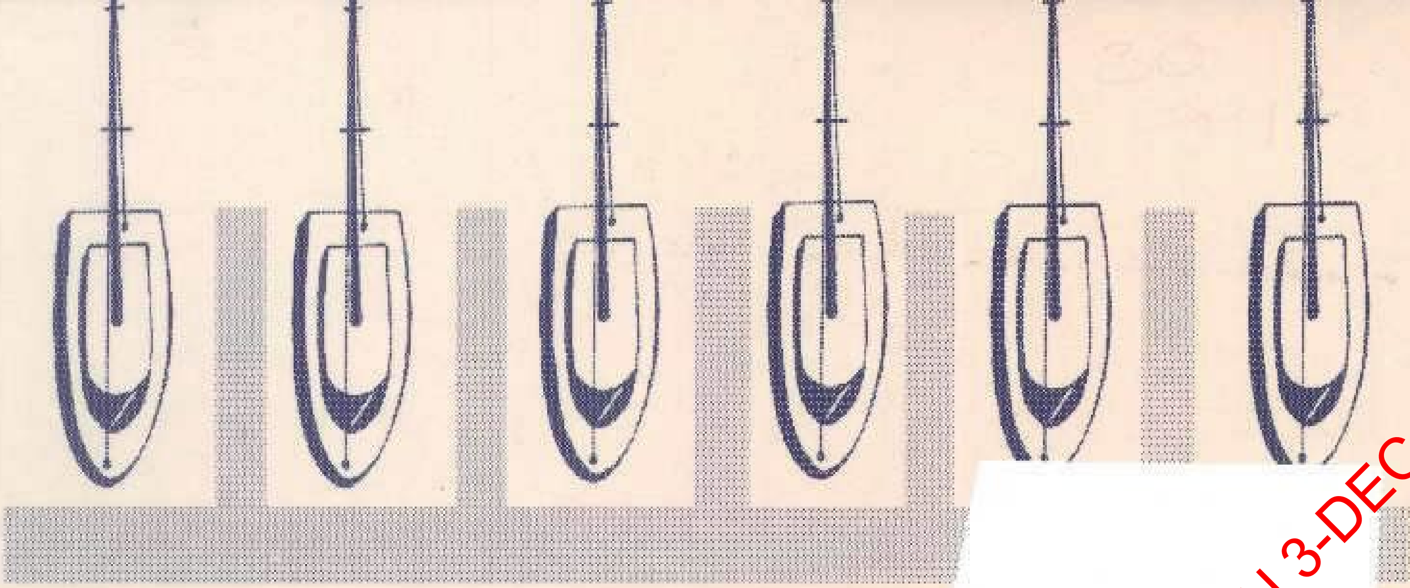

Environmental Guidelines for Marinas in the Great Barrier Reef Marine Park

Great Barrier Reef Marine Park Authority

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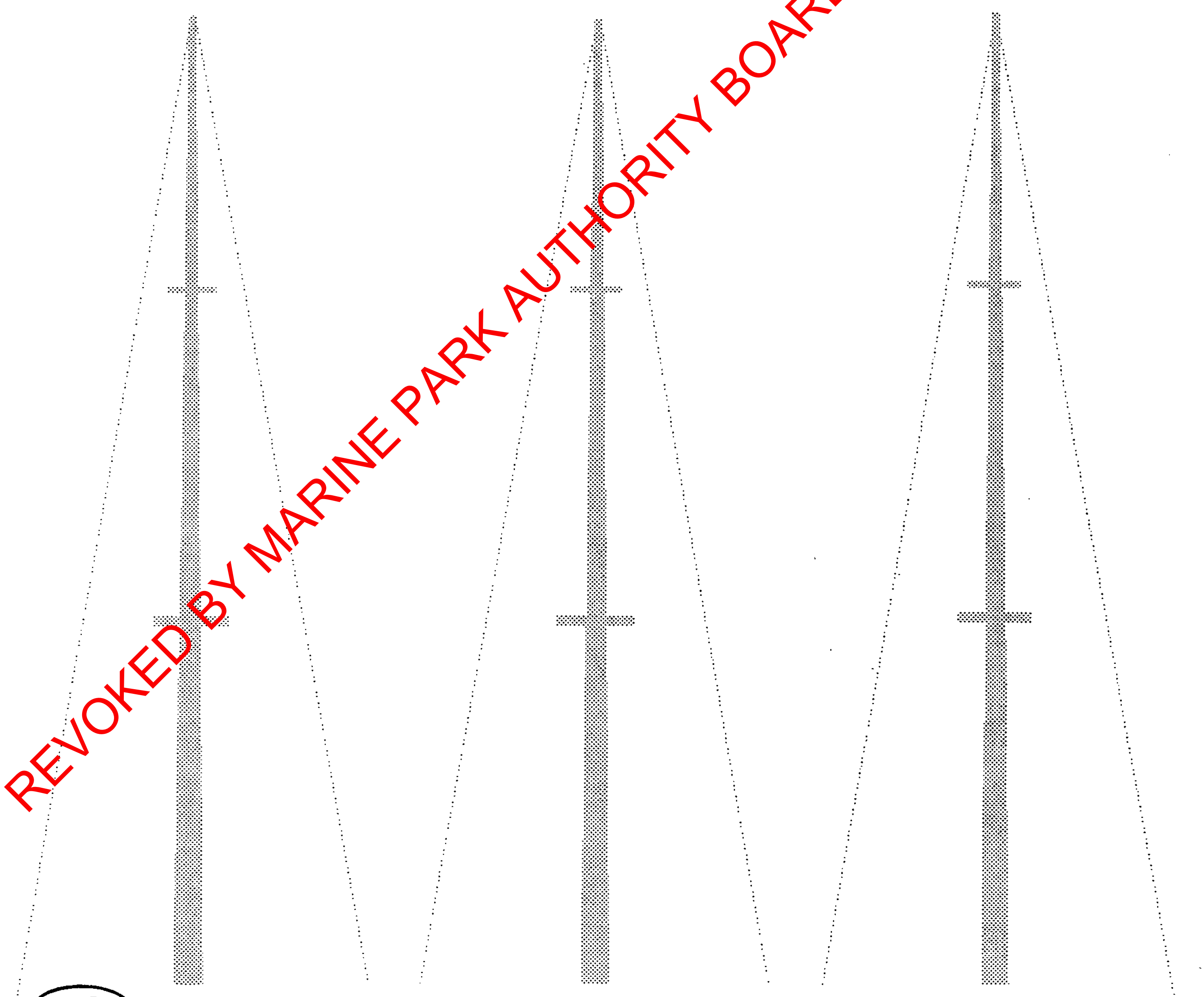
Edited by Michael Bugler with assistance from Sinclair Knight & Partners



Great Barrier Reef Marine Park Authority

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DISCLAIMER

This document has been prepared to provide guidance on aspects of the design, construction and operation of marinas in the Great Barrier Reef region. A wide range of physical, ecological and social environments exist within this region. Therefore these guidelines cannot be considered comprehensive for any specific development or aspect/s of a particular development. This document does not purport to be a complete guide on any subject. Independent technical advice should be sought on all matters covered by the document and the editor accepts no responsibility for any reliance placed on the document. Also, at each stage of a proposed development, relevant Commonwealth, State and Local government authorities should be consulted. These authorities and their responsibilities have been identified throughout this document where possible.

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FOREWORD

The Great Barrier Reef is the largest and most diverse coral reef ecosystem in the world. Most of the Great Barrier Reef region has been proclaimed as a Marine Park and inscribed on the World Heritage List in recognition of its global significance, and of the need to ensure its integrity for future generations.

The Great Barrier Reef Marine Park is a multiple-use park, one where many different activities are managed to minimise conflicts between users and degradation of the environment.

Marinas are one such use for the Marine Park and adjacent areas. As with so many other activities, marinas have the potential to create environmental, economic and social conflicts - the challenge for resource managers is to ensure that proposed marinas do not have significant impacts on the Great Barrier Reef Marine Park.

The Great Barrier Reef Marine Park Authority is the key Commonwealth agency responsible for management of the Great Barrier Reef Marine Park and has as its motto 'Ours to use wisely'. 'Wise use' is a resource management concept with many facets. A proposal must be seen to be socially desirable, safe, technically feasible and competent, economically viable and cognisant of ecological constraints before it could be deemed to show 'wise use' of our natural resources. With proper planning and implementation, marinas can be a 'wise use' of our coastal environment.

Experience has shown that there is a clear need for all parties involved in the planning, design, assessment and construction of marina developments to gain a thorough appreciation, prior to commencement, of the implications of embarking on a particular development. The need to do so is made all the more compelling due to the detailed, possibly time consuming procedures that may need to be followed to enable assessment of a proposal. These guidelines are a broad set of criteria designed to facilitate the planning and assessment of marinas. Strict adherence to these guidelines does not guarantee that approval will be forthcoming, but rather this document should be treated as a resource to provide generic guidance on matters that may help to minimise unnecessary environmental impacts arising from the construction and operation of marinas.

Judicious use of this document will assist a developer about to submit a marina proposal, and will facilitate an assessment of marina proposals by Authority staff. This document is therefore a planning and assessment tool, one which should lead more quickly to appropriate resource management decisions.

Graeme Kelleher

G. Kelleher
(Chairman)

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1.0 INTRODUCTION

1.1 Objectives

The primary objective of this document is to help with the implementation of 'environmentally friendly' marinas in the Great Barrier Reef region. Environmentally friendly' means having minimal detrimental impact on the physical, biological, cultural, social and built components making up our environment. This document should generally be seen as complementary to, rather than as a substitute for, 'Australian Standard AS3962-1991, Guidelines for Design of Marinas' (AS3962-1991).

This document is directed at two types of reader: a) staff of the Great Barrier Reef Marine Park Authority and State and Local Government agencies who have responsibility for the assessment of marina proposals and permit applications in the Great Barrier Reef region, and b) marina developers and their agents who desire to establish a marina within the Great Barrier Reef region.

This handbook provides background information on terminology and, for a wide range of specific issues, provides discussion and rationale leading to technical guidelines and recommendations. By so doing, it is hoped this document will assist developers and assessors in appreciating implications of marina development; will provide an overview and appreciation of the role of environmental legislation that affects marinas in the Great Barrier Reef region; and result in incorporation of environmental considerations early in the marina planning process.

This handbook is directed at the siting, design and development of the most common type of marina - commercial marinas for recreational boats up to 20 metres in length. Much of the material provided here has broader applicability, however specialised situations such as fishing vessel moorings, game fishing boat marinas, racing yacht marinas and museum boat marinas may need to encompass other specific considerations such as crowd loadings on walkways, car parking for spectators and specialised maintenance and handling facilities. Those aspects require individual assessment.

The subject matter in this handbook has been made as wide-ranging as possible. However, some aspects of maritime engineering and planning are complex and it is not practicable to present discussion on all subjects in a simple manner. Topics such as breakwater design, structural design of marina components, experimental design for baseline and other monitoring programs and environmental and planning legislation are the domain of qualified professionals, who should be referred to as required.

It is proposed that this handbook will be reviewed periodically and amendments or additions be published. These reviews will cover changes in design philosophy, legislation or technical knowledge.

1.2 Use of this Handbook

This handbook should be the first reference sought by Great Barrier Reef Marine Park Authority staff or developers who are about to embark upon an assessment of, or a concept design for, a marina respectively. For developers, it should be used as a guideline along with other relevant guidelines available from Commonwealth, State and Local governments.

Organisation of this handbook provides the user with a stepwise approach to environmentally sound marina development, with chapters encompassing environmental implications in general, followed by considerations for siting, design, construction and finally, marina operation.

A great deal of the text in this document is presented in a two-column format, with the body of the text in the larger right column and pertinent summary statements in the smaller left column. Those in *italics* are regulations or legislation considered mandatory by the relevant Commonwealth and State bodies. Information on the application and requirements of these legislation should be sought from the relevant administrative department or agency. Statements in the standard type face are considered advisory only.

Appropriate consideration of these guidelines by proponents will be regarded by GBRMPA and State Government as an indication that marina development issues have been earnestly addressed during the planning stages of a proposal. Clear reference should be made in documentation supporting a proposal, to the consideration of these and/or other environmental protection measures. In addition, the marina developer's attention to environmentally sound practices avoiding or minimising adverse impacts of design and construction can help assure the commercial success of the development, since marinas are dependent upon functional, healthy, safe and attractive environments for the recreational services they provide. Minimisation of potential impacts through good planning also reduces the timeframe for approvals, impact assessment costs and monitoring requirements.

The recommendations relating to each subject will be dependent upon individual site conditions, and, to that extent, are a starting point rather than hard and fast requirements. These guidelines or recommendations do not attempt to replace other planning, design and construction regulatory standards in existence for marina developments, but will hopefully complement them, and highlight the environmental implications of some planning and design features. References to appropriate documents are provided for areas that require other regulatory design considerations at a more detailed technical level. Aspects that may require professional assistance are also indicated.

1.3 Definitions

For consistency in the description of marina facilities, the following definitions are adopted in this handbook:

advection

Transport or distribution of material by water over some spatial or time scale. Advection is caused by relatively large scale water movements transporting the given property and thus effecting a local change in concentration.

air curtain

A method for mechanical containment of oil spills and blasting shock waves. Air is bubbled through a perforated pipe, causing an upward water flow that retards the spreading of oil. Air curtains are also used as barriers to prevent fish from entering a polluted body of water and to absorb energy transmitted by blasting shock waves.

anchorage

Area of water, usually protected, in which vessels moor by dropping anchor.

baseline study

A description of the existing ecological conditions and trends in the potentially affected region, providing a reference 'baseline' from which environmental scientists can: (1) predict the effects of the proposed action and recommend alternatives, (2) define appropriate mitigation measures, and (3) design future programs to monitor the accuracy of predictions and the effectiveness of mitigation. A baseline study requires systematic measurements using proven statistical methods and therefore differs from qualitative assessments (e.g. observations) that might be undertaken for preliminary site assessments.

berth

An area of water allocated for the wet storage of boats attached to a structure and allowing for walk-on access. Known also as a **pen**. Boats at marinas generally occupy single or double berths, where a single berth accommodates one boat between finger floats or piles and a double berth accommodates two boats between finger floats or piles.

boom

An extendable or deployable floating device usually used to contain spilled oil or other floating material.

breakwater

A solid barrier constructed in the water to create a sheltered area for boats.

bund wall

A barrier constructed temporarily to enclose and protect a region during construction. Bund walls are often established to enable water to be pumped from a site so that excavation can occur 'in the dry'.

channel

An unobstructed waterway which allows the movement of boat traffic. The entrance channel enables boats to move between the marina and the main waterway (river, bay, etc.) and interior channels within the marina allow boat movement between the entrance channel and the fairways.

channel depth

Depth of water in channel at Chart Datum (usually approximately MLWS but must be checked for each locality).

channel width

Width available for navigation at nominated channel depth (as opposed to width at the water surface, which may be much greater but cannot be utilised by deep draft vessels).

deck freeboard

The vertical distance between the deck of a platform structure and the water surface.

designated development

Development which by its activity, location, or by Local Authority policy, is designated as requiring mandatory environmental impact assessment pursuant to the Local Government (Planning and Environment) Act.

dissolved oxygen

The extent to which oxygen occurs in solution in water or waste water; usually expressed as concentration, in parts per million, or percentage of saturation.

disturbed land

Land that has been altered physically, biologically or chemically by the action of people e.g. land on which excavation has occurred or upon which overburden has been deposited.

diversion ditch/channel

Channel constructed across sloping land for the purpose of intercepting surface runoff, thereby changing the accustomed course of all or part of a stream. Also, a ditch or canal by which water is diverted from one stream to another.

drainage basin

Land surface occupied by a waterway drainage system, which consists of a surface stream or a body of impounded surface water together with all tributary surface streams and bodies of impounded surface water.

dredged basin
An excavated area of a river or harbour deeper than the surrounding waters.

dry storage (dry stack)
Storage of small to medium sized (up to 9 m) boats, generally in a multi-level rack system. Boats are conveyed to and from the water by a fork lift, crane or other device.

ebb flow
The period of receding tidal flow between high tide and the succeeding low tide.

estuaries
Waterways and areas where fresh water meets salt water (e.g. bays, mouths of rivers, salt marshes and lagoons). Estuaries are delicate ecosystems, serving as nurseries, spawning and feeding grounds for a wide variety of marine life and providing shelter and food for birds and other wildlife.

exceedance probability
Probability of a prescribed water level being attained in a specified time period due to extraordinary events e.g. cyclones, storm surges, etc.

fairway
Unobstructed waterways between rows of berths which allow movement between interior channels of a marina and individual berths. A navigable deep-water channel in a river or harbour or along a coastline.

finger
A floating structure connected to the walkway which provides pedestrian access both to and from a berthed boat.

flood flow
The period of advancing tidal flow between low tide and the succeeding high tide.

flotation freeboard
The vertical distance between water surface and the top of the flotation chamber of the pontoon.

flushing time
The measure of the time required to transport a conservative pollutant from some specified location. The volume of the estuary divided by the water flux rate; a useful figure for assessing load capacities.

groyne
A rigid structure, usually rock, built at an angle (usually perpendicular) from the shore to protect it from erosion or to trap sand. A groyne may be further defined

as permeable or impermeable depending on whether or not it is designed to allow sand to pass through it.

hardstand
An open paved area, used for the storage of boats and for maintenance activities such as painting, anti-fouling and repair work.

heavy metals
Metallic elements of high atomic weight, generally toxic to plant and animal life in low concentrations. Such metals can often become residual in the environment and exhibit biological accumulation. Examples are mercury, chromium, cadmium, arsenic and lead.

impact
An environmental perturbation that occurs in an ecosystem as the result of a disturbance. The term `positive impact', in relation to the natural environment, refers to the improvement or re-establishment of a previously degraded environment. In relation to the social environment positive impact refers to an `improvement' of a social situation, such as poverty or deprivation, but must always be used with caution.

jetting
Use of blasts of water and/or air injected in sediment to facilitate placement of pilings and blocks.

land use patterns
Natural or imposed configurations resulting from the spatial arrangement of the different uses to which various plots of ground are put at a particular time.

leaching
Extraction of dissolved or suspended materials from a solid by a liquid.

locked-harbour
Marine harbour that is, or can be, separated from adjacent waterways by a mechanical device such as a lock or tide gate.

marina
Shoreside facilities for mooring and servicing recreational boats, and including water-based as well as land-based facilities for boats and boat-users. Water-based marina facilities include moorings and berths for boats, as well as jetties and pontoons. Land-based marina facilities include the dry or rack storage of vessels, ship chandlery sales, areas set aside for ship repair and maintenance, sail lofts, slipways and hoists (which are both land and water-based), as well as areas for food and boating sales. Small boat harbour or boat bases providing dockage, supplies, and services for small pleasure craft.

mitigation

Specific procedures to reduce or avoid potential adverse impacts.

mixing zone

Zone of initial dilution in the immediate area of a point source of pollution.

monitoring program

A study program for measuring specific parameters designed to detect changes in environmental conditions and to differentiate between natural and human induced conditions. The program often includes extensions of certain aspects of the baseline study program selected for their ability to detect alterations in local ecosystems caused by the project of interest. Monitoring programs are often subdivided into construction, operation and post-operational phases and may be both quantitative and qualitative.

mooring

A detached or free standing structure to which a boat is moored. Several types of mooring exist, including:

Fore and Aft Mooring	anchors or piles to which boats are attached by both bow and stern lines.
Island Mooring (Star)	a floating structure secured by an anchor or a pile to which one or more boats may be moored.
Swing Mooring	an anchor or pile to which a boat is attached to allow alignment with wave, wind or current.
Trot Mooring	a system for the fore and aft mooring of several boats in rows.
Buoy Mooring	single point mooring attached to a floating buoy to which a vessel may be attached.

open marina

Marina designs consisting of piers and/or docks extending into coastal water with minimal protective impermeable barriers.

outfall

Structure extending into a body of water for the purpose of discharging an effluent (sewage, storm runoff, cooling water etc).

pen

See 'berth'.

point source

A stationary emitting point of a pollutant, e.g. a discharge pipe; in contrast to an area source or a diffuse source.

reactive monitoring
Monitoring done to allow control of the level of an impact, such as the level of introduced sediment in water (as opposed to monitoring done to confirm the presence or magnitude of predicted and accepted impacts).

rehabilitation
The process of converting a disturbed environment to its former or other productive uses. The process of making a site habitable to organisms that were originally present or others that approximate the original inhabitants.

recruitment
Addition of individuals to a biological species population through reproduction and immigration.

residence time
The measure of time required before a pollutant is transported from some specified location.

revetment
A sloped facing of stone or concrete built to protect existing land or newly created embankments (breakwaters, bund walls) against erosion by wave action, currents, or weather.

riprap
Larger facing, or protective mounds of rock placed on embankments and breakwaters to prevent erosion, scour, or sloughing of structure or embankment. (See revetment)

seiche
A long period oscillatory wave motion in an enclosed or semi-enclosed body of water which is dependent on the geometry of the basin, reflecting characteristics of surrounding walls, wave period and resonance.

sewage pump-out facility
An installation to pump out on-board sewage holding tanks in vessels. They are usually connected to the main sewage system, often via a small pumping station.

silt curtain
Floating wall of filter material weighted to the bottom which encloses dredging or dumping operations to limit the escape of turbid waters.

straddle-lift
A hoist designed to vertically lower or lift boats in and out of the water and to carry them to maintenance or storage areas.

substrate

Seabed, floor of the ocean.

turbidity

A measure of the optical clarity of water, dependent upon the light scattering and absorption characteristics of both suspended and dissolved material in the water column.

water quality

A term used to describe the chemical, physical and biological characteristics of water in respect to its suitability for a particular use.

water table

The upper surface of the ground water or that depth below which the soil is saturated with water. It is defined by the level at which water stands in wells that penetrate the water body just far enough to hold standing water. In wells that penetrate to greater depths, the water level will stand above or below the water table if an upward or downward component of ground water flow exists.

weep holes

Drainage hole in a structure allowing release of groundwater to prevent a build up of water behind the structure.

wind rose

A diagram depicting the percent occurrence of wind speed and duration from all directions on a monthly or annual basis for a particular location.

