

Beneficial reuse of natural material for coastal management

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Introduction

Overview

Infrastructure projects can generate excess natural materials that in some cases are suitable for coastal beneficial reuse

There is a need for coastal management interventions along the NSW coastline

Two case studies to provide insights on identifying opportunities, the barriers and measures that assist in realising beneficial reuse opportunities in NSW

Sydney tunnels



Greg Britton

Phil Watson

Northern Beaches,
Sutherland and Central
Coast

Stockton

City of Newcastle

Damian Snell (SWASH)

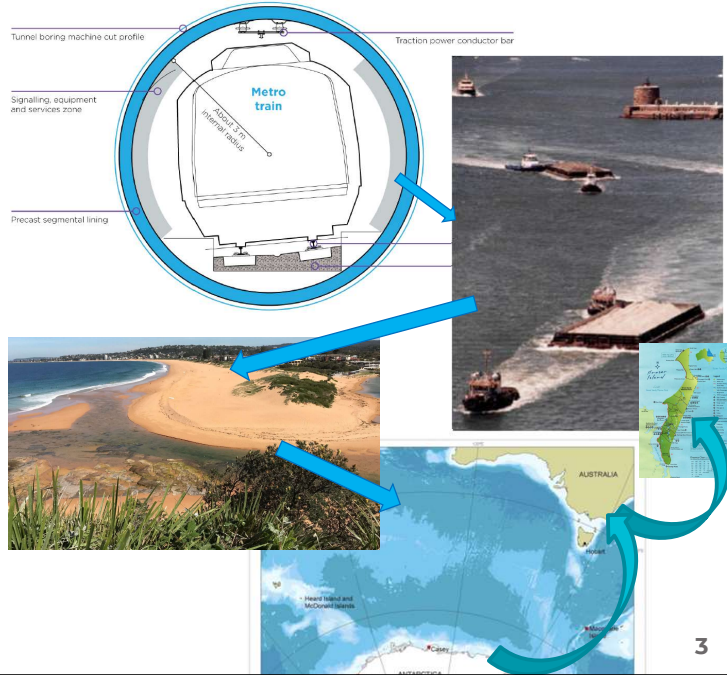
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The opportunity



- The Bays to Olympic Park tunneling to generate 930,000m³ of clean crushed sandstone at White Bay:
 - 93,000 truck movements (32t/load) **or**
 - 1,650 barge movements (1,800t/load)
- Nearby beaches (e.g., Collaroy-Narrabeen and Wamberal) have a **need for sand** (beach nourishment) and other coastal protection works
- Win-win: lower project costs/risks and wider benefits (metro & coastline)
- A sustainable approach that delivers environmentally and socially



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Project approvals



Table 1: Spoil management hierarchy for Stage 1 (source: Sydney Metro West EIS, 2020).

Priority	Reuse options	Possible reuse options
1	Within the Stage 1 footprint	<ul style="list-style-type: none"> • Reuse spoil for landscaping, structural fill, general fill, fill embankments and mounds within a short haulage distance of the source • Reuse spoil to restore any pre-existing contaminated sites within the Stage 1 construction footprint • Reuse spoil as a feed product in construction materials.
2	Environmental projects (outside of the Stage 1 footprint)	<ul style="list-style-type: none"> • Reuse spoil for coastal protection, such as beach nourishment and land raising • Reuse spoil in flood mitigation projects.
3	Other development projects (including other Sydney Metro projects)	<ul style="list-style-type: none"> • Reuse spoil for landscaping, structural fill, general fill, fill embankments and mounds on projects within a financially feasible transport distance of the site • Reuse spoil for land reclamation or remediation projects • Reuse sand for manufacturing concrete and shale for manufacturing bricks and tiles.
4	Land restoration	<ul style="list-style-type: none"> • Reuse spoil to fill disused facilities (for example mines and quarries) to enable either future development or site rehabilitation.
5	Landfill management	<ul style="list-style-type: none"> • Reuse spoil to cap completed landfill cells • Reuse spoil in daily covering of landfill waste.

Material generators spoil management approvals typically require the reuse option be legally able to receive the material.

