pontoons should be purpose-built, heavy and wide pontoons to provide the stability[17] required for safe all-ability use under environmental loadings. On-ramp pontoons are generally not suitable for all-ability access due to their slender shape and gradient limitations imposed by the boat ramp surface. Surface materials should be slip-resistant and firm under all weather conditions. Avoid excessive texture for slip resistance which may create rolling friction that interferes with wheelchair mobility, and consider edge protection to manage falling off the travel path if required.

Davits can be used on purpose-built pontoons to achieve all-ability access (refer Figure 27). Davit design should be undertaken in consultation with the relevant organisations (i.e. Sailability). It is recommended that user groups are responsible for assembling and dismantling the davit crane when required. Installing a permanent fixture may result in misuse and vandalism.

[16] Consistent with design guidance provided in AS 3962-2001.
[17] Seakeeping criteria in the literature can be used to define the maximum pontoon accelerations for comfort and safety of different user groups.

Figure 27: Example of a davit used to achieve all-ability access from a pontoon

7.2.3 Jetties

Jetties are usually more resilient structures than pontoons. Jetties are unlikely to be feasible in waterbodies where the water level fluctuates with large tidal ranges, season or regular sluice/gate control.

Jetties should:

- be at least 1.5 metres wide, clear between kerbs and handrails. At major urban and regional ramps, a minimum clear width of 1.8 metres is preferred;
- have a deck level that is as low as practicable and no higher than the boat ramp Crest Level (refer Section 5.1.5);
- provide a Usable Berth Length that is at least 1.5 times the length of the Design Vessel at the Design Low Water Level;
- incorporate meshed decks where possible to reduce shading of sensitive aquatic habitat (e.g. seagrass);
- incorporate stepped landings extending below the jetty deck level if operational water levels fluctuate more than 300 mm; and,
- be designed for a minimum uniformly distributed live load of 5.0 kPa or minimum concentrated live load of 4.5 kN, whichever produces the more adverse effect.

Stepped landings (refer Figure 28) should:

- be wide enough to allow safe loading and boarding of boats;
- include steps with a nosing line maximum grade of 30 degrees to the horizontal, and a minimum stair tread width of 450 mm;
- incorporate meshed surfaces (refer Figure 28) where possible to reduce shading of sensitive aquatic habitat (e.g. seagrass);
- have slip resistant surfaces provided on all landings which may be submerged during water level fluctuations; and,
- have the lowest landing accessible at the Design Low Water Level. A level of 0.6 metres above the Design Low Water Level is recommended for the lowest landing in sheltered areas.

Figure 28: Example of stepped tidal landings at the end of a jetty

Cleats, vertical rubbing or fender strips should be provided with jetties. Bolted fixings are preferred where possible.

It is desirable for jetties to be accessible to all boat users. It is desirable for travel paths along jetties to be sufficiently wide for use by persons in wheelchairs or using other mobility aids. Cross-slopes should be minimised while allowing for drainage if required. Surface materials should be slip-resistant and firm under all weather conditions. Avoid excessive texture for slip resistance which may create rolling friction that interferes with wheelchair mobility, and consider edge protection to manage falling off the travel path if required.

As discussed above for pontoons (refer Section 7.2.2), davits can also be used on jetties to achieve all-ability access.

Safety provisions for jetties should include the following:

- where direct access to the water or vessels is not required and where a person falling from the jetty is likely to fall more than 1.5 metres to strike a hard surface or the seabed, a guardrail in accordance with AS 1657 should be provided; and,
- where persons who fall from a jetty would not be able to easily regain the shore, safety ladders should be provided. These should be of durable construction and extend from deck level to below the Design Low Water Level in accordance with

AS 1657 and AS 4997. Safety ladders should be located at maximum 60 metre intervals.[18]

7.2.4 Gangways

Gangways to pontoons are commonly of aluminium construction to minimise weight (refer Figure 24 and Figure 29). It is desirable that gangways are accessible to all boat users. The gangway should have a minimum access path width of 1.2 metres. The gangway gradient, dependent on the pontoon float level affected by tide or flooding, should be 1V:14H or flatter for at least 80% of the time to provide unassisted access.

For assisted access, a gangway gradient of 1V:8H is generally acceptable and may be suitable at small local facilities with consent from the local disability access committee. Relevant committees should be consulted to understand the predicted usage and desired maximum gradient and other specific requirements prior to design.

Gangways should be designed for either of the following live loads, whichever produces the most adverse effect:[19]

- A uniformly distributed load over the clear width and length, of 3 kPa, and a load on the handrail on one side, in accordance with AS 1170.1.
- A concentrated load of 4.5 kN.

The gangway access path should comply with other requirements of a ramp with meaning under AS 1428.1, with particular regard to non-slip surfacing and hand and kerb rails. Meshed surfacing should be incorporated where possible to reduce shading of sensitive aquatic habitat (e.g. seagrass).

[18] Consistent with design guidance provided in AS 4997-2005.
[19] Consistent with design guidance provided in AS 3962-2001.

Figure 29: Aluminium gangway providing access from the foreshore

7.3 Holding Beaches

Natural beaches are frequently used for vessel holding adjacent to ramps (refer Figure 30). It is less common and potentially problematic to artificially create a beach where there are uncertainties associated with sediment transport and beach maintenance.

