Ports Australia

Environmental Code of Practice for Dredging and Dredged Material Management

August 2016

Cover photo top: Courtesy of Fremantle Ports.
Cover photo bottom: Courtesy of Pilbara Ports Authority (Dampier).

ADOPTION OF THE CODE OF PRACTICE

Ports Australia has developed this Code of Practice in consultation with members, port customers, regulators and associated industry representatives (e.g. dredging contractors).

The Code was endorsed by the Ports Australia Board at its meeting on 8 July 2016.

Through this Code of Practice, Ports Australia's members have endorsed the principles contained in this document and are committed to conducting activities consistent with the Code when planning and undertaking dredging programs.

Ports Australia also invites other stakeholders (for example other port users or customers, governments, dredging contractors) to also demonstrate the same level of environmental responsibility and management in undertaking or supporting dredging programs.

Ports Australia has used current relevant information from Australia and internationally to support the development of this Code of Practice. This included:

- examples of similar industry codes and guidelines;
- state/territory policies and guidelines;
- published papers and research activities relating to minimising dredging impacts; and
- best practice methodologies, tools, systems etc.

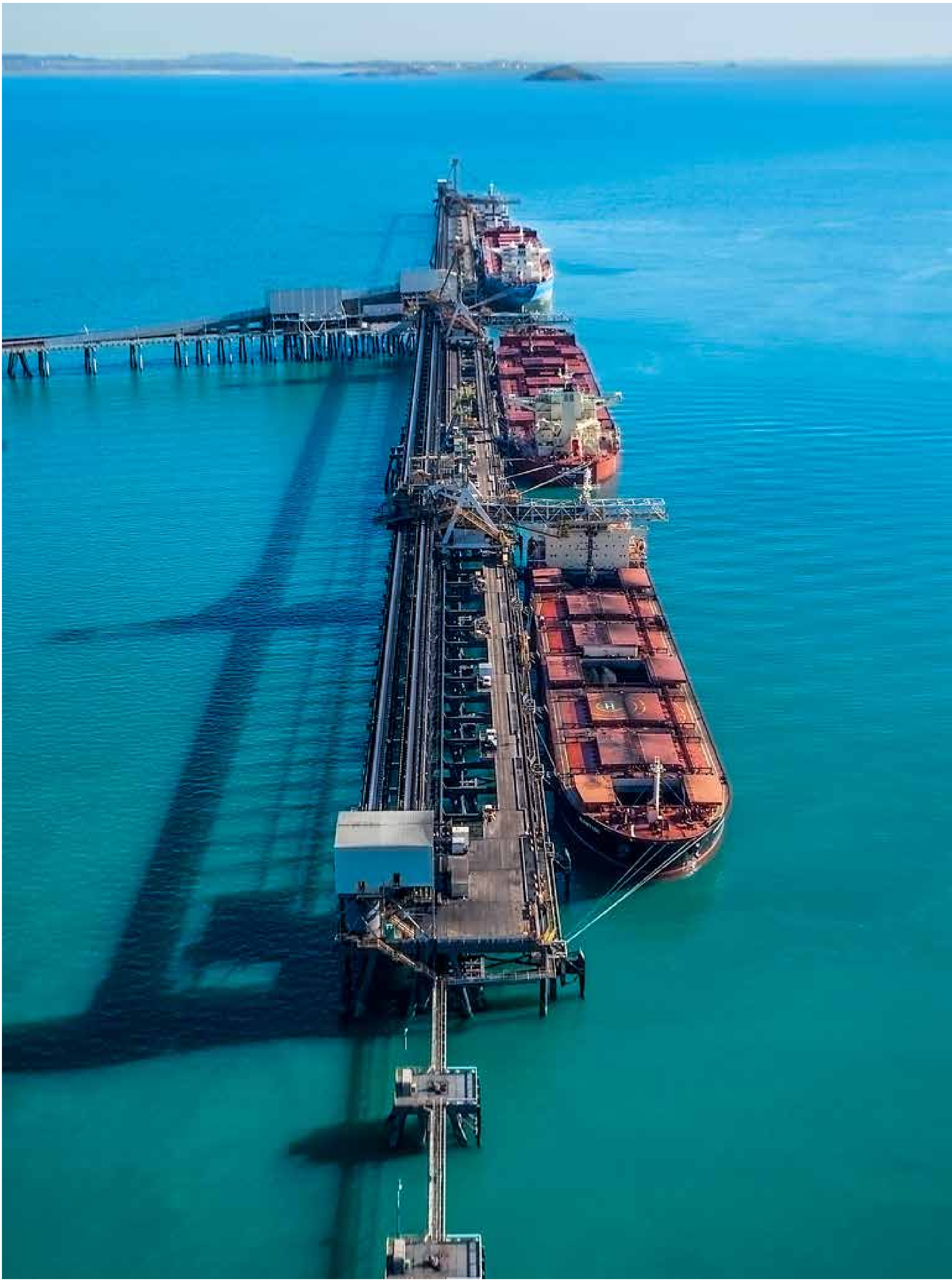

Photo courtesy of Dalrymple Bay Coal Terminal.

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With thanks to:

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Ports Australia

PURPOSE

As an island nation dependent on maritime trade, Australia's ports are a vital link between Australian communities and industry and overseas markets and commodities.

The National Ports Strategy notes that:

> *"As a maritime nation, Australia's ports are an important gateway for goods and for our defence. Consequently, ports and associated infrastructure are of the utmost economic and social importance to Australia".*[1]

Ensuring we have ports that are efficient, safe and with adequate capacity is the joint responsibility of governments (at all levels), port managers, industry and other stakeholders.

Development and maintenance of appropriate infrastructure that can facilitate trade is a primary element of port planning and operations. The establishment and ongoing management of waterside infrastructure, including shipping channels, ship berths and swing basins, is as important as the development and maintenance of landside infrastructure such as roads, railways and port terminals.

The majority of Australia's exports and imports travel through our ports. In 2012–13, sea freight accounted for 99.7% of Australia's total merchandise exports and 98.4% of imports.[2] Trade volumes through Australian ports are growing and this growth is expected to continue.[3] This will involve more ships visiting our ports and also larger ships as the global shipping industry is continually looking to improve the economies of scale of its operations.[4]

In order to remain competitive with international trade, ports need to conduct regular maintenance dredging to keep shipping channels and berths open and safe. Periodically ports also need to enhance or increase infrastructure capacity through capital dredging programs.

