

Design of the Eden Wave Attenuator

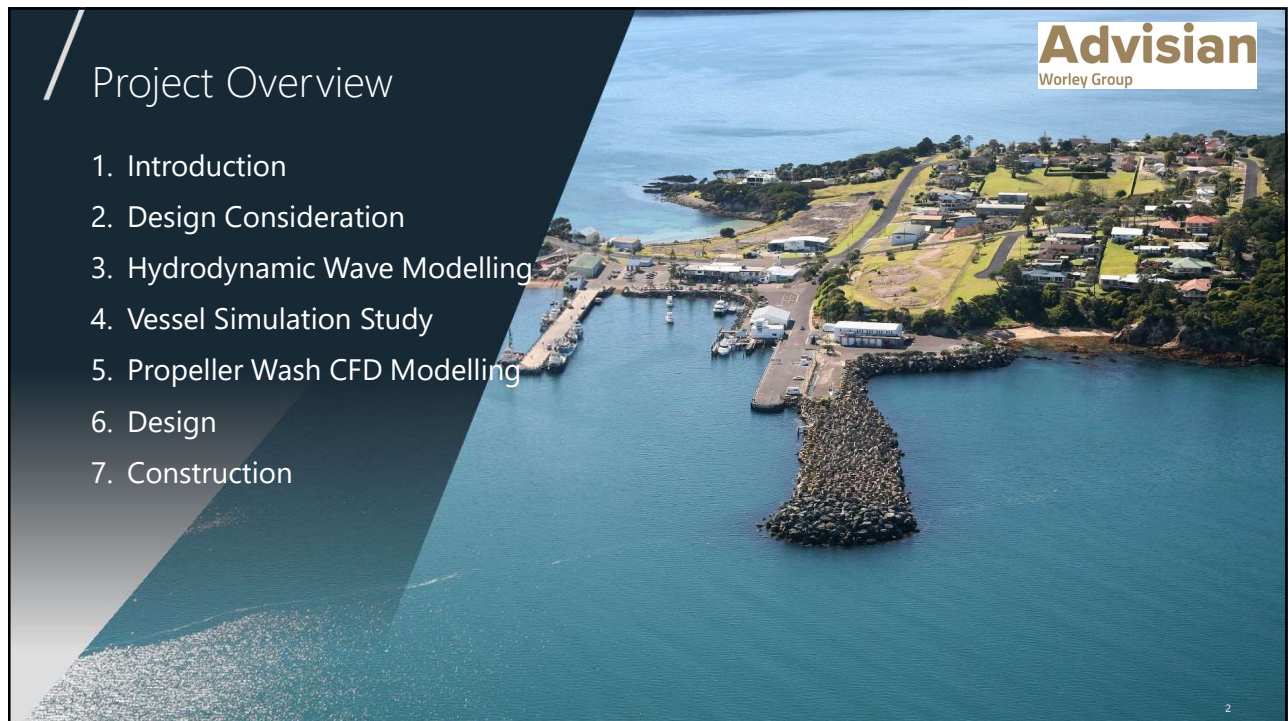
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PIANC Asia Pacific Conference 2022

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Project Overview

1. Introduction
2. Design Consideration
3. Hydrodynamic Wave Modelling
4. Vessel Simulation Study
5. Propeller Wash CFD Modelling
6. Design
7. Construction

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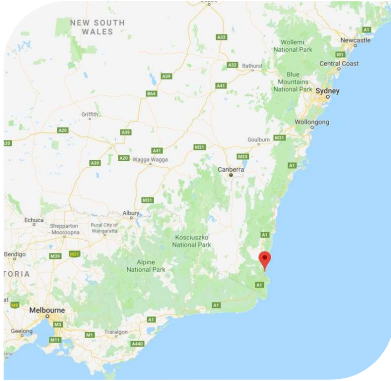
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Introduction

- **Location**
Eden, NSW
- **Client**
NSW Department of Industry (Crown Lands)



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Eden Safe Harbour Project



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Eden Safe Harbour Project

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Project Scope: To create a more sheltered waterway in Snug Cove to permit the future development (installation of floating marina berths).