1.4 Abbreviations

A	Walkway width
AHD	Australian Height Datum
B	Average beam of boats
bmax	Maximum beam of boats
BOD	Biological Oxygen Demand
C	Finger walkway width
Cd	Drag co-efficient
CEPA	Commonwealth Environment Protection Agency
COD	Chemical Oxygen Demand
DEST	Department of the Environment, Sport and Territories
E	Clear space between walkways
EIS	Environmental Impact Statement
EMMP	Environmental Monitoring and Management Program
EP(IP) Act	Environment Protection (Impact of Proposals) Act
F	Fairway width
F_D	Drag force due to current
F_d	Drag force due to wind
FIRB	Foreign Investment Review Board
GBR	Great Barrier Reef
GBRMP	Great Barrier Reef Marine Park
GBRMPA	Great Barrier Reef Marine Park Authority
HAT	Highest Astronomical Tide
IAS	Impact Assessment Study
L	Length of longest boat
L_{av}	Length of average boat
Lb	Length of berth
LOA	Length overall of boat
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MLW	Mean Low Water
MLWN	Mean Low Water Neap
MLWS	Mean Low Water Spring
MSL	Mean Sea Level
PER	Public Environment Report
Pz	Design wind pressure
QDEH	Queensland Department of Environment and Heritage
QDHLGP	Queensland Department of Housing, Local Government and Planning
QDPI	Queensland Department of Primary Industries
QDT	Queensland Department of Transport (Marine and Ports Division)
TOR	Terms of Reference
V	Wind Velocity
Wb	Width of berth
Wdb	Width of double berth

2.0 ENVIRONMENTAL CONSIDERATIONS

This chapter is designed to provide the handbook user with an appreciation of the potential consequences of marina development upon the environment of the Great Barrier Reef. It also provides an overview of the environmental legislation and studies that need to be undertaken as an integral part of the design, construction and operation of a marina.

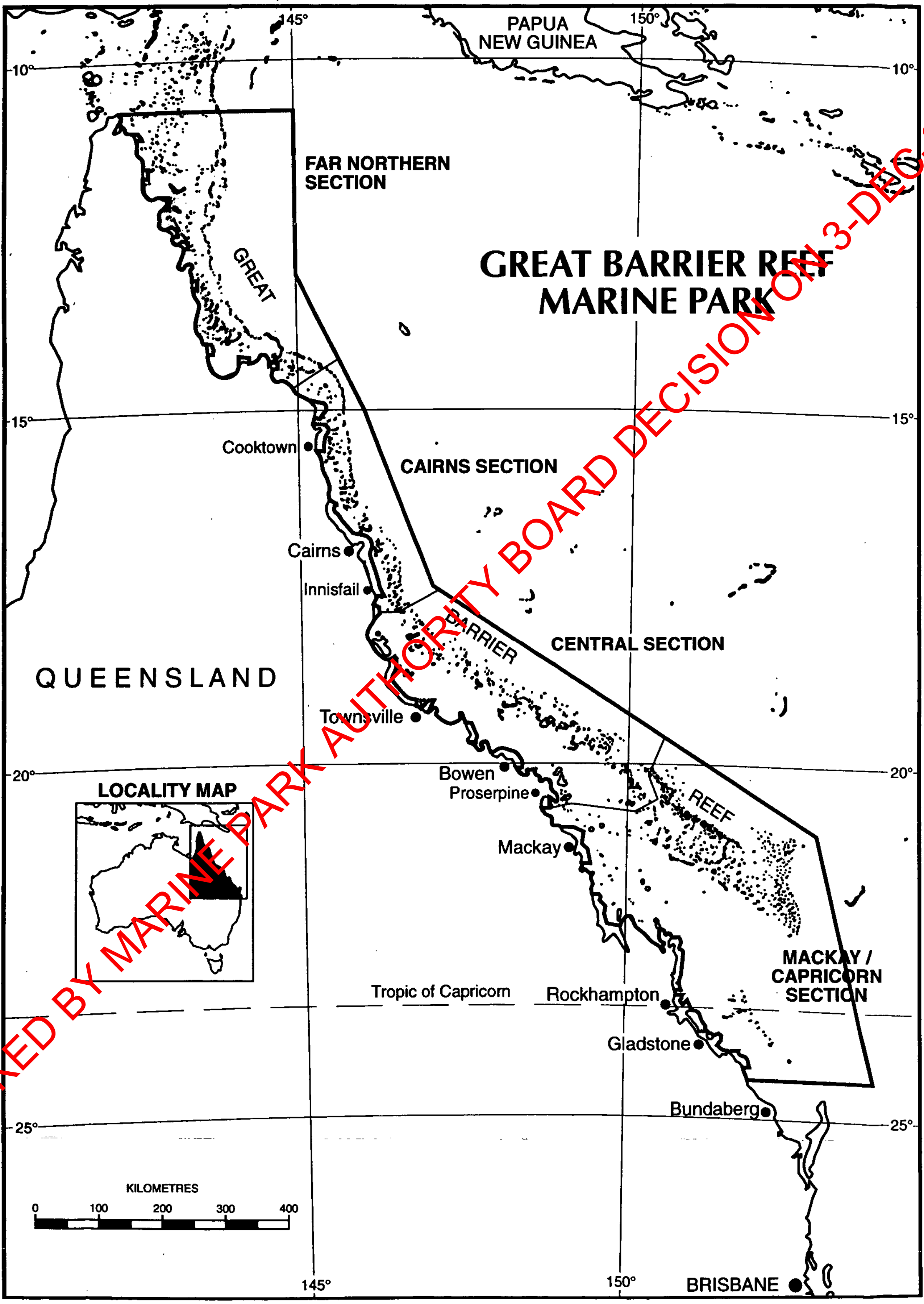
2.1 Background

The Great Barrier Reef Marine Park (GBRMP) is the largest marine park in the world. It includes most of the Great Barrier Reef region which is inscribed on the World Heritage List, in recognition of its outstanding universal value. The Great Barrier Reef Marine Park Authority (GBRMPA) which was established under the *Great Barrier Reef Marine Park Act 1975,* is a Commonwealth statutory body and is responsible for management of the Marine Park. The GBRMP stretches along some 2 800 km of the coast of Queensland. Figure 1 shows a map of the Queensland coast with the Great Barrier Reef Marine Park and Queensland Marine Park boundaries and areas marked. Under agreement between the Commonwealth and Queensland Governments a complementary approach to the management of the Marine Parks has been adopted. The GBRMPA is responsible for the management, planning, policy programs and general oversight of park management. Queensland Department of Environment and Heritage (QDEH) is the principal agency responsible to the Authority for day-to-day management of the Park and has responsibility for managing Queensland Marine Parks which are adjacent to the GBRMP. Due to the coastal siting of most marinas in or immediately adjacent to the Marine Park, they are under the jurisdiction of not only the GBRMPA, but also Queensland and Local Government Departments and legislation. As the design, construction and operation of a coastal marina may often overlap these three spheres of government jurisdiction, their development can be complex and involve a large number of government bodies and requirements. Section 2.3 of this document outlines the legislative framework which needs to be considered when developing a marina which may come under the jurisdiction of the GBRMPA, State and Local authorities. Appendix 1 lists administrative authorities for the relevant legislation and advisory bodies that should also be contacted when planning a marina development, and that will assist in determining the relevant planning legislation and jurisdiction applicable to the development.

2.2 Impact of Marinas

Most coastal construction projects, including coastal marinas, will impact the environment in a variety of ways. Impacts can be perceived or real, and may be either beneficial or detrimental to the environment - beneficial in as much as a previously degraded environment may be restored. One of the major concerns of the community is the alteration of the environment caused by marina construction and operation. Adverse impacts from dredge and fill operations may include coral reef, seagrass and other marine habitat loss or degradation, wetland alteration, destruction of shellfish beds, increased turbidity or siltation, reduced dissolved oxygen or resuspension of nutrients or toxic pollutants.

Figure 1. Map of Queensland coast showing Great Barrier Reef Marine Park



Shoreline and protective structures affect the physical, chemical and biological components of the environment and may alienate beaches and change flooding characteristics. Adverse effects may result from alterations in water circulation, deposition/erosion characteristics, blockage of migration routes or shading in shallow-water habitats or addition of toxic chemical preservatives. On the other hand, the marina structures may provide suitable habitats for colonisation which may help to compensate for natural habitat altered or lost during construction. Certain structures may also attract fish into the area.

Runoff from marinas and sewage discharged from boats may affect the natural productivity of a site. Coral, algae and other animals and plants are sensitive to elevated nutrient concentrations and can be killed, overgrown or out-competed by other plants and animals. As a result, the composition or structure of a community can be dramatically altered. Boat operation also may result in physical impacts to shorelines and to sensitive biota including intertidal oyster banks, reefs, seagrasses, mangroves, waterfowl, dugong and turtles.

The potential for environmental impacts is a function of many variables, including marina location, design, services offered, number and type of boats served, marina management and operational performance. As a result, the potential for, or the degree of environmental changes is not the same for all marinas. Inevitably there will be different sets of environmental circumstances for every project that is assessed. Thus the need for environmental studies (baseline data, planning, impact assessment, and monitoring studies) in the design, implementation and operation phases of marina development becomes apparent.

2.3 Legislative Frameworks

Commonwealth Government

A developer proposing to plan a marina development in, or adjacent to the Great Barrier Reef Marine Park, should contact the Great Barrier Reef Marine Park Authority as early as possible, supplying preliminary information about the proposed site and development. A developer should bear in mind from day one that the GBRMPA has no mandate for either the promotion or discouragement of development *per se*, but rather for the wise use of the GBRMP.

If a proposal for a site within or partly within the GBRMP has the potential for significant environmental impacts (this includes most marina proposals) then GBRMPA must recommend to the Minister responsible for the Commonwealth Department of the Environment, Sport and Territories (DEST) that the proposal be subject to the provisions of the Commonwealth *Environment Protection (Impact of Proposals) Act 1974* (EP(IP)Act). Note that the EP(IP) Act may also be involved if any Commonwealth level decision is required, for example, if approval by the Foreign Investment Review Board (FIRB) is needed.

The object of the EP(IP) Act is to ensure that matters affecting the environment to a significant extent are fully examined and taken into account in decisions by the Australian Government. Under this Act, environment is defined to include all aspects of the surroundings of human beings, whether affecting them as individuals or in their social groupings. It therefore encompasses social, economic, physical (built or natural) and biological aspects.

The EP(IP) Act specifies a formal process for the assessment of impacts. It allows for the assessment of a development proposal through public review, usually as either a Public Environment Report (PER) or an Environmental Impact Statement (EIS). A PER is more narrowly focussed than an EIS and may be required where there are not expected to be as many or as widely spread environmental impacts. An EIS or PER provides:

- information for interested people to understand the proposal and its likely impacts;
- a forum for public consultation; and
- a framework for decision makers to consider environmental and other aspects of the proposal.

The PER or draft EIS is made available to the public for comment and for official review (under terms of the EP(IP) Act). The Commonwealth Minister responsible for this Act makes recommendations to the GBRMPA on whether the project should be allowed to proceed and, if so, under what conditions. The GBRMPA then makes its own decision taking into account:

- the content of the proposal and conformity with the GBRMP Act and Regulations;
- assessment of the PER or EIS;
- the recommendation of the Minister responsible for the EP(IP) Act; and
- public comment.

The main procedural steps for project assessment under the EP(IP) Act are outlined in Figure 2. If a permit is granted, it will specify the conditions and restrictions on the development to which the developer must adhere. One such condition is usually that any construction conform to a Code of Environmental Practice which may involve an Environmental Monitoring and Management Program (EMMP). EMMPs are discussed in Section 2.4.

State and Local Government

Most of the marina proposals examined by GBRMPA are situated on the coastal margins of Queensland, often adjoining and sometimes straddling the boundaries of the landward margins of the Commonwealth GBRMP and Queensland Crown lands and waters including Queensland Marine Parks. In these cases, Queensland legislation is also applicable and the Queensland Government may require that an impact assessment be undertaken in accordance with the *Local Government (Planning and Environment) Act 1990.*

This Act specifies that marinas within Local Authority areas, which have more than 30 moorings or refuelling facilities, are 'designated developments' under the Act. As such, any application to the local authority for approval must contain an Environmental Impact Statement. The Act is administered by the Queensland Department of Housing, Local Government and Planning (QDHLGP). The steps involved in the environmental impact assessment process in Queensland under the Local Government (Planning and Environment) Act, are described in Figure 3. The process is initiated by a proponent submitting a 'Request for Environmental Impact Statement Terms of Reference' form to the QDHLGP or the local Council. A copy of this form is enclosed in Appendix 2. However, Terms of Reference and assessments are conducted in consultation with the Queensland Department of Environment and Heritage and other appropriate Government bodies called 'referral agencies'. Typical referral agencies for a marina development are listed in Appendix 4. (Note that although the above and the following are correct at the time of writing, new Coastal Protection (Queensland) legislation, into which parts of the Harbours Act, etc. will be amalgamated, is currently in preparation.)

For proposals involving only Crown Land, the Queensland Government may require an impact assessment in accordance with the State *Development and Public Works Organisation Act 1971* (Section 29), as Crown Land is not covered by local authority planning schemes.

In most marina development cases both Queensland and Commonwealth Governments will require impact assessments pursuant to their individual legislation. However, it will usually be agreed by both governments that only one environmental study is produced under a jointly coordinated set of guidelines and Terms of Reference which satisfy the separate and collective requirements of all the regulatory authorities concerned. Coordination for the project assessment and procedures may be designated to either State or Commonwealth in accordance with cooperative arrangements which exist between them.

Summaries of the requirements and typical Terms of Reference (TOR) for preparation of a joint Environmental Impact Statement (EIS) under Queensland and Commonwealth legislation for a typical marina development are outlined in Appendix 3.

Permits

As well as being assessed under the EP(IP) Act, a marina proposal is also assessed by GBRMPA according to criteria set out in the GBRMP Regulations, to obtain a GBRMP permit. These criteria include the effect of the proposal on cultural and heritage values, on the environment and the conservation of resources, on existing and future use and amenity, and on the aptness of the project under the zoning plans. Conditions attached to Marine Park Permits are often used as a means of implementing recommendations forthcoming from the impact assessment process. It should be noted that acceptance of the EIS does not necessarily guarantee issue of a Marine Park permit. In addition, there are usually two permits: one for construction and another for operation - each with its own set of monitoring requirements. Similarly, permit conditions may specify contingency upon issue of other State and Commonwealth permits.

Permit Application Assessment Fees are charged by the GBRMPA and QDEH to cover the costs of assessing applications for permits. A single fee is charged for assessment of effects on the GBRMP and the adjacent Queensland State Marine Parks. Appendix 5 provides a brief guide to Permit Application Assessment Fees and Charges.

In June 1992, the Minister Mrs Ros Kelly announced the introduction of Marine Park Fees from 1 July 1993. These fees will be paid quarterly in arrears by all standard operators, including marina constructors and operators. As at 1 July 1993, the fee applicable for the establishment and operation of a marina consists of a flat fee of $190 per quarter or a scaled fee of $1 per berthed vessel per day (or part thereof), whichever is the higher. Operators will be required to complete a logbook (which will be supplied) on a daily basis, and submit a quarterly return.

2.4 Environmental Studies

Environmental planning, impact assessment, mitigation of adverse effects and judgement as to whether a proposed development constitutes 'wise use' of a resource clearly depend upon a knowledge of the resources at risk. It is assumed that developers applying for permission to undertake a project will provide a description of the environment sufficient to enable an assessment of the risk to be made. Experience indicates that these descriptions are often subjective and qualitative - in very few instances are they suitable for an adequate assessment of environmental impact. The ideal inter-relationship between various environmental studies for the environmental impact assessment process is shown in Figure 4.

Environmental planning studies are the first important step in the environment consideration process. These studies are generally based on qualitative descriptions of the environment. Proper environmental planning serves a number of important functions:

- it identifies environmental constraints and opportunities at the site which may affect the design/engineering of the marina;
- it allows preparation of initial advice information to both Commonwealth and State Government Approval Bodies, from which Terms of Reference (TOR) for the Environmental Impact Statements can be issued; and
- it allows the planning of pilot studies which will be a necessary precursor for the design of baseline studies.

Figure 2. Description of Project Assessment Process under Commonwealth Environment Protection (Impact of Proposals) Act

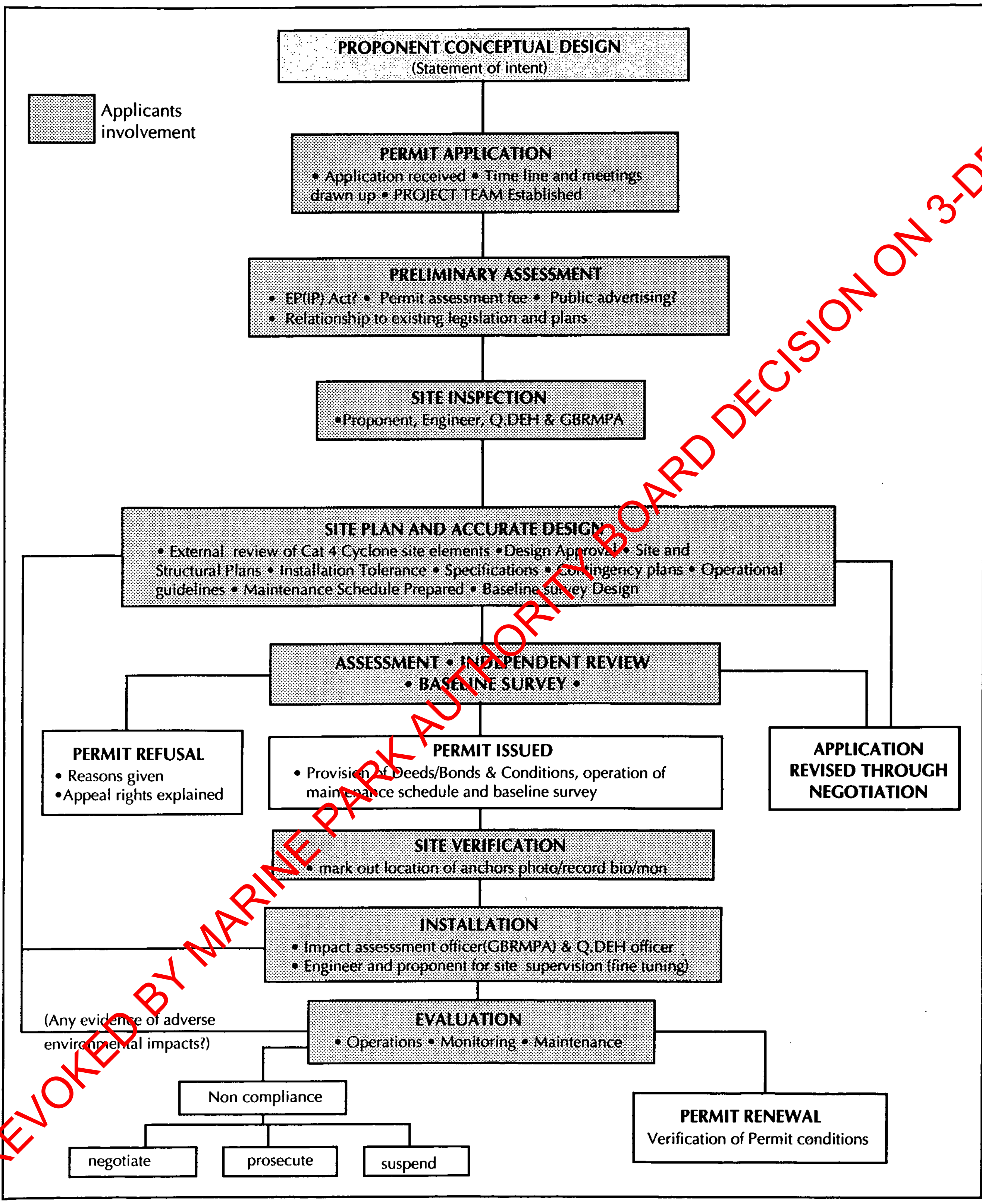


Figure 3. Description of EIA Process under Queensland Local Government (Planning and Environment) Act

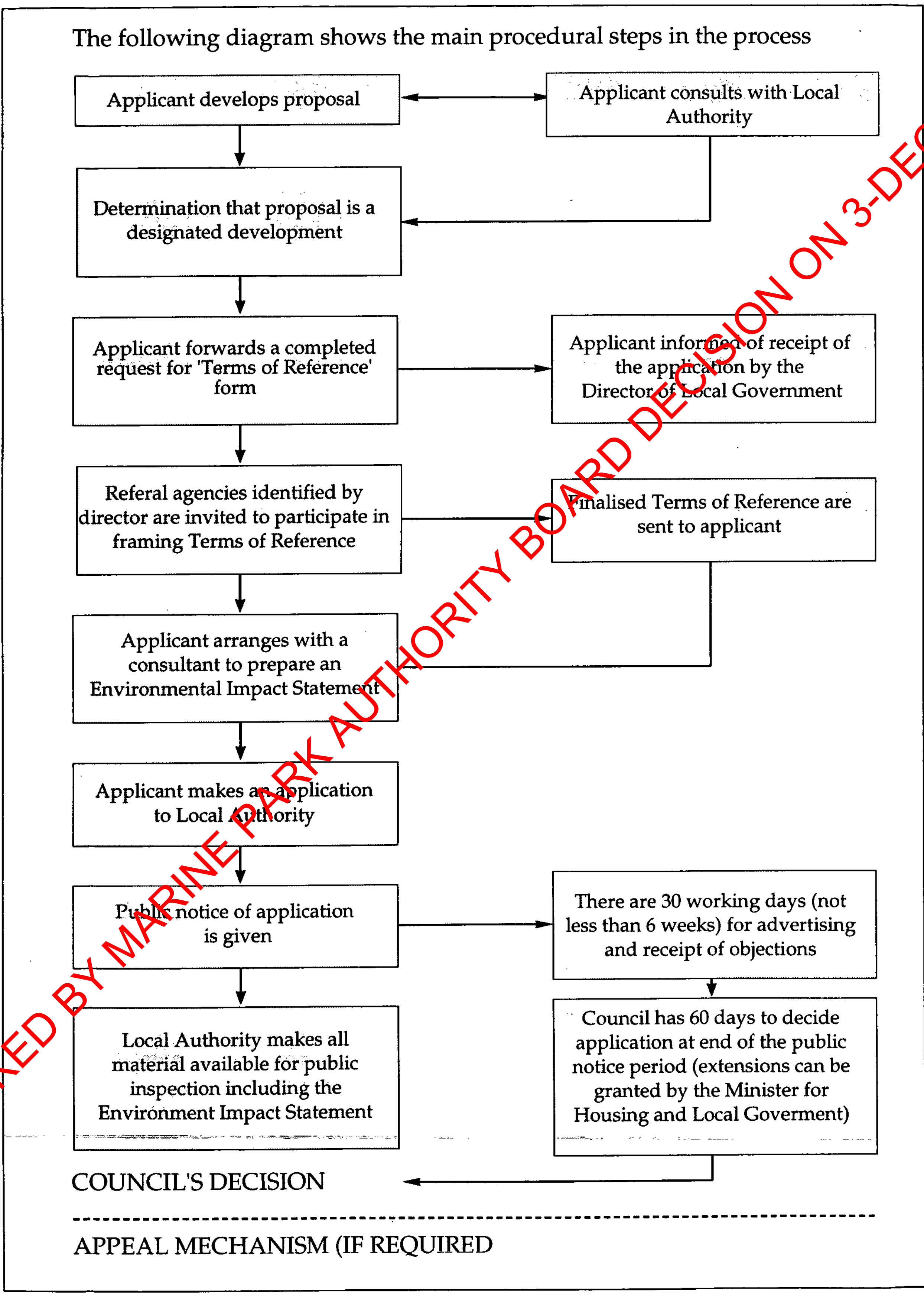
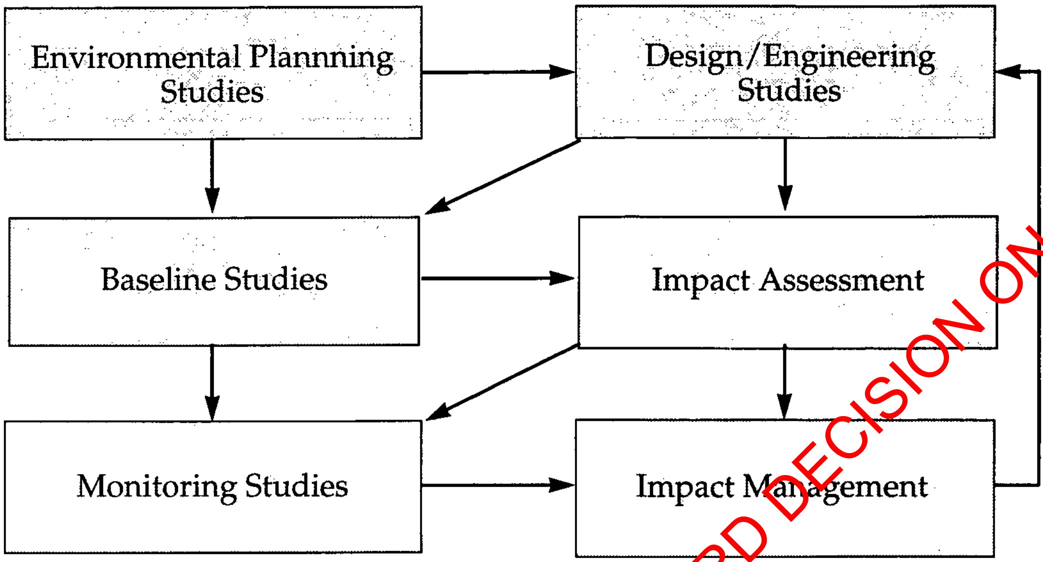


Figure 4. Ideal inter-relationship between environmental studies for the Environmental Impact Assessment Process



Since baseline studies must be demonstrated to be adequate for detecting change, 'pilot' studies are usually required to precede the baseline to test the selection of sites, parameters and times as being appropriate to detect change with reasonable confidence. Pilot study results are used to provide a statistical basis for the experimental design of the baseline and ongoing components of the monitoring program. Note that all monitoring is at the cost of the developer, and that monitoring program design will be subjected to peer review by GBRMPA to ensure its scientific validity.

