

Manual

Design Criteria for Floating Walkways and pontoons

October 2015

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1 Introduction

1.1 *Applicability of these design criteria*

This manual applies to the design of floating structures that are intended to support launching and retrieval of recreational trailer boats. Floating structures that are applicable to these design criteria are:

- modular floating walkways that are to be constructed on boat ramp lanes
- standalone pontoons with gangways (usually constructed adjacent to boat ramps).

These design criteria are not to be used for the design of pontoons used for public transport.

1.2 *Scope of design*

The scope of the design generally extends from the connection with landside facilities (the start of the abutment) to the flotation module(s) and includes:

- piles and pile restraint system
- flotation modules including deck furniture
- abutment, connections with the flotation modules and interaction between the abutment and the floating walkway support lane (for floating walkways only)
- abutment, and fixed and hinged sections of the gangway (for pontoons only).

1.3 *Extent of design*

The following criteria shall be considered:

- durability and maintenance
- dimensional and geometry requirements
- loading and stability
- design for safety (hazards associated with slips, trips and entrapment of body parts, and operational movements of vehicles and vessels on and near the ramp)
- geotechnical conditions and positional requirements of piling
- relation between the floating walkway support lanes and the boat ramp lanes
- geometry requirements of gangways (for pontoons only).

2 Definition of terms

Table 2 – Definition of terms applicable to design of pontoons and floating walkways

Term	Definition
Contractor	The Principal Contractor under the Design and Construct Contract
Designer	The Registered Professional Engineer of Queensland (RPEQ) engineer responsible for the design of the floating walkway.
Floating structure	A generic collective term for floating walkways and pontoons.
Floating walkway	A linear pontoon system constructed from multiple hinged flotation modules and supported on a boat ramp lane at low tides. It is directly connected to a cast insitu concrete abutment and generally does not have a gangway or access span.
Pontoon	A pontoon system that floats at all times, is separated from a boat ramp and needs a hinged gangway for access.
Unobstructed width	The width of the floating walkway deck from the outside of the pile cage to the edge of the trafficable concrete deck surface (but excludes intrusion by bollards/mooring cleats).
Clear gangway width	For pontoon gangways only – the clear width available inside of handrails or the inside of the gangway truss (whichever is lesser).
Design tidal planes	The design water levels. The design tidal planes should be referenced by the nearest primary and secondary place defined in the <i>Queensland Tide Tables</i> Standard Port Tide Times.
HAT	Highest Astronomical Tide
LAT	Lowest Astronomical Tide
MHWS	Mean High Water Springs
MRTS	Main Roads Technical Specification

3 Referenced documents

Table 3 – Referenced documents

Reference	Title
MRTS70	Concrete
MRTS78	Fabrication of Structural Steelwork
SD4000	Precast planks for boat ramps – Types RG4000 and RG3500
SD4020	Boat ramp construction – Precast plank installation and anchor beam types 1 and 2
SD4021	Boat ramp construction – Earthworks and crushed rock core details
SD4022	Boat ramp construction – Fully grouted shoulders and ungrouted shoulders
SD4023	Boat Ramp Construction – Slabs and Joint Details
MRTS300	Boat Ramps
http://msq.qld.gov.au/Tides/Tide-tables.aspx	<i>Queensland Tide Tables</i> Standard Port Tide Times.
http://www.ehp.qld.gov.au/coastal/development/pdf/building-engineering-standards-tidal-works.pdf	Building and engineering standards for tidal works
AS3962:2001	Guidelines for design of marinas
AS/NZS 1170.1:2002	Structural design actions - Permanent, imposed and other actions
AS/NZS 3679.1:2010	Structural steel Part 1: Hot-rolled bars and sections
AS/NZS 2312:2002	Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings
AS1428.1:2009	Design for access and mobility – General requirements for access – New building work
AS 1428.2:1992	Design for access and mobility – Part 2: Enhanced and additional requirements – Building and facilities.

4 Components and design requirements

4.1 General

The facility shall be designed:

- for a life of 25 years
- to be durable and resistant to wear and tear, abuse and vandalism
- using corrosion resistant materials suitable for the marine environment.

4.2 Dimensions

4.2.1 Floating walkways

Floating walkways shall comply with the dimensional requirements shown on the project drawings and Table 4.2.1.