The removal of any rock at an existing natural beach, subject to consideration of environmental impacts, can improve conditions for vessel holding and soft launching of smaller vessels such as PWCs, inflatables and non-powered craft.

Figure 30: Example of a natural holding beach being used adjacent to a boat ramp

8 ANCILLARY RAMP AMENITIES

In addition to the construction of the boat ramp and manoeuvring area, accessways, rigging and washdown bays, parking areas and boat holding structures, it is recommended that the following ancillary features are considered to improve the amenity of the facility:

- Signage (refer Figure 31):
    - legally enforceable signage to indicate speed limits, delineation of car and trailer and car only parking spaces and parking requirements or restrictions (e.g. ticketing, time limits, no parking areas);
    - concise signage to direct users though the facility including accessways to the ramp manoeuvring area, rigging and washdown areas, and indicating the direction of traffic flow;
    - targeting boat ramp and waterway etiquette (e.g. use of rigging areas, time limits for occupation of boat holding structures, use of winches for boat retrieval, release of bilge water);
    - boating safety information board;
    - map of the boat ramp facility and local waterway area; and,
    - liaison with the owners/insurers of the facility and RMS to develop an appropriate signage scheme.
- Garbage facilities:
    - located along the exit accessway near washdown bays, at fish cleaning tables and at amenities blocks;
- Lighting:
    - at the ramp to facilitate night and early morning usage;
    - in parking areas;
    - provision of time of day, motion-activated or solar-powered lights to reduce power consumption;
    - use of reflective markers or tape on pylons/bollards to help identify ramp features in low lighting areas; and,
    - provision of solar powered marine beacons to identify the location of ramps and holding structures at night time in isolated areas where it is not feasible to install regular lighting.
- Fish cleaning table:
    - located away from waterway areas;
    - provide disposal chutes or rubbish bins for fish waste in accordance with EPA requirements; and,
    - include a shelter over the table.
- Amenities block:
    - located close to the boat ramp and disabled access parking; and,

- may include toilet and shower facilities.

- Landscaping:
  - to improve the visual amenity of the facility;
  - to provide shade for parking areas;
  - low-lying shrubs are preferable to maintain sight lines and the spread of lighting within the facility; and,
  - to provide infiltration areas for surface runoff.