Impact assessment is the integral part of the process by which development proposals are refined prior to submitting the EIS and seeking approval from regulatory authorities. As the mitigation of adverse impacts must be of serious concern to a developer, then impact assessment must become a key element of the ongoing process of concept and design refinement.

When considering the implications of a marina development proposal, or modifying concepts or designs to mitigate unacceptable or undesirable impacts, be aware that impacts are judged in many different ways. One important criteria for judging wise use' is to examine the reversibility of an effect. As a rule, permanent changes (whether apparently unacceptable or acceptable) constitute a 'primary concern' and should be more carefully assessed. Poor water quality, which can usually be remedied through design and/or management modification, is given a 'secondary level' rating, but dredging causes permanent change and has a permanent environmental effect, and therefore warrants a 'primary level' rating. Typical rankings for other categories of effects are provided in Table 2.1.

Table 2.1 Primary and secondary level effects as judged by 'reversibility' of impacts. (Primary level impacts are generally non-reversible and result in permanent or long-lasting changes to the existing environment. Secondary level effects are those which can be mitigated or reinstated over time.)

'primary' level effects	'secondary' level effects
Social and cultural impact Habitat destruction Aesthetics modification Reclamation/dredging impacts Changes in coastal process at construction	Coastal process changes (long-term) Changes in marine flora and fauna Water quality degradation Design parameters Construction and operational of management procedures

Other criteria for assessing 'wise use' include the size, intensity, specificity, duration and predictability of impacts (Table 2.2). When attempting to mitigate or to judge the acceptability of adverse impacts, those that affect a large region, that are extremely intense or that affect large portions of the community for long periods of time should be scrutinised most carefully. Pronounced or obvious benefits or enhancements that cover a large section of the community within a large region for an extended period of time are to be sought whenever possible.

There will inevitably be instances when marina design or assessment decisions must rely on incomplete data. In these circumstances it is critical that the reliability of the data or the questionable predictability of the impact be clearly identified. While it may be acceptable to adopt a particular course of action if the assessor or designer knows the risk of making an incorrect decision, it is never acceptable to make a decision when the likelihood of that decision being wrong is unknown.

The time taken to appropriately fulfil the statutory impact assessment processes (i.e. produce TOR and guidelines, have a report prepared, go through a public review process, comment on issues raised and receive a response from government agencies) can amount to a minimum of 6 months or, in the case of large projects, even several years. It is imperative that marina developers consider the likelihood of such an assessment and its effects on project timing and costs from the initial stages of concept development.

Table 2.2 General Impact Assessment Criteria

criteria	desired condition
size	small area of negative impacts, large area of positive impacts
specificity	small segment of the community negatively impacted, broad positive impacts
intensity	intensity weak or barely discernible negative impacts, pronounced or extreme positive impacts
reversibility	reversible negative impacts, irreversible for positive impacts
duration	short-term negative impacts, long term positive impacts
predictability	reliable predictions through appropriate monitoring in all cases

Baseline studies have a dual purpose:

- they provide a quantified description of the physical, biological, economic, social and cultural environment for the purpose of conducting the impact assessment study; and
- they provide a robust set of measurements prior to any site works, against which later monitoring can be compared.

Long-term monitoring relies upon a baseline of pre-existing conditions and subsequent comparisons with this during construction and operation. These studies must be quantitative and well structured to provide a standard against which to detect a change. GBRMPA usually invites peer review, at the developer's expense, of the design of baseline and other monitoring studies to ensure their scientific validity.

Baseline data can often be collected as part of the data collection for the preparation of the EIS. This can result in significant time and cost advantages to a developer. If the EIS does not provide sufficient information about the environment at the site and surrounding areas for future comparisons, then baseline surveys will need to be undertaken before the commencement of any construction or operation.

Once satisfactory baseline information has been obtained, environmental **monitoring studies** are initiated. These begin as soon as possible, no later than the commencement of construction and may continue in some form throughout the operational life of a project. These studies are designed to detect changes in specified aspects of the environment to determine whether those changes result from the construction or operation of the development - or are a natural environmental variation - and to trigger management actions that result in impact mitigation (see below). Usually the GBRMPA contracts an agreed environmental consultant to undertake the necessary baseline study and environmental monitoring program as approved by GBRMPA. The developer pays the costs of the program and pays the GBRMPA to oversee and manage that program.

Impact management and monitoring studies are intimately tied. The purpose of impact management is to verify predicted impacts and to prevent damage to the environment over and above a level predetermined to be the acceptable level of change. This requires the development of a response component within the environmental monitoring and management plan - a set of predetermined management responses for situations where monitoring detects adverse impacts that are approaching or exceeding the acceptable level of change. Impact management requires two types of monitoring studies: a) those longer term, regular event monitoring episodes that can detect gradual changes over prolonged periods against a high degree of natural variation; and b) reactive monitoring studies that detect the presence of damaging impacts in time to allow mitigation before the environment is degraded.

Baseline studies, monitoring studies and impact management are collectively referred to as an Environmental Monitoring and Management Program (EMMP). Descriptive studies may be suitable for impact assessment but they do not suffice for an EMMP study which needs to be quantitative, scientifically rigorous and able to detect environmental changes. EMMPs can be both time consuming and detailed. Therefore their timeframe and cost must be carefully considered by the developer in planning a marina development.

It is important that developers gain a clear understanding from the outset that long term baseline studies will have to be conducted prior to the commencement of any site works, and that some degree of **quantitative** monitoring may have to be continued throughout the construction and operational phases of a project. As all of these studies can take considerable time and effort, for which the developer is paying, it is imperative to carefully choose appropriately qualified and experienced consultants and assistance for these specialist areas. Failure by the developer (or their consultants) to provide appropriate data will mean that resurveys will be required at their cost and with obvious delays. Developers should seek specific guidance on monitoring requirements, approved and appropriate consultants, and should make specific allowance in project schedules and budgets for the conduct of these studies. Remember that program design will be subjected to peer review before it is cleared for implementation.

2.5 Design Planning and Engineering Studies

The other integral components in the environmental assessment process are the design planning and engineering studies. Initial designs and layouts should be influenced by biological, environmental, socio-economic, structural and aesthetic considerations. However the engineering of marinas will be dictated by physical environmental factors and feasibility. Design and construction of breakwaters will depend on proper calculation of wind and waves generated, type of materials used in construction and potential effects of failure of those designs under extreme events. The designs of structures will also have an impact on the environment. Design planning and initial engineering studies should be carried out hand in hand with environmental studies. This will not only ensure a better design project but may prevent costly re-design and delays later in the project, if environmental constraints are discovered.

It should be remembered that although there exist standards for design and construction of marinas and their components, sometimes these standards are not appropriate or adequate for the provision of environmental protection. These standards and criteria can often be modified slightly, often at no additional cost, to better suit the existing environment and minimise adverse environmental effect on the site. Developers should seek the assistance of the relevant Commonwealth and State authorities, and published standards when designing, but should also be prepared to extend or improve designs to avoid interference with, or protect, sensitive environmental features.

Intending developers should always have concept plans and designs scrutinised by Commonwealth and State authorities prior to full design, engineering or construction. Similarly, all monitoring programs must be approved by GBRMPA and QDEH prior to implementation. Design planning and engineering considerations and criteria are discussed in the following chapters.

3.0 SITING OF MARINAS

Proper siting is probably the single most important aspect of developing a coastal marina in an environmentally sound manner. A well chosen marina location that meets the developer's needs and at the same time minimises environmental impacts should be the most cost effective to develop and is more likely to receive the quickest approval by regulatory authorities and to minimise monitoring requirements. Importantly, marina siting will also greatly dictate the design and engineering criteria of the development (refer also to AS3962 - 1991).

This chapter provides information and guidance on coastal marina site evaluation and selection. The discussion contains an overview of the advantages and problem areas associated with certain marina sites and introduces topics of marina development to be expounded in more detail in later sections.

The ultimate environmental performance of a marina depends not only on the site location but on the design, construction, operation and maintenance of the facility. Every marina site presents unique aspects in relation to providing adequate recreational boating facilities at a reasonable cost to the developer while minimising adverse environmental effects. The engineer and developer may need to evaluate several planning and design options in determining the most suitable marina development. Designing the marina to take maximum advantage of the natural attributes of the site can contribute significantly to reducing or eliminating potential environmental problems from marina construction. This evaluation includes, among other aspects, considerations of land and water access, access to utilities, the area required for facilities, ambient weather and physical environmental conditions, sensitive environments in need of protection, the existing social environment and aesthetics.

3.1 Zoning

Check GBRMP zoning of proposed marina site

Joint permits granted by GBRMPA and QDEH are required for the development and operation of marinas within the GBRMP.

Zoning and zoning plans are one of the principle tools for management of the GBRMP. Zones within the Park range from highly protected areas with restricted access through to general use areas. Marina developments can only be permitted in certain zones and it is unlikely that a marina could be allowed in a more protected zone if it involved destruction or alteration of the marine environment.

3.2 Wind Climate

Assess local winds, waves, currents, tides and flooding for desired sites.

Wind, waves, currents, tides and floods are collectively termed coastal processes and influence the distribution of sediments and thus the shape of the coastline. Winds can influence marinas indirectly through their effect on wave climates (Section 3.3) or directly by affecting comfort, manoeuvrability of vessels in confined areas, or design strengths necessary to prevent damage to vessels and structures in extreme conditions.

Berths should be aligned directly into the prevailing winds.

The marina designer must evaluate local wind conditions both in terms of prevailing winds and predicted wind conditions under adverse weather conditions. A desirable site would allow berths to be aligned directly into the prevailing winds, thus limiting lateral movement and pressures on moored vessels and ensuring that vessels do not lay off fingers, making boarding difficult.

Assess direction and strength of winds on marina operations with consideration of extreme conditions.

The design of a marina must be such that it can be entered under adverse weather conditions and would provide enough shelter that vessels could manoeuvre within channels and fairways to enable access to berths without threat of collision. The proposed site should ideally provide shelter from the prevailing winds. Careful consideration should be given to the direction and strength of the strongest winds in relation to both manoeuvrability and design strengths.

Highly exposed areas may benefit from the use of wind breaks.

In areas exposed to extreme conditions the wind climate may be modified by planting a tree wind break or careful positioning of land-based buildings to act as a barrier.

3.3 Wave Climate

Sites must have safe and comfortable wave climates. (See Table 3.1)

The most essential purpose of a marina is the provision of a safe passage to a sheltered area for boating or shipping-related activities. Thus, the site should be free of, and readily protected from, strong surge or the potential for wave damage. It is necessary to determine the wave climate of a potential site as it is the most important engineering factor that governs the siting of a marina. The provisionally recommended criteria for a 'good' wave climate in small craft harbours are set out in Table 3.1. These criteria would appear suitable for adoption in the GBRMP.

Wave parameters to include:
- **height, period and direction of waves**
- **steepness**
- **coincidence with extreme winds and currents.**

It is necessary to examine the steepness, height, period and direction of waves, the coincidence of waves with extreme winds (cyclones) and currents, and the probability of occurrence of wave characteristics related to likely structural or boat damage (i.e. whether the wave climate exceeds recommended criteria for marinas). This will enable the developer to design and incorporate adequate protective works (breakwaters) and mooring structures. It should be noted that the Beach Protection Authority can supply data on expected combined tide and surge levels for various recurrence intervals along most of the Queensland coast.

TABLE 3.1 Recommended criteria for a 'Good' Wave Climate in small craft harbours

Direction and Peak Period of Design Wave	Wave Event Exceeded Once in Fifty Years	Wave Event Exceeded Once A Year	Wave Event Exceeded Once Each Week
Head seas less than 2 seconds	these conditions not likely to occur during this event	less than 0.3 m wave height	less than 0.3 m wave height
Head seas between 2 and 6 seconds	less than 0.6 m wave height	less than 0.3 m wave height	less than 0.15 m wave height
Head seas greater than 6 seconds	less than 0.6 m wave height or 1.2 m horizontal motion	less than 0.3 m wave height or 0.6 m horizontal motion	less than 0.15 m wave height or 0.5 m horizontal motion
Beam seas less than 2 seconds	these conditions not likely to occur during this event	less than 0.3 m wave height	less than 0.3 m wave height
Beam seas between 2 and 6 seconds	less than 0.25 m wave height	less than 0.15 m wave height	less than 0.1 m wave height
Beam seas greater than 6 seconds	less than 0.25 m wave height or 0.6m horizontal motion	less than 0.15 m wave height or 0.3 m horizontal motion	less than 0.1 m wave height or horizontal motion

* For criteria for an 'excellent' wave climate multiply wave height by 0.75 and for a 'moderate' wave climate multiply wave height by 1.25.

Source: Mercer et al. (1982)

3.4 Water Circulation

Site marinas in areas of high water exchange rates.

Through optimal site selection and marina design, many of the problems associated with either excessive or inadequate circulation can be avoided or minimised. High water residence times will lead to deterioration of water quality within the harbour basin. In the absence of adequate flushing, accumulated wastes from harbour-related activities (e.g. minor oil spills, land runoff and sewage from boats) diminish the attractiveness of the harbour and could threaten the quality of nearby fisheries and beaches. Although the overall aim should be to minimise the entry of pollutants, marinas sited on estuaries, creeks, and waters characterised by high flushing rates or high rates of water exchange should exhibit fewer water quality problems than marinas in areas of low water exchange. High exchange rates tend to dilute and disperse any sanitary waste or stormwater runoff pollutants from a marina.

Place marina structures so as to maximise the rates of water exchange.

Revetments or harbour structures may interact with local wind, tide and wave forces to alter offshore currents, sand distribution, and shoaling processes. A variety of other factors including depth and orientation, and groundwater flow into the harbour will influence seawater residence time and circulation within the harbour. In addition, water quality can be indirectly affected when structure emplacement, particularly breakwaters, reduces water circulation. Therefore, all structures should be designed and placed so as not to restrict water circulation or mixing within the marina basin or to increase shoaling. Water circulation can be ensured by using properly designed culverts, pilings and bridge spans, and by using discontinuous mounds for open water discharge.

Incorporate currents, wind patterns, wave conditions and groundwater influx in studies of harbour flushing.

The marina designer must have good knowledge of nearshore currents, wind patterns, wave conditions (regular and storm), and groundwater influx to determine the harbour configuration for maximising both harbour flushing and safety (refer to Section 4.1 for more specific guidance on configurations).

A hydrographic survey should be carried out including a past history of the substrate.

Tidal range, natural water depth at the site and the projected completed project depth at the marina are hydrographic considerations necessary for evaluating the natural circulation of the area and the projected flushing rate of the marina basin. During the hydrographic survey, it is also important to note the locations of underwater hazards or obstructions and to review the past history of the substrate in terms of siltation rates, marine life, bottom growth and shoaling.

Examine tidal, eddy and flood-related currents and tide range.

Currents which need to be considered in marina design are tidal currents and those associated with rainfall induced flooding. Tidal currents vary in direction between ebb and flood, whereas currents associated with flooding are generally directed downstream. Eddy currents should also be considered, as should tide range.

Qualified personnel must assess:

- **the effects of flooding on marina**
- **the effects of the marina on flood behaviour**
- **flood levels for various recurrence intervals.**

Physical model studies which examine the effects of rainfall induced flooding on the marina, and conversely, the effects of the marina on flood behaviour, may be required, particularly if the marina occupies a significant portion of an important floodway. Such investigations should be supervised and carried out by qualified personnel. For marina sites located in flood prone areas it will be necessary to establish flood levels for various recurrence intervals. The model results should then be applied to assess the likely biological and physical results.

Plans must show the relationship between MLW and the other datums used.

Maritime structures should be related to the Mean Low Water (MLW) mark. MLW is **not** a standard tidal plane and must be calculated by approved methodology. Where land based structures or services are associated with the maritime structures and are related to a different datum (e.g. AHD, local water supply or sewerage datum), it is essential that plans show the relationship between MLW and the other datum. AHD should be used where ever possible.

MLW must be established in a tidal planes study and surveying.

Where the proposal is adjacent to or in the GBRMP, the location of MLW, which forms the boundary of GBRMP, must be known quite precisely. A simple procedure for initially estimating MLW is to:

- consult the local harbour or marine authority over the actual local height of MLW (or, alternatively, determine the average for low tides over the last eight years);
- identify a tide, using a tide chart, that has a lower limit at that height;
- be on site at the appropriate time and install markers at water level at the correct time; and
- note that this estimation will probably have to be confirmed by survey prior to final approval.

Avoid pile jetting.

Structures that may be required at the marina include bulkheads, revetments, pilings, piers and breakwaters. A temporary increase in turbidity during emplacement is a direct water quality impact from these structures. This may be alleviated, if necessary, by use of pile-driving rather than jetting or by bunding the area if jetting must be used.

3.5 Implications of Sea Level Changes

GBRMPA policy is that structures withstand a category 4 cyclone. Minimum acceptable 'Greenhouse' allowance is 0.4m.

It is GBRMPA policy that, for structures in the GBRMP, breakwaters and protective works shall be designed to withstand a category 4 cyclone, including the effect of wave action, and incorporate allowance for sea level rise as predicted to result from the 'Greenhouse Effect'. The minimum acceptable 'Greenhouse' allowance for structures in or adjacent to the GBRMP is 0.4 m. This allowance should be applied to all protective structures and marina or adjacent structures having structural lives of greater than 20 years. It may be acceptable to place non-essential or short-lived facilities (pathways, internal roads, carparks) at lower levels, so long as a developer legally indicates recognition that these structures may need to be raised or replaced at a later date. The general adoption of these criteria elsewhere is highly recommended.

Examine flooding probabilities.

Where flooding occurs, consideration should be given to the possible combination of the design flood flow and other wind and tidal forces that may tend to exacerbate flooding levels. The water level during flooding can be raised considerably above high tide level. The Queensland Government is considering adoption of a policy that new residential development does not occur on land with a greater than 10% risk of inundation in any 50-year period.

3.6 Geotechnical and Sediment Processes

Assess natural sedimentary processes and likely impact of the marina on these.

An understanding of the existing natural sedimentary processes at the proposed marina site, and the likely impact of the marina on these processes is important in the planning and design of the marina. In most marina developments involving boat harbour construction along a section of coast or within an estuary, the greatest potential for sedimentation problems is at the boat harbour entrance. This sedimentation is due to longshore wave-induced sediment transport or tidal-induced bedload sediment transport for the coast or an estuary, respectively. Within the boat harbour, the main mechanisms for sedimentation are settling out of fine suspended sediments brought down by floods (in the case of boat harbours constructed on estuaries) and deposition of material at stormwater outlets.

Minimise sedimentation through harbour design (Section 5.2). Consider initial overdredging and the ongoing need for bypass dredging.

Every effort should be made to maintain longshore sediment movement - including allowance for possible future bypass dredging, It may not be possible to avoid sedimentation at the marina site, but, by careful planning, it is possible to minimise the degree of sedimentation (see Section 5.2) and ensure that any sedimentation which does occur can be relatively simply (and economically) removed. It is important that the likely siltation rate is adequately assessed so that a suitable allowance can be made. Maintenance dredging operations are very expensive and could be hampered by the presence of marina structures and boats. Consideration should be given in these cases to the option of initially over-dredging.