The Australian port industry has been delivering successful and sustainable dredging programs for decades and, in many ports, for more than a century.

Public interest in dredging has grown in step with a significant shift towards greater environmental awareness. Despite Australian ports having an excellent track record in undertaking sustainable dredging programs[5], dredging and dredged material relocation in Australia has in recent years been subject to high levels of political, media and public interest.

Photo courtesy of Gladstone Port.

CODE OF PRACTICE PRINCIPLES

Leading practice management of environmental risks associated with dredging is well defined and recognised internationally and nationally. This Code of Practice sets out a series of environmental principles that Australian ports follow when undertaking dredging and when reusing, relocating or disposing of dredged material.

Australia has an excellent environmental record in the successful implementation of dredging programs.[5] Port Managers invest considerable time and funding into understanding and monitoring the environment within and surrounding their operations. The monitoring and research work undertaken by ports forms a significant contribution to the existing scientific knowledge on coastal environments in Australia.[6]

In Australia dredging and dredged material relocation is closely regulated and monitored. Australia is a signatory to global conventions (the London Convention and London Protocol) that works to prevent marine pollution by the dumping of wastes and other matter at sea. The London Protocol aims to 'protect and preserve the marine environment from all sources of pollution and take effective measures, according to their scientific, technical and economic capabilities, to prevent, reduce and where practicable eliminate pollution caused by dumping or incineration at sea of wastes or other matter' (Article 2, London Protocol 2006). The London Protocol is given effect via the *Environment Protection (Sea Dumping) Act 1981* (the Sea Dumping Act), which applies to all Australian waters. All at-sea placement of material is prohibited, however, permits may be issued to allow the placement of specified materials. Clean dredged material may be permitted for at-sea placement under certain strict conditions.

All States and the Northern Territory also have independent governance and regulations relating to dredging and placement of dredged material.

These laws and conventions are designed to make sure that dredging activities are properly assessed and managed and that unacceptable impacts to our natural environment are avoided.

Ecologically Sustainable Development

The National Strategy for Ecologically Sustainable Development, endorsed by all Australian jurisdictions in 1992, defined the goal of ecologically sustainable development as: *"development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends"*. [7]

The following principles of ecologically sustainable development are outlined in the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999*:

1. Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations (the 'integration principle');
2. If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation (the 'precautionary principle');
3. The principle of inter-generational equity – that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations (the 'intergenerational principle');
4. The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making (the 'biodiversity principle'); and
5. Improved valuation, pricing and incentive mechanisms should be promoted (the 'valuation principle').

Port managers recognise these principles of ecologically sustainable development and strive to adopt these principles through this Code of Practice and in the delivery of dredging programs.

Table 1 provides the key elements of the Code of Practice. The relationship between the various elements of the Code of Practice is indicated in Figure 1.

These principles are applicable to all ports and dredging operations, however, the manner and scale in which they may be delivered will vary to suit the specific port, the scale of the dredging program and the environmental risks that are relevant.

A program may be a large (capital) dredging project with one or more dredging campaigns or an ongoing/long-term maintenance dredging schedule with continuous or periodic dredging every 1, 3 or 5 years or as needed. Application of this Code of Practice will vary to best meet the needs of the port, the local environment, the stakeholders affected and the type of dredging being undertaken.

Sensitive Environments

Many Australian ports are located in or adjacent to high value sensitive environments. Many of the coastal areas, estuaries, rivers and bays where ports are located also support areas and ecosystems that are important to maintaining environmental health, fish nurseries, fauna breeding and other environmental functions. These areas include wetlands, tidal flats, mangroves, coral reefs, seagrass beds etc.

Many of these areas are recognised and protected nationally and internationally, such as:

- World Heritage properties
- International (Ramsar) or national listed wetlands
- National heritage sites
- Threatened species habitats
- National parks, marine reserves and other conservation areas
- Fish habitat zones.

The value and status of surrounding environments is a key consideration for ports when designing and implementing dredging programs. The presence of sensitive environments may influence the dredging design, timing and material placement options available. For example, there is a mandatory prohibition on the disposal of capital dredging material in the Great Barrier Reef World Heritage Area, while in other situations there may be exclusions to avoid important lifecycles events for marine species (e.g. coral or fish spawning events).

Table 1: Code of Practice elements for the environmental management of dredging

ELEMENT	SUMMARY
Environmental Awareness	Ports are committed to ensuring dredging programs are informed by an understanding of environmental values that may be affected by dredging and dredged material relocation.
Environmental Risk Assessment and Management	Ports are committed to the assessment and management of environmental impacts of dredging programs. This involves applying risk evaluation, monitoring and adaptive management approaches.
Avoidance, Mitigation and Offsets	In all aspects of the planning, execution and management of dredging, ports apply the environmental management hierarchy of avoid, mitigate and offset.
Dredged Material Relocation	Ports are committed to evaluating all viable options to minimise social and environmental impacts in the relocation or reuse of dredged material.
Dredging Operations	Ports are committed to the highest standards of environmental management utilising industry leading practices, fit for purpose equipment and site relevant environmental protection measures.
Monitoring	Monitoring plays an important role in the adaptive management of dredging programs and in informing future planning and project execution. Ports are committed to ensuring that management decisions are based on the most recent and relevant scientific information.
Consultation	Stakeholder input is important in the design and execution of successful dredging programs. Ports are committed to the implementation of effective, transparent and timely engagement and communication with stakeholders interested in or affected by dredging programs.
Compliance	Ports are committed to ensuring that all legal and regulatory requirements are fulfilled when planning and undertaking dredging programs.
Transparency and Accountability	To demonstrate performance and broaden the understanding of dredging activities, ports commit to making information publically available and sharing information on dredging programs.
Research and Innovation	Ports are committed to ongoing research and innovation that will improve our understanding, performance and environmental stewardship associated with dredging. Ports also appreciate that research can contribute to the broader public good by building on our collective knowledge base.

