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AQUATIC ECOLOGISTS
deep thinking. science.

Dredging in the Great Barrier Reef

Reflections

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Outline

New policies re offshore disposal

Cumulative Impacts

- narrow focus
  - one potential impact of dredging
  - on one key receptor

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Offshore Disposal

State and Federal by-partisan policy:

- stop disposal of capital dredge spoil on GBR
- precautionary approach – impact debated, high risk

Debate continues on finer points

- when?
- which proposals?
- Great Barrier Reef Marine Park, or World Heritage Area?
- capital v maintenance

- If not offshore, where?

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Beneficial Reuse - constraints

- suitability for reuse
  - fill - load bearing constraints
  - construction - low clay and silts
  - beach nourishment
- prohibitive costs to transport
- availability of coastal land
- large area needed to dewater
- permanent loss of habitat
- tailwater management
- alteration of coastline and dynamics
- spills, failure of bund walls in estuarine environment
- PASS ($36.60 to $158.10/$m^3$ SKM 2013, source of lime)

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Beneficial Reuse

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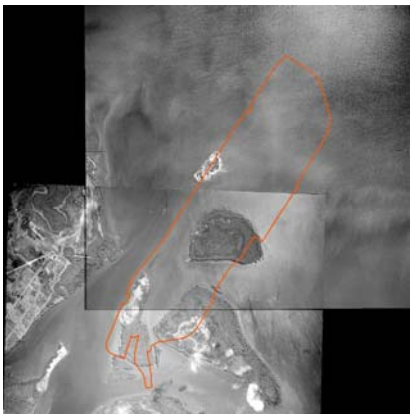
Beneficial Reuse – the new challenge



> 264 hectares approx. 17.5 M m^3

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A Question of Scale: or size does matter

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Gladstone western basin 23 M m^3 (17.5 M m^3 onshore)
Gladstone channel duplication 12 M m^3
Townsville 5.5 M m^3
Cairns 5 M m^3
Abbott Point 1.7 M m^3

Port Douglas 35,000 m^3
Rosslyn Bay 35,000 m^3

Media reports 83 - 127 M m^3

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Potential Impacts from Dredging

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Direct
- habitat removal
- habitat burial
- fauna strike

Indirect
- noise
- turbidity
- sedimentation
- toxicity

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Turbidity may impact . . .

Coral
Sponges
Seagrass
Fish behaviour
Reproduction of fish and invertebrates
…
…

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Turbidity: Dredge Related Sources

- removal of sediment
- disposal of sediment
- movement of the boat (propeller shallow water)
- release of tail water from hopper
- tail water from disposal on land
- variation with dredge and habitat
- interactions

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Dredging 101 for Ecologists

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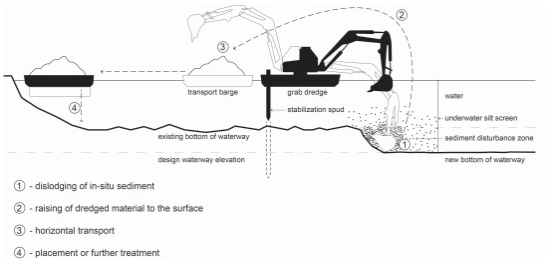
- Mechanical
  - bucket, grab, back hoe
  - scoop the sediment up
  - load to a barge
  - often fixed in place



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Dredging 101 for Ecologists

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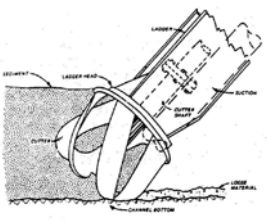
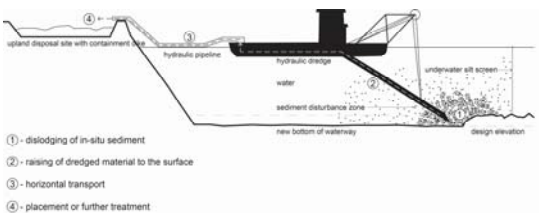
- Hydraulic
  - cutter suction, suction hopper, trailing suction hopper
  - cutter – harder sediment
  - hopper, barge or pipeline
  - suck the sediment up
  - often more mobile