Figure 31: Example signage used at boat ramp facilities

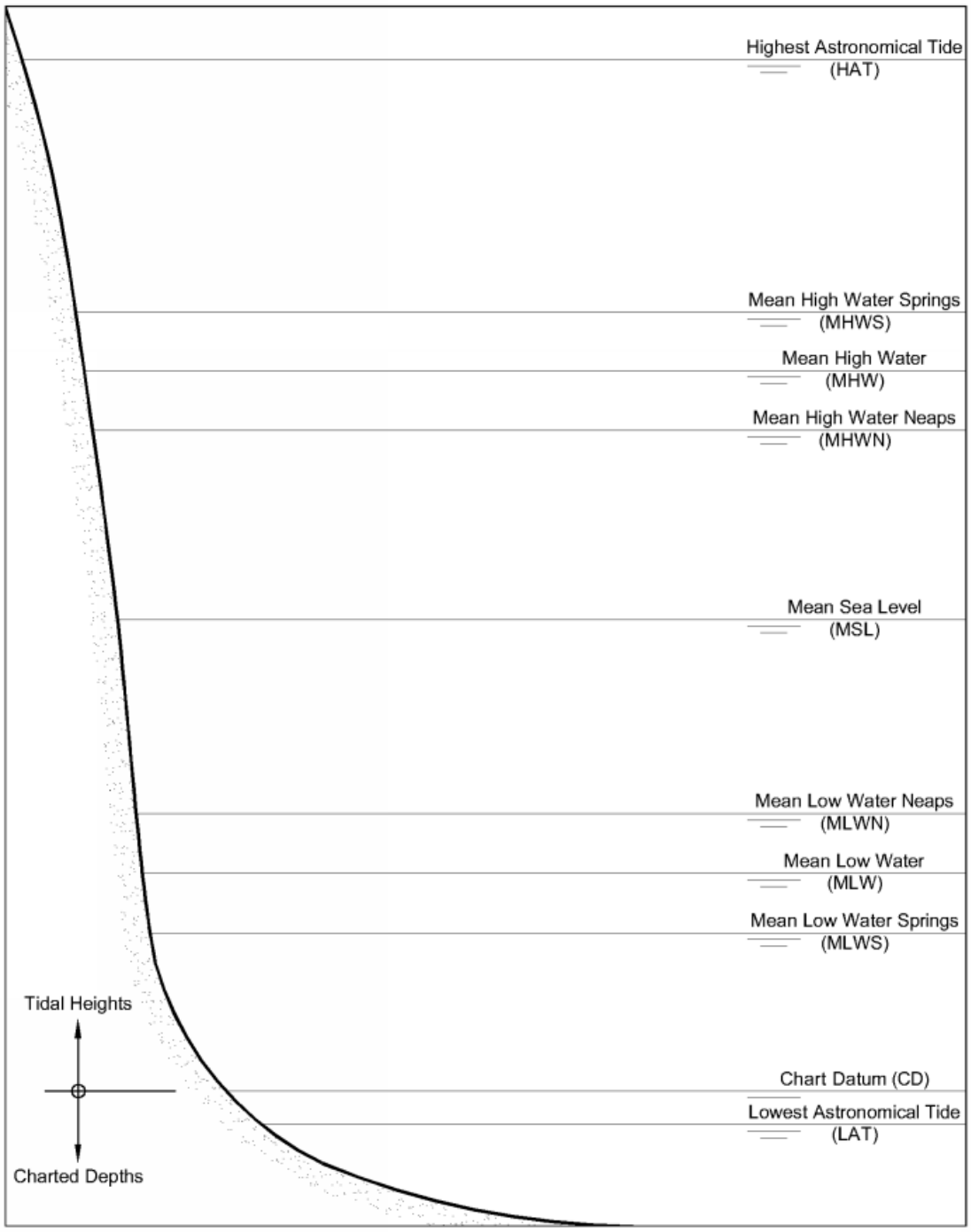
9 GLOSSARY

Accessway	A road that provides the vehicular thoroughfare to a boat ramp or parking area.
Accretion	Build-up or accumulation of sediments.
Cast in situ	The process of placing concrete in formwork and allowing the concrete to harden in an intended position where it remains.
Cleat	A fitting to which ropes are tied.
Crest Level	The elevation of the transition between the boat ramp and manoeuvring area.
Crossfall	Slope of the manoeuvring area or access way perpendicular to the direction of travel. Direction of travel in the manoeuvring area is towards the boat ramp.
Cut-off Wall	A concrete wall built along the sides and/or bottom of a boat ramp to help protect it from being undermined.
Davit	Device with mechanical arms and a winch that is used to lower items into the water.
Dead Load	The weight of the structure.
De-rigging	See Tie Down.
Design Low Water Level	The minimum operable water surface elevation over the intended life of a boat ramp defined to maximise usage of the boat ramp under the range of environmental conditions likely to be encountered at a site. In waterway areas influenced by tides, the Design Low Water Level should be defined by the Lowest Astronomical Tide (LAT) as determined from local tide surveys. In non-tidal areas, the Design Low Water Level should be determined from analysis of water level records to determine the lowest water level that is reasonably likely to be experienced during the proposed period of usage. The influence of artificial structures (e.g. dams) or water abstraction activities within waterways may also need to be accounted for.

Design High Water Level	The maximum operable water surface elevation over the intended life of a boat ramp defined to maximise usage of the boat ramp under the range of environmental conditions likely to be encountered at a site. This is used to set the crest level of a boat ramp so that it is not submerged during elevated water level and wave runup conditions. This water level should be defined in consultation with local authorities and include allowances for astronomical tide, storm surge, wave setup, freshwater flooding, and predicted sea level rise over the design life of the facility that is based on projections that are widely accepted by competent scientific opinion, or as stipulated in local regulations.
Design Vessel	The largest sized vessel that is proposed to use the facility.
Draft	The vertical distance between a boats water line and the lowest part of the boat including hull fittings and motor.
Erosion	Removal or loss of sediments.
Freeboard	The vertical distance between the water surface and the deck of a floating structure including pontoons and vessels.
Gangway	A structure which provides pedestrian access between a walkway or shore and a floating structure or vessel.
Geotextile	A synthetic fabric that is placed under rock fills to prevent underlying material from washing out.
Jetty	A horizontal decked walkway on piered or piled footings providing pedestrian access from the shore to the waterway generally aligned perpendicular to shore.
Live Load	Applied weight that is added to the structure during use.
Longitudinal Grade	Slope of the boat ramp, manoeuvring area or accessway parallel to direction of travel. Direction of travel in the manoeuvring area is towards the boat ramp.
Manoeuvring Area	The area at the top of the ramp that allows the driver of car and trailer combinations to align their combination before reversing down the ramp.

Mean High Water Level	In waterway areas influenced by tides, the Mean High Water Level should be defined by the Mean High Water Springs (MHWS) tide condition. In non-tidal areas, the Mean High Water Level may be determined from analysis of water level records or local knowledge. This water level should include an allowance for predicted sea level rise over the design life of the facility that is based on projections that are widely accepted by competent scientific opinion, or as stipulated in local regulations.
Mean Water Level	The average sea surface elevation over a long period, preferably 18.6 years or more, or the average level which would exist in the absence of tides. In non-tidal areas this average water surface elevation would be determined from analysis of water level records or local knowledge.
Nosing Line	A line drawn along the nosing of steps.
Pontoon	A floating platform used for access to the water or a vessel.
Precast Plank	A concrete reinforced section that is prepared and hardened in a designed shape before placement in a desired position.
Proponent	Entity responsible for commissioning of the design, construction and ongoing maintenance of a boat ramp.
PWC	Personal Water Craft or jetski.
Rigging	The act of preparing a boat for launching, including removal of tie down straps.
Scour	The removal of material from around a structure by the force of moving water.

Tidal Planes Typical tidal planes are shown below.