Figure 1: Relationships between the various elements of the Code of Practice

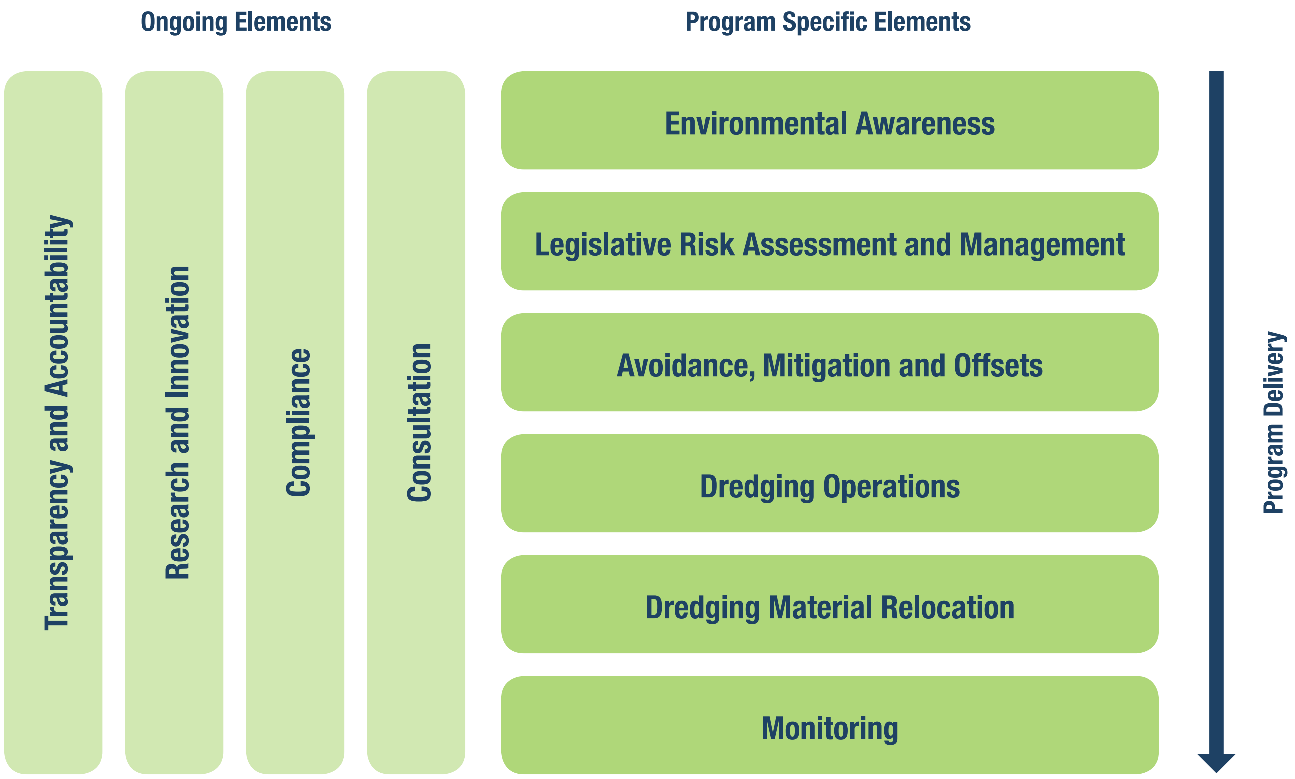


Photo courtesy of Ports North (Cairns).

PORTS AND DREDGING

Ports are vital to maintaining and growing the Australian economy, enabling the export of our agricultural, mineral and manufactured commodities and imports such as food, fuel, cars and household goods that support our way of life. The importance of ports is recognised in the National Ports Strategy[1] and related transport legislation and regulations.

Ports Australia strongly believes that port growth can continue while also ensuring important environmental and social values are protected. Ensuring that an appropriate balance is achieved is a primary aim that is supported by robust monitoring and good port master planning.[8]

Dredging is an essential part of port operations. Dredging is an expensive activity and is undertaken only where absolutely necessary.

Most ports are located in sheltered, shallow inshore areas and have constructed channels and berths that provide safe access for vessels. These channels initially need to be constructed and then often require periodic routine maintenance to remove sediment that naturally accumulates in the deeper channels.

Types of Dredging

There are primarily two types of dredging.

1. The removal and relocation of natural previously undisturbed seabed to increase water depth for shipping channels, swing basins and berth pockets; known as capital dredging.
2. The removal of mobile natural sediments that settle into existing channels, basins and pockets to ensure continued safe navigational movement of vessels and port operations; known as maintenance dredging.

Capital dredging

Capital dredging is required to create new or expand existing transport infrastructure such as channels, swing basins and berths and has occurred at almost all Australian ports since their establishment.

Most ports are located in naturally shallow areas and periodic channel and berth widening and deepening is necessary to ensure ports can accommodate:

- the increasing numbers of ships trading with Australia associated with ongoing trade growth. Increases in ship numbers often result in a need to undertake dredging to increase channel widths or development of passing lanes to maintain safety, create new berths and swing basins; and
- the larger ships that form an increasingly greater proportion of the global shipping fleet.[4] Larger ships are used to achieve economies of scale that result in reduced shipping costs and hence cheaper trade. Relying on smaller ships would lead to additional import/export costs, more shipping traffic and ultimately an undersupply of suitable ships as smaller, older vessels are decommissioned. The use of older and smaller vessels will also potentially lead to poorer environmental performance due to increase shipping movements, increased noise, poorer emission controls and navigational risks (breakdowns, collisions and groundings).

Capital dredging typically involves a range of sediment types including sands, clays, silts, gravel and solid rock. Some of this material, particularly sand and rock, may be suitable for re-use.

Failure to undertake capital dredging and provide new or deeper channels, swing basins and berths will result in lost trade opportunities and inefficient port operations, with direct economic and social costs to business and the community.

Maintenance dredging

Dredging to maintain navigational waterways is an essential part of port operations in Australia. It is needed to remove sediments that accumulate in shipping channels and berths having been transported naturally by waves, rivers, coastal currents and tides.

Channel depths must be maintained to allow ships safe access.

Maritime authorities monitor channels and berths to ensure that the designated safe depths and under keel clearances are available for safe movement of all vessels. When depths begin to decrease a maintenance dredging program will be planned and implemented.