A comprehensive geotechnical investigation is recommended and should include:

- **soil, sediment and rock classification**
- ***in situ* soil density**
- **stratigraphy**
- **soil strength parameters and deformation**
- **chemical composition of any sediments to be excavated.**

A comprehensive geotechnical investigation is recommended at all sites. The investigation should be designed to gather all information which might be relevant to the particular site. Requirements for different sites will vary and it is necessary to plan each geotechnical investigation individually. Typical information required from a geotechnical investigation includes soil, marine sediment and rock classification; grain size distributions and shape; *in situ* soil density; stratigraphy; soil strength parameters; soil deformation parameters and, if there is any doubt over the possible presence of contaminants, chemical composition of any sediments to be dredged. Such an investigation is necessary for several reasons. It will identify the range of material types at the site, which may strongly influence the layout, cost and project feasibility. It is also necessary for the detailed design of the facility, particularly for excavation (if required) and the marina structures, e.g. jetties, mooring piles, breakwaters, seawalls, reclamations and land based facilities. Geotechnical properties may influence construction timing, techniques and costs, all of which may also affect the results of an assessment of environmental impacts.

3.7 Flora and Fauna

Include in the environmental assessment an appraisal of cumulative losses at a local, regional and state level.

Loss of wetland and submerged vegetation may result from a variety of construction activities (also from changes to water levels and/or water flow), although dredge and fill operations have historically been the most destructive. The marina developer must carry out a comprehensive environmental assessment. Included in this should be an evaluation of the significance of any rare, endangered or protected species at local, regional, national and international levels, and the significance of cumulative impacts (of which the proposed development is just one) at these levels.

Be aware of the ramifications of dredge-and-fill operations on flora and fauna and carry out these activities so as to minimise turbidity and sedimentation.

Modification of the shoreline and nearshore submerged lands by dredging and filling activities results in the destruction by removal or smothering of benthic habitats and life forms such as coral reefs and their associated fauna. The degree of destruction obviously depends on the quantity and quality of the benthic community at the site and the extent of the construction activity. Additional direct effects of dredge-and-fill operations include generation of turbidity plumes and crushing of shallow reef communities by heavy equipment. The disposal of dredged material should occur on land. Offshore disposal of this material can cause significant turbidity and sedimentation and is not regarded as an acceptable option in most cases.

Minimise contaminants input directly or in surface runoff.

Inhabitants of the aquatic environment can also be affected by changes in water quality, which at times include nutrient enrichment and low dissolved oxygen resulting from sewage and upland runoff, hydrocarbons from boat exhausts and fuel spills, heavy metals from antifouling paints and other pollutants.

Locate marinas to minimise loss of wetlands and seagrasses.

Marinas are designed to provide safe, protected moorings for boats and are therefore usually located in calm waters on protected shorelines. These calm, sheltered areas generally support wetlands and submerged seagrass beds. Thus, the potential for habitat loss or alteration of these productive habitats is a major consideration in marina siting and design.

Site marinas to minimise impacts on primary productivity, nursery areas, coastal processes and coastal aesthetics.

The importance of plant communities such as mangroves, salt marsh grasses and seagrass beds lies in the vital functions that they perform in the aquatic ecosystem. First and foremost is their role in converting sunlight and nutrients into food useable by animals, thus forming the base of the aquatic food chain. In addition to serving as a food source, wetlands and submerged vegetation provide shelter and nursery areas for the young of many economically important species such as prawns, crabs, barramundi and whiting. Maintenance of water levels and inundation is vital to the health of mangrove forests and should be observed. Another important function of vegetation is to trap silt and absorb pollutants and excess nutrients resulting from surface runoff. Vegetation also protects upland areas by stabilising coastal sediments and preventing erosion. Finally, natural vegetation increases the aesthetic appeal of the coastal zone.

Avoid sensitive areas such as oyster beds, particularly those used for human consumption.

Oyster beds are habitats requiring specific consideration during marina siting and development. In addition to their direct economic value to man, oyster beds provide spawning and nursery areas, substrates for attachment for many organisms, and food for invertebrates, fish, birds and humans. Oyster beds physically influence the marsh-estuarine ecosystem by modifying current velocities, changing sedimentation patterns and actively augmenting sedimentation through biodeposition. Oyster beds could be affected by physical disruption of habitat during marina construction or by changes in water quality resulting from marina operation or boating activities. A poorly sited or designed marina has the potential to degrade water quality so that oysters are unfit for human consumption - contamination by antifoulants or sewage being the most common causes.

The potential ramifications of the loss of a coral community are extensive. Coral reefs can serve a variety of functions, some that are not readily apparent:

- they provide protection to the shoreline from the effects of large wave action;
- they can provide fish for economic stability, recreational fishing and meal value;
- they are an important resource for education and culture; and
- they provide aesthetic values by playing a significant role in tourism and the 'sun, sand, and sea' appeal of the Queensland coast.

Coral reefs are particularly susceptible to turbidity related impacts.

Coral reefs are sensitive to episodic events in which turbidity is temporarily raised to many times the ambient amount, and thus are particularly susceptible to turbidity caused by dredge-and-fill processes. Episodic events may be tolerated if they are infrequent and do not greatly exceed the upper levels of natural turbidity at the site. However, above a threshold, such an event may kill coral reefs. Chronic stress from turbidity may manifest itself in more subtle ways, i.e. by changing the community structure of the reef. Advanced knowledge of currents in the area of construction, and of sedimentation characteristics, allows prediction of direction and persistence of turbidity plumes, thereby facilitating assessment of potential impacts of dredging on surrounding marine communities. Local currents also play a role in recruitment and survival patterns related to the distribution and zonation of corals and other marine life. Thus, dredging and the resultant physical alteration of topographic features that may alter current regimes can also have profound effects on reef community structure in the surrounding area.

3.8 Social Amenity and Infrastructure

Marinas are to include appropriate and aesthetic social amenities and infrastructure.

Marinas will typically include such facilities as berthing or docking areas, shoreside facilities for unloading, loading, storage, and refuelling operations, a small-boat launching ramp and various related infrastructure to accommodate activities such as access to water, power, waste disposal facilities (especially for vessels), shower and laundry facilities, and land access (e.g. roads). Some additional guidance on these facilities may be found in AS3962-1991.

Provide for periodic repair and maintenance without loss of safety or amenity.

Most harbours also require periodic maintenance to repair protective structures, service aids to navigation, and to restore navigation depths (via maintenance dredging) within the channel and basin. Provision for adequate maintenance must be made in such a way that safety and amenity of users are not jeopardised by repair and maintenance activities.

Assess possible changes in aesthetic value of the area.

Marina location also influences the effect a marina will have on shoreline aesthetic values because introduced sights, sounds and smells will be different from the natural environment (Chmura and Ross 1978). Poorly maintained marinas will further degrade aesthetic values. Aesthetic values are often subjective and difficult to measure. However, techniques are available and qualified sociologists and landscape architects can assist in these areas. Marinas located in a pristine area may lessen aesthetic appeal, whereas marinas located in a developed area may enhance the aesthetic appeal and quality of the water front.

3.9 Archaeology

Archaeological surveys will require a permit.

A comprehensive surface archaeological survey should be undertaken by a qualified archaeologist to identify pre-historic and historic relics and other culturally significant features. These surveys must be done by registered archaeological consultants under an archaeological research permit required under the provisions of the *Cultural Record (Landscapes Queensland and Queensland Estate) Act 1987.*

Contact the State Historic Preservation Officer for information on historical or archaeological resources.

Historical or archaeological resources present at the marina site or discovered during construction that may be impacted by marina development can be identified by contacting the State Historic Preservation Officer, Heritage Unit, QDEH. Mitigative measures can include:

- preservation or restoration of the artefacts;
- photographic documentation; and
- survey or excavation by professional historians or archaeologists.

3.10 Safety

Site use aspects must be tightly controlled.

Construction activities often involve heavy machinery, traffic, blasting and pile driving which may be hazardous to the public and workplace. Blasting activities are regulated by the Queensland Mines Department and will be conducted to guidelines specified by that Authority. Construction supervisors are required to exercise all suitable cautions including public notification and exclusion, warning sirens and protective barriers.

Blasting in Marine Park requires application to GBRMPA also.

Blasting activities are generally constrained within the GBRMP and are regulated by GBRMPA. Blasting within the GBRMP therefore requires close and early consultation with GBRMPA as well as with the Queensland Mines Department. It is GBRMPA policy that blasting in the Marine Park is considered a technique of last resort, and will only be approved if other methods can be demonstrated to be unsuitable.

3.11 Navigation

Navigation aids must be provided to appropriate standards.

Aids to navigation such as channel beacons, buoys and leads are required for entrances to marinas and channels of access. All navigation aids will be designed, installed and maintained in accordance with Queensland and Commonwealth Departments of Transport.

3.12 Economic Considerations

Financial viability studies must separate capital costs from estimates of costs of ongoing operations.

The ultimate financial success of a marina may often be dependent on or linked to associated tourist facilities, residential and or commercial property sales rather than the marina being self sufficient financially. The demand or need for the use of public land and waters to provide 'added value' commercial or residential developments should be clearly assessed and justified. Whilst it is sometimes acceptable to offset capital costs by sale of associated land, it is also necessary to demonstrate ongoing viability without subsequent income from sale of capital assets.

Comprehensive economic planning and impact studies should be conducted as part of any EIS.

Demand for facilities should be assessed by studying boat registration statistics and tourist projections, boat owner surveys, public subscription and regional planning studies. The belief that 'marinas breed boats' is questionable and design should be substantiated by demand studies. The developer should also clearly identify to assessment agencies the financial support available to the project. Appropriate conduct of initial environmental, engineering and social studies in the planning stages should also provide potential developers and investors with more accurate estimates of the development and associated costs such as approvals, construction and monitoring considerations, prior to committing more substantial funds to the project.

Developers will be required to post an environmental bond or bank guarantee.

In most cases developers constructing a marina in the GBRMP are required to post a substantial bond or bank guarantee to GBRMPA to cover any environmental damage or rehabilitation costs of the project. These funds may be applied to complete construction of specific components of the project; to allow removal and environmental repair; or to clean up or repair the site following accidental damage.

3.13 Existing Use

Comprehensive social impact assessment is required.

Proponents should be able to demonstrate the effect of the proposal on existing use of the site and nearby areas. This will necessitate a survey of current use and may include separate public consultation with interest groups etc. Properly designed surveys for social impact assessment will be required.

4.0 DESIGN OF MARINA STRUCTURES AND FACILITIES

The ultimate environmental performance of a properly sited coastal marina depends on the marina design, construction and operation. Guidelines for the design of marinas are currently available in Australia. 'Australian Standard AS3962-1991, Guidelines for Design of Marinas' details appropriate design and engineering standards for marinas in Queensland. However, given the World Heritage status of the GBRMP, and the sensitivity of marine ecosystems in the Park, engineering and design criteria which may meet these standards may still have unacceptable environmental consequences in the Marine Park. Subsequently, in some situations and environments the designer's job may require stricter, novel or more 'environmentally friendly' alternatives which minimise effects on the Park as much as possible. **It should be stated here that the guidelines outlined in this section are in no way prescriptive or mandatory by law and compliance with the guidelines does not necessarily guarantee the acceptability of a development.** The following design notes are included as a helpful guide to developers as many specific approvals are the responsibility of State and Commonwealth authorities apart from GBRMPA. They have been included however because even if the marina design, construction and operation are in accordance with these standards, there is still potential for impact on the marine environment. Marina developments need to be judged on a case-to-case basis. However, it is hoped that more knowledge of the environmental implications of engineering and design recommendations as spelled out in these guidelines, will assist designers, developers and operators achieve sound, economical marina developments with acceptable environmental impacts.

The layout of marina land facilities is usually determined by the physical constraints of the particular location and the need to enable efficient material and activity flow paths. It is recommended that a land to water area ratio of between 50:50 and 40:60 be adopted for preliminary planning of a marina development, depending on the extent of shore-based facilities to be provided. However, financial viability of land/water ratio must also be carefully considered as the 'real estate' created by reclamation in many marina developments is the principal financial asset of the development.

4.1 Basin

In the design of a marina basin, the following should be considered:

Minimise vertically faced structures.

• Vertically faced structures lead to reflection of wave energy, causing confused seas and high wave energy within the berthing area.

Seek expert advice in marina basins exposed to ocean wave energy.

• Basins exposed to ocean wave energy may be subject to longer period oscillations and resonance (seiche).

Design of the basin must facilitate adequate flushing of the marina.

• Adequate flushing of a marina is necessary for maintaining the water quality of the marina basin and adjacent waterway. Natural circulation near the site should be maintained whenever possible. Poorly flushed marinas can become stagnant and permit the concentration of pollutants from the marina facility and boats. The settling and accumulation of organic material and fine sediments can result in decreased dissolved oxygen levels and shoaling within the marina basin.

Give consideration to the diversion of streams and creeks to high flushing zones.

• Adjacent streams or creeks should not be allowed to discharge into the marina basin as they may cause water quality problems.

Minimum depth of the basin should not be less than 2.5 m at MLWS.

• It is recommended that the minimum depth within the mooring basin (at MLWS) should be no less than the maximum draught of moored craft plus half the predicted wave height plus tolerance of 0.3 m or 0.5 m for seabed conditions comprising soft material or rock respectively, plus allowance for siltation. As a general rule, these factors sum to at least 2.5 m as a minimum during MLWS.

Maximise tidal exchange and mixing in the basin; minimise backwaters and current constrictions.

The configuration of a marina basin may enhance or hinder flushing rates. Open marinas located on existing channels will generally have the same flushing rate as the channel. Marina basins with excessively deep or dead-end areas that have lower than natural rates of exchange tend to accumulate potential pollutants or require inordinate periods of time for flushing and organic decomposition. Semi-closed marinas or marinas with dredged basins should be designed to maximise tidal exchange and mixing within the marina. Marina basin design features that promote flushing include:

Ensure channel depths eliminate 'sills' ponding deep basin areas.

- Basin depths that are not deeper than the open water or channels to which the basin is connected and never deeper than the marina access channel. Basin and channel depths should gradually increase toward open water. Dredging of natural channel sills for larger marinas should be avoided.

Provide two openings, or partial walls on one side.

- Two openings at opposite ends of the marina to establish flow-through currents.

Minimise 'dead' water by creating curved surfaces.

- Basins with few vertical walls and gently rounded corners or circular or oval shaped basins. Even bottom contours, gently sloping toward the entrance with no pockets or depressions.

Minimise long reaches where water flows are restricted.

- For rectangular marinas, the length to breadth ratio should be in the range of 0.5-3.0 to promote good mixing characteristics; for similar reasons, entrances should be centrally located.

4.2 Entrance Channel

Entrance channel width should conform with AS3962-1991.

While the width of entrance channels is clearly dependent on many factors, AS3962-1991 states that the channel should be the greatest of 20 m, or, the length of the longest boat to use the marina plus 2 m, or 5 times the beam of the broadest monohull to use the marina. For marina basins of say 200 to 300 berths the entrance channel should have a minimum navigable width of 30 to 50 m in unexposed conditions.

Entrance channels should be straight; aligned into prevailing winds; and not in an area of shoaling.

The entrance channel should be as straight as possible and follow an existing natural channel if available. The entrance channel should also be aligned in the direction of prevailing winds to promote mixing. The entrance should not be located in areas of shoaling as increased maintenance dredging is required and sills between the marina and open water can form causing reduction in flushing.

Mark channels in compliance with Commonwealth and State Departments of Transport requirements.

In the interests of safety, channels must be properly marked, both approaching and inside the marina and in compliance with Commonwealth and Queensland Department of Transport (Marine and Ports Division) requirements.

4.3 Fairways

Preferred fairway width is 1.75L.

To minimise manoeuvring accidents, it has been found that minimum fairway widths between rows of berths in well protected waters should be the greater of 20 m or L + 2 m (where L is length of longest boat in marina). The preferred width is 1.75L.

4.4 Berthing Facilities

Marina layout must attempt to accommodate present and likely future boating requirements.

Marina designers should carefully plan the layout of berths. While boat sizes 25 years hence may not be forecast with any certainty, for the initial 'loss' of a few berths, the marina's future suitability might be enhanced. The layout can affect operational efficiency, convenience to boat owners, security, safety and the comfort of owners working or living on board.

The following floating design features are desirable:

Water area for turning = 2.25L.

• Turning areas should be provided, particularly adjacent to fuelling berths and dead-end channels. Water area for turning, entering and leaving berths should be 2.25 times the length of the longest boat (minimising chance of collision).

Berths at right angles to walkway.

• Berths should be orientated at right-angles to the walkway (maximises numbers, reduces manoeuvring difficulties).

Fingers symmetrically opposite.

• Berths should be arranged so that, wherever possible, fingers are symmetrically located on opposite sides of the walkway (reduces manoeuvring difficulties).

Smaller berths closer to shore.

• Smaller berths should generally be located closer to the shore (more easily manoeuvred into and out of).

Berth access close to marina office.

• Access to berths should be close to the marina of fice (for security reasons).

Berths for hire and bare boat charter craft should allow greater tolerance for inexperienced drivers.

Careful consideration should also be given to the allocation of berths for hire and bare boat charter craft in the marina. In general, hire boats are used more frequently, and by less experienced people than privately owned boats at the marina. Berths for these boats should be readily accessible to the open waterways so as to minimise manoeuvring within the marina. They should also be wider to accommodate inexperienced drivers.

Marina berths may be fixed or floating.

Marina berths may be **fixed**, i.e. piled jetty, or **floating**, i.e. pontoon type. Fixed moorings usually consist of piled walkways (jetties) and mooring piles. One boat moored between a pair of mooring piles is a typical arrangement. Floating moorings are usually pontoons arranged to provide walkways to vessels. These walkways may be located by means of guide piles or cables/chains (attached to anchor blocks), allowing free vertical movement. The boats are moored in either single or double berths, separated by finger pontoons. In areas of high tidal range, floating berths are clearly advantageous, whilst fixed berths are more acceptable in reduced tidal ranges.

Effective (design) berth widths and lengths for fixed moorings are:
(Wb) = B + 1.0 m
(Wdb) = $B_1 + B_2$ + 1.5 m
(Lb) = L + 2.0 m

An allowance should be made in the design of craft berths for manoeuvring (taking account of cross currents) and also clearances when moored. Craft may be moored in both single and double berths. The effective (design) berth widths and lengths for fixed moorings are as follows:

Single Berth width (Wb) = B + 1.0 m
Double Berth width (Wdb) = $B_1 + B_2$ + 1.5 m
Berth length (Lb) = L + 2.0 m

Suggested berth dimensions for floating berth are :
(Wb) = B + 0.6 m
(Wdb) = Wb1 + Wb2
(Lb) = L + 1.0 m

As with fixed berths, clearances are required for craft in floating berths (refer Figure 5). The beam requirement is not as high, however, because the craft's beam at the waterline is generally smaller than the maximum beam, and craft on floating berths can be more tautly moored than in fixed berths where some slack is provided in mooring lines to account for tidal variations. The suggested berth dimensions for floating berths are:

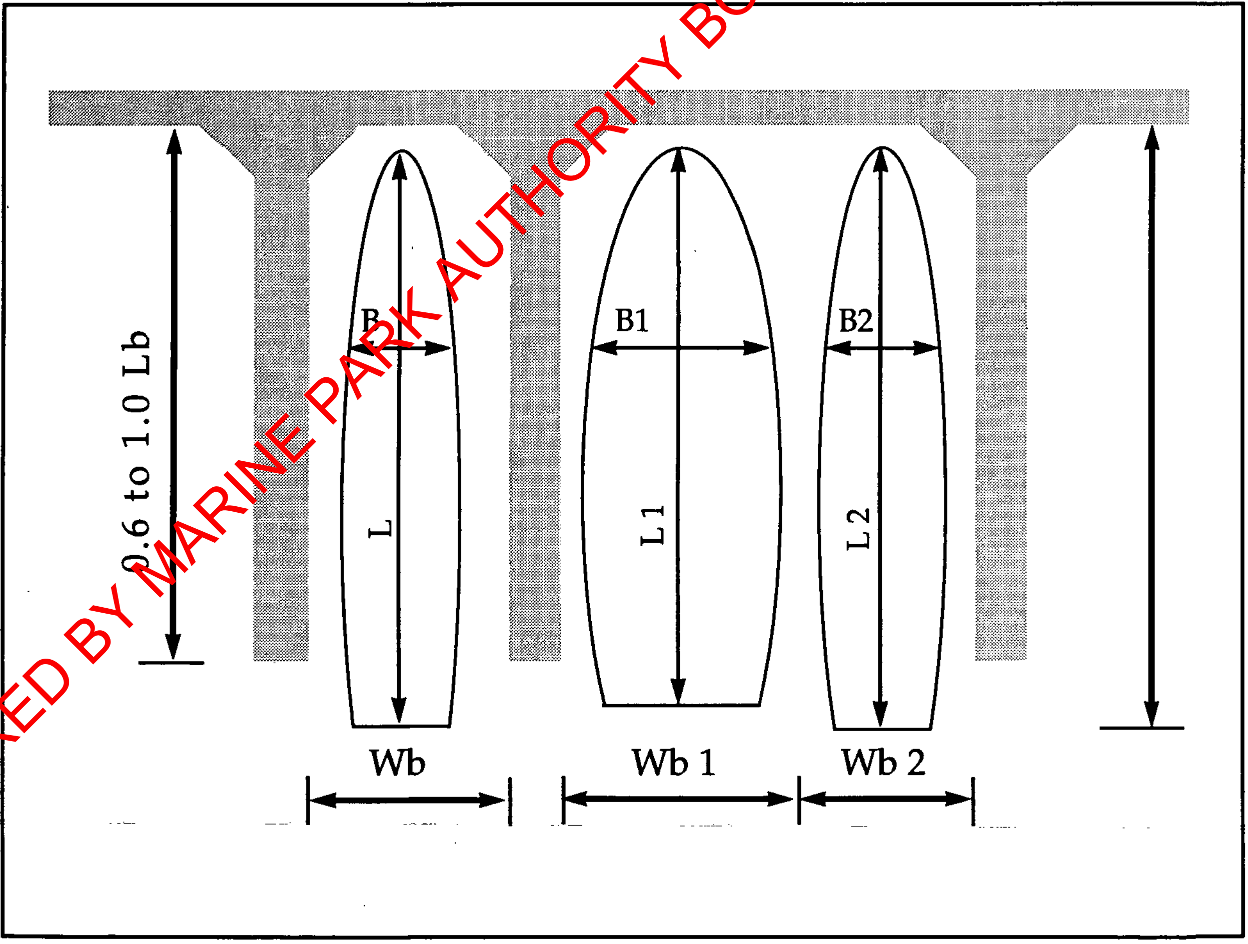
Single Berth width (Wb) = B + 0.6 m
Double Berth width (Wdb) = Wb1 + Wb2
Berth Length (Lb) = L + 1.0 m

4.5 Walkways

Recommended walkway widths given in Table 4.1.