Note 1: Refer to the latest Australian National Tide Tables produced by the Australian Government – Department of Defence for tidal levels at specific locations and definitions.
Note 2: MSL approximately corresponds to Australian Height Datum (AHD)

Tie Down	The act of readying a boat for transportation on a road.
Toe Depth	Depth of the vertically lowest point of the surface of a boat ramp.
Trailer Sailer	Small yacht or large dinghy style of sailboat that is moved to sailing locations and stored on a road trailer.
Under Keel Clearance	Vertical distance between the lowest part of a vessel hull and the seabed.
Usable Berth Length	The length of the berthing area at jetties and pontoons which provides at least 300mm Under Keel Clearance for the Design Vessel in a complying wave climate of 0.2m (refer Section 4.3) and soft bed conditions. For suitable water depth in non-complying wave climates and hard bed conditions see Clause 3.2 of AS 3962-2001.
Vertical Fender Strip	Fixed structure attached to a jetty to provide protection to vessels.
Washdown	The act of cleaning a boat, motor and/or trailer with freshwater following retrieval at a boat ramp.

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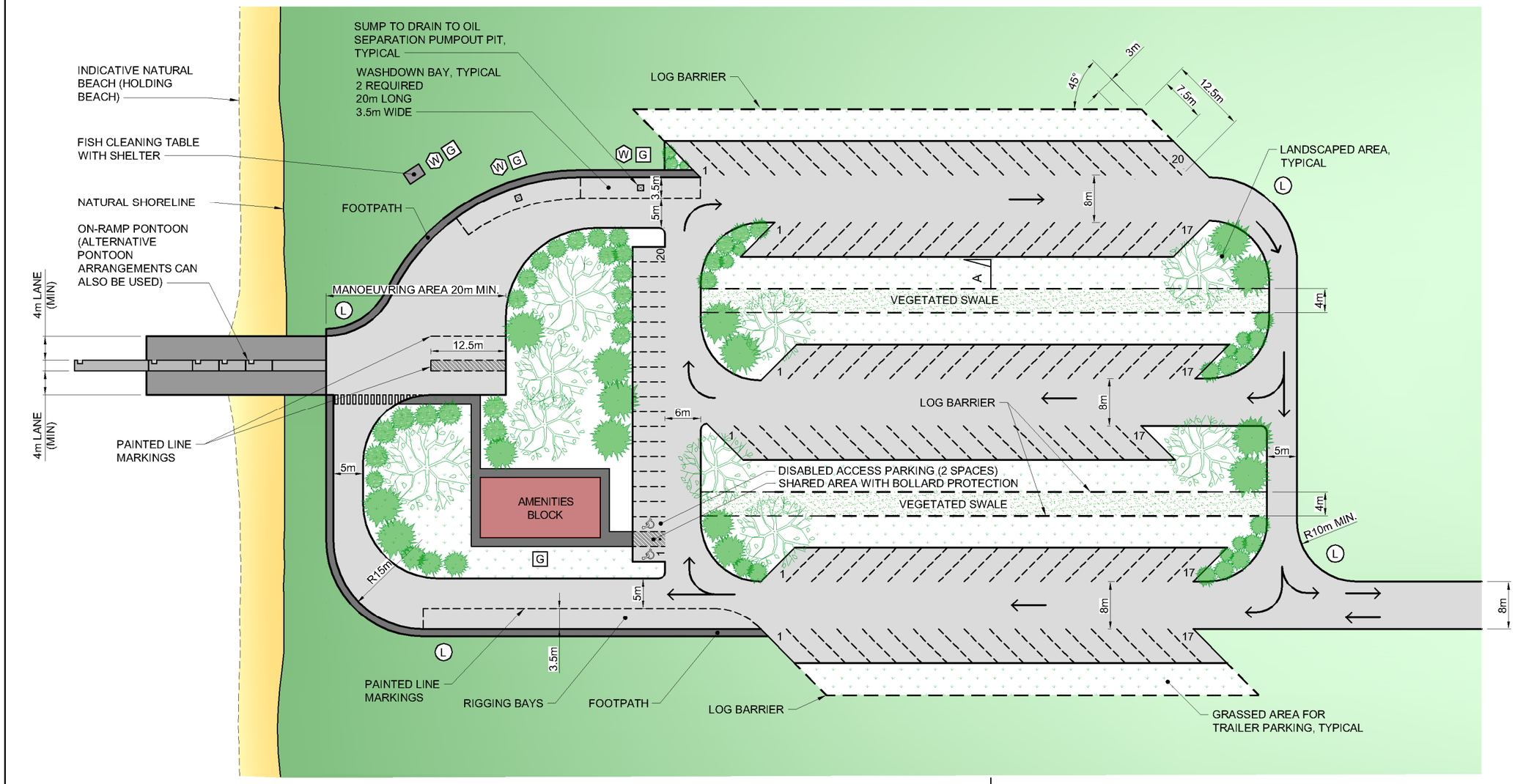
APPENDIX A
Drawings