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Suspended Solids and Seagrass

Turbidity proxy for suspended solids

Suspended solids block light
Seagrass needs light to photosynthesise

- survival: photosynthesis > respiration
- respiration increases with stress
- respiration continues whether there is light or not (e.g. night)

Move to establish light based triggers for seagrass

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Light and Seagrass

Gladstone Western Basin dredging approval conditions:

- development of a light based management plan
  - seagrass key sensitive receptor
  - may afford protection to other ecological assets

>2 years of extensive research by Fisheries Queensland now (JCU TropWater) and UTS, supported by water quality monitoring by Vision Environment

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Light and Seagrass

Available light is modified by:
- weather conditions
- season
- time of day
- type of suspended sediment
- depth

Light required is modified by:
- species
- morphology of that species
- condition (resilience)
- environmental stressors e.g. exposure, depth, sediment condition
- season

Very site and species specific

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Light Based Trigger

10 sites

Continuous logging of light

Monitoring of seagrass condition

Monitoring of seagrass distribution

Laboratory and field experiments on:
- spectral quality
- shading (good news)
- tidal exposure (bad news)

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Light Based Trigger

Established a light based trigger

- 14 day rolling average
- specific to one species, one depth, one location

During dredge campaign trigger was largely complied with

On the one hand seagrass here remarkably resilient

- withstand very little light for up to 3 – 4 weeks

On the other hand . . .

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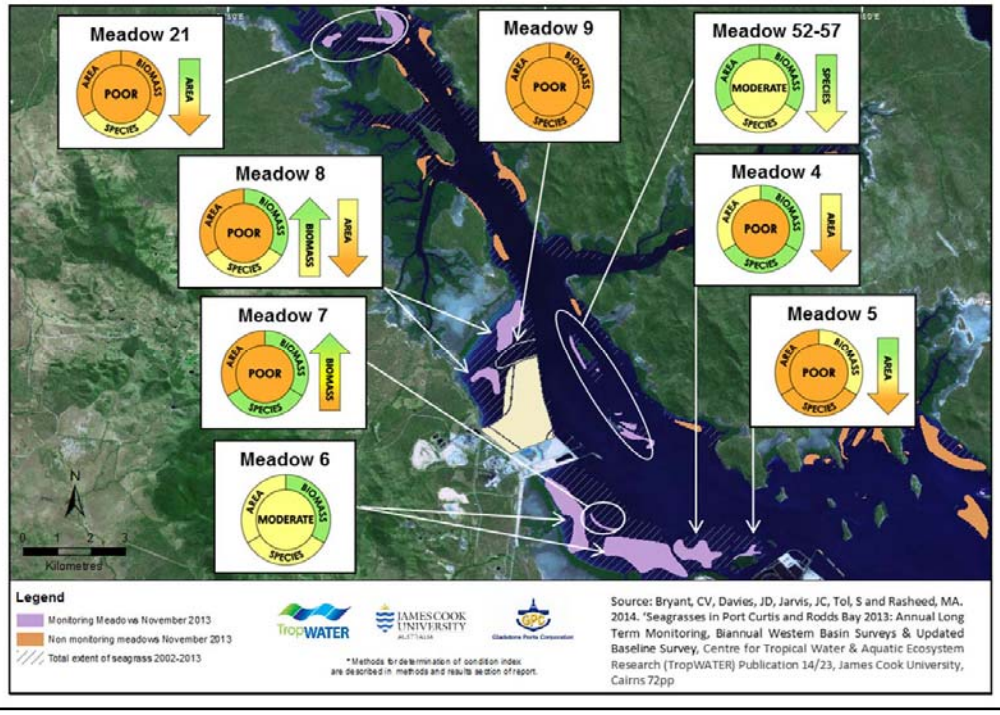