→ Receivers need approval for placements!!

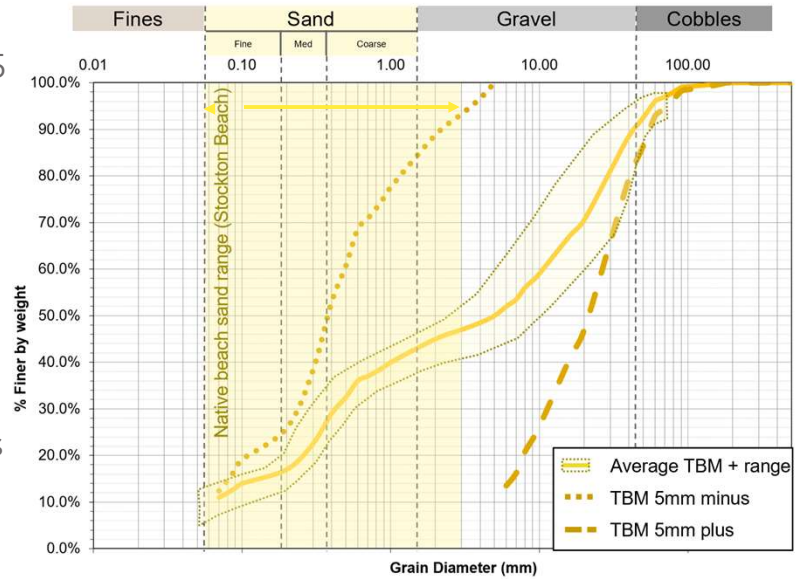
E84 Notwithstanding the above, the Proponent must investigate opportunities to maximise spoil removal by non-road methods and schedule final track laying as soon as practicable following completion of tunnelling with a view to transporting materials and equipment for station fit-out, systems and commissioning by rail to minimise truck movements in town centres and the Sydney CBD. The findings of the investigation must be reported to the Secretary before commencement and before completion of tunnel spoil generation as relevant. A decision to not adopt spoil haulage or materials delivery by non-road methods must be demonstrated to the satisfaction of the Secretary.

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Source material – particle size

- Crushed sandstone with VENM classification as 11:34:55 (fines : sand : gravel/cobbles)
- Screening can be used to separate sand (5mm minus) and gravels (5mm plus)
- 5mm minus suitable for beach nourishment projects in NSW (conforms to Florida's 'Sand Rule')
- 5mm plus material suitable for artificial reefs



**Total QTY: 930,000m³ ; 5mm minus: 465,000m³
5mm plus: 465,000m³**

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Source material - colour



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Reuse of coastal protection: nourishment

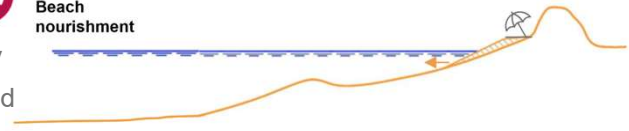


Pumping ashore to visible beach:

- Highest cost, lowest efficiency
- Fines content in source exceed permissible threshold



Beach nourishment



Rainbow to surfzone:

- Requires TSHD, inefficient
- Engineering feasibility
- Fines content and surf zone placement



Nearshore nourishment



Bottom dump in the nearshore:

- Lowest cost, maximum efficiency
- Mimics natural storm bar
- Raw or 5mm minus would be washed and sorted by natural coastal processes
- Positive coastal protection and beach amenity outcomes as well as recreational benefits in the short term