Walkway widths depend on likely usage levels, length of walkway and the extent of ancillary services mounted on the walkway. The walkway should be wide enough to allow two-way pedestrian traffic with barrows. Marinas with live-aboard patronage will be expected to comply with AS1170 Version 2 loading standards. Where walkway lengths exceed 150 m, the minimum widths should be increased by 0.5 m for every 100 m of length over 150 m. Table 4.1 provides recommended walkway widths.

Figure 5. Floating berth dimensions



Optimum finger length is 0.8 Lb.

Fingers have lower levels of usage; hence the width may be reduced to provide passage of only one person at a time. The length of the fingers should fall between 0.6 times the berth length and 1.0 times the berth length, however the optimum appears to be 0.8 Lb. This is sufficiently long to enable boarding and securing of the boat. Shorter fingers may be subjected to oscillations from short period wave action, and may also require provision of additional free-standing mooring piles.

Fendering is required along walkways of both fixed and floating structures.

It is usual to provide fender (or buffer) strips along the edges of walkways and fingers. Fendering is needed along walkways for two reasons. Firstly it should prevent vessels getting under fixed structures, and secondly it will reduce the damage in the event of a collision. The latter applies to both fixed and floating structures.

A 'tee' should be incorporated at the end of each walkway.

A 'tee' should be incorporated into the end of each walkway to prevent wave buffeting of boats berthed at the distal end of the walkways. This area should be used for temporary mooring only.

Table 4.1 Recommended walkway widths

	Minimum	Preferred
Primary Walkway	2.4 m	3.0 m
Secondary Walkway	1.8 m	2.0 m
Finger	0.75m	1.0 m
Fuel Berth Finger	2.4 m	3.0 m
Access Gangway	1.2 m	-

4.6 Reclamations

Reclamation not to cover natural MLW. Reclamation crossing MLW may be broken and bridged.

Reclamation works are not to cover the natural location of the GBRMP boundary (MLW), but that line may be bridged. MLW is not a standard tidal plane and must be calculated by an approved method.

Contact GBRMPA for further information on defining MLW and GBRMPA boundaries.

Where a marina is proposed at a site where MLW forms the boundary of the Great Barrier Reef Marine Park, reclamation over this point would result in alteration of the GBRMP boundary. Except for trivial instances (which generally must be judged on legal advice for each case) the boundary of the GBRMP cannot be altered without the approval of both houses of the Commonwealth Parliament.

4.7 Piers and Pilings

Moored wooden structures can impact water quality within the marina basin through the leaching of wood preservatives. Potential impacts can be avoided or reduced by:

Consideration should be given to the most appropriate materials to be used for wetted surfaces.

- Using alternative materials such as concrete-filled, steel-reinforced PVC, plastics or other non-conventional materials.

- Using highly refined (grade one) creosote that contains less tar, or alternative preservatives such as chromated copper arsenate (CCA salt) to minimise chemical leaching.

Design and place structures to minimise impacts on aquatic habitats.

In addition, the use of solid structures should be avoided in order to minimise habitat loss by allowing adequate water circulation. The marina designer should also minimise structure width to allow for maximum sunlight penetration. Docks and piers should be elevated as high as possible and orientated in a north-south rather than an east-west direction. These designs will avoid excessive shading of aquatic habitats.

Mooring pile 0.9 times the berth length from the walkway.

For ease of berthing and protection of craft when moored, the mooring pile should be located approximately 0.9 times the berth length from the walkway.

4.8 Breakwaters

For fixed breakwaters use design features to enhance flushing rates.

Breakwaters can be fixed or floating. Fixed breakwaters can interfere with currents and reduce the flushing rate within the marina, resulting in reduced water quality and increased shoaling. Solid breakwater design should therefore include consideration of natural current and sediment flow, wave patterns and overall flushing characteristics. Circulation can often be maintained by providing openings in solid breakwaters, at both ends of fixed breakwaters or between the fixed breakwater and shore.

Design for a category 4 cyclone. Incorporate allowance for sea level rises.

Breakwaters and protective works should be designed to withstand a category 4 cyclone, and incorporate allowance for sea level rise as predicted to result from the 'Greenhouse Effect' (refer Section 3.5).

Sloping riprap structures are preferred for breakwater construction.

Sloping riprap structures are preferred for fixed breakwater construction. If the land margin needs stabilisation, a sloping riprap wall with underlying filter cloth is preferred - these have the advantages of maximising habitat niche creation, economy, reduction of wave reflectance problems and minimisation of sedimentation.

Floating breakwaters have a number of advantages over fixed breakwaters but are only effective for sheltered sites.

The alternative to fixed breakwaters are floating breakwaters. Although floating breakwaters are only effective for wavelengths shorter than twice the width of the breakwater and are not effective on open coasts, they offer certain advantages over fixed breakwaters as follows:

- construction cost is nearly independent of water depth;
- they can be used where soft or unstable bottom precludes the use of fixed structures;
- they can be easily relocated if necessary (i.e. reversible impact);
- they can minimise potential interference with fish migration and shoreline processes and can reduce benthic habitat modification; and
- they can be used in areas of high tidal range where high breakwater walls would provide unaesthetic visual effects.

4.9 Fuelling Facilities

Locate fuelling facilities leeward of marina with respect to prevailing winds and leeward of exits.

The location of a fuelling facility is a critical decision with respect to safety. It should be located to be easily accessible by visiting and passing boats, without access through the main berthing area. The facility should be located to leeward of the marina with respect to the prevailing wind in the boating season and to leeward of exits to permit safe evacuation of boats in the event of fire. They should preferably be in the area of greatest flushing in order to minimise water quality impacts.

Ensure easy access to the fueling facility and the emplacement of the safety precautions.

When planning a fuel berth, the following points should be considered in order that a good balance between maximum benefit and potential environmental impacts are achieved:

- access to fuel berth by boats in marina and visiting boats;
- access of fire fighting vehicles to fuel berth;
- provision of adequate fire fighting equipment;
- lighting of berth (for safety and security);
- provision of fuel spillage protection devices to be kept on site;
- size of fuel storage tanks;
- flexible fuel supply lines from shore to berth as approved by the Department of Transport;
- automatic fuel cut-off valves and refuelling by authorised personnel only;
- location of bowsers on shore in preference to on pontoon;
- proximity to marina office;
- fuel facilities should have back pressure automatic shut-off nozzles;
- any fuel transfer systems operating within or across the intertidal zone should use vacuum operated pumps, dry break couplings or drip trays;
- provision for reporting and dealing with all spills; and,
- security against vandalism and unauthorised use.

4.10 Amenities

Specialist requirements for marinas larger than 200 berths or dedicated to racing.

Recommendations for the planning of marina facilities, with particular reference to amenities are given below. The values quoted are for a typical commercial operation of moderate size, say 200 craft. Club facilities and marinas berthing a significant number of racing yachts would demand a greater number of the particular amenity.

Toilet blocks should be provided at convenient points. Recommendations for marina toilet facilities are given in Table 4.2.

Table 4.2 Toilet block requirements

Item	Ratio (per marina berth) Male and Female
Toilets	1 per 50 people
Urinals	1 per 75 people
Wash basins	1 per 50 people
Showers	1 per 75 people
Deep Sinks	one at each block

Amenities should be close to berths and easily accessible by disabled persons.

The range of amenities which are provided at a marina will depend upon the size of the marina and requirements of the clients. Marinas with more than 50 pens should provide rest rooms with showers, basins and toilets convenient to the pens.
It is usual that toilets and showers are provided, however, laundry, locker and similar facilities may be worthy of consideration. No berth should be in excess of 300 m from an amenities block. Access and ease of use by disabled persons should be incorporated in the design and location of amenities buildings.

4.11 Waste Treatment and Disposal Facilities

Onshore pump-out facilities will be required for `designated developments'.

For marinas which are **designated developments** in Queensland, the provision of sewage pump-out facilities onshore will become a condition of development consent.

Assess appropriate marina onshore wastewater collection systems.

Three types of onshore marina wastewater collection systems are available: marina-wide systems, portable/mobile systems, and slip side systems. Marina-wide wastewater collection systems include one or more centrally located wastewater pump-out installations. Vessels requiring the wastewater pump-out services would dock at the pump-out installation and a flexible hose would be connected to a wastewater fitting in the deck of the vessel. These units pump to an onshore holding tank (or truck) or to an onshore wastewater collection and treatment system. Portable/mobile systems are similar to marina-wide systems except that the pump-out stations are mobile. The mobile unit includes a positive displacement pump and a small storage tank. Slip side systems provide continuous wastewater collection facilities at each slip. In general, there are two types of slip side systems, each with modifications available to customise the system. Pump-out systems use an on board grinder pump to transport wastes to a main sewer. Vacuum systems use differential pressure to transport wastewater from each slip to a central collection tank from which wastewater may then be pumped to a sewer or hauled to a wastewater treatment plant. Both types of systems can also handle bilge water discharged from boats if the flow rates do not exceed a specified rate. The system may be used on either floating or fixed docks.

Sewerage system connections are preferred.

Larger projects, that is, marinas with more than 50 pens, should have sewage pump-out facilities unless all users are short-term transients. These can be conveniently placed adjacent to refuelling points. Pump-out and public facilities should preferably be connected to a sewerage treatment system.

Septic systems require a minimum drain field setback of 35 m from surface water.

With marina-connected septic systems, the problem of chemicals from onboard holding systems may be solved by using two septic systems in series for both marina and pump-out use (thus increasing residence time). A minimum drain field setback of 35 m from surface waters is recommended.

Live-aboards cannot discharge directly.

Note that it is GBRMPA policy that any sewage discharge into the Marine Park receives tertiary treatment (nutrient removal). Live-aboard vessels will therefore not be permitted to use direct flow toilets onboard.

4.12 Administrative Areas

Administration centre should have a good view over entire marina.

The extent and sizing of administration areas depends on the size of the marina, extent of shore-based activities and whether offices for government authorities are to be provided. The administration centre should command a good view over the entire marina for safety considerations and client management.

4.13 Maintenance Areas

Maintenance area should allow for one boat per 25 craft.

As a guide, allow enough area for maintenance of one average sized boat per 25 craft at the marina. This will vary depending on craft types and the rate of fouling. For initial planning, provision of 5% of total land area for maintenance is reasonable. Maintenance areas should be located above high tide mark to avoid contamination of incoming tidal water.

Maximise landward length of the slip.

The landward length of the slip should be maximised to permit as many boats as possible to be slipped simultaneously. Tandem cradles assist in this regard and are favoured. Transverse slipping of smaller boats can increase slipway utility.

Slipway gradient of 1:15 is preferred.

Slipway gradients of 1:10 to 1:15 have been found to be the practical limits for most situations. In general, a gradient of 1:15 is preferred (the steeper gradients are useful for small boats only).

Paving design must allow for very high point loads.

In the design of slipways, hardstand and maintenance areas, the paving design must allow for very high point loads. Such loads are generated beneath the wheels of fork lift trucks (as used in dry stacks), hardstand cradles (for small boats and cruisers), under keel chocks, slipway rail supports, parallel boat lifts and straddle transporters.

Maintenance area drainage should include a collection pit.

Careful attention must also be paid to drainage and disposal of stormwater and wash down wastes. Disposal facilities are required to take used sump oil, hull scrapings and other wastes associated with maintenance areas. Maintenance area drainage should therefore include a collection pit from which waste can be removed and bunds around the area to divert external stormwater. Where possible, remove marine growth and paint by mechanical means.

Wastewater disposal may require specific licenses.

Options for wastewater disposal include: pump out pit contents for disposal at an approved site; connect to sewer if contaminants are not harmful to the treatment system (a ***trade waste permit is required***); and discharge to waters after treatment to an acceptable standard (a ***discharge licence is required***) (refer 'Sewage Discharges into the Great Barrier Reef Marine Park, GBRMPA 1993').

Provision should be made for regular cleaning of slipways.

Wastewater from slipways also need to be contained and disposed of, although this is difficult. Slipways should be regularly cleaned by sweeping or vacuuming and the solids removed. Traps may be able to be installed at the lower end to collect wastes which can also be regularly removed.

4.14 Boat Launching Facilities

Boat launching ramp needs should be identified.

Boat launching ramps are required at most marina facilities for the launching and recovery of hire boats, transient craft, dinghies, boats for sale and for deliveries from manufacturers. The need for such facilities should first be identified.

The following guidelines cover the principles of planning and design which may be modified to suit the scale, scope and particular purpose of the marina ramp. Separate ramps for different purposes may be indicated.

Desirable features are:

Boat launching ramps should have the following characteristics:

Locate away from sensitive areas.

- Locate boat ramps away from sensitive areas such as seagrass beds or shellfish beds. Preferred areas are shorelines without wetland vegetation and adjacent to waters with adequate navigation depths.

Recommended slope 1:10. Recommended widths 4.0 m (single) and 3.7 m (multiple).

- To reduce risk of accident, ramp slope should be 1:10 (recommended) and not exceeding 1:8. For ease of use, lane width minimums are 4.0 m (single lane) and 3.7 m (multiple lanes).

Align perpendicular to predominant waves.

- The effect of waves, currents and boat wash should be minimised. The ramp should be aligned perpendicular to the predominant waves so that the boat is not moved sideways during launching and retrieval.

Examine existing amenity of proposed area.

- In general, boat launching facilities should not be located where the ramp activities will have an adverse effect on the existing amenity of the area or where there will be conflict with other activities of the marina.

Adequate water depth at ramp toe.

- Adequate water depths at the toe of the ramp at low water should allow all tide boat launching.

Boarding jetties of 15 m length.

• Boarding jetties or pontoons should be not less than 15 m in length for all water levels.

Car manoeuvring areas to be provided.

• Sufficient area should be provided for approach ramps, manoeuvring cars and trailer parking areas.

Double width ramps recommended.

• Construction of single ramps should be avoided wherever possible. The additional cost of a double width ramp is relatively minor compared to the cost of constructing an additional lane at a later date.

Sufficient lighting.

• Provide minimum lighting for ramp usage.

Indicate ramp lanes by painted lines.

• Ramp lanes should be indicated by painted lines, not kerbs which may cause problems during manoeuvring of boat trailers.

A grooved surface using appropriate ratio cement.

• Deep, square-shouldered grooves moulded into the surface at an angle of 45 degrees to the ramp contours. Concrete used should be the equivalent of 35 Mpa, with slump of 80 mm, water/cement ratio of 0.45 and 20 mm minimum aggregate size.

Marine ways and hoists can be used to minimise shoreline alterations.

As an alternative to ramps, marine ways (dolly) and hoists can be used to minimise shoreline alterations. A marine way precludes the need for a pier or dredging at marinas with a gradual submarine slope and permits preservation of a vegetated fringe, while hoists require pier construction.

4.15 Air Quality

Facilities/activities involving releases into the air should be placed and controlled to avoid downwind air quality problems.

Air quality problems can arise from: vapours from volatile organic solvents used in degreasers, primers, thinners, paints and antifoulants; spray painting drift; dust from abrasive blasting, sanding, planing, wood shaving and sawdust. Paint, spray odours and dust fallout can be a very real nuisance to neighbours at the development, but can be controlled in a number of ways such as maintaining adequate separation distances between boat building/maintenance areas and neighbours; restriction on use of atomised spray guns which produce large amounts of overspray; enclosing workshops and provision of ventilation where appropriate; use of spray 'booths'; conduct of abrasive blasting during low wind conditions and minimisation of dust from sanding by use of suitable dust collectors or industrial vacuum cleaners.

4.16 Parking

Assessment of parking requirements should include:
- **craft usage patterns**
- **public usage of other marina services**
- **alternative parking possibilities**
- **special parking for disabled persons**
- **access special areas for large vehicle**
- **parking for cars and attached trailers.**

A large portion of the land area associated with a marina may be required for car parking (refer also to AS3962-1991). Where land is not readily available, it has to be purchased or reclaimed. This can amount to a major cost in a marina development. In assessing the number of car parking spaces required, the following factors should be considered (together with any others which might apply to a given development):

- size and type of craft at berths likely to use the marina (this relates to crew/passenger numbers and maintenance requirements);
- frequency of use of the various types of craft (to establish a base parking demand);
- likely usage patterns of craft during public holidays and summer periods (to establish peak parking demand);
- location of marina site and adjacent areas for passive recreation, tourism, etc by the public;
- provision of adequate car parking for other marina services and special use areas, such as repair facilities, ferry and charter services, restaurants, shops, sailing clubs, dry storage or for boat launching ramp facilities;
- availability of overflow parking in surrounding streets or nearby areas during peak periods; an
- delivery areas should be provided adjacent to marina walkaways.

Provide parking for people with a disability.

Parking spaces should be made available for persons with a disability (refer AS1428). These spaces should be wider than normal (at least 3.7 m) and should be identified as being reserved for people with a disability. They should be located close to the land based buildings and comprise at least 1% of the available parking spaces. Allowance should be made for people with a disability to cross kerbs and other obstructions.

Provide for (and separate from the public) large and commercial vehicles.

Allowance should be made where the projected activities of the marina require access for large vehicles, (e.g. delivering sail or power boats, and cranage). Wherever possible, delivery and maintenance vehicle traffic should be kept separate from car park areas and circulation roads.

Minimum parking requirements detailed opposite.

Assessment of each aspect of the marina development is necessary, and appropriate car parking requirements need to be assigned. Parking may be allocated using the following minimum provisions:

0.6 parking spaces per wet berth
0.2 parking spaces per dry storage berth
0.5 parking spaces per marina employee
0.2 parking spaces per swing mooring licensed to the marina

Parking area design should consider many factors:

Provide separate areas for car parking only.

• Provide separate areas for 'car only' parking, and provide sufficient car and trailer parking to meet projected demands for normal usage.

Allow for drive-through parking spaces.

• Design drive-through parking spaces for ease of manoeuvring car and trailer combinations.

Locate parking close to the ramp or provide a loading zone.

• Locate parking as close as possible to the ramp such that all parking spaces are no more than 200 m away. If this is not possible a loading zone should be provided close to the rigging and wash areas.

Allow emergency vehicle access.

• Provide easy access for emergency vehicles to 'high risk' areas such as workshops.

Avoid large asphalted areas through use of green areas.

• Avoid large asphalted expanses through the use of green areas. Green areas in the form of strips or islands may be used as a means of controlling traffic and trailer parking areas.

Grass trailer parking areas.

• Experience has shown that grass can withstand trailer loads without undue damage and therefore it is recommended that all trailer parking areas be grassed.

Provide overflow grassed parking areas.

• Provide overflow grassed parking areas wherever possible.

Route parking runoff via landscaped areas.

• Encourage runoff from paved areas to nourish adjacent site landscaping, rather than piping the runoff away from the site.

Ensure a high standard of architectural treatment.

• Undertake a high standard of architectural treatment (both structural and landscape) in order that the car parking area does not detract from the visual appeal of a marina.

Clearly signpost parking controls.

• Parking areas will be enhanced if a set of rules for traffic are adopted and clearly signposted.

Design in accordance with local council regulations.

• Design parking in accordance with local council regulations.

Plan sufficient flexibility to cope with future demand.

• The boat launching facility should, if possible, be designed and located such that future land and water based expansions to the launching ramp may be possible as a result of increased demand.

4.17 Commercial Facilities

Appropriate balance of commercial facilities should be considered.

Appropriate commercial facilities are often essential to the financial viability of a marina. They can also complement the marina and in turn the marina activities often add value to commercial developments.

4.18 Revetment Design

Place revetments as far upland as possible.

Breakwaters or revetments are used to absorb and reflect wave energy away from the marina and to protect boats within the marina basin. Revetments should be situated as far upland as possible and provide access ways over wetlands to avoid shallow intertidal areas.

Use sloping revetments where possible.

Sloping revetments (stair-step or sloped 45° or less) and vegetated revetments provide better habitat and protection for juvenile fish and are preferable to vertical walls, where feasible. If vertical walls are necessary, they should contain weep holes covered with a filter cloth.

Assessment of a suitable design should include hydrographic and geotechnical surveys.

Solid breakwaters can reduce water circulation and affect water quality. Design of these structures should therefore include consideration of natural current and sediment flow, wave patterns and overall flushing characteristics. Additional items which should be considered in the design of a breakwater include: tidal range; water depths; stability of the structure (permissible damage levels); overtopping; availability of suitable rock or use of concrete armour; and foundation stability.

4.19 Aesthetics

Use sloping riprap walls for land margin stabilisation.

The marina designer should aim to maximise vegetated landscaping. If the land margin needs stabilisation, a sloping riprap wall with underlying filter cloth is preferred. These have the advantages of maximising habitat niche creation, economy and reduction of wave reflectance problems. In some cases, stabilising walls have been successfully vegetated with mangrove plantings to provide strength and soften the visual intrusion of such walls.

4.20 Boat Clearances from Revetments and Quays

Allow 1.0 m clearance from boat stern to point of minimum depth on sloping revetment and a similar value from boat stern to quay wall.

The water area available for berths is strongly influenced by the revetment or quay wall treatment. Allow typically 1.0 m clearance from boat stern to point of minimum depth on sloping revetment and a similar value from boat stern to quay wall. Craft with transom hung rudders or deep skeg rudders may require greater clearance. For sloped revetments, the distance from the bank to the boat should be minimised. The further the boat from the bank, the longer the walkway and the more difficult the access.

4.21 Fixed Moorings

A wave height range of 0.5 m to 0.6 m is commonly adopted as the maximum for fixed mooring systems.

Mooring structures within a marina should be designed for the wave climate within the harbour, related to an appropriate return period. Moorings are often anchored using piles (a fixed mooring). A wave height range of 0.5 m to 0.6 m is commonly adopted as the maximum for fixed mooring systems. It is important to be aware that while the mooring system may not be damaged by loadings imposed by 0.5 to 0.6 m waves, the craft may suffer damage to mooring cleats or other fittings.

4.22 Floating Moorings

Floating moorings where wave height is less than 0.3 m, water depth is excessive, sea bed is unsuitable for pilings or establishment costs are prohibitive.

Floating mooring systems are generally used in harbours with small wave heights. A widely accepted practice for the design of wave protection in small craft harbours incorporating floating mooring systems has been that wave heights (within the harbour) should not exceed 0.3 m. Floating mooring systems are also used in sites with excessive water depths, unsuitable sea bed conditions, or prohibitive piling establishment costs.

Four major types:

The floating mooring uses an anchoring system of either:

Clump weight

- concrete or steel clump moorings consisting of a series of weights connected by chains and connected to the pontoons by anchor lines, usually with intermediate drag plates or weights to reduce shock loads;

Anchored

- commercial anchor systems;

Pile driven

- anchor piles driven into the sea bed and cut off at or near bed level, connected to the pontoons by anchor lines, also with intermediate drag plates or weights. This system is used where water depths make full length piles uneconomical; or

Auger moorings.

- screw or auger moorings.

Require periodic survey and major maintenance or repair in 15-20 years.