Figure 2: Typical shipping channel terms and depths

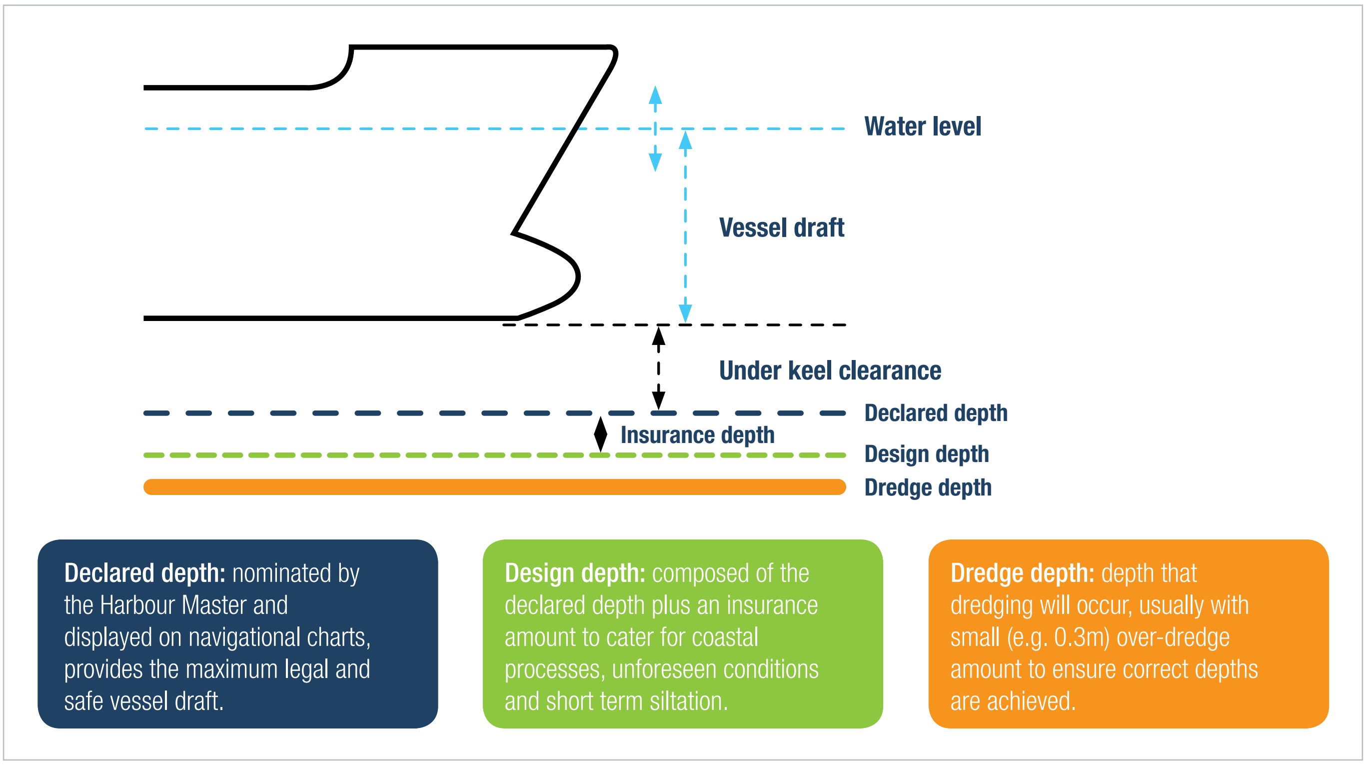


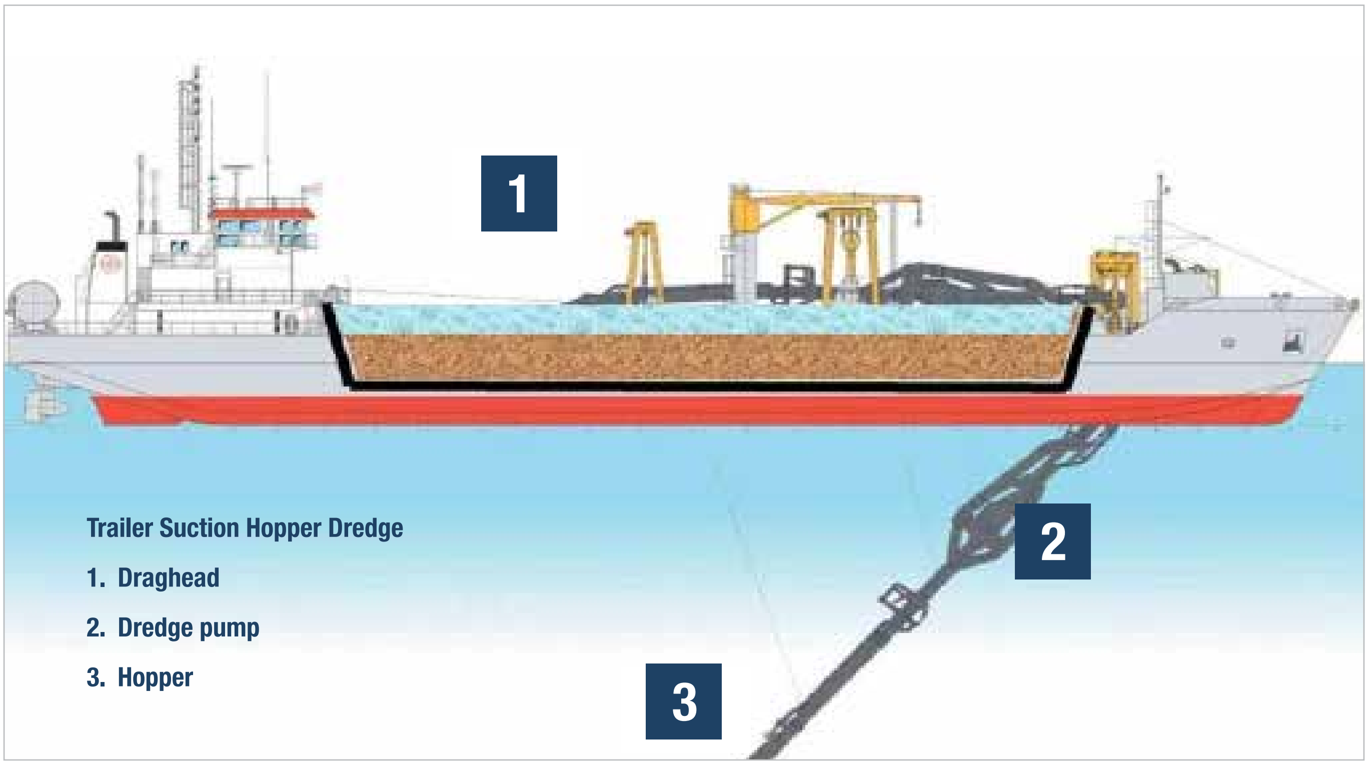
Figure 2 presents the basic profile of a shipping channel and the key terms used to describe channel depths. These depths are needed to maintain safe vessel movement and provide for the variation encountered in channel design, siltation and vessels motion due to tides, waves, wind and weather events. In some ports channel areas do not require maintenance dredging or only require infrequent maintenance dredging as they are naturally deep and sediment accumulation rates are low.