Coastal profile

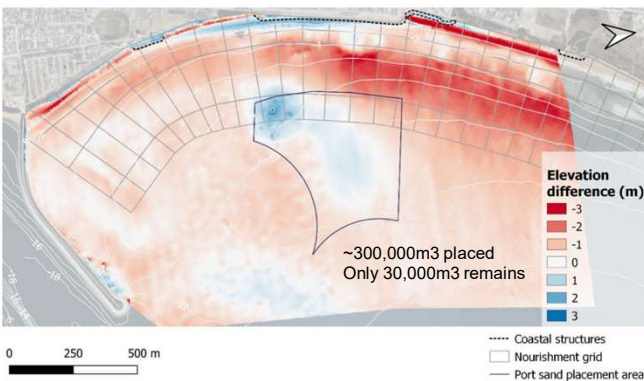
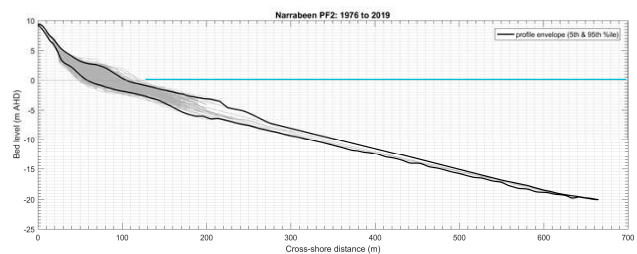
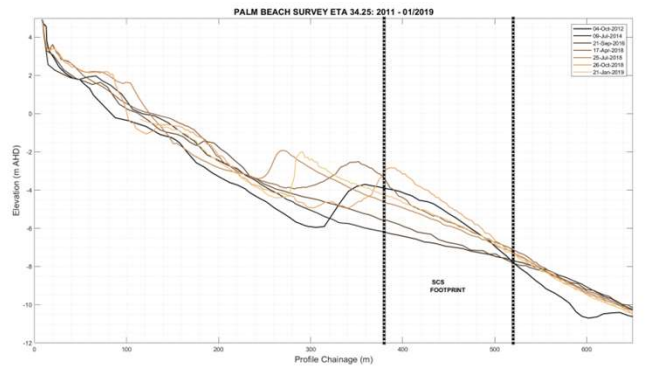



Figure 20: Elevation difference between 2018 and 1995 topography and bathymetry surveys.




Metro opportunity



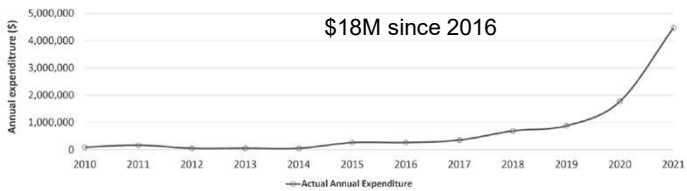
Feasibility	Generator	Receiver
• Source materials	●	●
• Construction methods	●	●
• Reuse opportunities:		
○ Beach nourishment	●	●
○ Artificial reef/habitat creation	●	●
• Approvals	●	●
• Tendering (time + cost + risk)	●	●

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The opportunity



- Beneficial reuse of dredged material from Port of Newcastle as an alternative to sea disposal
- Port of Newcastle is a river port, directly adjacent to Stockton Beach
- Stockton Beach suffers from ongoing sand loss (146,000m³/yr) as a result of the deepwater shipping channel
- Coastal management costs at Stockton are rising - the outcomes less than desirable



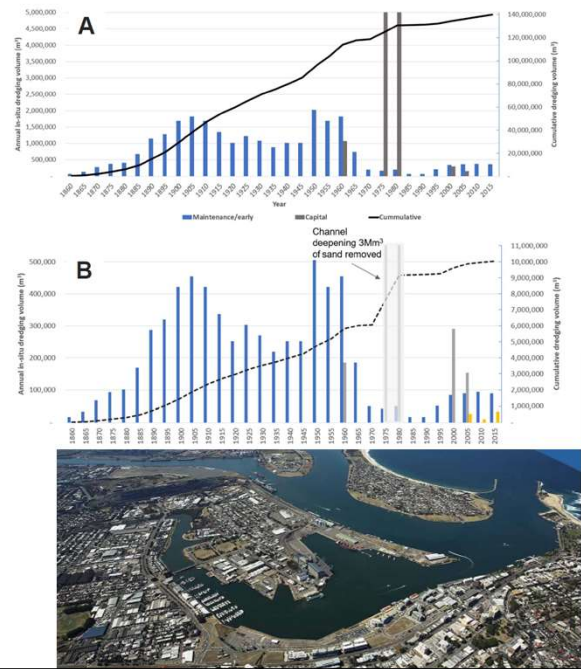
Year	Annual expenditure (\$)
2010	~200,000
2011	~200,000
2012	~200,000
2013	~200,000
2014	~200,000
2015	~200,000
2016	~200,000
2017	~200,000
2018	~200,000
2019	~200,000
2020	~200,000
2021	~4,500,000