Objectives:

- create a sheltered waterway area in Snug Cove;
- provide the opportunity for future development;
- not to negatively impact on existing port operations;
- be delivered by the end of the year 2022/early 2023; and,
- not to cause a significant environmental impact.

Solution: Installation of a Wave Attenuator



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Design Considerations:

- achieve as a minimum a **'moderate' wave climate** in accordance with AS 3962
- **sea and swell** approaching the site (Large fetch to the SW producing seas with design periods up to 4s)
- **propeller wash** generated by tugs and cruise ships
- variable **geotechnical** conditions
- proximity of **existing harbour infrastructure and operations** including cruise ship arrivals
- minimum design life of **50 years**
- **impacts of changes** to existing wave and current conditions on natural and build assets
- presence of **ecological** sensitive areas



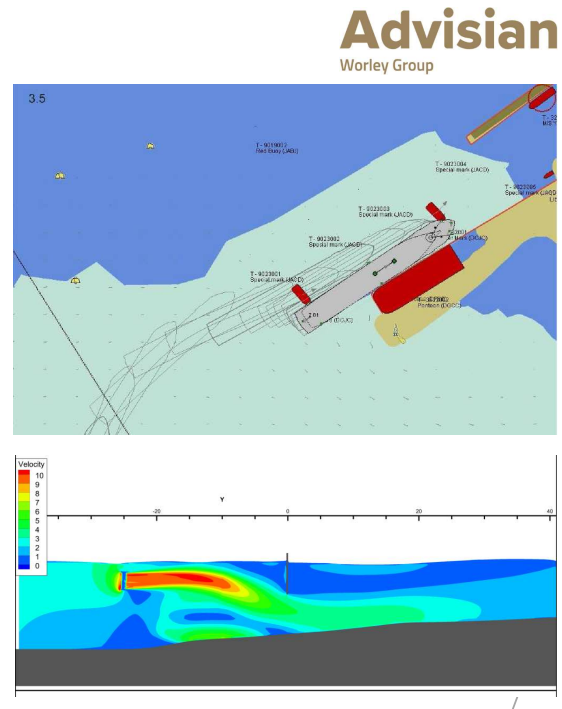
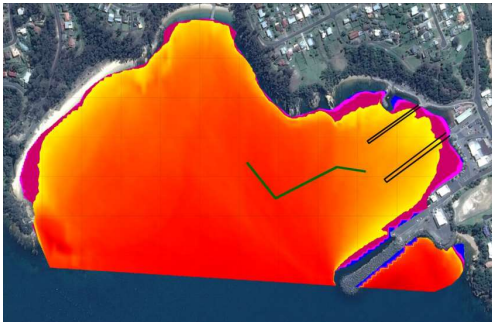
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Specialist Studies

- Hydrodynamic numerical wave modelling;
- Vessel simulations of approaching cruise ships and tugs; and,
- Computational Fluid Dynamics (CFD) modelling of propeller wash.



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Hydrodynamic Numerical Wave Modelling

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Table 2-3 AS3962 Criteria for a 'Moderate' Wave Climate in a Small Craft Harbour

Direction and Peak Period of Design Harbour Wave	Significant Wave Height	
	Wave Event Exceeded Once in 50 Years	Wave Event Exceeded Once Every Year
Head Seas Less than 2s	Conditions not likely to occur during this event	Less than 0.38m wave height
Head Seas Greater than 2s	Less than 0.75m wave height	Less than 0.38m wave height
Oblique Seas Greater than 2s	Less than 0.5m wave height	Less than 0.38m wave height
Beam Seas Less than 2s	Conditions not likely to occur during this event	Less than 0.38m wave height
Beam Seas Greater than 2s	Less than 0.31m wave height	Less than 0.19m wave height