In most cases, however, maintenance dredging is undertaken on a regular basis. This can vary from continuous dredging to periodic works that occur once every few years or less frequently. The frequency and volume of material to be dredged depends on the rate of sediment build up caused by climatic conditions (e.g. land based sediment runoff, winds, currents). This can be substantial after extreme weather events such as cyclones or floods.

Ports could not function without maintenance dredging. Channels and berths would silt up and ships could not carry full loads. The cost of importing and exporting goods would increase and shipping would be highly inefficient. Eventually the associated additional costs would be borne by the community and in extreme cases a port would be forced to close.

Almost all material from port related maintenance dredging is relocated to offshore material placement areas. These designated areas are carefully located away from sensitive areas such as coral reefs, seagrass beds or areas of commercial or recreational use. In many cases maintenance dredged material is high in silt and clay content, making it unsuitable for reuse. In a few instances where the material is suitable, ports are reclaiming land and maintenance material is placed in bunded areas that will be subsequently consolidated into useable land. In many ports this is not possible[9] as any suitable nearby areas are occupied having been historically developed for residential or commercial uses, or because they are of high cultural or environmental value (e.g. mangrove wetlands, fish nursery areas, beaches).

Figure 3: Cross section of a Trailer Suction Hopper Dredge



Dredging Equipment

There are many types of dredgers that have been developed for different conditions and jobs. Some are highly specialised while others are more generic and can be used in a variety of circumstances.

Hydraulic dredgers, commonly used for maintenance dredging, remove loosely compacted materials using hoppers or hydraulic pipelines. Mechanical dredgers remove loose or hard compacted materials by backhoe or clamshell (grab). In Australia, trailing suction hopper dredges and large cutter suction dredges are most frequently associated with the dredging of large volumes of materials, while smaller volumes are removed by small cutter suction dredges, grab and backhoe dredgers. Figure 3 provides a generic profile and key components of a Trailing Suction Hopper Dredge.

Photo courtesy of Southern Ports Authority (Albany).

THE PRINCIPLES EXPLAINED

Environmental Awareness

Ports are committed to ensuring dredging programs are informed by an understanding of environmental values that may be affected by dredging and dredged material relocation.

An informed understanding of the environment potentially affected by dredging and the relocation of dredged material is essential to effective environmental management.

Australian ports seek to have a comprehensive appreciation of their environment and use scientific monitoring and research to obtain an understanding of the:

- condition of the environment;
- historical trends;
- natural variation; and
- impacts from other human activities.

Ports often engage independent organisations (e.g. universities, CSIRO, specialist consultants) to undertake environmental surveys and monitoring and routinely provide this information to stakeholders interested or involved in the management of the port or surrounding areas.

Environmental Risk Assessment and Management

Ports are committed to the assessment and management of environmental impacts of dredging programs. This involves applying risk evaluation, monitoring and adaptive management approaches.

The port industry incorporates environmental risk assessment and management into its planning and execution of dredging activities.

Understanding potential risks from dredging is the foundation on which all dredging management is based. Each dredging program will have different risks and site-specific features; accordingly each program is individually designed.

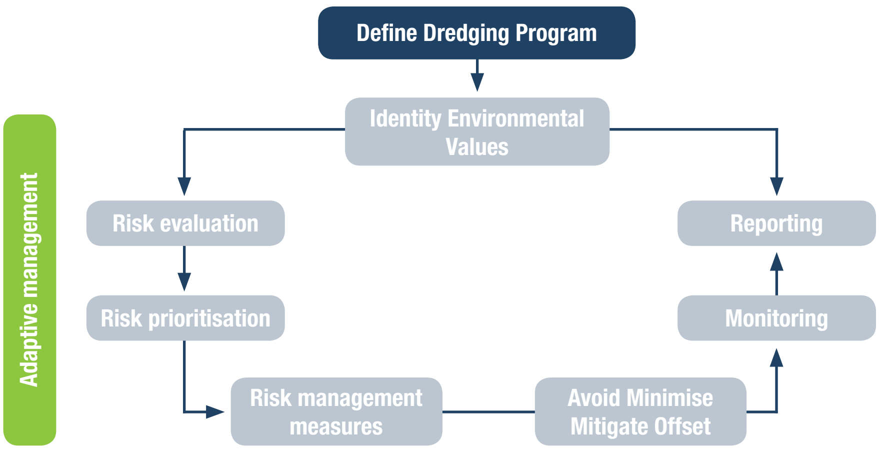
The design of a program involves the identification of:

- environmental values present at a port and surrounding areas;
- risks that may create detrimental impacts;
- the size and duration of the proposed dredging program;
- dredging methods and mitigation measures to avoid and reduce impacts; and
- adaptive management strategies that incorporate monitoring results.

Importantly, risk based management approaches adopted by ports take into account the results of previous and ongoing monitoring programs.[5]

To ensure consistent and proper application of risk based adaptive management, ports utilise data on nearby environmental resources and adopt formalised environmental management systems, as shown in Figure 4.

Figure 4: Application of adaptive and risk management process



The risk of impacts from dredging and material placement will vary depending on the type of dredging (maintenance or capital); the type of material to be dredged; the volumes and duration of dredging; and the local environment at the dredging and placement location. A variety of management practices are utilised by ports to address the environmental risks associated with dredging and dredged material disposal.

Regulatory agencies have guidelines that specify the risk assessment, modelling and management techniques to be adopted.[10,11] Once the likelihood and consequence of possible impacts are known and the physical characteristics of the dredged material are understood, appropriate avoidance, mitigation, management and monitoring programs can be developed.