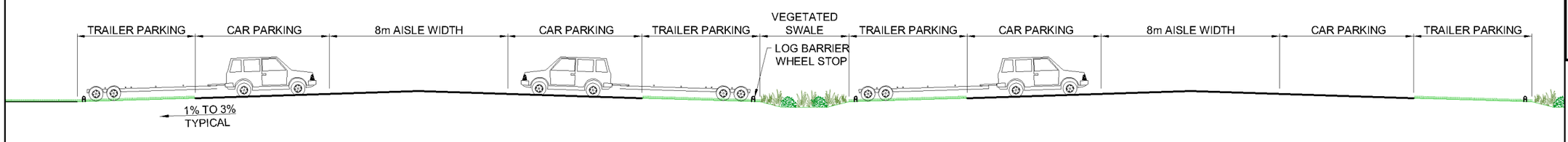
BRFG-001 General Layout for Regional Boat Ramp Facility
BRFG-002 Detail Plan and Typical Sections
BRFG-003 Typical Details

DRAWING No.
BRFG–001

DO NOT SCALE



PLAN
1:750 (A3)



SECTION A - A
THROUGH CAR AND TRAILER PARKING
45 DEGREE REAR TO KERB
1:200 (A3)
(REFER TO PLAN FOR GEOMETRY)

2 0 2 4 6 8 10m
1:200 (A3)

7.5 0 7.5 15 22.5 30 37.5m
1:750 (A3)

LEGEND

- G GARBAGE FACILITIES
- L LIGHTING POLE
- W FRESHWATER SUPPLY

NOTES

1. THIS IS A GENERAL ARRANGEMENT ONLY. ALL LOCATIONS WILL REQUIRE SITE SPECIFIC DESIGN TO ADDRESS LOCAL OPPORTUNITIES AND CONSTRAINTS.
2. LOCATION OF ANCILLARY FACILITIES IS INDICATIVE.

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NSW GOVERNMENT Transport Roads & Maritime Services

PROJECT:
NSW BOAT RAMP FACILITY GUIDELINES

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GENERAL LAYOUT FOR REGIONAL BOAT RAMP FACILITY

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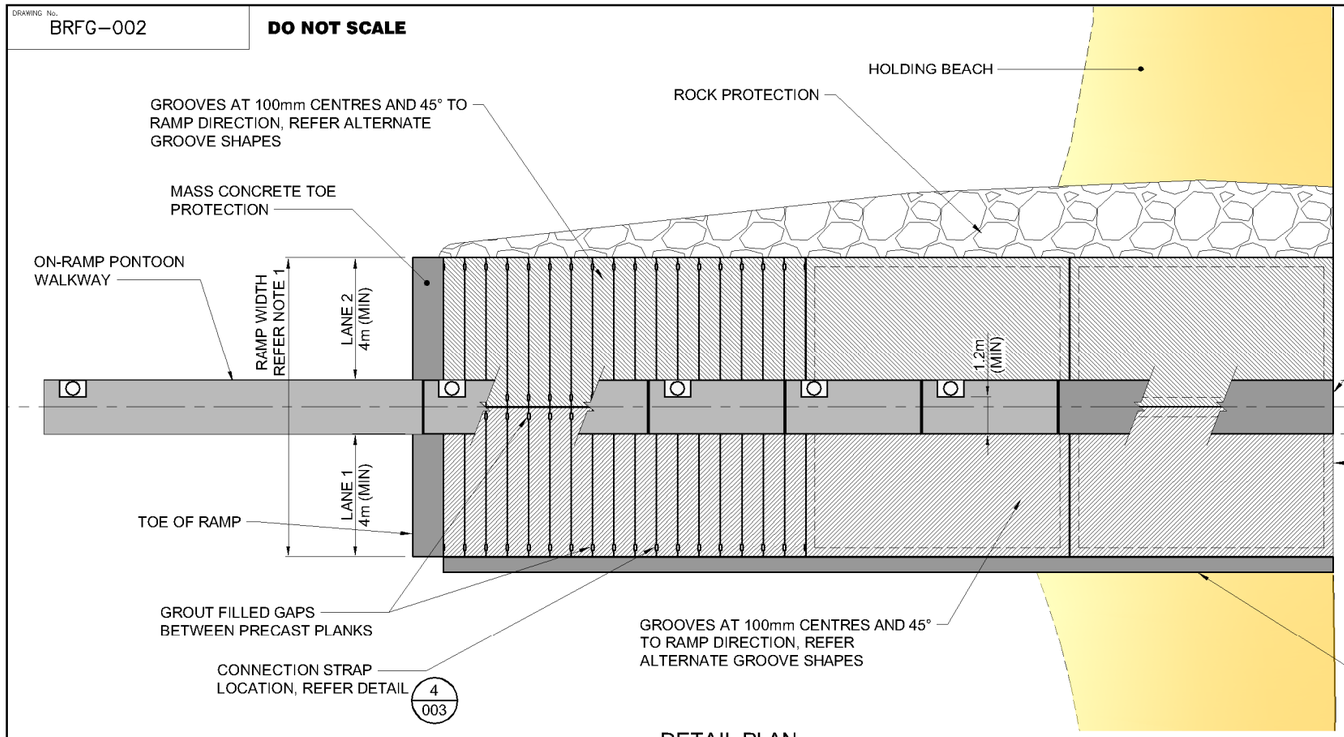