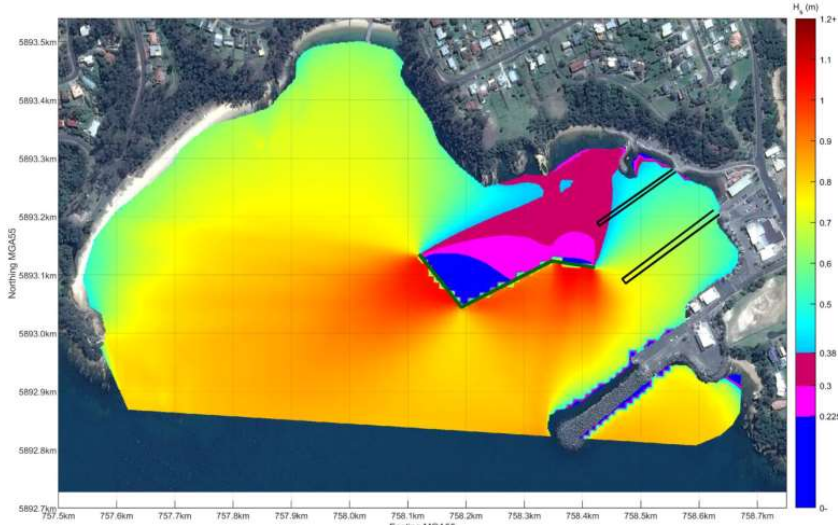


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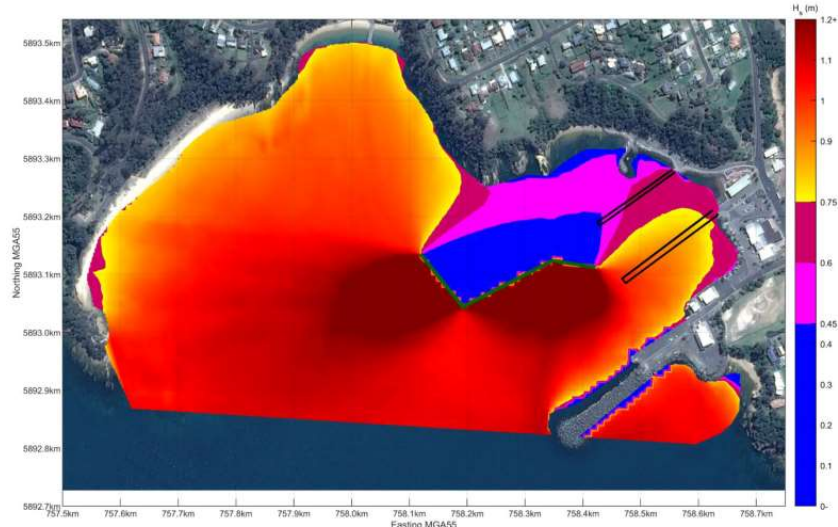
Hydrodynamic Numerical Wave Modelling