Issues commonly considered in the environmental assessment of dredging projects are outlined below.

Photo courtesy of Southern Ports Authority (Albany).

Turbidity plumes and sedimentation effects

Dredging and dredged material relocation will cause sediment to be introduced to the water column (turbidity) and impacts may result as these sediments spread and resettle (sedimentation).

Sediments suspended by dredging activities result in turbidity plumes that may be transported by currents to adjacent areas. Turbidity plumes and sedimentation rates vary depending upon the type of dredging and the type of material being dredged. Impacts from increased turbidity can include reduction in light to marine plants and smothering from sediment deposition.

Monitoring of maintenance dredging has shown that impacts are typically short term and localised with plumes being confined to the channels, berth and nearby areas.[9]

Turbidity modelling in Australia is an advanced science and actual impacts have been consistent with or less than predicted impacts.[5] Many inshore areas regularly experience natural short-term periodic increases in turbidity and sedimentation (e.g. due to tidal currents or river discharges). In many cases, effects attributed to dredging by some stakeholders may in fact be associated with natural events such as storms, floods and, in tropical areas, cyclones.[12] The impact of turbidity plumes and associated sedimentation or changes in light penetration must be considered in the context of natural levels and weather events.

Water quality

Potential impacts to water quality are closely associated with the turbidity issues outlined above. A risk-based approach to the management of water quality is the most effective process.[9] This involves assessing the risks to environmental values from changes to water quality and developing mitigation measures to reduce those risks (e.g. selection of appropriate equipment, timing dredging to coincide with specific weather conditions).

In larger capital dredging projects this involves hydrodynamic modelling to estimate changes in turbidity or suspended sediments. A variety of climatic scenarios (e.g. certain wind strengths and directions) and dredge operational activities are assessed. This information is then combined with data on the location of environmental values to help predict what impacts may result. Impacts to water quality from maintenance dredging are generally better understood given the ability to refer to previous monitoring of similar works and because volumes and dredging durations represent a lower risk than capital dredging.

Table 2: Dredging related application of environmental management hierarchy

STEP	EXPLANATION
AVOID	The first step in the management hierarchy used by ports is to adopt practices that will prevent or avoid environmental impacts. Options often considered in relation to dredging include: • designing the location and profile of channels to reduce the need for capital and subsequent maintenance dredging. • ensuring that dredging and disposal activities are conducted at a time of the year to avoid impacts to sensitive species or critical life-cycle stages (e.g. coral spawning). • detection and avoidance of marine fauna (whale, dugong etc.).
MITIGATE	The second step in the hierarchy is to adopt practices to minimise and reduce impacts. Examples may include: • selection of dredge equipment specifically to reduce plume extent and the duration of dredging; • the use of specialised equipment (e.g. turtle excluding devices); • detection of management thresholds (generally related to water quality) that trigger certain management actions to prevent or minimise ecological impacts.
OFFSET	The final step is to adopt practices that address any significant residual effects via an environmental offset that compensates for significant impacts and provides for an equivalent or better (net benefit) environmental outcome. Offsets are generally only necessary for large capital dredging projects, examples include: • Penrhyn Estuary rehabilitation at Port Botany.[14] • Sandringham Bay fish restoration project associated with the Port of Hay Point. In some cases a financial contribution to research or broader environmental management or enhancement program may be an appropriate form of offset.

Sediment quality

Ports conduct comprehensive studies to determine if sediment proposed for dredging contains any harmful contaminants. This testing is done in line with Australian Government guidelines for the sampling and testing of sediment.[13] These guidelines are recognised internationally and were developed to meet industry and government standards. The guidelines aim to ensure that only material assessed as suitable is placed back in the marine environment. The guidelines outline a recommended sampling regime and the use of accredited analytical laboratories to assess contamination levels in sediments.

Additional environmental aspects

In addition to the assessments outlined above, there are a variety of additional environmental aspects that ports consider in the planning and execution of dredging and dredged material placement. Considerations include:

- direct loss of marine plants (e.g. seagrasses or mangroves);
- impacts to marine fauna (fish, whales, dolphins, turtles, dugongs, benthic (bottom dwelling) invertebrates etc.);
- fishing and other coastal activities;
- cultural heritage;
- emissions (e.g. contamination, air quality, noise);
- navigation and shipping safety; and
- changes to coastal currents and water flows.

Avoidance, Mitigation and Offsets

Ports are committed to ensuring dredging programs are informed by an understanding of environmental values that may be affected by dredging and dredged material relocation.

The avoid, mitigate and offset approach is a globally acknowledged environmental management framework.[17] The application of this approach by ports to dredging programs is described in above Table 2.

Photo courtesy of Port Authority NSW (Port Kembla).

Dredged Material Relocation

Ports are committed to evaluating all viable options to minimise social and environmental impacts in the relocation or reuse of dredged material.

In accordance with international and national legislation and guidelines, the selection of dredged material relocation solutions is based on an evaluation of all viable options.[13]

Decisions are guided by various considerations, including:

- sediment type and contamination levels;
- suitability and availability for re-use (beach nourishment, coastal rehabilitation, land reclamation, construction);
- environmental impacts;
- land or sea area relocation availability and suitability; and
- engineering, economic and social implications.

In line with the principles of ecologically sustainable development, careful evaluation is undertaken to determine the best options of where to relocate dredged material and the long-term consequences of each option. In many instances there are limitations to what option can be feasibly selected. The broad options are summarised below.

Reuse

The reuse of dredged material is dependent on the type of material, the location and local demands. At different times and locations dredged material has been used for:

- reclamation or landfill (refer land based placement section below);
- agriculture;
- environmental enhancement;
- providing fill/sand for the construction industry;
- production of building materials (concrete, bricks etc.); and
- beach nourishment.