DETAIL PLAN
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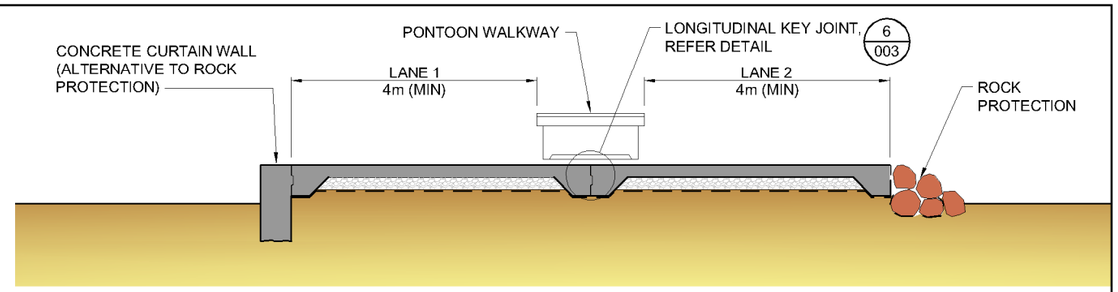
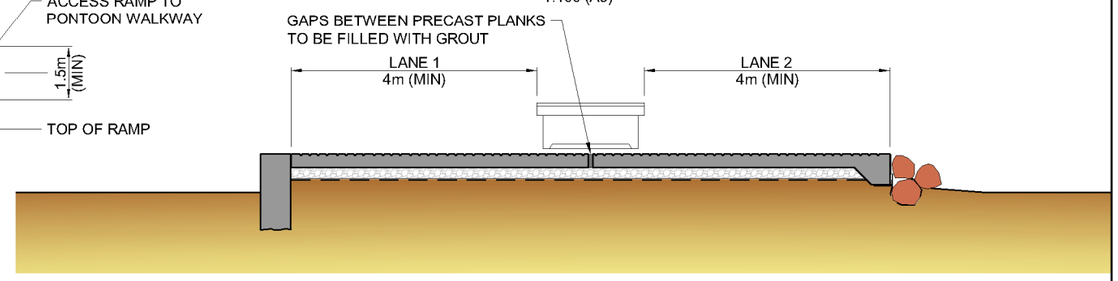


TYPICAL CROSS SECTION - CAST INSITU
1:100 (A3)



TYPICAL CROSS SECTION - PRECAST PLANKS
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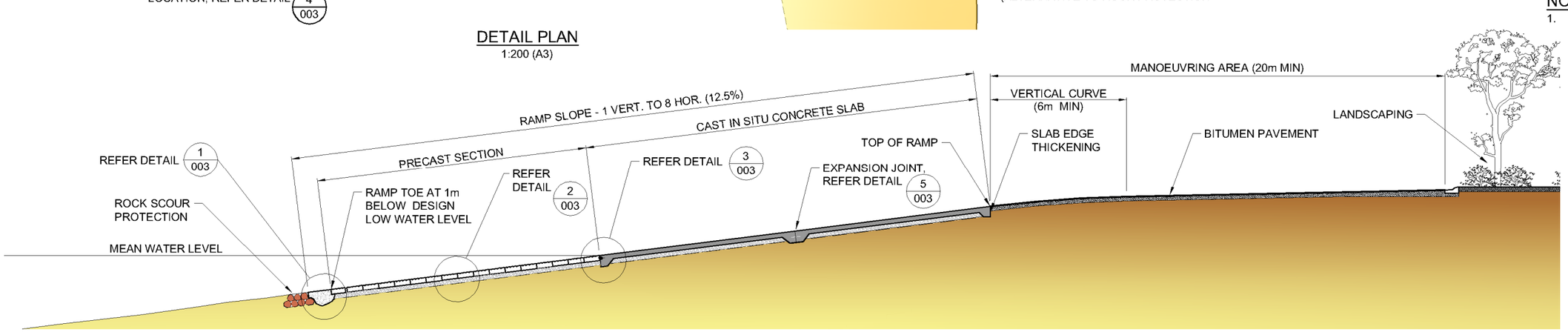

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ON-RAMP PONTOON WALKWAY NOT SHOWN
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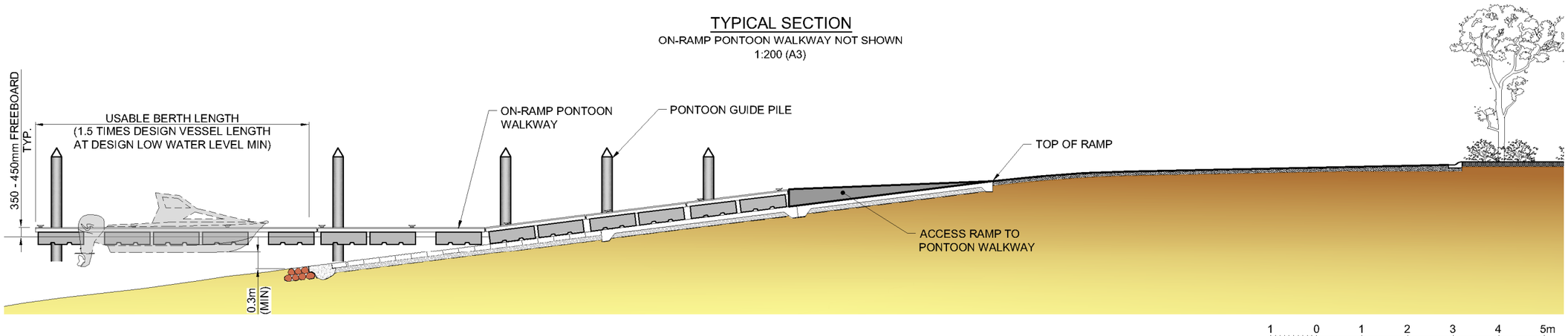