Table 4.2.1 – Dimensional requirements – floating walkways

Criteria	Requirement
Walkway width	2400 to 2500 mm wide measured from outside edge of the flotation modules including integrated aluminium walers but excluding bolted walers and fenders. 1500 mm minimum unobstructed width at the pile locations.
Walkway length	The minimum and maximum lengths are shown on the General Arrangement in the project drawings. The tolerance in length is to accommodate other design criteria and different standard sizes of floating walkway modules.
Freeboard	375 mm (minimum) to 500 mm (maximum).

4.2.2 pontoons

Pontoons shall comply with the dimensional requirements shown on the project drawings and Table 4.2.2.

Table 4.2.2 – Dimensional requirements – pontoons

Criteria	Requirement
Pontoon width, length and shape	Refer to project specific drawings.
Freeboard	375 mm (minimum) to 500 mm (maximum)

4.3 Loading and stability

The floating structure shall comply with the following loading and stability requirements.

Table 4.3 – Loading and stability requirements

Criteria	Requirement
Stability	Stability load: 2.0 kPa (from Table 4.1 AS3962:2001 for unrestricted access). Stability of the floating structure shall comply with Clause 4.12 of AS3962:2001. These loads should be applied over the whole of the deck area and at a location to cause the most adverse reaction (Clause 4.7.3 of AS3962:2001).
Positive flotation	The flotation modules shall have positive flotation as defined in Paragraph 1 of Clause 4.14 of AS3962:2001. Systems without positive flotation shall not be used.
Loadings – general	The floating structures shall be designed for the loads defined in Clause 4.1 of AS3962:2001 and for the load combinations defined in Clause 4.2 of AS3962:2001. Loads shall be for unrestricted access (defined in Clause 4.3.1 of AS3962:2001).
Permanent loads	Refer Clause 4.4 (Dead Loads) of AS3962:2001.
Floating structure live loads	Refer Clause 4.7 of AS3962:2001 (for an unrestricted access facility).
Environmental loads	The design shall consider the worst case scenario combination of the following environmental loads (defined in Clause 4.8 of AS3962:2001): <ul style="list-style-type: none"> • wave • wind • current (including flood, debris mat of thickness two times the draft of the pontoons, and negative lift).
Berthing load	Refer to Clause 2 of the <i>Design Criteria Annexure</i> .
Other loads	Refer to Clause 2 of the <i>Design Criteria Annexure</i> .

4.4 Flotation modules

Flotation modules shall be robust, durable and vandalism resistant. The modules shall meet the design and materials requirements defined in the following table.

Table 4.4 – Flotation modules – materials and design requirements

Component	Requirement
Protection of the flotation module positive flotation core	<p>Allowable materials for the core protection liner (or membrane) include rotomoulded tubs, welded high density polyethylene (HDPE) membranes or composites.</p> <p>The liner/membrane shall include at least one layer on the sides, ends and base of minimum thickness 6 mm to protect the flotation chamber core from debris and sharp objects.</p> <p>Concrete shells used as core liners are permitted, provided concrete cover requirements are met.</p> <p>The base of the flotation modules shall have a minimum 20 mm clearance from the ramp surface to provide protection from wear and debris on the ramp surface. This shall be provided by replaceable feet or a minimum of six HDPE blocks (one at each corner and one in the middle of each side).</p> <p>The point loads imposed on the module shall be considered in the design.</p>
Walkway deck – concrete	<p>The design concrete mix shall be S50/20 for durability classification C defined in MRTS70.</p> <p>All reinforcement to be hot dipped galvanised.</p> <p>The deck shall ideally have 65 mm minimum cover to the exposed surface. Where 65 mm cover cannot be achieved, the deck shall have a minimum 45 mm cover with a post-cast silane coating or concrete admixture to reduce ingress of moisture and chlorides.</p>
Walers	<p>Marine grade aluminium (series 6000) treated with a bitumastic paint on the inside faces in contact with concrete.</p> <p style="text-align: center;">or</p> <p>Structural hardwood waler with outer softwood fender.</p>
Walkway deck/walers interface	<p>The edge of aluminium walers in contact with the concrete deck is to be sealed with silastic to prevent moisture ingress.</p>
Walkway deck surface finish	<p>Broom finished non-slip surface to within 25 mm of the waler system.</p>
Bolted connections (including through bolts, walers, fenders and module fittings)	<p>Grade 316 stainless steel bolted connections that are electrically insulated from contact with dissimilar metals.</p> <p>Composite through bolts will be accepted subject to them providing similar capacity to stainless steel.</p>

4.5 Deck furniture

Deck furniture shall meet the design and materials requirements defined in the following table.