Screw and auger moorings require more maintenance than a piled system. Periodic servicing by divers is required. However, they have been shown to work effectively. The working life of floating structures is generally shorter than that of fixed structures, with major maintenance or replacement typically required within 15 to 20 years of installation.

4.23 Choice of Materials

Select materials for their resistance to degradation and compatibility with other materials.

The selection of materials for all structural, buoyancy and cladding elements of marinas should be given careful consideration. The environment is extremely aggressive at marinas fronting sea water. The factors which influence the selection of materials are exposure or vulnerability to:
attack by marine organisms (e.g. ship worms, barnacles, algae); tidal zone conditions; stress reversal or fluctuation; fatigue; corrosion; erosion; wear (e.g. at hinges due to constant movement); spillage of solvents; fire hazard; and electrolytic corrosion due to the connection of incompatible materials. Materials should be selected having regard to their compatibility with other materials to which they may be connected.

Adhere to Australian Standard Specifications for materials.

Australian Standards Specifications exist for the majority of construction materials and these should be used. The list is too large for inclusion in this document. Standards are obtainable from the Standards Association of Australia, 80 Arthur Street, North Sydney 2060.

Petroleum resistant polystyrene to be used in foam structures.

Foam structures should be made of petroleum resistant polystyrene foam rather than expanded bead foam - it lasts longer, has greater cohesion and better fouling resistance.

Minimise waterproofed areas.

Waterproofed (concrete/bitumen) areas should be minimised. Gravel or shell grit surfacing is an attractive alternative appropriate in many instances and has benefits of decreasing runoff velocity, increasing infiltration and allowing suspended solids to settle out of runoff water.

Avoid the use of antifouling paints wherever possible.

While wood preservative such as CCA are suitable, antifouling paints will not be approved for use on non-boat facilities in the GBRMP unless it can be shown that they do not release heavy metals into the water. If the use of creosote is necessary then use Grade 1 not 2 or 3.

4.24 Safety Requirements

Incorporate safety features into design.

A marina facility should be designed with consideration given to safety so as to reduce the risk of injuries and damage to life and property. If safety features are incorporated into the initial design of the marina it will ultimately facilitate site management and reduce safety hazards that otherwise arise due to poor planning. When planning the marina layout, the designer should ensure easy access for people with a disability is provided to all areas of the marina. Steps should be avoided wherever possible.

5.0 CONSTRUCTION

Unregulated or thoughtless construction techniques often represent the greatest potential for environmental damage from a marina development. Impacts which may occur during the construction of the marina should be identified early in the planning process. Careful planning for unavoidable impacts should be undertaken to minimise them and their effects. Consideration should be given prior to the letting of any construction contracts, as to an appropriate set of contract conditions that will protect the marina environment from careless or destructive construction practices.

Note that, certainly for works in the GBRMP, an officer will be appointed to act as Environmental Supervisor for GBRMPA and QDEH interests. This person will be empowered to stop or suspend works in certain specified circumstances. This person's salary, on-costs and reasonable expenses will be paid for by the developer.

5.1 Dredging and Excavation

Consult Commonwealth and State authorities on legislation governing dredging and reclamation.

Dredging, excavation and reclamation are often involved in marina construction. Dredging and excavation can be very destructive activities and are closely controlled by various articles of legislation. Early consultation is strongly recommended with all authorities involved in the legislation.

Assess natural turbidity levels and local environmental parameters to determine likely impacts of dredging.

Impacts from excavation, dredging and construction activities may be environmentally significant, depending upon the physical and biological characteristics of the surrounding water body. The degree of impact depends on the type of material excavated; the health of the existing environment; the character of site-specific habitats, wildlife, water quality, and adjacent developments; and the manner in which the dredging and disposal is conducted. Dredging may increase natural turbidity levels by resuspending silt or by introducing spoil material into the water column. Wave action, erosion of unstabilised dredged canal banks, and leaching of unconsolidated spoil mounds can also increase turbidity. Natural turbidity may be relatively high due to sediment from rivers and elevated turbidity levels from dredging can be temporary and localised.

The dredge-related effects of siltation, however, can have a prolonged and serious impact through seagrass destruction, shoaling and circulation changes, stress on coral reefs and burial of organisms (see Section 3.6).

The abatement of dredging effects initially involves assessing the need for dredging or excavation. Ideally, a marina should be sited in a well flushed, protected, deep water, natural harbour with high circulation that does not require dredging for navigation or require spoil filling of submerged wetland areas. Realistically, such areas are not always available or economically feasible. However, minimising the amount (area and volume) of material dredged and the frequency of dredging activities will reduce the environmental impact as well as the cost of maintaining the marina.

Site marina to minimise dredging, excavation and reclamation.

Dredging needs can be reduced by placing deep draught boat access points or slips in areas that are closest to the entrance or are naturally deeper.

When dredging or excavation is required, the following issues should be addressed:

Written permission of the Authority required for maintenance dredging.

• Dredging is to be undertaken only in a manner which uses the best practicable available technology to minimise impacts on the site. No maintenance dredging is to commence without the prior written permission of the GBRMPA.

Minimise dredging.

• Minimise the amount of material dredged and the frequency of dredging.

Choose appropriate dredging method.

• Choose an appropriate dredging method. A wide range of techniques exist. Each is suited to particular localities and geotechnical conditions. Environmental impacts differ markedly between methods, and differ for each method according to the conditions the dredge is working in.

Use silt containment techniques.

• Use silt screens or similar containment methods around excavation if appropriate. Screening can lead to a dramatic reduction in resuspended sediments in adjacent areas.

Dredge when dissolved oxygen levels are higher.	• Dredge during colder months when dissolved oxygen levels are higher (cold water has a greater capacity for dissolved oxygen than does warm water).
Minimise dredge or fill operations in wetlands.	• Dredging and filling in wetland areas should be undertaken only if the proposed activity is water-dependent and there are no feasible alternatives.
Reduce dredging in bay habitats or at key times of wildlife breeding.	• To the maximum extent feasible, dredging and filling activities should be restricted in nursery areas and shellfish grounds and during critical periods in the life of important sport and commercial species.
Dredge in such a way as to minimise water quality degradation.	• Dredging and excavation should not enclose mangroves; create stagnant water conditions, lethal fish entrapments, or deposit sumps; or otherwise contribute to water quality degradation.
Prevent dispersal of silty water.	• Designs for dredging and excavation projects should, where feasible, include protective measures such as silt curtains and bunds to protect water quality in adjacent areas during construction by preventing the dispersal of silt materials.
	In determining what is done with the dredge spoil generated by marina construction, the following process should be undertaken:
Reduce dredge spoil.	• All opportunities to reduce the need to dredge and to reduce the production of dredge spoil are to be investigated and adopted if feasible.
Productive uses of dredge soil to be sought.	• All productive uses of the dredge spoil and opportunities to re-use or recycle it are to be investigated and adopted if feasible. Note that dredging specifically carried out for the purpose of obtaining material for other purposes (beaches, reclamation) is defined as mining and is specifically forbidden in the GBRMP by law. Dredge spoil can however be used for beach nourishment (if suitable material) if this is not the primary purpose of the dredging.
Investigate terrestrial disposal sites.	• If no productive uses are feasible then terrestrial disposal sites are to be investigated and adopted if feasible.

Consult with QDEH and other Queensland agencies for land sites.	• Selection of terrestrial disposal sites should be undertaken in close consultation with QDEH and other Queensland agencies, and may require permission under various relevant legislation.
Upland disposal preferred.	• Upland disposal of dredge spoil is preferred. Wetlands and mudflats should not be utilised unless there are no feasible alternatives.
Existing dumping sites favoured.	• Existing disposal sites should be utilised to the fullest extent possible (where feasible).
Hazardous materials cannot be dumped in wetlands.	• Dredged materials containing hazardous levels of toxic materials shall never be disposed of in wetland areas.
Vegetate bunds to minimise silt loss.	• Bunds surrounding disposal areas should be shaped and vegetated immediately with outfalls positioned to empty into non-wetland areas.
Consider public health implications.	• Attention must be given to possible adverse impacts of alternative deposition sites on public health and welfare.
Dredge only after disposal sites acquired.	• In all cases, dredging activities shall not be approved until satisfactory disposal sites have been acquired.
Confine discharges.	• Confine discharges to the smallest practicable deposition zone to protect adjacent substrates.
Prefer public permitted disposal sites.	• Use currently permitted public disposal sites.
Dedicated upland sites are viable alternative.	• Dedicating permanent upland disposal sites as part of the marina specifications would help eliminate future problems related to disposal of maintenance dredging material. These sites can be sites that have been previously used or represent an environmentally satisfactory alternative.
Maximise fill potential of existing sites.	• The carrying capacity at existing disposal areas could be increased by raising the height of containment embankments.

Use impervious basins for contaminated spoil.

• Disposal of toxic and organic materials is required in impervious containment basins. Settling of contaminated suspended particles may be enhanced by the addition of a cationic polyelectrolyte with further treatment using sand filters and activated charcoal before discharge.

Use runoff retention systems to minimise water quality impacts.

• Upland retention or treatment of runoff from the discharged material is desired to remove dissolved pollutants before they reach the aquatic environment. A simple treatment such as ozonisation or aeration can be adequate for reduction of BOD and COD before the discharge of supernatant liquid from spoil areas enters into receiving waters.

Plan for possible odour problems.

• Consider the potential odour problems from spoil during the selection of the disposal site and site preparation.

Ensure dumping grounds are not filled to interfere with flushing and hydrodynamics.

• When dumping spoil, maintain the same elevation as marshes and other contiguous areas to promote natural tidal flooding and flushing.

Consider creation of 'spoil islands' for habitat replacement.

The creation of 'artificial' islands of spoil in a nearshore area may be acceptable in some instances, particularly if re-vegetation is used to replace lost wetland areas. Spoil islands would be best placed up-drift of dredged areas, since stabilised islands will then intercept further material and reduce ongoing dredging requirements.

Sea dumping of spoil is undesirable.

Should no productive uses or terrestrial disposal sites be feasible then sea dumping of the spoil may be considered.

Sea dumping site selection must be done in conjunction with the authorities.

Selection of sea dumping sites should be undertaken in close consultation with GBRMPA, DEST (CEPA) and QDEH. Permission will be required under the Environment Protection (Sea Dumping) Act and/or the GBRMP Act.

5.2 Mitigation of Siltation

No sediment laden material to wash into the Marine Park.

All works, including on-land works, are to be carried out in a manner that ensures sediment laden material does not wash into the Marine Park. Excavation should be conducted during the drier months of the year. Silt capture curtains may be required if wet excavation is proposed and water currents are below 1.5 knots. Wet excavation of clay material is to be minimised as far as practicable, unless the site can be effectively bunded.

Erosion and sediment controls required.

Install erosion and sediment controls before upland construction begins.

Pile driving is preferred to jetting.

A temporary increase in turbidity may occur during emplacement of marina structures. This may be alleviated by the use of pile driving rather than jetting.

Use a drilling and tamping method of blasting.

If blasting cannot be avoided, the preferred method is drilling and tamping using multiple small charges rather than single large ones. Staggered detonation times or explosives with slower detonation velocities should be employed. Remember that GBRMPA regards blasting as the technique of last resort in the Marine Park, and will not approve it unless it is demonstrated that other techniques are not feasible.

Marina basin dewatering, floor stabilisation and reflooding to be carried out to the Authority's satisfaction.

Dewatering of the marina basin and the disposal of dredge tail water may be by pumping to an agreed offshore location after settlement and filtering to remove suspended particles as far as practicable (see Section 5.1). The floor of the marina basin is to be stabilised to the Authority's satisfaction. Reflooding of the marina basin is to be carried out in an agreed controlled manner over several tidal cycles prior to the removal of temporary bund walls.

5.3 Scheduling of Activities

Do not schedule dredging during critical life stages of local aquatic organisms.

Schedule dredging and other construction activities at times other than during spawning, migration or critical life stages of fish and other aquatic organisms. Critical periods may vary with geographic location, tidal cycles, or seasonal rainfall patterns.

Table 5.1 Environmental Concerns during construction phases of marina development: short-term concerns (Adapted from Carpenter et al. SPREP)

Activity	Consequence to Environment	Environmental Impacts	Human Health and Welfare Impacts	Mitigation
Dredging/disposal of dredge spoils	• Turbidity • Sedimentation • Benthic destruction • Dredge spoil	• Water quality degradation • Habitat destruction and species loss • Toxicity 1. Ocean disposal - species loss 2. Land disposal - leachate damage	• Public health risk • Welfare losses 1. Subsistence 2. Recreation 3. Economic (fisheries, tourism) • Loss of potentially productive land • Aesthetics	• Design and siting - avoid high quality areas • Siltation controls 1. Silt curtains 2. Settling ponds 3. Appropriate technology • Productive use of dredge spoil • Compensatory habitat creation
Blasting	• Concussion • Noise • Seismic shock	• Destruction of corals • Fish kills • Disturbance of endangered species	• Property damage • Welfare losses 1. Subsistence 2. Recreation 3. Economic (fisheries, tourism)	• Timing to avoid migratory or spawning seasons • Minimise charge size placement/ configuration of charges • Use air curtains
Site clearance/grading	• Denuded landscape • Altered soil profile • Altered topography • Noise	• Soil erosion • Water quality degradation • Habitat destruction and species loss • Increased runoff • Increased risk of land slippage	• Destruction of cultural resources 1.Archaeological sites • Welfare losses 1. Subsistence 2. Recreation 3. Economic (fisheries, tourism) • Loss of potentially productive land • Cultural displacement • Aesthetics	• Design and siting - avoid sensitive areas • Archaeological survey/excavation • Grading controls 1. Drainage berms 2. Settling basins • Relocation of displaced population
Construction activities	• Fugitive dust • Machinery emissions • Congestion/traffic • Structural addition to coast and landscape • Fertiliser/pesticides	• Disturbance of endangered species • Toxicity; species/habitat loss • Water quality degradation • Eutrophication	• Worker safety • Public health risk 1. Respiratory irritation • Welfare losses 1. Quality of life 2. Subsistence 3. Recreation • Aesthetics	• Noise and emission control ordinances • Toxic substance controls • Timing to avoid migratory or spawning season • Compensatory enhancement

6.0 OPERATION

A coastal marina designed and constructed using the most environmentally sound methods can still be environmentally harmful without proper operation and maintenance. Key areas of concern during the operational phase of a marina development are the conduct of day-to-day management and maintenance; user education to marina management goals; control over boating operations; maintenance dredging; runoff control; boat wastes; fuel management; noise management; and staff training. In an effort to keep water quality near the marina as high as possible, some or all of the following may form part of the Marine Parks operating permit for the facility in the form of an agreed Operations Procedures Manual. In addition, it is very likely that some form of quantitative water quality monitoring will be required. Remember that operating a marina, as well as construction, requires a Marine Parks permit and involves application fees, and probably a bond, insurance, and an operator funded monitoring program.

6.1 Marina Operations and Maintenance

Marina staff should be familiar with specified standard operational procedures.

The dock master and marina attendants should be completely familiar with specified standard operating procedures. It may be helpful for marina staff to receive training and certification from suppliers and equipment manufacturers on proper operation and maintenance of boats and specialised marina equipment. The specification of performance standards for marina equipment could be an effective management tool for controlling pollutant releases.

Ensure routine marina upkeep and maintenance.

Routine marina upkeep should include: the regular collection of all litter in covered containers; the regular maintenance of fuel pumps and spill prevention systems; the removal of debris that accumulates on the shore and in grease/solids traps; as well as maintenance of 'wear and tear' on structures and coatings.

6.2 User Education

Inform boaters of regulations regarding sewage discharge.

An effective means of controlling sewage pollution from boats is to educate boaters about the potential health and environmental hazards associated with the discharge of sewage and to encourage boaters not to discharge either treated or untreated wastes into a marina basin. It is important to note that, for waters actually within the GBRMP, sewage must be treated to tertiary level prior to release from point-source discharges. Permanently moored live-aboard vessels may be considered point sources for discharge purposes and may be constrained from directly discharging wastes. Marina operators or harbour masters should post regulations prohibiting the discharge of any waste into marina waters and inform their clients of Federal and State regulations and policies when slips or dry storage spaces are rented. This would be very helpful in preserving water quality. It also makes good business sense to maintain an aesthetically pleasing environment.

6.3 Boat Operation and Maintenance

Inform boaters of benefits of unleaded fuels and well tuned engines.

Boat motor emissions can be reduced through the increased use of unleaded fuels. Public education directed toward the importance of well tuned engines is another mitigative measure to be considered for reducing emissions and increasing efficiency.

Encourage use of non-phosphate detergents.

Use of non-phosphate detergents for washing boats would greatly reduce the amounts of nutrients entering the water from this source.

Control hydrocarbons in bilge discharges.

Hydrocarbons entering the water from bilges may be controlled by using oil filtration devices on bilge pumps, or commercial oil-absorbent pads placed in the bilge to soak up oil and fuel prior to bilge water discharge. Sump plumbing should collect oil drainings before they enter the bilge.

Perform boat maintenance activities upland and confine or treat residues and spills.

Painting, sand blasting, engine repairs, boat washing and similar boat maintenance activities performed on shore either indoors or behind canvas screens would help confine any residue or spills from these operations. These operations should be conducted upland, away from marina waters and preferably behind areas enclosed with bunds, drainage channels and sediment traps. This would facilitate cleanup and help prevent contamination of marina waters from runoff during rain storms. Another desirable pollution control option is to regularly collect and remove particles (from sediment traps or the work area) or otherwise treat the runoff from boat painting and scraping areas.

Take measures to reduce copper levels.

Marina operators can reduce copper levels by eliminating the use of copper-based antifouling paints on floats, buoys, and other non-boat surfaces. This step may encourage additional fouling on these surfaces, however, these fouling communities are an important food source for foraging fishes which in turn attract sport fishes into the area.

Copper concentrations within the marina, as with detergents, sewage, and other pollutants, also can be reduced by proper marina siting and design that allows adequate tidal flushing.

Avoid use of air-based spray equipment.

Maintenance painting should not involve spray equipment, particularly air-driven spray guns which produce large volumes of over-spray drift.

Do not use tributyltin oxide based paints.

Use of tributyltin oxide based paints in Queensland requires approval from the Minister under the *Chemical Usage (Agricultural and Veterinary) Control Act 1988*, and can then only be used on vessels greater than 25 m in length and at prescribed levels. Disposal of all waste is also determined by the Minister. Guidelines for the use and disposal of these paints are currently being developed by QDPI.

6.4 Maintenance Dredging

Dispose of dredged material in upland areas (see Section 5.1).

Maintenance dredging may be necessary in some marinas. Provisions should have been made during marina planning to dispose of any dredged material in upland areas away from the marina. There is a general trend to reduce sea dumping of maintenance spoil. See Section 5.1 for possible impacts of dredging and options for disposal of dredged material. Remember that dredging to deliberately obtain material for beach nourishment is not allowable in the GBRMP.

Suction head dredges preferred.

Most maintenance dredging involves spot dredging of silt fines or sands. Suction head dredges have been used for this work around marina structures to prevent damage that dragline and clamshell dredges may cause. A suction head dredge uses high pressure water jets to loosen bottom material and compressed air to operate pneumatic slurry pumps that force material in concentration through a discharge line. Turbidity can be a problem if such operations are not conducted with caution and adequate control.

6.5 Runoff

Employ an effective stormwater management plan.

Water quality in the marina basin can be impacted by pollutants in stormwater runoff from upland facilities, spills and discharges from boats. These pollutants include sediment, nutrients, petroleum hydrocarbons, metals and bacteria. Maintaining water quality within the marina basin requires effective use of a stormwater management plan. This plan would cover waste minimisation, use of vegetation and detention ponds, first-flush retention and trapping of wastes from specific problem areas.

Build and maintain pit traps from spoil disposal areas.

Drainage for dredge spoil deposit areas should include a collection pit from which waste can be removed. Maintenance must include regular cleaning of sediments trapped in this collection pit.

Minimise clearing and create vegetated buffers.

Clearing in the marina area should be minimised and vegetated buffers such as marsh, mangrove or natural vegetation retained or created on the site between land and water areas. Vegetation will reduce runoff and associated erosion effects. In addition there will be some assimilation of materials present in the runoff.

Take measures to decrease runoff velocity and increase infiltration.

Retain at least the first 2.5 cm of rainfall and route runoff through swales, wetlands, retention and detention ponds and other systems that will increase the time for assimilation of pollutants, decrease runoff velocity, increase infiltration, and allow suspended solids to settle and thereby remove particulate pollutants. The use of porous surfaces (crushed stone, shell) wherever possible, particularly in parking areas, will provide similar benefits. Stormwater discharges are not regulated by GBRMPA as yet, but may be in the future.

Locate outfalls in areas of high flushing rates.

When outfalls are necessary they should be located to discharge into areas with high flushing rates either externally adjacent or remote from the marina basin. This is most important for runoff of urban origin. Sewage outfalls within the GBRMP are regulated by GBRMPA. Effluent must be 'tertiary treated' (nutrients removed) or equivalent.

6.6 Boat Wastes

Sewage outfalls must conform to GBRMPA Sewage Discharge Regulations.

Controlling sanitary wastes from boats is one of the primary marina permitting issues because of the potential impacts from bacterial contamination. Overall faecal coliform counts should not exceed 200 per 100 ml of sample water within the facility at any time. Sewage outfalls within the GBRMP will be required to conform to GBRMPA's Sewage Discharge Regulations (the `20/30 standard' - 20 mg/l BOD_5, 30 mg/l suspended non-filterable solids). This standard is coupled with maximum total nitrogen and total phosphorus levels of 4 and 1 milligrams per litre (ppm) respectively (refer 'Sewage Discharges into the Great Barrier Reef Marine Park, GBRMPA 1993'). This source of pollution can also potentially result in contraventions of Queensland water quality standards. Because of these regulatory concerns, proper management plans and designs for these wastes can be critical to marina development.

Prevent potential sanitary waste discharge.

On board marine sanitation devices (MSDs) are normally classified as Type I, Type II, or Type III. Type I and II MSDs treat and discharge the wastes to the water body. Type III devices are on board holding tanks which must be periodically emptied to an onshore facility. Potential sanitary waste discharge into marina waters can be mitigated by:

- posting and strict enforcement of discharge rules in the marina;
- requiring all boats with installed MSDs to be connected to a sanitary waste collection system when moored in the marina;
- sealing discharge outlets from Type I and Type II MSDs when boats enter the marina and/or requiring all boats berthed in the marina to have an approved Type III MSD or a portable toilet; and

• banning live-aboards or requiring that these boats be permanently connected to a slip side sanitary waste collection system.

Further tightening of marine pollution laws are likely in future.