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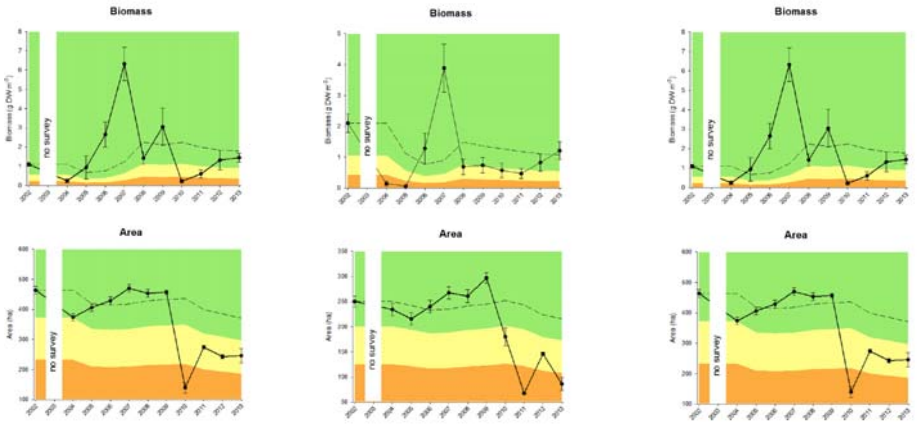

Meadow 6 Meadow 8 Meadow 43

Bryant et al 2014

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Loss of Seagrass

2009 to 2013 63% lost (3800 ha in shallow water)

Similar decrease in Cairns, Mourilyan, Townsville, Abbott Point, all along coast
But not in far north, or along western coast of QLD

Decreases follow floods:

- low light
- low salinity
- high nutrients
- high water temperature

Major flooding 2010, 2011, 2013

Some increase in 2012, dryer year

Decline started before major capital dredging

Bryant et al 2014. Seagrasses of Port Curtis and Rodds Bay, November 2013 – TropWater Report 14/23 2014

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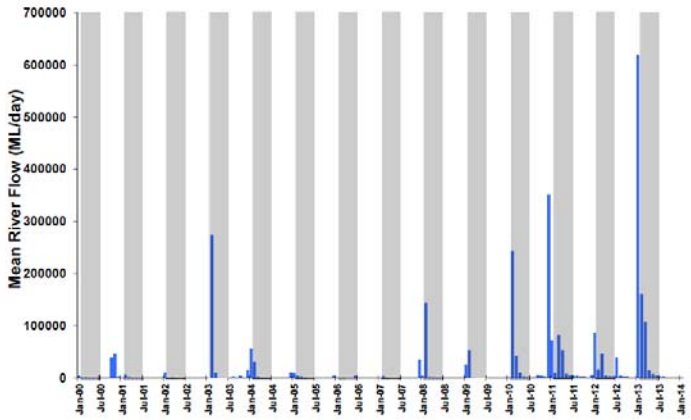

Figure 22 Mean river flow for the Calliope River from January 2000 to November 2013. (Department of Environment and Resource Management 2013, Station: 132001A).

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Resilience

Does dredging exacerbate impacts of flood by prolonging periods of low light?

Is the light required for maintenance the same as for re-establishment and growth?

Do changes to sediment inhibit germination and recolonisation?

Does repeated recolonisation reduce seed bank?

Does flooding decrease capacity of adult plants to grow?

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Cumulative Impacts

Implications for management of further dredging
- low abundance
- low resilience
- low regenerative capacity

Should same trigger apply?

Implications for catchment and regional management
- Why is loss associated with floods so high?
- Will catchment management alone resolve this?
  - loss due to floods >> greater than dredging
  - >> direct filling for beneficial reuse

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In Summary

Careful what you wish for – ongoing issues to be resolved now no disposal at sea

Light based trigger for seagrass
- extensive research
- careful application (site & species specific)

Floods dwarfed impact from dredging

Review application of triggers based on resilience

Implications for dredge management, broader catchment management, and regional management

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