Table 4.5 – Deck furniture – materials and design requirements

Component	Requirement
Pile restraint system – general design requirements	Can be either a roller or block system and shall be designed to: <ul style="list-style-type: none"> • minimise maintenance • minimise wear on the pile sleeve • prevent lockup between the restraint guide and the pile sleeve if the deck surface twists relative to the pile (in situations subject to flood currents).
Pile restraint brackets – materials	Marine grade aluminium (series 6000) or 316 stainless steel.
Pile rubbing blocks – materials	HDPE with a minimum 50 mm rubbing surface against the pile sleeve. The pile block shall be independent of a pile cutout blanking plate (if installed).
Pile cages – materials	Marine grade aluminium (series 6000) expanded aluminium mesh securely connected to the floating walkway deck to be vandal and theft resistant.
Pile cages – dimensions	Minimum 1000 mm high and shall restrict entry to the pile restraint system from walkway surface. Shall comply with Clause 3.6 and Table 3.3 of AS/NZS 1170.1:2002 for building structure type C3.
Fendering – design requirements	Fendering shall be: <ul style="list-style-type: none"> • moulded HDPE or a system using treated softwood with a moulded HDPE fender • able to accommodate the design berthing load in longitudinal and transverse directions • securely bolted to the walers. The bolting system shall have the capacity to absorb energy by sliding in the tracks or having a sacrificial outer fender. The berthing edges shall be essentially straight and flat without protrusions and the corners shall have a 20 x 20 mm chamfer.
Mooring cleats	200 mm double horn type cleat with a maximum spacing of 3 m fixed to the deck or walers with two bolts transferring the mooring load to the deck reinforcement.
Bolted connections (including through bolts, walers, fenders and module fittings)	Grade 316 stainless steel bolted connections that are electrically insulated from contact with dissimilar metals.
Lighting	Refer to Clause 3 of the <i>Design Criteria Annexure</i> .

4.6 Abutment

4.6.1 General requirements

Abutments shall:

- comply with the requirements of MRTS70 *Concrete*
- not be steeper than one on eight
- have a minimum thickness of 200 mm at the upper (thinner) end
- have sufficient mass to restrain the floating structure if it becomes separated from the restraint piles in situations subject to flood currents or wave action
- neatly join slabs at ground level and be free of trip hazards
- have chamfered or radius trowelled edges free of fins, projections and sharp edges
- have non-slip medium broom finish.

Project specific abutment requirements are defined in Clause 4 of the *Design Criteria Annexure*.

4.6.2 Abutment for floating walkways

Abutments for floating walkways shall:

- neatly join the deck height when in the LAT and HAT positions
- be visible from the ramp approach (subject to site specific requirements) from the driver's position in a reversing vehicle
- have a minimum thickness of 400 mm at the re-entrant corner if it is keyed to an existing ramp slab or precast plank.

Abutment Connection Type 1 (unhinged abutment connection)

This abutment type shall be used where:

- the upper abutment level is lower than HAT + 0.3 m + freeboard, or
- the site is subject to flood conditions or wave conditions.

An aluminium transition plate shall be installed between the abutment and the first floating walkway module. The plate shall be securely attached to the first walkway module with a heavy duty aluminium piano hinge and be designed to remain in the horizontal position if the module rises above the abutment in an extreme event.

The plate shall have a non-slip surface and shall not be a trip or safety hazard. The underside of the plate shall have HDPE rubbing strips to minimise abrasion to the plate and the concrete surface.

Abutment Connection Type 2 (hinged abutment connection)

This abutment type can only be used where:

- the upper abutment level is higher than HAT + 0.3 m + freeboard
- the site is not subject to flood conditions
- the project specific design criteria allow this abutment connection type.

4.6.3 Abutment for pontoons

The abutment shall:

- neatly join the gangway with a piano hinge.