1 year ARI – Hs incident waves 0.69 to 0.77m



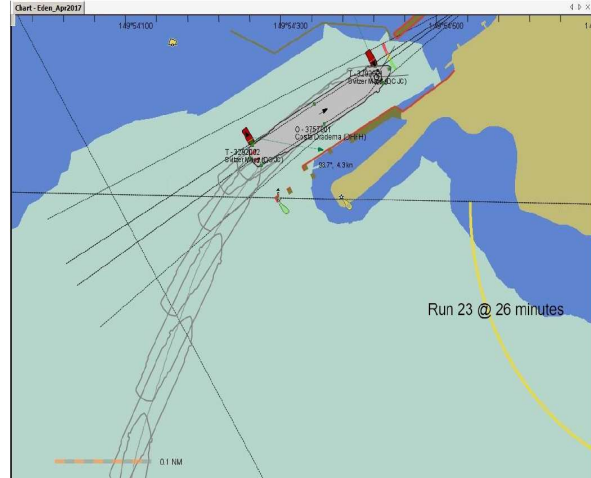
Hydrodynamic Numerical Wave Modelling

50 year ARI – Hs incident waves 0.89 to 1.05m

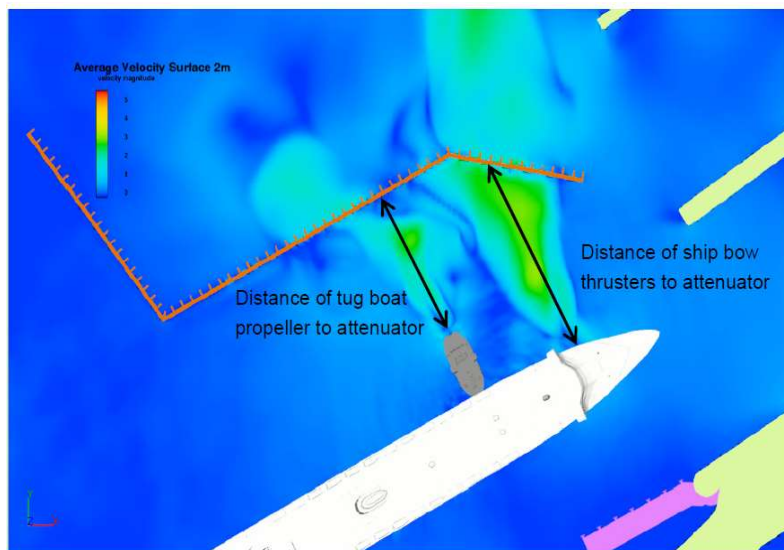


Vessel Simulations

Case 23 in the Smartship report which was identified as the worst case scenario in a normal operating maneuver.



Vessel Simulations



Assessment of Propeller Wash

- The attenuator required to withstand forces from cruise ship and tug wash
- Redirected propeller wash not to impact the area
- Assess the impacts of propeller wash on vessels in the lee of the attenuator



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Assessment of Propeller Wash

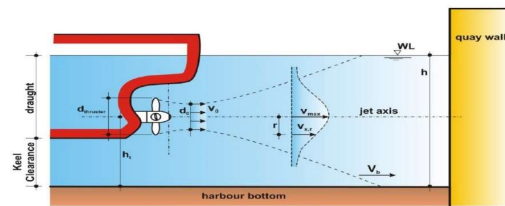


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Assessment of Propeller Wash

- The protected area must also be suitable for small craft having regard to wash created by cruise ships and tugs

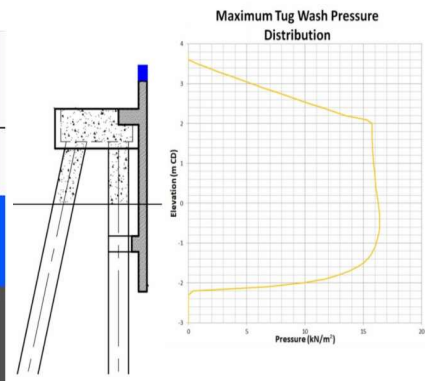
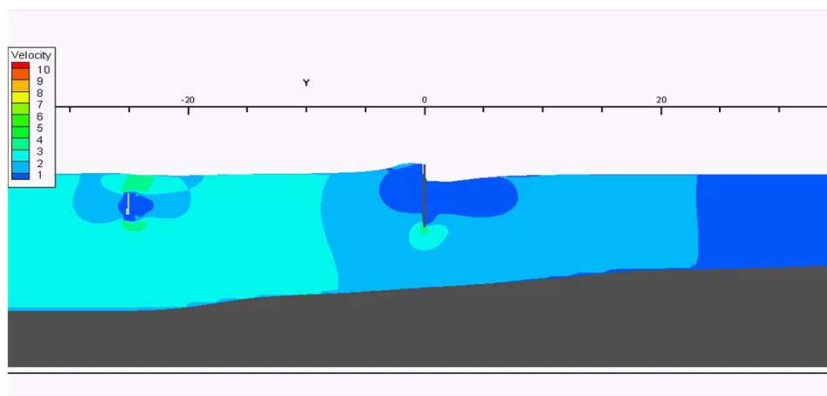
Depth Below Water Surface (m)	Horizontal Distance from Propeller (m)								
	0	3 (stern of vessel)	5	10	15	20	25	50	100
0	0	0	0	0.69	2.2	2.76	2.94	2.53	1.78
1.5	0	0.01	0.86	3.39	4.47	4.12	3.80	2.70	1.81
2.5	0	3.4	6.63	5.65	5.61	4.68	4.13	2.70	1.82
3.15 (centre of propeller)	9.64	9.64	9.64	6.21	5.85	4.79	4.19	2.76	1.82
3.8	0	3.4	6.63	5.65	5.61	4.68	4.13	2.75	1.82
4.8	0	0.01	0.86	3.39	4.47	4.12	3.80	2.70	1.81
6.3	0	0	0	0.69	2.2	2.76	2.94	2.53	1.78