Australia is part of the International Maritime Organisation (IMO) and is a participant in the *International Convention for the Prevention of Pollution from Ships* (MARPOL 73/78). MARPOL outlines specific limits on discharges of oil, some chemicals, garbage and sewage. A total ban on discharge of oil, some chemicals and garbage exists within the Marine Park.

Provide wastewater pumpout facilities.

With regard to boat holding tank wastes, marina experience has shown that collection facilities should be conveniently available at existing fuelling stations. Facilities for pumping out larger boats that remain in their slips and for handling wastes from small portable toilets should also be provided as required (see Section 4.11).

Provide convenient rest-room amenities.

Another method of handling boat wastes is to provide convenient shoreside rest room facilities of adequate size with hot showers and wash basins. Rest rooms, if well maintained, will tend to reduce boat toilet use (see Section 4.10).

Ensure control of pollutants from bilge water. Waste oil reception facilities must be provided as per IMO/MARPOL requirements.

Oily wastes can enter marina waters from the discharge of bilge water. This type of pollution can be reduced or eliminated through strict marina rules and management. Boats can be fitted with oil filtering sump plumbing and contain oil-absorbent pads in their bilges (see Section 6.3). Control of pollutants from bilge water can also be implemented through discharge of bilge water into a slip side vacuum system. These systems can handle wastewater at rates up to 75 litres per minute.

Provide adequate garbage disposal services as per IMO/MARPOL requirments.

Allowance should also be made for garbage disposal services capable of handling heavy weekend or seasonal usage. Strategically placed and serviced rainproof litter receptacles, convenient to boat users, should be installed and regularly emptied (see Section 4.10).

As a general rule, operators should assume that direct discharge of untreated matter from live-aboard vessels would not be permitted.

6.7 Ecological Considerations

Control vessel access and speed to protect banks, marine animals and safety values.

Enforcement of speed limits within marinas and adjacent waterways and clearly marked channels will assist in safety and the protection of aquatic organisms. In addition, control of boat speeds can help prevent shore erosion due to boat wash. Eroding areas should be immediately stabilised. Posting of no-wake zones can help prevent damage from boat-generated waves.

Establish grounds maintenance guidelines.

Grounds-keeping is an important maintenance responsibility. The marina grounds should be kept clean and attractive. Good maintenance practices should be extended to the marina waters and shoreline. In addition to the normal grounds-keeping duties, the maintenance staff should consider:

- utilising professional landscaping practices;
- conservative use of insecticides, herbicides and fertilisers which could create water quality problems by leaching;
- prevention and clean up of petroleum spills from upland fuelling stations; and
- maintaining a regular rubbish/garbage collection schedule.

Provide special facilities for fish cleaning.

Fish cleaning facilities (including waste disposal) should be provided at boat launching ramps. Care should be taken in northern regions when placing fish cleaning facilities as estuarine crocodiles may be attracted by them.

Prohibit fishing in marina.

Fishing should also be prohibited within the marina area to reduce the risk of accidents and rubbish production.

6.8 Fuel Management

Employ appropriate safety procedures.

Fuel docks and launching ramps are the primary sources of small spills of oil and fuel. See Section 4.9 for safety procedures which should be followed at fuelling facilities.

Train fuel attendants in prevention and handling of fuel spills.

Fuel spills at marinas are generally very small, but they may be frequent. Contamination from fuel spills may be avoided through training fuel attendants to prevent and to clean up any fuel spills. Fuelling of ramp-launched boats before launching would prevent spills going directly into the water.

Produce an oil spill contingency plan.

Management will be required to have an oil spill contingency plan and appropriate equipment for dealing with a spill, if fuelling points are provided. Oil spill contingency plans will be subject to review by GBRMPA and QDOT.

6.9 Staff Training

Carry out appropriate staff training.

Marina personnel should be sufficiently experienced, trained and familiar with marina operation and maintenance plans to:

- handle administrative requirements and problems;
- properly execute or manage marina services such as boat launching, fuelling and boat repairs;
- exercise necessary control over marina activities; and
- maintain the premises in good condition.

6.10 Noise Management

Publicise noise management guidelines.

Manufacturers have made significant progress in reducing the noise levels of boat engines. At marinas, consideration must be shown to both the neighbours and customers. As sound travels across water easily, management of noise is important, particularly after dark. Marinas in residential areas should maintain a 'good neighbour' policy by stipulating and enforcing rules to control noise. Buffers between marina sites and residential areas should be provided and maintained. If necessary, posting and enforcing rules can be used to limit noise.

Design buildings and install equipment to minimise noise.

Other than engine noises, the main sources of marina noise are: cutting, grinding, hammering, planing, sand blasting, air compressors and staple guns, and trucks and forklifts. The use of adequate amelioration measures can substantially reduce noise levels. These measures include: maintaining adequate separation distances between boat building/maintenance areas and neighbours; restricting hours of operation for noisy activities; designing buildings to contain noise; the use of acoustic barriers and damping and insulating materials; using optical signals instead of horns, alarms and telephone bells; and fitting efficient exhaust mufflers to vehicles and equipment.

6.11 Management Handbook

A clear and complete operations and maintenance plan should be available at all times.

Proper site planning can help avoid or minimise many of the impacts that can result from marina development. During marina operation and maintenance, implementation of a clear and complete operations and maintenance plan can contribute significantly to the environmentally sound performance of the marina facility. Dock masters and marina attendants should be fully familiar with all management practises and permit conditions. Attention to the agreed housekeeping standards by users should form a component of the duties of these employees. Monitoring of results can be used to help modify or add management procedures. It is likely that preparation of and adherence to an Operations Procedures Manual will form a permit requirement for larger marinas operating in the GBRMP.

Distribute management notes as berths are rented.

Management notes outlining the housekeeping standards and availability of dockside waste management facilities should be distributed as slips/berths are rented.

6.12 Role of Monitoring

Maintain ongoing monitoring reporting.

After approving a marina proposal for construction or operation, regulatory agencies typically seek feedback on the effectiveness of marina management at achieving the levels of environmental impact predicted by the developer. Operation of a marina may be subject to different Commonwealth and State permits and monitoring requirements although these are usually consolidated. These monitoring programs may examine the effects of maintenance dredging; water quality in relation to sewage discharge or runoff; monitoring for hydrocarbons and metals in sediments; changes to amenity and the social environment; and other project-specific factors. Monitoring requirements, discussed previously, are intended to ensure that resource managers can respond if unacceptable environmental degradation occurs. It is therefore necessary to continue with the approved monitoring program, constantly providing feedback to the required resource management agencies, throughout the operational life of the development. Site specific programs are paid for by developers/owners.

Table 6.1 Environmental concerns during operational phases

Activity	Consequence to Environment	Environmental Impacts	Human Health and Welfare Impacts	Mitigation
Maritime wastes and effluents	• Organic petroleum residues • Heavy metals • Sewage effluent • Antifouling compounds	• Water quality degradation • Toxicity; species/habitat loss • Eutrophication • Change in ecosystem structure	• Public health risk • Welfare losses 1. Subsistence 2. Recreation 3. Economic (fisheries, tourism) • Aesthetics • Clean-up costs	• Discharge regulations • Shoreside collection facilities • Education • Enforcement
Oil Spills • Chronic • Catastrophic	• Oil and oily wastes	• Acute toxicity; species/habitat loss	• Public health risk (long-term)	• Emergency response plan - clean-up and removal
	• Decomposition products • Floating, suspended, and dissolved pollutants • Detergents from clean-up action	• Water quality degradation • Intertidal habitat degradation • Change in ecosystem structure • Coating of birds and animals	• Welfare losses 1. Subsistence 2. Recreation 3. Economic (fisheries, tourism) • Catastrophic risk (cost of clean up) • Aesthetics of water and beach	• Design-specific safeguards 1. Containment structures 2. Overflow controls
Coastline modification • Harbour configuration • Coastal topography	• Altered physical oceanography • High residence times	• Beach erosion/accretion • Sand transport • Change in ecosystem structure • Eutrophication • Accumulation of wastes	• Public health risk • Welfare losses 1. Property 2. Recreation 3. Economic (e.g. nearshore fishery) • Aesthetics	• Comprehensive predesign phase environmental survey • Appropriate site-specific design • Compensatory reserves
Runoff - from shore - delivery by stream	• Sediments/organics - toxics - inorganic nutrients	• Water quality degradation • Toxicity; species/habitat loss • Eutrophication • Change in ecosystem structure	• Public health risk • Welfare losses 1. Subsistence 2. Recreation 3. Economic (fisheries, tourism) • Aesthetics	• Drainage control system 1. Ponding basis 2. Storm drain maintenance
Land use changes	• Secondary development • Enhanced access	• Urbanisation • Overfishing/ resources depletion • Change in ecosystem structure	• Public health risk 1. Air pollution 2. Water pollution • Welfare losses 1. Quality of life 2. Loss of agricultural land 3. Overburdening of infrastructure • Aesthetics	• Land use planning and control • Resource management 1. Catch limits 2. Education • Appropriate site selection avoiding sensitive areas

Activity	Consequence to Environment	Environmental Impacts	Human Health and Welfare Impacts	Mitigation
Solid waste disposal	• Waste from human activities pollutes water and soil • Leaching from landfills or dumps • Smoke and fumes from burning	• Water and air quality degradation • Toxicity; species/habitat loss • Marine life entanglement	• Public health risk • Welfare loss 1. Economic (tourism) • Aesthetics • Clean-up costs	• Plentiful supply of litter receptacles • Routine clean-up • Adequate treatment and disposal technology
Land-based sewage effluent	• Suspended solids • BOD • Pathogenic organisms • Chlorine • Freshwater demand • Toxic industrial waste	• Water quality degradation • Eutrophication • Toxicity; species/habitat loss	• Public health risk 1. Pathogenic exposure transmission 2. Food web toxic accumulation • Welfare loss 1. Subsistence 2. Recreation 3. Economic (fisheries, tourism) • Aesthetics • Clean-up costs	• Waste management program
Harbour operations (terrestrial and marine)	• Noise • Congestion/traffic • Hazardous material concentration	• Welfare loss 1. Quality of life 2. Economic (time costs) • Public safety	• Vessel operations management • Noise ordinances • Toxic substance controls	

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8.0 APPENDICES

APPENDIX 1

LEGISLATION WHICH MAY AFFECT COASTAL MARINAS IN OR ADJACENT TO QUEENSLAND AND GREAT BARRIER REEF MARINE PARKS

(All legislation and Departments referred to are Queensland unless indicated.)

Legislation	Administration Authority	Synopsis of Effects on Coastal Issues
Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Commonwealth)	Aboriginal and Torres Strait Islander Commission	Back-up legislation to State legislation protecting Aboriginal and Torres Strait Islander archaeological sites and traditional places
Australian Heritage Commision Act 1975 (Commonwealth)	Australian Heritage Commission	Protection for items of cultural and natural heritage listed on the National Estate
Beach Protection Act 1968	Coastal Protection Unit Department of Environment and Heritage	Controls coastal land use and development
Chemical Usage (Agricultural & Veterinary) Control Act 1988	Department of Primary Industries	Use of and disposal of Tributyltin antifouling paints
Coastal Waters (State Title) Act 1980 (Commonwealth) and *Coastal Waters (State Powers) Act 1980* (Commonwealth)	Commonwealth Attorney-General's Department	Allows the State title to the seabed within coastal waters and the management of specific Commonwealth Waters and/or function in such waters
Cultural Record (Landscapes Queensland and Queensland Estate) Act 1987	Department of Environment and Heritage	Preservation of important aethetic values such as landscape
Environment Protection (Impact of Proposals) Act 1974 (Commonwealth)	Commonwealth Department of the Environment, Sport and Territories	Ensure that matters significantly affecting the environment are fully taken into account by or on behalf of the Australian Government
Environment Protection (Sea Dumping) Act 1981 (Commonwealth)	Commonwealth Department of the Environment, Sport Territories	Disposal of dredge spoil
Fisheries Act 1976	Department of Primary Industries	Protection and management of fisheries resources in Queensland
Great Barrier Reef Marine Park Act 1975 (Commonwealth)	Great Barrier Reef Marine Park Authority	Administration of GBRMPA and protection of the GBRMP
Harbours Act 1955	Department of Transport	Foreshore protection, management of construction works, reclamation and land below LWM
Integrated Resort Development Act 1987	Department of Housing, Local Government and Planning	Provide establishment, operation and management of approved integrated reports
Land Act 1962	Department of Lands	Administration of land, use and development of Crown Land

Legislation	Administration Authority	Synopsis of Effects on Coastal Issues
Local Government (Planning and Environment) Act 1990	Department of Housing, Local Government and Planning	Provides for planning, development and assessment of environmental for designated and other developments in Queensland
Marine Parks Act 1982	Department of Environment and Heritage	Provides for conservation of marine areas and declaration of zoned marine parks for their sustained use and protection
Mineral Resources Act 1989	Department of Minerals and Energy	Provides for assesment, development and utilisation of mineral resources
Minerals (Submerged Lands) Act 1981 (Commonwealth)	Under review between Commonwealth and Department of Resource Industries	Provides for mineral exploration and development in State territorial sea and Commonwealth adjacent waters
National Parks and Wildlife Act 1975	Department of Environment and Heritage	Management of national parks (including some coastal areas and islands)
Off-shore Facilities Act 1986	Department of the Premier, Economic and Trade Development	Controls moored or fixed facilities in the adjacent waters of Queensland
Petroleum Act 1923	Department of Minerals and Energy	Controls exploration and development for onshore areas
Petroleum (Submerged Lands) Act 1967 (Commonwealth)	Commonwealth Minister for Primary Industries & Energy with operation assistance from Queensland Department of Minerals and Energy	Controls exploration and development for offshore areas from 3 nautical miles to the edge of the continental shelf
Pollution of Waters by Oil Act 1973	Department of Transport	Regulates to prevent spillage of oil and provides that prescribed authorities recover costs in the event of a spillage
Queensland Marine Act 1958	Department of Transport	Removal of obstructions and materials below water
Queensland Marine (Sea Dumping) Act 1985	Department of Environment and Heritage	Regulates the dumping into the sea of wastes and other matter
Recreation Areas Management Act 1988	Department of Environment and Heritage (part only)	Declaration and management of recreation areas
River Improvement Trust Act 1940	Department of Primary Industries	Protection and improvement of the beds and banks of rivers; repair and prevention of damage; and prevention and mitigation of flooding
Rural Lands Protection Act 1985	Department of Lands	Provides for protection of land from certain animal or vegetable pests

Legislation	Administration Authority	Synopsis of Effects on Coastal Issues
Sea Installations Act (1987) (Commonwealth)	Commonwealth Department of the Environment, Sport and Territories and Great Barrier Reef Marine Park Authority	Relates to certain installations in the sea
State Development and Public Works Organization Act 1971	Department of the Premier, Economic and Trade Development	Section 29 prescribes arrangements for impact
State Environment Act 1988	Department of Environment and Heritage	Protection of environmental, cultural and heritage resources. Assessment of development projects
Surveyors Act 1977	Department of Lands	Provides for the definition of legal coastal cadastral boundaries
World Heritage Properties Conservation Act 1983 areas (Commonwealth)	Commonwealth Department of the Environment, Sport and Territories	Protects natural and cultural properties in World Heritage (e.g. GBR)

APPENDIX 2

REQUEST FOR ENVIRONMENTAL IMPACT STATEMENT - TERMS OF REFERENCE

FORM 11

Local Government (Planning and Environment) Act 1990

Section 8.2 Reg. 16

REQUEST FOR ENVIRONMENTAL IMPACT STATEMENT TERMS OF REFERENCE

I, (here insert name of applicant) of (here insert address of applicant for the service of notices) hereby request that you notify me of the terms of reference in respect of the environmental impact statement required to be submitted by me as part of an application to the .... Council for a designated development, the details of which are as follows:

1. Property description of the land the subject of the proposal:

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2. Postal address of the land the subject of the proposal:

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3. Area of the land the subject of the proposal:

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4. Nature of the proposed use:

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____

5. Description of the proposal and associated infrastructure, including a layout plan:

____

____

____

If relevant:

1. Details of processes to be utilised in conducting the use, including the use of any hazardous chemicals designated in the current Australian Code for the Transport of Dangerous Goods by Road or Rail:

2. The capacity of the facility:

3. Area of the land intended to be utilised:

4. Annual production or annual production capacity as a result of the proposed use:

5. A brief description of the vegetation on the land:

6. Details of the means of transporting goods and materials to and from the land (including details of quantities, operating frequencies and routes):

7. Details of all products to be stored on the land (including hazardous materials designated as such in the current Australian Code for the Transport of Dangerous Goods by Road and Rail) including details of the quantities to be stored and the means of storage:

8. Details of the method of disposal of wastes from the land, including any treatment details:

9. Details of any proposed clearing, excavation or filling on the land:

10. A locality map indicating the location of the land the subject of the proposal:

(Signature of Applicant)

(Date)____________________

APPENDIX 3

TYPICAL JOINT STATE/COMMONWEALTH TERMS OF REFERENCE FOR AN ENVIRONMENTAL STUDY OF A COASTAL MARINA WITHIN OR ADJACENT TO THE GREAT BARRIER REEF

In most marina development cases both Queensland and Commonwealth Governments will require impact assessments pursuant to their different individual legislations. However, it will usually be agreed by both governments that only one environmental impact statement is produced under a jointly coordinated set of guidelines and Terms of Reference which satisfy the separate and collective requirements of all the regulatory authorities concerned. Coordination for the project assessment and procedures may be designated to either State or Commonwealth in accordance with cooperative arrangements which exist between both.

The IAS will be required to address some or all of the following matters together with any specific addition the management agencies feel necessary.

(i) EXECUTIVE SUMMARY

The summary should include:

- the title of the proposal,
- the name and address of the proponent,
- a statement of the **objectives** of the proposal,
- a brief discussion of the **background to, and need for the proposal,**
- a brief discussion of the **alternatives** considered, and reasons for selecting the preferred option,
- a brief **description of the proposal,**
- a brief **description of the existing environment,**
- a **description of the principal environmental impacts** (both adverse and beneficial), and
- a **statement of the environmental protection measures** and safeguards, standards and monitoring procedures proposed.

(ii) MAIN REPORT

1. INTRODUCTION

1.1 Title of Proposed Development

1.2 The Proponent

- Name and address.
- Corporate structure.

1.3 Objectives

- broad statement of objectives which have led to the proposal including the rationale/need for the development and development program.

1.4 Scope of the Proposal

- facilities (general description)
- background to the proposal including alternatives considered
- envisaged time frame for construction, nominal project life and anticipated establishment costs
- comparisons with other nearby and regional facilities and expected developments
- necessary approvals and applicable legislative requirements
- tenure and zoning (including marine zoning).

2. DETAILED DESCRIPTION OF PROPOSED DEVELOPMENT

2.1 Location

- locational constraints including topographic and environmental constraints, and Marine Park zoning.

2.2 Description of Facilities and Components

- marina
- resort
- commercial/recreational

2.3 Operations Usage

- activities and services provided
- access arrangements
- plans for expansion, further activities on facilities
- maintenance
  - facilities
  - equipment
  - dredging

2.4 Design and Construction Details

- detailed concept and staging proposed;
- materials (including such things as quantities and sources of materials for fill, breakwater construction, beach replacement, aggregate for construction, and transport routes and methods);
- blasting/excavation/dredging extent, methods;
- buildings - construction, limitations/standards (e.g. cyclone rating, height);
- breakwaters - dimensions, construction description;
- marina and entrance channel - construction methods and containment/disposal of spoil;
- services (including any consultations with, or arrangements by authorities or bodies responsible for adequacy or augmentation of services necessitated by proposal - water, sewage (new standards have recently been developed in relation to the discharge of waste into the Marine Park), electricity, waste disposal, road maintenance; and
- a construction schedule.

2.5 Workforce

2.5.1 Construction Workforce

(a) Build up of the workforce by quarterly periods.
(b) Source of recruitment of workforce, for example, external, existing, contracted workforce. If available, desired occupational composition of workforce should be supplied.
(c) Expected demographic characteristics of the workforce, and the impact of these workforce characteristics on the existing levels of service provision by Local Authority and Government agencies.

2.5.2 Operational Workforce

(a), (b), (c), as for above.

2.5.3 Housing

Statement of details of the manner in which the proponent proposes to accommodate the workforce, both construction and operational, the timing and location of such housing.
Details to include numbers to be housed, occupancy basis, location and timing.

2.6 Waste Disposal and Water System

2.6.1 Waste Disposal

Detailed information should be provided on:

(a) the physical and chemical nature of any wastes generated
(b) the location, site suitability, extent and methods of disposal of any liquid wastes. Details of the proposed sewage treatment plant should be given, including details of the plant type and capacity, together with an assessment of likely odour dispersion
(c) the methods proposed for on-site collection of solid wastes

(d) the design and dimensions of waste disposal ponds, and the materials and methods of construction proposed to prevent seepage and contamination
(e) full details of the criteria adopted to determine storage capacity requirements of these structures are required
(f) the arrangements for stormwater disposal.

The following methods should also be considered:

- disposal of liquid effluent and sludge from sewerage disposal;
- disposal of wastes from water supply treatment plant; and
- nutrient and trace element addition to ground and water surface.

Describe measures for collection, treatment and disposal for domestic sewerage and other liquid wastes generated by uses of the marina.

2.6.2 Water system

Detailed information is required on:

(a) the quantities and quality of all waters brought on to the project area and obtained directly from it. In particular, proposed sources of supply (e.g. surface storages such as dams, weirs, municipal supply pipelines etc.) should be described, together with estimated rates of supply from each source (average and maximum rates) on both daily and annual base. Due allowance shall be made for fire fighting or other emergency water supply.
(b) water usage within the project area. The report should provide full details of anticipated water usage during the construction and operational phases of the project.
(c) waste waters originating on the project area. This should detail their sources, general nature, estimated rates and wherever possible anticipated quality, together with intended means of disposal and/or recycling should be included.

2.7 Coastal Management

Provide details of the cross section and plan shape, an assessment of the stability under normal and category 4 cyclone conditions, and the source of sand to be used in the formation of any new beaches to be created.

3. ALTERNATIVES CONSIDERED

Describe any prudent and feasible alternatives to the proposed development with an overview of the perceived consequences in each case. Discussion should include the reasons for the choice of the preferred option, and the likely situation and use of the site if the project does not proceed.

4. EXISTING ENVIRONMENT

Briefly describe aspects of the existing environment of the site and adjacent areas, including the Great Barrier Reef Marine Park and Queensland National Park that may affect or be affected by the proposal.