SECTION AT ON-RAMP PONTOON WALKWAY
1:200 (A3)

NOTES

1. LANE WIDTHS:

SINGLE LANE	4.5m
SINGLE LANE WITH KERBS	4.0m
RECOMMENDED FOR MULTIPLE LANES	4.0m

1 0 1 2 3 4 5m
1:100 (A3)

2 0 2 4 6 8 10m
1:200 (A3)

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DETAIL PLAN AND TYPICAL SECTIONS

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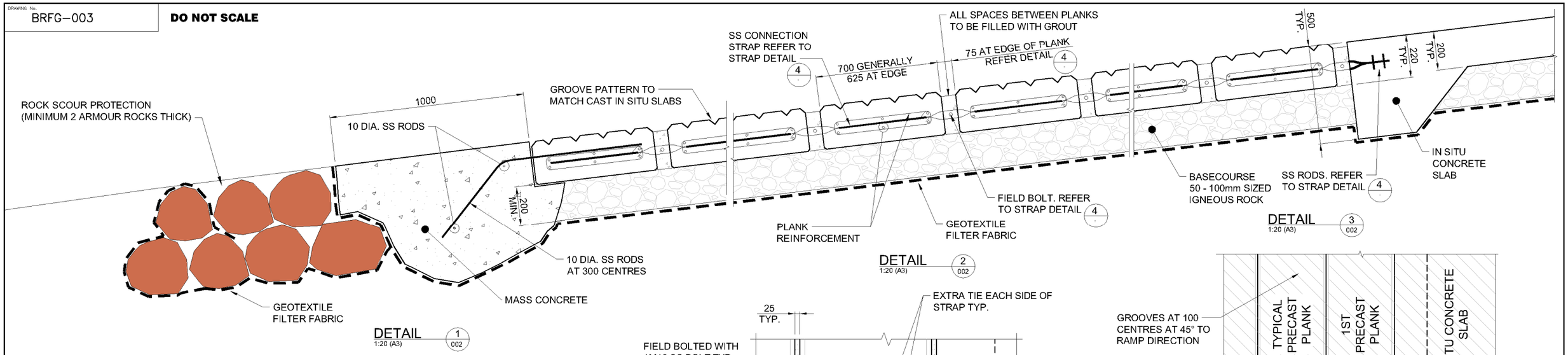

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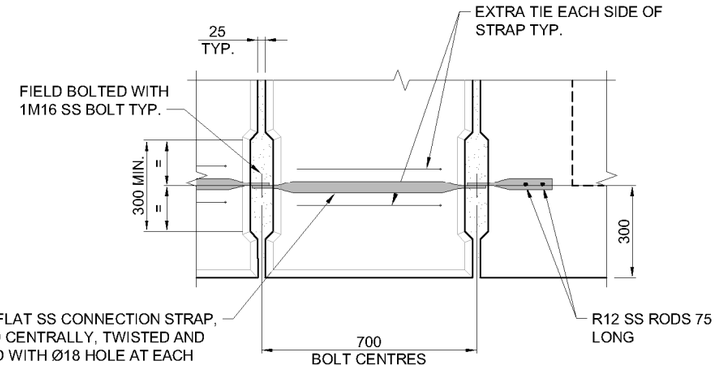
DETAIL 3 (1:20 (A3)) 002