4.7 Situations subject to wave action or flood currents

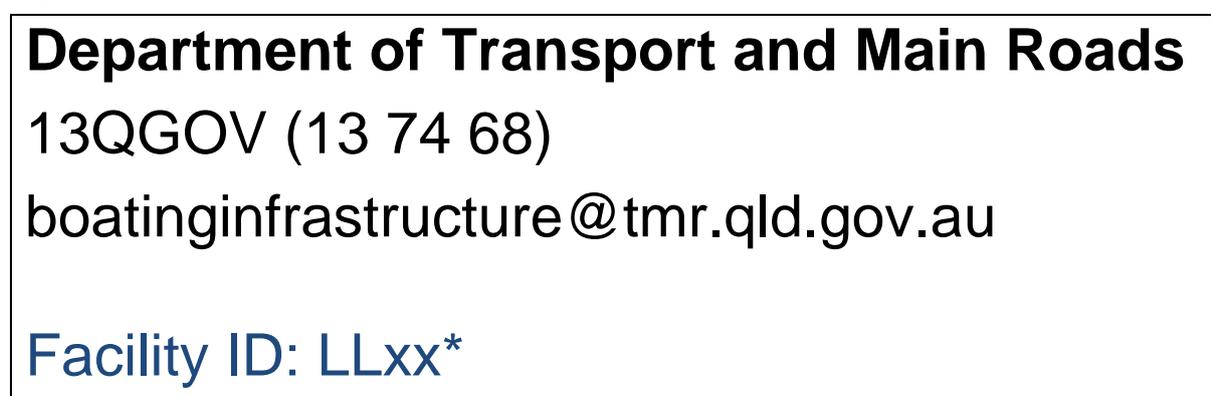
This clause only applies to situations subject to wave action or flood currents when defined in Clause 5 of the *Design Criteria Annexure*.

4.7.1 Identification plate

An owner identification plate made from an engraved 3 mm aluminium plate, dimensions 70 x 100 mm with 5 mm radius corners, adhered (2 part epoxy) to the concrete deck of each module in a location where it is readily visible but will not be a trip or slip hazard.

The information required on the Identification plate is shown in Figure 4.7.1.

Figure 4.7.1 – Identification plate details



*Facility ID: LLxx to be supplied by the Principal.

4.7.2 Storm surge/Flood anchors

This clause applies only to situations subject to wave action or flood currents defined in Clause 5 of the *Design Criteria Annexure*.

Floating walkway

The flotation modules shall be securely connected to each other and to the abutment with a grade 316 stainless steel wire rope and shackle anchor system with sufficient retention strength if the walkway separates from the restraint piles.

The anchor rope shall be coiled with cable ties within a recess in the abutment face towards the modules so that it is concealed from view.

Pontoon

The flotation module(s) shall be securely connected to with a grade 316 stainless steel wire rope and shackle anchor system with sufficient retention strength to the restraint piles.

The anchor rope shall be coiled with cable ties so that it is concealed from view.

5 Piling – design requirements

5.1 Geotechnical conditions

Irrespective of whether a geotechnical investigation has been undertaken and provided, the actual geotechnical conditions are at the Designer's and Contractor's risk. This risk includes natural and artificial causes of hard or soft material. The designer shall make an assessment of the site's soil conditions to ensure that the pile design can resist the induced moments and forces.

Refer to Clause 6.1 of the *Design Criteria Annexure*.

5.2 Piles – materials and requirements.

The piles, sleeves and paint system shall comply with the requirements of the following table.

Table 5.2 – Piles, sleeves and paint protection system

Component	Requirement
Piles: materials, size and quantity	<p>Steel used in piles shall:</p> <ul style="list-style-type: none"> comply with the requirements of AS/NZS 3679.1:2010 have a suitable grade, wall thickness and diameter for the number of piles used to resist the maximum design loads combination. <p>Fabrication of piles shall comply with MRTS78.</p> <p>Piles shall have a welded, sealed endcap fitted after driving.</p> <p>Refer to Clause 6.2 of the <i>Design Criteria Annexure</i> for project specific spacing or quantity requirements.</p>
Pile cutoff height	<p>Tidal waters HAT height level plus 2.5 m</p> <p>Non-tidal waters Normal average wet season high water (not including flood events) level plus 2.5 m</p>
Sleeves	<p>Minimum 12 mm HDPE sleeve driven at least 1 m into the natural substrate. The sleeve shall have a 12 mm HDPE endplate bonded to the top of the sleeve so that the internal void is airtight (this is independent of the pilecap).</p>
Paint protection system	<p>Two component high solids epoxy coating system complying with AS/NZS 2312:2002.</p> <p>The paint system shall be a single manufacturer's product.</p> <p>Colour: black.</p> <p>Application: Two coats to achieve a minimum dry film thickness of 500 microns.</p>
Retroreflective band	<p>All piles shall have a 300 mm wide retroreflective band (3M Scotchlite Diamond Grade Yellow or equivalent) 300 mm below the pilecap.</p>