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The opportunity

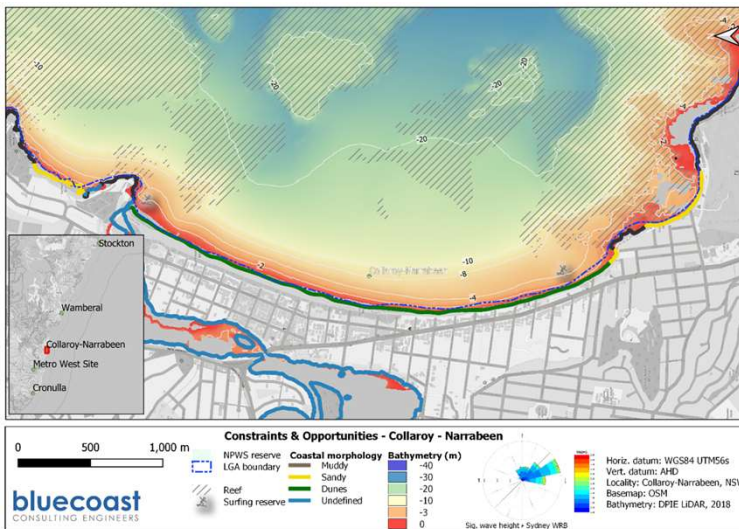
- **Capital dredging:**
 - 1980's: 3M m³ of sand dredged in for channel deepening project
 - 2010-11: 1M m³ of excess material from NCIG port development project sea dumped
 - 2017: Stolthaven berth pocket, 180,000m³ of sand sea disposed
 - Future: South Arm Hydrogen Hub (1-3M m³)
- **Maintenance dredging:**
 - 160-years of continuous dredging – 145 M m³ (sand and silt) or 15-45M m³ sand component dump at sea
 - Future: can we minimise this **waste**?



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Realising beneficial reuse

1. Understand what is acceptable?



Being prepared

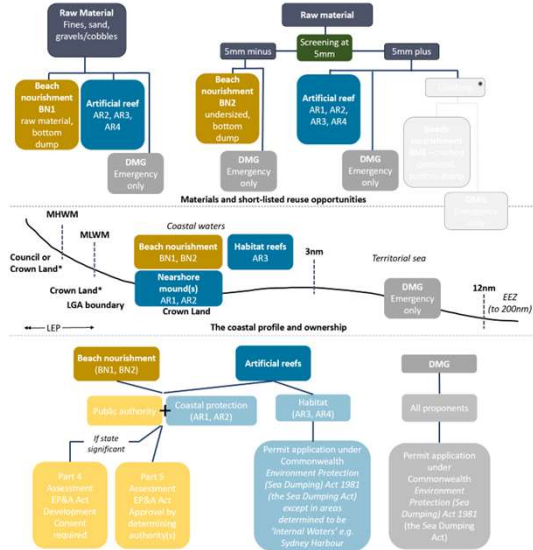
- Good understanding of native beach material, coastal processes and environmentally sensitive sites
- Develop beach nourishment acceptance criteria (e.g. 'Florida sand rule')
- Must contain less than 5% fine sediment (silt and clay sized particles) when placed on the upper beach from offshore sources or less than 10% from maintenance of navigation channel sources. This criterion is relaxed to less than 20% fines for beneficial use/placement in the nearshore.
- Must contain less than 5% fine gravel.
- Shall not contain coarse gravel or cobbles in a percentage or size greater than found on the native beach.
- Shall not contain construction debris, toxic material or other foreign matter.
- Where possible be flexible! Consider alternatives and assess on a case-by-case basis (e.g. raw tunnel material, mixed sediments - can they become unmixed?)