Use of these options can be limited due to a lack of demand, transport distances, land availability and material type. In addition,

Table 3: Common considerations in land placement of dredged material

ISSUE	CONSIDERATIONS
SITE SELECTION	Locating a suitable site requires a large area (often 100s ha) to accommodate the volume of material typically involved. Large areas of suitable flat coastal land are often limited and are often used for residential, commercial purposes or have environmental constraints. The site needs to be within a viable distance from the point of dredging.
WATER QUALITY	Material pumped ashore has a high water content that has to be discharged into nearby waterways or back into the ocean. Substantial areas are required for settlement ponds and their management can be complex, particularly in wetter climates. Dredged material is saline and disposal on land can have adverse impacts on the local and regional groundwater aquifers and associated vegetation communities.
DRYING	Material needs to be dried and consolidated to a stable form before the disposal area can be used for another purpose or the material relocated. The period required to dry the material using natural processes depends upon the thickness of the placed material and the climatic conditions (especially rainfall), and may take many years (potentially decades). Options are available to enhance drying rates (e.g. chemical thickeners, surcharging, sand and wick drainage).
ACID SULFATE SOILS	Many types of sediment associated with capital dredging projects contain Potential Acid Sulfate Soils. Specific management techniques need to be adopted to avoid impacts should such material be placed on land.
LONG-TERM MANAGEMENT	The design and construction of bunds and settlement ponds has associated risks (as with any engineered structure). Whilst these can be managed, there is longer-term risk associated with storing large volumes of dredged material on coastal land due to the potential for failure of bund walls and release of stored material, particularly during extreme weather events. Selection of sites used to store dredged material needs to consider the implications for long term management, including the integrity of engineered structures, monitoring and safety of operational staff and the public.

in Australia dredged material is almost always mixed with high levels of salt water that needs to be removed before the material can be used, this may involve extensive efforts, costs and time to dry or treat the material to make it suitable.

Maintenance dredging material typically involves fine-grained materials (e.g. silts or mud), which have limited reuse potential given the poor engineering quality. The reuse potential of sands and gravels is greater and some capital dredging projects may involve sediments with a high proportion of sands. Options for beneficial use can be limited due to the physical properties of the sediments and the lack of available land for drying out the dredged material to enable it to be transported and used elsewhere.[15]

Land based placement

Land-based relocation is a viable option in some circumstances and involves placement of material in a dedicated storage area or reclamation area.

Disposing of large volumes of dredged material on land presents a range of site selection and environmental issues, some of these are outlined above in Table 3.

At-sea placement – use of Dredged Material Placement Areas

At-sea placement is an environmentally appropriate technique to manage dredged material and involves the use of a specific, carefully selected location. A review of International Best Practice Port Development commissioned by the Australian Government concluded that ocean disposal is the most common practice internationally.[16]

Dredged material placement areas are an essential part of port infrastructure and most ports have an approved offshore site where dredged material is relocated. Sites are selected based on:

- the physical environment (e.g. depth, seabed and sediment types, tidal flows and currents);
- the biological environment (e.g. avoidance of coral reefs, seagrasses, rocky reefs, key fish habitats etc);
- economic and operational feasibility (e.g. distance to port, size, capacity); and
- other users within the area (e.g. shipping lanes, recreation, fisheries, military, historic/heritage).

Studies in northern Australia show that the recovery of material placement areas typically occurs quickly, usually within 6-12 months.[5]

Dredging Operations

Ports are committed to the highest standards of environmental management utilising industry leading practices, fit for purpose equipment and site relevant environmental protection measures.

The execution phase of a dredging and relocation activity involves the implementation of a range of environmental management measures. Dredging operations are informed by the earlier planning work, including hydrographic surveys, identification of priority areas, and selection of dredging techniques and equipment.

An Environmental Management Plan (EMP) is usually used to guide dredging operations. EMPs are a standard approach in most construction and industrial activities. Dredging EMPs generally contain:[17]

- a description of the dredging activity;
- roles and responsibilities;
- details of the environmental values and risks;
- prescribed avoidance and "no go" areas/activities;
- selection and use of appropriate dredging equipment for the activity being undertaken;
- environmental management measures, controls and performance targets;
- environmental management maps and diagrams;
- monitoring activities and trigger levels (where appropriate);
- corrective actions and non-compliance reporting;
- timing schedules; and
- evaluation and reporting procedures.

For ports with ongoing or frequent maintenance dredging needs, a long-term dredging management plan may be used for multiple dredging activities over a 5 or 10 year period. These plans are regularly reviewed and updated based on monitoring results and feedback.

Monitoring

Monitoring plays an important role in the adaptive management of dredging programs and in informing future planning and project execution. Ports are committed to ensuring that management decisions are based on the most recent and relevant scientific information.

Operational monitoring focuses on the impacts of a specific dredging activity to inform adaptive management and to confirm predictions. Aspects monitored might include: turbidity and water quality; sedimentation rates; the condition of sensitive receptors (e.g. corals, seagrasses); fauna presence; and real time weather conditions and forecasts.

Longer-term monitoring is also undertaken to improve future dredging by improving our understanding of the environment and the natural changes that occur seasonally or over longer cycles. Long-term monitoring to understand background conditions enables better assessment of impacts.

Several Australian ports undertake a range of long-term monitoring programs, often in partnership with universities, scientific institutions, industry and government.[18, 19, 20]

Most programs are designed on the basis of a site-specific risk assessment that considers whether the dredging and dredged material relocation works are likely to pose a risk to environmental values. This risk-based approach to monitoring design is considered leading practice.[16] Where complimentary, monitoring programs are integrated with broader regional monitoring programs where these exist.

Consultation and Communication

Stakeholder input is important in the design and execution of successful dredging programs. Ports are committed to the implementation of effective, transparent and timely engagement and communication with stakeholders interested in or affected by dredging programs.

A key feature of large dredging programs is the provision of opportunities for timely and meaningful stakeholder involvement. The extent of consultation will vary between single capital dredging projects and ongoing maintenance dredging. Input is often obtained through a Technical Advisory and Consultative Committee.[13]

What constitutes effective and appropriate consultation will vary depending on the environmental (or economic or social) values, affected stakeholders and what dredging activities are being undertaken (e.g. ongoing maintenance dredging or a large capital program). Stakeholders who may be consulted could include the local community, traditional owners, terminal operators, local industries, planning authorities, local government and national and state regulatory agencies.

Compliance

Ports are committed to ensuring that all legal and regulatory requirements are fulfilled when planning and undertaking dredging programs

Dredging and dredged material placement are subject to detailed and complex regulatory approval processes under international conventions, and national and state/territory legislation.