5.3 Pile locations and configurations

5.3.1 Floating walkways

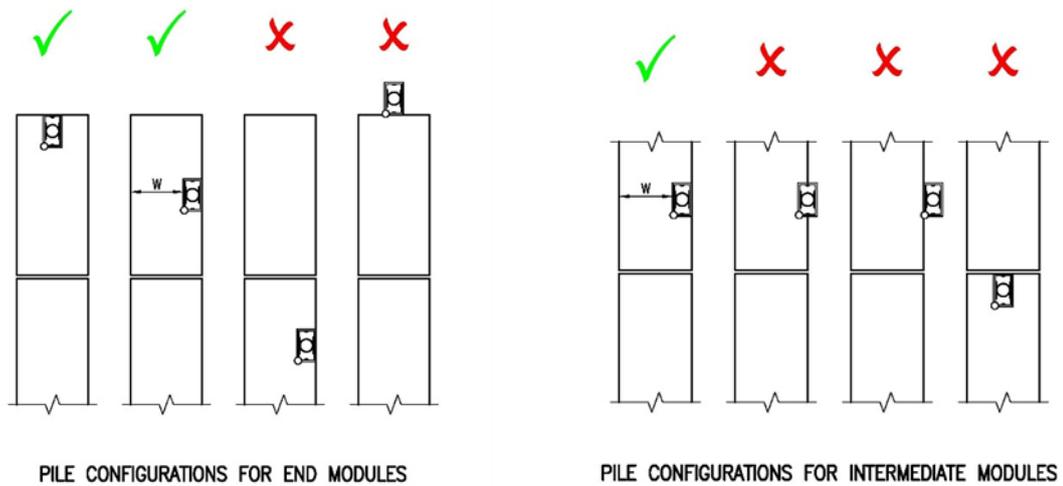
Piles shall be located so that:

- side and end berthing faces are not restricted
- clear walkway width is greater than 1500 mm

- potential for body parts entrapment is minimised
- the last (end) module is positively restrained and is not dependent on the module connection for structural rigidity
- their positions within the support lane considers the set out of existing or proposed precast planks so that only a single plank is affected at each pile.

The diagrammatic representation of the pile location requirements are shown in Figure 5.3.1.

Figure 5.3.1 – Acceptable pile locations within flotation modules



Notes.

1. W is 1500 mm minimum unobstructed width at the pile locations.
2. Piles indicatively shown on the right side. Refer to the project drawings for the pile locations.

5.3.2 Pontoons

Refer to the project specific requirements or drawings for pile location requirements.

6 Floating walkway support lane (for floating walkways only)

6.1 Design of a new floating walkway support lane

This clause applies when the design includes the vertical alignment of a new 4000 mm wide support lane.

The design of the abutment shall be integrated with the floating walkway support lane and shall comply with these requirements:

- The trafficable surface below Mean High Water Springs (MHWS) shall use RG4000 planks (refer SD4000) and connection details using anchor beam Type 1 or Type 2 (refer SD4020).
- The trafficable surface above MHWS can be RG4000 planks or broom finished cast insitu concrete slab.
- The piles shall be spaced so that only one plank is affected at each pile location.
- Cross sections and details of the support lane shall comply with SD4020, SD4021, SD4022, SD4023 and MRTS300.
- Concrete, reinforcement and stainless steel link bars shall comply with SD4020.

6.2 Modification of an existing ramp lane

The design of the lane shall be in accordance with Clause 10.2 of MRTS300.

7 Gangways (for pontoons only)

The gangway includes the hinged section and a fixed (unhinged) section (if required). The design of the gangway shall comply with the requirements of the following table.