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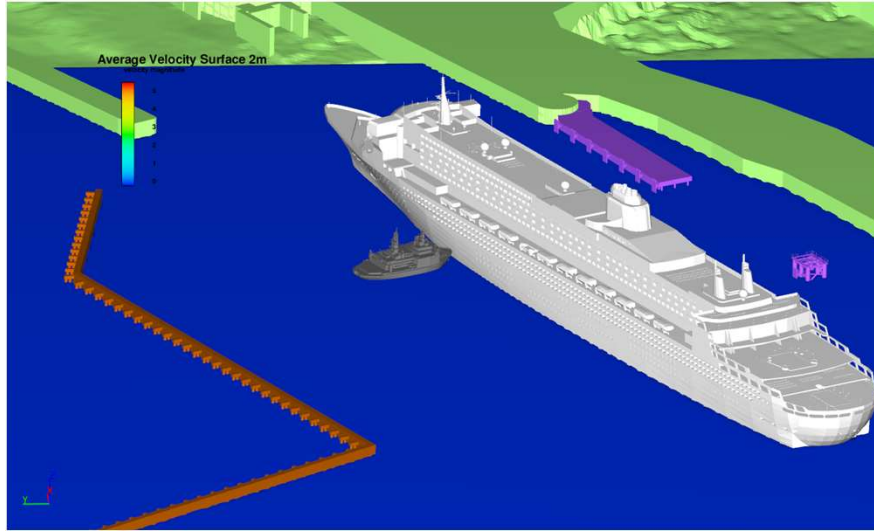
Assessment of Propeller Wash



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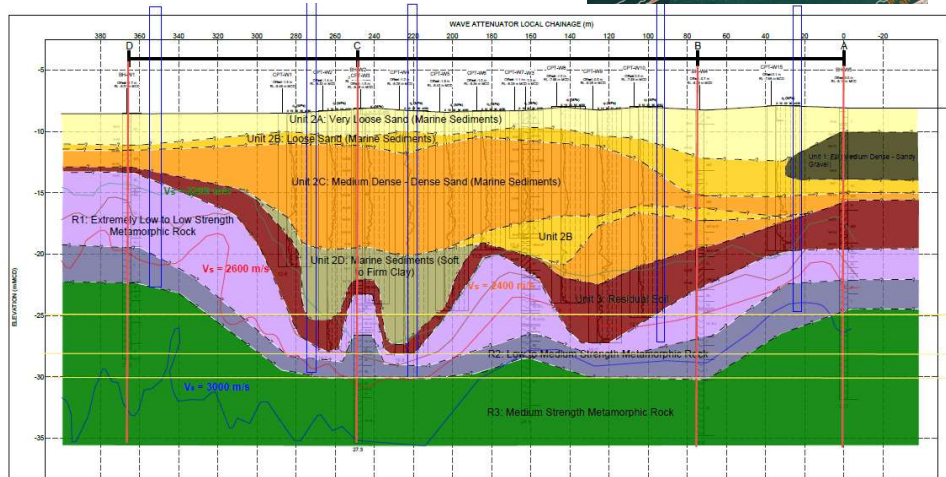
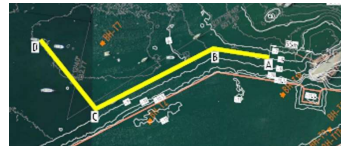
Assessment of Propeller Wash