Australia is a signatory to the London Protocol[21], a global convention that aims to 'protect and preserve the marine environment'. Under the Protocol, member nations may allow the placement of certain materials in the marine environment (including dredged material), subject to certain conditions.

For routine works (e.g. ongoing maintenance dredging of ship berths), the approval process may require a focussed description of the nature of proposed works and potential impact processes. Mitigation requirements may be minor given the low level of impacts and the absence of nearby sensitive environmental values. Monitoring of potential impacts may occur periodically as the impacts are not considered of significant concern and are well understood.

Photo courtesy of Wayne Young.

Projects that have the potential to result in more significant impacts, such as large capital projects, typically require a detailed environmental impact assessment, often in the form of an Environmental Impact Statement (EIS) or similar report. The assessment is based on a terms of reference prescribed by regulators consistent with the environmental management hierarchy, London Protocol and the National Assessment Guidelines for Dredging (NAGD).[13]

The NAGD is recognised internationally as an industry-leading guideline that provides the framework for the environmental impact assessment and permitting of the ocean disposal of dredged material.

The framework includes:

- evaluating material placement options;
- assessing loading and disposal sites;
- screening of sediments to detect any contaminants that may impact marine life or human health;
- assessing potential impacts on the marine environment and other users; and
- determining management and monitoring requirements.

In most cases, several permits will be required for each dredging program. Each permit or approval will contain a set of conditions to regulate the dredging activity, addressing matters such as:

- timing, volumes and location;
- environmental triggers or prohibitive limits; and
- monitoring and reporting activities.

This framework of legislation, approvals and condition setting is implemented to protect the environment, meet community needs and expectations of transparency and accountability and enable dredging and material placement to be undertaken responsibly and effectively.

Transparency and Accountability

To demonstrate performance and broaden the understanding of dredging activities, ports commit to making information publically available and sharing information on dredging programs.

Transparent and open information sharing is important to improve knowledge and to understand community values, client needs and government expectations. Communication and reporting is an important component of this, to demonstrate performance and provide for community accountability.

Ports aim to provide the public with transparent and understandable information on the impacts of dredging operations either through project specific reports, annual reports or through Ports Australia publications.

Research and Innovation

Ports are committed to ongoing research and innovation that will improve our understanding, performance and environmental stewardship associated with dredging. Ports also appreciate that research can contribute to the broader public good by building on our collective knowledge base.

Ports continually examine ways to improve performance and develop alternatives that may deliver better site-specific solutions than previously applied measures. In this way, innovation, whether technical, scientific or in management, is encouraged and tested.

The development of port master planning guidelines[8] that can assist ports deliver enhanced master plans is a contemporary example that can provide increased investment confidence and greater transparency for all stakeholders.

Ports do not operate in isolation when it comes to innovation and research. Ports collaborate and partner with a range of scientific, commercial and government organisations to trial new approaches and conduct research into dredging activities.

Through its national body, Ports Australia, the industry has various forums, including working groups and annual conferences, for sharing information on the latest science and management, both nationally and internationally. This information is regularly released publically through published reports, public enquiry submissions and conference proceedings.[5, 8, 2]

REVIEW AND REPORTING

Ports Australia will monitor the effectiveness of the Code, guided by Australian Standard AS3806 (the Australian Standard on Compliance Programs). This information will form the basis for a biennial report to the Ports Australia Board, which will also be published on the Ports Australia website.

A full review of the Code will be undertaken at five yearly intervals to ensure that the Code is relevant, up to date and that it continues to meet industry and stakeholder expectations. This review will focus on the effectiveness and relevance of the Code against current industry leading practice globally and regulatory requirements nationally.

Photo courtesy of Fremantle Port.

GLOSSARY

Term/Acronym	Definition and usage in this Code of Practice
Capital dredging	The removal of natural seabed to create or increase the depth and/or width of shipping channels, swing basins and berth pockets
Dredging	A common usage term used to refer to the extraction of seabed to create or maintain ship passage, channels, berths and swing basins.
Dredging program	Refers to the broad range of dredging and material relocation activities undertaken. This may include a large (capital) dredge project with one or more campaigns; and/or an ongoing/long-term maintenance dredging schedule with continuous or periodic dredging every 1, 3, 5 or even 10 years.
Dredging project or activity	Refers to a single dredging event that may form all or part of a dredging program.
EMP	Environmental Management Plan
DMPA	Dredged Material Placement Areas
London Protocol	Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 and 1996 Protocol.
Maintenance dredging	Removal of sediments that accumulate in existing channels, berths and swing basins to enable ongoing use of the port.
NAGD	National Assessment Guidelines for Dredging
Port	This term is used to describe both the: physical harbour area where ships are docked for loading and unloading of cargo; and for the authority or corporation that administers the use of the wharves, berths and terminals within the port area.
Relocation (of sediment)	Refers to the pumping, shipping, barging of dredged seabed material to an alternative placement location
Placement (of sediment)	The dumping, unloading or pumping of seabed material into a selected location, bunded pond, reclamation area etc.
Sediment	Seabed material that may be composed of one or more of: sand, silt, mud, gravel and/or rock.

NOTES

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5 Morton and Sprott 2013. Dredging and Australian Ports Subtropical and Tropical Ports, Ports Australia. http://www.portsaustralia.com.au/aus-ports-industry/publications/

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12 SEWPaC 2013. Independent Review of the Port of Gladstone – Report on Findings – July 2013. Report prepared by Commonwealth Department of Sustainability, Environment, Water, Population and Communities. http://www.environment.gov.au/marine/gbr/port-gladstone-review

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16 GHD 2013. Environmental Best Practice for Port Development: An analysis of International Approaches. Report prepared for the Department of Sustainability, Environment, Water Population and Communities, Canberra, Australia.

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18 Queensland Ports Seagrass Monitoring https://research.jcu.edu.au/tropwater/resources/queensland-ports-seagrass-monitoring

19 Port Cutis Integrated Monitoring Program. http://www.pcimp.com.au

20 http://www.wamsi.org.au/dredging-science-node

21 International Maritime Organization (IMO) (1996) Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 and 1996 Protocol. http://www.imo.org/About/Conventions/ListOfConventions/Pages/Convention-on-the-Prevention-of-Marine-Pollution-by-Dumping-of-Wastes-and-Other-Matter.aspx

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