Table 7 – Gangway – materials and design requirements

Component	Requirement
General	The gangway shall be laterally restrained to prevent deflection and sideways movement under the vertical service loadings.
Gangway structure	Marine grade aluminium (series 6000).
Maximum slope at LAT	Refer to Clause 7 of the <i>Design Criteria Annexure</i> .
Design live load	Refer Clause 4.5.1 of AS3962:2001 (for unrestricted access).
Aluminium mesh infill	The sides of the gangway shall be infilled with A127 Standard Diamond Tempa Tuff Mesh A (or equivalent) welded to the gangway.
Clear gangway width	Refer to Clause 7 of the <i>Design Criteria Annexure</i> .
Deck surface	Shall be a non-slip surface suitable for the marine environment complying with the restrictions or requirements defined in the project specific annexure.
Handrails	Shall be aluminium and comply with: <ul style="list-style-type: none"> • Clause 12 of AS1428.1:2009 <i>Design for Access and Mobility</i> Figure 29(a) Circular. • Clause 10 of AS1428.2:1992 <i>Design for access and mobility – Part 2: Enhanced and additional requirements – Building and facilities</i>.
(Aluminium) Transition plate between gangway and pontoon	Shall be: <ul style="list-style-type: none"> • non-slip • designed to remove trip and safety hazards • connected with a piano hinge with isolation between dissimilar materials. <p>HDPE or nylon rubbing strips shall be fitted on the underside of the cover plate to protect both the cover plate and the pontoon surface.</p>

8 Design deliverables

8.1 Requirements for fabrication and construction drawings

The drawings shall include:

- a) a fully dimensioned General Arrangement drawing (plan view and elevation of the proposed works)
- b) structural and fabrication details of the structure and components
- c) pile set out plan
- d) the design criteria, loads and water levels
- e) the finished levels of the works (including pile heads)
- f) civil construction details of the proposed works
- g) references to MRTS and Australian Standards.

These details will also be shown if they do not appear on other drawings provided by the Principal:

- a) details of the proposed works for which approval will be sought (including removal of existing structures and construction of new structures)
- b) adjacent existing structures which are not part of the proposed works
- c) the tidal planes relative to Australian Height Datum (AHD) (and the derivation source if not supplied by the Principal)
- d) the MHSW contour on the plan view (if the floating walkway is located in tidal waters)
- e) the set out point and bearing.

8.2 Certification of design

The designer shall certify the construction drawings and shall also certify (by declaration notes on the drawings or by a separate Engineer's Certificate) that the design of the works:

- a) is suitable for the intended usage
- b) is structurally adequate for the intended location and anticipated usage
- c) is structurally adequate to allow for the scour resulting from flood and tidal conditions (if applicable)
- d) does not impose loads on existing structures that would exceed their design capability
- e) would not adversely affect the stability of the bed and the banks of the waterway in which the works are to be constructed
- f) is designed in accordance with all appropriate Australian standards and guidelines except as detailed in the minimum design criteria in the Queensland Department of Environment and Heritage Protection (DEHP) *Operational policy – Building and engineering standards for tidal works*
- g) does not adversely affect the use of adjacent structures
- h) has a non-slip surface.

8.3 Design Report

The Design Report shall contain the following sections:

- a) document control page (for signoff by the designer and the client)
- b) project details and scope
- c) design details:
 - i. site investigations (geotechnical, flood height and current, wave climate)
 - ii. design tidal planes and flood levels (if applicable)
 - iii. assumptions and design methodology
- d) a *Design Requirements Checklist* detailing compliance with these design criteria (or the reason for noncompliance)
- e) referenced Standards and MRTS
- f) *Pile Loading Summary* (refer Appendix 1)
- g) *Stability and Buoyancy Summary*
- h) certified fabrication and construction drawings
- i) workplace health and safety hazards for the construction and operation phases of the works
- j) special design and or construction requirements for approval conditions
- k) *Appendix* – design calculations for:
 - i. stability and buoyancy (metacentric calculations in accordance with Clause 4.12 of AS3962:2001)
 - ii. pile loadings and capacities.

9 Supplementary requirements

These design criteria are varied by the supplementary requirements given in Clause 8 of the *Design Criteria Annexure*.

Appendix Pile Design Summary

	Pile 1	Pile 2	Pile 3	Pile 4	Pile 5	Pile 6	Pile 7
Pile length							
Embedment							
Pile diameter							
Wall thickness							
Pile capacity							
Berthing load							
Debris mat load							
Log impact load							
Flood/current load							
Total load (worst case scenario – designer to define)							
Pile capacity (bending moment capacity) exceeds worst case scenario load (yes/no)							