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Realising beneficial reuse

2. Be legally able to receive suitable material



*Based on investigations completed to date creating the oversized for additional beach nourishment is unlikely to be brought forward. However, investigations are on-going and the findings of these may warrant further consideration.

Being prepared

- Consider seeking approval for beach nourishment in advance to avoid missed opportunities
- Are you preparing a CMP? Consider CMP actions of developing acceptability criteria and/or obtaining concept approval
- Develop beach nourishment acceptance criteria (e.g. 'Florida sand rule')
- Where possible be flexible! Consider alternatives and assess on a case-by-case basis (e.g. raw tunnel material, mixed sediments - can they become unmixed?)

Realising beneficial reuse

3. Tendering (time + cost + risk)

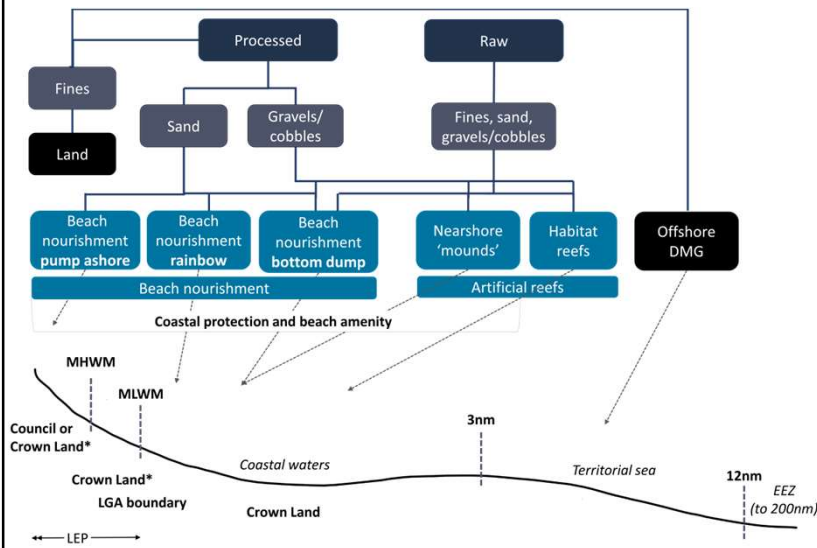


Being prepared

- Who owns the material? Consider government policy so generators are clear on reuse expectations
- Understand generators timeframes particularly around approvals and tendering. Get in early!
- Where possible be flexible! Consider placement methods and other opportunities – think out side the box

QUESTIONS

Introduction



Presentation outline:

- Source materials
- Reuse opportunities:
 - Coastal protection
 - Habitat creation
- Construction methods
- Approval pathways

*Council likely to be Crown Land Manager appointed under the Crown Land Management Act 2016

Reuse for habitat creation/coastal protection

Nearshore mounds (with/without armoured)

- Semi-permanent storm bar offering coastal protection
- Ecological and recreational benefits (enhanced surf amenity)
- Armouring of mound, permanent nearshore feature
- More predictable performance outcomes
- Additional cost for armouring

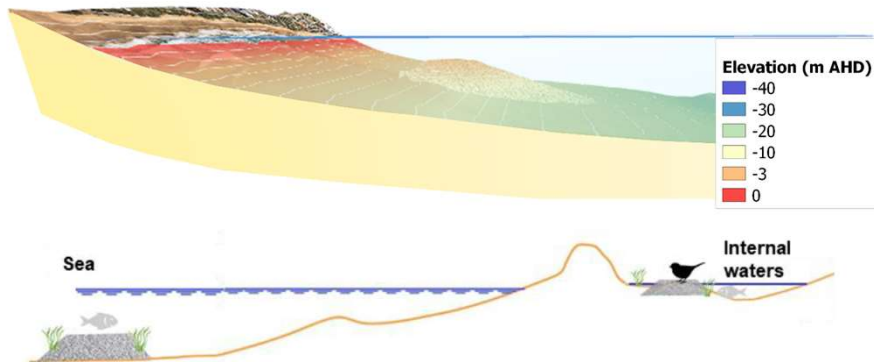


Photo 1. Wave Refraction due to Nearshore Berm. 12/92.



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