

Garden Island Contaminated Dredging & Disposal Case Study

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Summary

The Garden Island Defence Precinct is a key operational and support base for the Royal Australian Navy located in Sydney Harbour. The aim of the overall project was to provide a fully functioning and future proofed wharf, at the northern end of Garden Island (East) that would meet the berthing and maintenance requirements for the forecast growth of current and future-planned vessels. This included the dredging of contaminated materials from the cruiser wharf and oil wharf berth pockets, which were treated and disposed of onshore in accordance with NSW Environmental requirements.

Key Words: Dredging, Contaminants, Environmental, Sydney Harbour

Introduction

Birdon utilised its spud mounted backhoe dredge “BHD Sydney”, with Liebherr 984 - 100 tonne excavator and bucket (with interchangeable ripper attachment for rock), and two spud mounted split hopper barges, Pelican (1000m³ capacity) and 139 (500m³ capacity), to dredge and remove the following materials:

- Maintenance Dredging:
 - 18,500m³ of contaminated materials (made ground/marine fill)
- Capital Dredging:
 - 8,000m³ of Clay materials
 - 1,000m³ of Rock materials



Figure 1 Dredge Pocket (blue shading) for the Garden Island Dredging Works (Source: [1]).

Contaminated Maintenance Dredging

One of the chief constraints to modern day dredging operations is the presence of contaminated materials. The presence of these contaminated materials is the result of times gone by where the regulations, and environmental expectations and awareness, around ports and harbours, particularly key ports such as Sydney, were simply not what they are today.

Presently, all parties involved in dredging operations have a duty of care to the surrounding environment from the planning phase, right through to completion and handover. As such, there are strict processes in place, which while time consuming, are critical to the sustainability of the marine environment prior to the commencement of, and during, dredging operations. These processes were utilised throughout Birdon’s Garden Island Dredging Campaign and are briefly outlined below.

Ultimately, the Made Ground/Marine Fill maintenance dredging materials were classified by the NSW EPA as a Restricted Solid Waste (RSW) due to the levels of the organotin compound Tributyltin (TBT) found within the material. Therefore, this required the material to be disposed of onshore, via road transport, to a licensed waste disposal facility, under the control of an Environmental Protection Licence. While this necessary component seems straight forward, as alluded to above the time it takes for contractors/clients to get this point can be very time consuming. The Head contractor engaged Progressive Risk Management (PRM) to carry out a comprehensive sediment sampling, laboratory testing and waste classification process. Samples were analysed for the following Contaminants of Potential Concern (CoPC):

- Heavy Metals (arsenic, cadmium, chromium, lead, mercury, nickel, zinc), including
- leachability (TCLP).
- Total Petroleum Hydrocarbons (TPH).
- Polycyclic aromatic hydrocarbons (PAH),
- Polychlorinated biphenyls (PCB).
- Organochlorine Pesticides (OCP).
- Organotin (particularly tributyltin (TBT), including TCLP.
- Per- and poly-fluoroalkyl substances (PFAS), including TCLP.

As outlined above, PRM concluded that “based on the 6 Step process outlined in NSW EPA, 2014a and the current guidance from the NSW EPA regarding organotin, the marine sediments are considered to be classified for offsite disposal as Restricted Solid Waste (non-putrescible)” due to the high level of the organotin TBT in the samples (note: while acid sulfates are also a common issue in dredging of this nature, particularly re odours and subsequent contamination, they were not present in this material).

Following the classification of the material as RSW, the methodology of disposal had to be established. The eventually process utilised by Birdon is detailed as follows:

- The RSW was loaded into Birdon’s split hopper barges and transferred to a designated waste transfer facility.
- Due to the soft and saturated nature, the material was unsuitable for road transport in its original state.
- Birdon developed a proprietary polymer additive that was mixed into the material using two wharf-based 30 tonne long reach excavators, which rendered the material “spadeable”.
- The material was then loaded into trucks for transport to the designated waste disposal facility.

While it can be debated in the industry, that the abovementioned methodology is costly due to the holding of the water by the polymer (or “bulking” the material), Birdon found through its own experiences that the methodology is more cost effective to other methods for the following key reasons:

- Treatment with other mixtures (such as cement) was found by Birdon to have a larger bulking factor than the polymer, takes longer to become “spadeable”, and is harder to manage (re dust etc.) onsite.
- Removing supernatant water requires on land facilities to remove, treat and then dispose of the water, which was found not

only to be difficult, timed consuming and costly, but also requires additional licencing requirements from the EPA for the discharge water.

Ancillary Capital Dredging

The natural clay and weathered sandstone rock materials were designated suitable for offshore disposal. A Commonwealth Sea Dumping Permit was issued prior to the works, which specified the offshore disposal site. The materials were loaded into Birdon’s split hopper barges and towed approximately 10 nautical miles offshore to the disposal site using GPS tracking systems. Once at the site, the bottom doors of the split hopper barge are opened remotely from the tow vessel, and the material disposed of within the required dumping ground.

Quality & Environmental Control

In addition to the implementation of primary and secondary silt curtains for the dredging works, Birdon facilitated the following monitoring and recording processes, which were provided weekly to the client, to ensure a high level of quality and environmental control was maintained:

- Daily dredging logs
- Waste tracking certificates
- Disposal facility weigh bridge docketts
- Offshore dumping records
- Daily water quality monitoring records
- Daily pre-start/toolbox meeting
- Health and safety records



Figure 2 Birdon’s Backhoe Dredge loading contaminated dredging materials into Birdon’s split hopper barge at Garden Island (Source: [2]).

Discussion and Conclusion

The outlined methodology was proven to be a more efficient and cost-effective alternative to traditional contaminated dredging & disposal methodologies.

References

- [1] Lend Lease Construction, GIBDT Construction Management Plan, 2019, Garden Island Defence Precinct, Sydney.
- [2] Birdon Group, 2019, Garden Island Defence Precinct, Sydney.
- [3] PRM, Waste Classification Report, 2019, GIBDT.