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Design - Geotechnical



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Design – Concept Options

Option 1
Raker & Vertical Pile

Option 2
Two Vertical Piles

Option 3
Mono Pile

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Design – Concept Options

Loads

D-C = 82KN/m (Waves)

C-B = 80KN/m (Tug Wash)

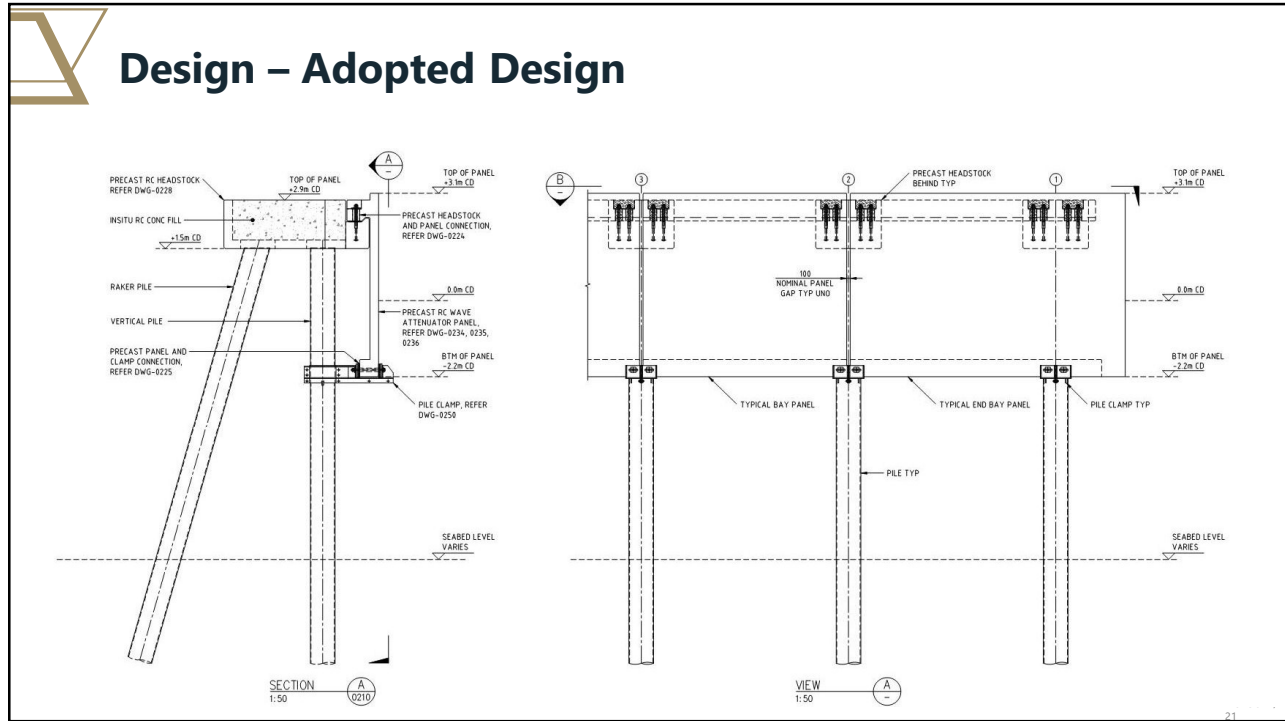
B-A = 75kn/m (Waves)

Design Table

Item	Description	Option		
		Option 1 - Vertical and Raker Piles	Option 2 - Two Vertical Piles	Option 3 - Mono Pile
1	Pile Size (DIA & THK, mm)	714ODx19WT	914ODx20WT	1600ODx25WT
2	Pile Length (m)	25 to 33m, total = 3562m	25 to 30m, total = 3493m	29 to 33m, total = 1917
3	Pile Mass (t)	10.7t, total = 1160t	13.9t, total = 1540t	31.7t, total = 1862t
4	Embedment (type and depth, m)	No Rock sockets	No Rock sockets	Potential for Region CD
5	Head Stock Size (l x h x w, m)	3500x1300x1450	5000x1600x1600	N/A

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Construction



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