PRECAST PLANK CONNECTION STRAP DETAIL

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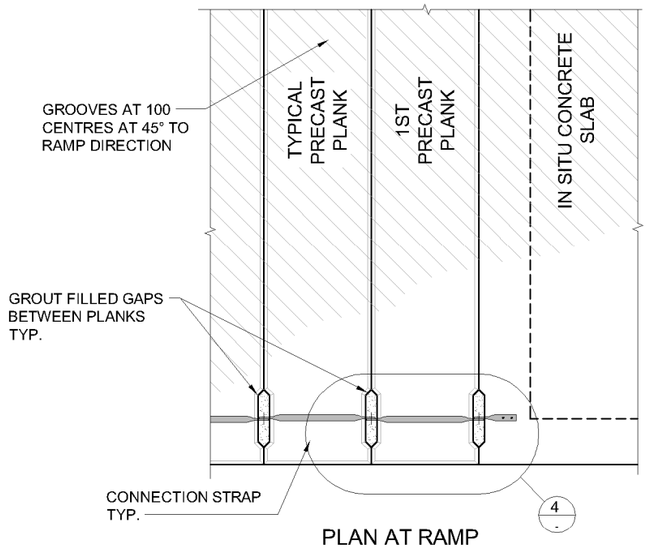
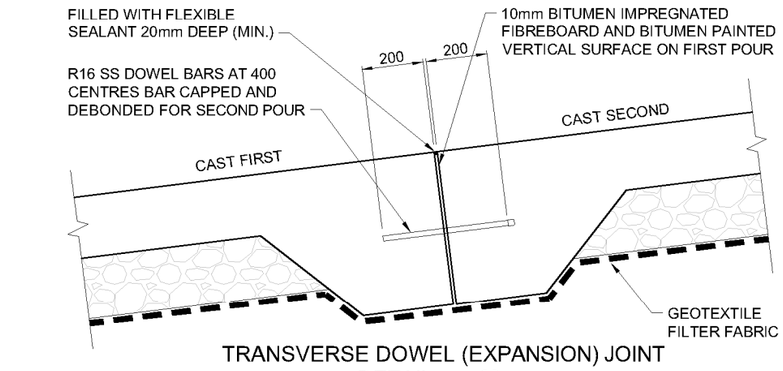
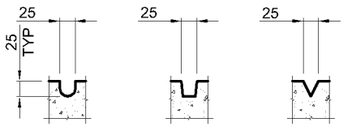


PLAN AT RAMP
IN SITU CONCRETE AND PRECAST
PLANK INTERFACE
1:40 (A3)

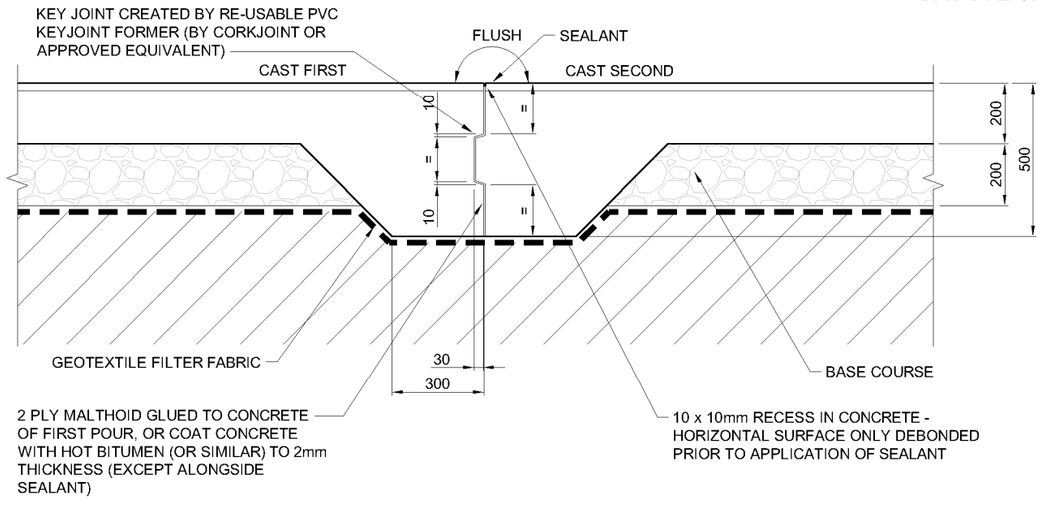


TRANSVERSE DOWEL (EXPANSION) JOINT

DETAIL 5 (1:20 (A3)) 002

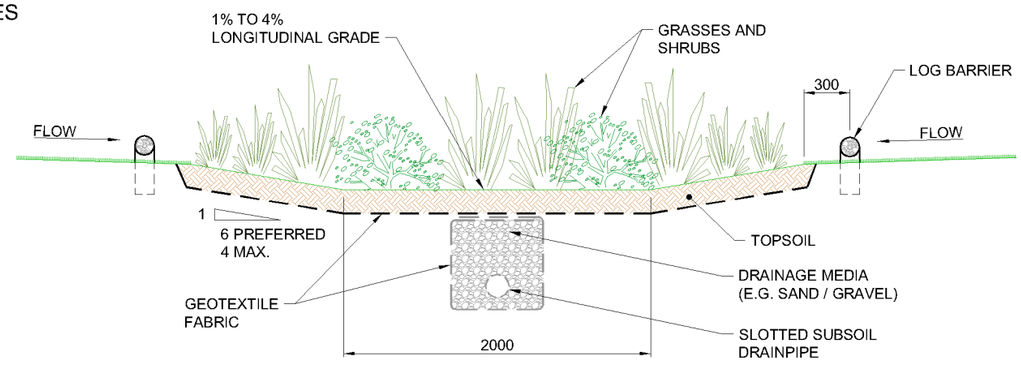


ALTERNATIVE
GROOVE SHAPES



LONGITUDINAL KEY JOINT DETAIL

DETAIL 6 (1:20 (A3)) -



TYPICAL VEGETATED SWALE SECTION

1:40 (A3)

NOTE: SUBSOIL DRAINAGE SHOWN MAY NOT BE REQUIRED FOR FREE DRAINING SOILS

200 0 200 400 600 800 1000mm
1:20 (A3)

400 0 400 800 1200 1600 2000mm
1:40 (A3)

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