4.1 Geology

Provide a description and map of the geological features of the area to be affected, including:

- Physical and chemical properties of underlying materials, including hazards such as geological faults, and unstable areas.
- Likely influences of the geological features on water quality in the area, particularly if disturbed during construction.
- Quality and quantity of mineral resources and construction material present. In particular, potential for the extraction of quarry rock and other construction materials should be identified.

4.2 Soils/Marine Sediments

Provide a detailed soil survey of the area to be affected, particularly in respect of development capability and response to environmental stresses. To inventory the soils, it will be necessary to obtain information on the following aspects:

- soil description in terms of the Great Soil Groups and/or the Northcote system;
- erosion hazard rating;
- rockiness;
- load-bearing capacity - in particular, consider the suitability of in situ material including overlying marine sediments as a base for reclamation and for the foundation of breakwaters, revetments and other structures (including pile driving).

4.3 Oceanography

Provide an assessment of existing water quality of the area likely to be affected by the proposal.
Water quality should be assessed in terms of physical, chemical and biological characteristics. Seasonal variations should be accurately described. The basis for this assessment should be a monitoring program representative of seasonal conditions.
Monitoring should include parameters which would assist in the description of impacts on water quality, water movement and biological productivity.

Recommended parameters are:

- current velocity and direction at different tidal states
- tide heights
- bathymetry
- nutrient status (organic/inorganic)
- dissolved carbon and oxygen
- salinity
- pH
- turbidity
- pathogenic organisms
- toxic substances and bottom sediments
- heavy metals.

The monitoring program should accommodate variations between spring and neap tide conditions.

Describe and quantify the hydrodynamics of the surroundings, including the known bathymetry of the area.

Physical oceanography, in the context of littoral drift, likely transport patterns of sediments, the effect of wind and tide regime on wave state in the area, and tidal range would be relevant.

4.4 Hydrology

4.4.1 Surface Water

Assess the surface water quality in the vicinity of the project. Details provided should include a description of existing surface drainage patterns, flows, likelihood of flooding and present water uses.

The water quality assessment should be done by a monitoring program, consisting of a number of surveys which are representative of both wet and dry season conditions. The program should include an adequate number of storm events, with sampling stations located upstream and downstream of the lease areas, and should be designed to enable adequate description of water quality throughout both rising and falling stages of streamflows. Complementary streamflow data should also be obtained to aid in interpretation. Details of the proposed program should be discussed with the Director, Water Resources Division, Water Resources Commission before commencing.

4.4.2 Groundwater

Assess the quality, quantity and significance of groundwater in the project area, together with an assessment of groundwater use in neighbouring areas and the possible significance of the project area to groundwater recharge.

4.5 Existing climatic conditions and air quality

4.5.1 Existing climatic conditions

Describe the existing climatic conditions of the area. The following data should be provided:

- wind speed and direction presented as average annual, seasonal and monthly wind roses and tables;
- diurnal wind speed and direction plotted for each month of the year;
- data on precipitation, evaporation, humidity, insolation and fog conditions including rainfall amounts, intensity and variations. The erosivity of rainfall and associated runoff events should be described;
- incidence of cyclones including pressure levels, potential for storm surge, and wind strengths.

Data should be gathered from the Bureau of Meteorology for a minimum of five years. Any expected variations in meteorological conditions between the data monitoring site(s) and the proposed site should be discussed. The effects of the climate on human comfort should be discussed in the context of activities planned for the proposed development.

4.5.2 Air Quality

Describe any pollutants to be emitted by the proposal including particulates, fumes, mists and gases.

4.6 Flora

- Provide a vegetation map with suitable descriptions of the mapping units. This should include the following:
- Describe the major species and communities present including aquatic plants, trees, shrubs and grasses;
- Discuss their conservation status and indicate how well the affected communities are represented and protected elsewhere, especially on a regional basis;
- Evaluate the extent of disturbances to natural vegetation and the incidence of exotic species and diseases, including dieback;
- Highlight sensitive and important vegetation types, including any vine forest patches, mangroves and seagrasses;
- Discuss important ecological relationships;
- Estimate the value of any commercial timber species present.

4.7 Fauna

Describe the fauna present or likely to be present in the area, including:

- species diversity and abundance for land animals, birds, reptiles, fish, terrestrial and marine invertebrates, and corals and other benthic organisms;
- any rare or endangered species;
- habitat requirements and sensitivity to changes;
- use of the area by migratory birds;
- movement corridors and barriers to movement;
- use of the area as a fish nursery.

4.8 Social and economic environment

This section shall include information on:
- The present population distribution and major population centres near the site;
- Population growth trends in the region;
- Regional workforce characteristics and employment/unemployment details;
- The local and regional economy, and the significance of the present proposal in this context; and
- The status and capacity of existing local and regional social facilities.

4.9 Archaeology and Cultural Heritage

A comprehensive surface archaeology survey should be undertaken by a qualified archaeologist to identify prehistoric and historical relics, and other culturally significant features of the site. All archaeological features and heritage sites should be described and identified on a map. Present management practices and arrangements should be discussed, and any inadequacies highlighted. Recommendations concerning the status of sites, their significance and their conservation and/or management should be made. **[A permit for the survey will be required under the provisions of the Cultural Record (Landscapes Queensland and Queensland Estate) Act. This permit should be obtained from the Department of Environment and Heritage.]**
Aboriginal anthropology of the region should be discussed, and the traditional land owners, traditional uses of local resources and any land claims described.
Any sites of Maritime Archaeological Significance in the adjacent Marine Park must be identified and documented.

4.10 Land Use Factors

Indicate present tenure, land uses, ownership and encumbrances of the proposed site. Describe town planning provisions affecting the land.
Discuss the capability and suitability of the site to be used for purposes including conservation, recreation, forestry and extractive industry.
Identify proximity and zonings of marine parks in or near the site.

4.11 Landscape evaluation

Assess the quality areas of high landscape and visual character of the site, in the context of factors such as:

- regional landscape diversity;
- existence of landscape features such as water bodies, hills, beaches and valleys which would contribute to regional landscape quality; and
- specific areas worthy of preservation or protection due to the quality or the uniqueness of the landscape present.

The present condition of the landscape could be described in terms of factors such as degree of disturbance, stage of regeneration, level of weed infestation and degree of degradation.

4.12 Recreational resources

Assess the value of the site for recreational usage in the regional context.

4.13 Summary of Constraints

Identify any areas or features of the site which may be considered as constraints on development, such as:

- existing leases
- areas subject to inundation
- areas of high landscape or conservation significance
- national parks
- marine parks
- areas of high erosion hazard or other environmental hazard
- areas which may be difficult to service
- areas of historic or archaeological significance.

5. FINANCIAL FEASIBILITY

Quantify the prospects for financial success of the proposed resort. The judgmental criterion to be adopted is that there must be an adequate demand for the proposed facilities at a price which will cover all operating and fixed expenses, service debt **and** provide a satisfactory return on equity investment.

The study should include the following:

5.1 Market Study

Identify present and future demand for the facility as well as the present and likely future supply of competitive facilities in the region.
Demand for the facilities should be described by segment (e.g. holiday, business, day visitors etc.) with key factors in the market growth in each segment being discussed.

The special advantages and disadvantages of the site compared with others in the region should be identified.

5.2 Marketing Program

This will include an estimate of the number of rooms, condominiums, marinas likely to be sold and their prices.

A profile of potential guests should be provided and target travel markets identified. Room occupancy rates selected for the analysis should be justified by analysis of present trends in the region.

5.3 Appraisal

This will determine the market value of the resort, and assess whether an adequate return to investment will be provided.

6. ENVIRONMENTAL IMPACT AND SAFEGUARDS

This section will address the possible environmental impacts of the project and detail safeguards. Unavoidable residual impacts must be clearly identified and their significance discussed.

6.1 Construction Impacts

- Undertake a geotechnical assessment of the proposed marina basin and access channel including quantities and nature of the material to be excavated. (Optional).
- Undertake a hydrodynamic analysis of the effects of the reclamation, including effects on tidal regime, current patterns and water quality. (Optional)
- Assess the impacts of dredging and dumping operations, including dispersion of resuspended solids, disposal of dredged materials and impacts on benthic species and coral reefs. This would include both any capital dredging for marina basin and channels and maintenance dredging as required. Describe the potential impacts of dredging on the marine environment of the area, including consideration of any possible effects on the marine parks in the area. Indicate area/locations for dredged material from construction and maintenance dredging. (Optional).
- Assess the impacts of the extraction and transportation of all the construction materials to the site. This would include the need for additional road maintenance and any temporary road improvements or intersections necessary for the haulage.
- Assess the sources and approximate volumes required of all quarried constructional materials. This would include land tenure and quality of source material.
- Detail self regulation measures to ensure compliance with legal load limits and to minimise haulage of constructional materials during periods of wet weather.
- Indicate proposed reclamation levels to accommodate storm surges and possible effects of the "Greenhouse effect". (Optional)
- Discuss the potential for increased soil erosion and turbid runoff during construction.
- Identify the impacts of noise and dust associated with construction works, including those associated with dredging.
- Describe proposed safeguards and rehabilitation measures to mitigate the effects of the construction works - particularly on adjacent Marine Park areas.
- Consider the impact of freshwater runoff from hardstands into the marine environment.

6.2 Safeguards and controls during construction

Describe and assess the effectiveness of any safeguards and controls for the protection of the environment which are intended to be applied to the project, including:

- the use of bunds, dry-break couplings and containment for fuel oils, gases and other environmentally hazardous substances during transfer, use and storage;
- scheduling;
- settlement ponds.

6.3 Ecological Aspects

Identify the potential effects of the proposed development on ecosystems and habitats including the following:

- survival of native plant populations
- availability and quality of habitats for indigenous and migratory species
- measures proposed to guard against the introduction of noxious flora and fauna
- other measures proposed to preserve and enhance nearby wetlands
- marine ecosystems, in particular benthic communities and mangrove systems.

All of these points should be considered in both a local and regional context, as appropriate.
In particular, the biological productivity of the area to be reclaimed and effects of this reclamation on productivity should be assessed.

6.4 Marina Facilities (Optional)

- Identify possible impacts of spillage of fuel and other hazardous substances and the potential for water quality deterioration due to venting of bilge water and the use of anti-fouling paints. Indicate proposed control and clean up measures.
- Discuss the following operational features:
  - marina management and operating rules
  - accident management
  - fuel storage
  - boat numbers and safety both inside and outside the marina

- maintenance dredging inside and at approaches to the marina
- estimate of frequency and volume
- discussion of dumping site.

6.5 National Parks / Marine Parks

- Assess the likely impacts of the proposal on any nearby national parks, marine parks or reserves. (Include possible demands for direct access to the park from the resort development).
- Assess likely increased use pressures on any nearby Marine Park, Great Barrier Reef Marine Park or off-shore island National Park.
- Discuss any possible measures to compensate for these increased use pressures.

6.6 Coastal Management

- Assess the potential impacts of the proposed development on coastal processes at the site or on the adjacent coastline, and indicate proposed actions to mitigate or accommodate their impacts. Describe methods of visitor management, especially with respect to controlling numbers and activities which may be detrimental to the surrounding environment.
- Describe impacts on water quality associated with storm water runoff from the site, and indicate any measures proposed to mitigate such impacts.

6.7 Visual Impact

Assess the visual impact of the proposed facilities. Describe measures proposed to mitigate any adverse impact.

6.8 Service Infrastructure

Describe the impact of the proposal on service infrastructure at the local and regional level including the following:

- any adverse effect of the development on the road network and the costs of measures to minimise those effects. Information is required about traffic generated by private and commercial movement during both the construction and operational phases of the development (including details of any staging). Should the movement of any very heavy and/or over-dimension loads be proposed, details about the intended routes to be used shall be given. Detail the provision necessary for future road corridors or re-alignments. Detail the project specific roadworks required due to the development.
- likely impacts of an increase in tourist visits on the existing public transport system. Indicate any potential for interchanging between transport modes (e.g. private car, coaches, charter boats).
- likely impact of the increased population on existing water supply in the area, and the general provisions proposed to accommodate these impacts.
- likely need in the future for the existing sewerage service, and the impact of this need on existing users.
- likely impact of the increased population on existing electricity supply to the area, and the general provisions proposed to accommodate the impacts.

6.9 Surface Water Quality and Quantity

- If river water intakes or bores are to be used, assessment will be required of the impact which the water consumption would have on both river flows and artesian aquifer pressures in the area.
- An assessment of the impact of any discharge to a watercourse is required. The location of all proposed discharge points should be clearly identified, along with the locations of any existing sources of potable water.
- For other forms of disposal, the report should assess the impact which each has on the surrounding environment, in respect of physical, chemical and biological effects. Specific references should be given to the processes of siltation and eutrophication and the effects of these on the marine environment and the littoral zone.
- The report should discuss anticipated flows of water to and from the project area under critical conditions, including the consequences of failure (under such conditions) of proposed pollution control works. Where dams, weirs or ponds are proposed, the report should investigate the effects of predictable climatic extremes (droughts, floods) upon the structural integrity of the containing walls, the quality of water contained, and flows and quality of water discharged.
- The need or otherwise for licensing of any dam as a referable dam under the Water Resources Act should be discussed.
- Describe the impacts on water quality associated with stormwater runoff and other critical conditions taking account the measures proposed to mitigate such impacts.

6.10 Groundwater Quality and Quantity

- An assessment should be made of any possible impacts which activities on the site, and disposal of any wastes, both during construction and operation, will have on the availability and quality of groundwater in the project area and within one kilometre of the boundaries of the project.

- The report should also define the extent of groundwater resources likely to be affected by the proposed project.

6.11 Consequence of failure of controls

The report should fully address the impact of unplanned releases of solid and liquid wastes on the adjoining environment. The probability of control failure and failsafe provision should be discussed. Proposed monitoring and action threshold levels should be fully set out.

7. ECONOMIC EVALUATION AND IMPACT

Provide an economic evaluation of the benefits and costs of the proposal to the local, regional and national economies.
Potential foreign exchange earnings should be indicated.
Economic costs should include:

- valuation of resources utilised, especially the Crown land involved;
- valuation of environmental impacts, especially impacts on the marine environment and loss of fisheries productivity; and
- valuation of the impact of the proposal on other sections of the tourist and retail industries in the area.

Note: *Secondary economic benefits (especially additional employment in the region) attributed to the project should not receive emphasis in the discussion unless those benefits can be demonstrated to be substantially different from other projects of a similar nature. Regional unemployment levels, along with projected employment growth without the project, should be incorporated into any discussion of secondary employment benefits.*

The economic analysis will be conducted from a community standpoint, and private financial considerations such as wages paid to employees and company taxes etc, are not relevant from this standpoint.

8. SOCIAL IMPACTS

This section will discuss the social impacts of the proposal. Matters to be included are:

- The impacts of the proposal on social infrastructure of the area, including schools, health care services, housing, police and emergency services;
- The effects of the proposal on other property owners and proposed developments in the area;
- Effects of the proposed development on commercial and recreational fishermen of the area;
- Effects of the proposal on public access to the coastline, including navigational access;
- Effects on the current use of the site area by members of the public for recreational, educational and scientific purposes and compensation for any losses in public access;
- Effects of the proposal on the population growth rate of the region;
- Implications of the proposed development for future development in the local area;
- The total incremental traffic generated in boatings channels, in particular addressing the effect on existing recreational and commercial operations; and
- Workplace, health and safety aspects.

9. CONCLUSIONS

This section will draw together the critical costs and benefits of the proposal and present a balanced overview of its net impact.

10. MANAGEMENT AND MONITORING

This section should describe an environmental management plan, the need for monitoring of project impacts and a proposed monitoring program. This section should cover both construction and operational phases.

11. CONSULTATION AND SOURCES OF INFORMATION

This section will provide details of the level and nature of consultation. A list of formal advisory bodies and contact points can be found in Appendix 4.

Note: *It is a requirement of the Department of Primary Industries that the developer consult with the Queensland Commercial Fishermen's Organisation and the Queensland Sport and Recreation Fishing Council and fishing clubs proximal to the development proposal for provision of comment from those organisations. Written comments will need to be incorporated into the assessment of the impacts on the existing fish habitat and dependent fisheries.*

12. STUDY TEAM

This section will provide names and curricula vitae of persons involved in the Study.

13. REFERENCES AND APPENDICES

This section will provide details of all references consulted. Detailed studies, technical information, standards and codes of practice may be provided as appendices.

APPENDIX 4

LIST OF TYPICAL ADVISORY BODIES FOR ASSESSMENT OF AN EIS (indicative only)

The Chairman
Great Barrier Reef Marine Park Authority
PO Box 1379
TOWNSVILLE QLD 4810

The Director
Department of Housing and Local Government
PO Box 31
BRISBANE ALBERT STREET QLD 4002

Principle Environment Officer
Planning and Assessment Unit
Queensland Department of Environment and Heritage
PO Box 155
BRISBANE ALBERT STREET QLD 4002

The Assistant Director
Heritage Unit
Queensland Department of Environment and Heritage
PO Box 155
BRISBANE ALBERT STREET QLD 4002

Senior Engineer Approvals
Queensland Department of Environment and Heritage
PO Box 155
BRISBANE ALBERT STREET QLD 4002

Maritime Conservation Branch
Queensland Department of Environment and Heritage
PO Box 155
BRISBANE ALBERT STREET QLD 4002

Main Roads Division
Department of Transport
GPO Box 1412
BRISBANE QLD 4001

Assistant Director
Technical Support
Division of Environment
Queensland Department of Environment and Heritage
PO Box 155
BRISBANE ALBERT STREET QLD 4002

Director, Land Planning
Department of Lands
Locked Bag 40
COORPOOROO DC QLD 4152

Director-General
Department of Primary Industries
GPO Box 46
BRISBANE QLD 4001

Queensland Tourism and Travel Corporation
Level 36
Riverside Centre
124 Eagle Street
BRISBANE QLD 4000

Director-General
Department of Transport
Cnr George and Margaret Street
BRISBANE QLD 4000

Assistant Secretary
Environment Assessment Branch
Department of the Environment, Sport and Territories
GPO Box 787
CANBERRA ACT 2601

Water Resources Commission
GPO Box 2524
BRISBANE QLD 4001

Education Department
PO Box 33
BRISBANE ALBERT STREET QLD 4002

Director-General
Department of Employment, Vocational Education, Training and Industrial Relations
BRISBANE QLD 4000

The Regional Director (Northern)
Queensland Department of Environment and Heritage
Marlow Street
PALLARENDA QLD 4810

The Under Secretary
Queensland Treasury
PO Box 191
BRISBANE ALBERT STREET QLD 4002

The Director-General
Department of Administrative Services
80 George Street
BRISBANE QLD 4000

Senior Engineer
Coastal Management Unit
Mineral House
Cnr George and Margaret Streets
BRISBANE QLD 4000

The Director-General
Department of the Premier Economic and Trade Development
P O Box 185
BRISBANE ALBERT STREET QLD 4002

The Shire Clerk
Local City Council

*NB It may also be useful to contact the following organisations and groups to seek comment and involvement early in the planning process:

Australian Conservation Foundation
672B Glenferrie Road
HAWTHORN VIC 3122

Queensland Commercial Fishermen's Organisation
PO BOX 392
CLAYFIELD QLD 4011

Queensland Sport & Recreational Fishing Council
PO Box 2083
CAIRNS QLD 4870

APPENDIX 5

BRIEF GUIDE TO PERMIT APPLICATION ASSESSMENT FEES

PERMIT APPLICATION ASSESSMENT FEES - A BRIEF GUIDE

What are permit application assessment fees?
Fees have been introduced to cover the cost of the assessment done on applications for Marine Parks permits by the Great Barrier Reef Marine Park Authority and the Queensland Department of Environment and Heritage. A single fee is charged for the assessment necessary to consider issuing a joint Commonwealth and Queensland Marine Parks permit.

Permits are used as a way to control environmental impacts and to separate any conflicting activities. They help protect the Reef and assist commercial operators.

Who has to pay a permit application assessment fee?
Anybody applying for a permit to conduct a commercial activity will be charged an assessment fee, unless the assessment is determined, by a delegate of the Great Barrier Reef Marine Park Authority, as minimal. Permit application assessment fees will also have to be paid whenever a new permit is needed.

What happens to the money?
Money from assessment fees helps reduce the cost to all Australians of managing the Marine Parks by having the users pay some of the management costs involved. The money stays with the GBRMPA and QDEH for management of the Marine Parks.

Costs are being kept to a minimum; for example, most commercial tourist permits will now be issued for up to six years which is more efficient than issuing permits on a one-year basis.

How do I know what fee I will be charged?
Fees charged depend on the type of operation applied for and will vary depending on its size and its potential for environmental impacts. Generally, the bigger the operation, the more likely there will be impacts, and the greater the cost of assessment.

An "initial fee" will be charged if you are applying for a permit for a new operation, or if you are making significant changes to an existing operation. A lesser "continuation fee" will be charged for applications to continue existing operations substantially as before. The fees listed at the end of this information sheet are a guide to how much you are likely to have to pay, but **the fee can only be decided definitely when you put in a firm application.**

If you are only operating vessels or aircraft and have not applied to use a structure or facility in the Marine Parks, the fee will be based on the total passenger capacity of all your vessels or aircraft covered by the application. Passenger capacity is the maximum number of passengers permitted for the vessel under the highest survey classification you hold for the vessel. You may be asked to provide proof of your surveyed capacity.

When do the fees have to be paid?
As soon as possible after we receive your application, we will send you a notice of the fee to be paid. You then have 21 days from the date of that notice to pay the assessment fee. However, for large operations requiring Environmental Impact Statements or Public Environment Reports there is provision for payment by instalment.

If the assessment fee isn't paid in 21 days your application will lapse. If your application lapses and your current permit expires, you will have to pay the higher assessment fee charged for a new operation when you re-apply. **No decision will be made on a permit application until the assessment fee has been paid.**

If you want, you can send payment with your application and we will confirm whether your payment is correct (or let you know the correct amount to be paid). A fee may be waived in exceptional circumstances where the assessment is minimal (an example of a minimal assessment would be a vessel name change).

Are fees refundable if my application is refused?
No. The fees are to cover our costs of assessing your application whether or not a permit is issued. Similarly, if you surrender your permit (for example if you sell your business) there is no refund.

How often do I have to pay permit application assessment fees?
Each time you make an application you will normally be charged an assessment fee. For example, if a tourist program permit is issued for six years and the operation does not change, you will not have to pay an assessment fee again until you apply for another permit in six years' time. Some other permit types are annual - so, an assessment fee is required each year.

What if I want to change my operation?
Changing your operation means that a re-assessment of the impacts of the new operation will have to be done, so if you want to change your operation you must let us know **before** the changes take place. If the changes are significant, then further assessment for the permit may be required and you may be charged an "initial" assessment fee.

Examples of significant changes are:

- increase in passenger capacity,
- changes in type of activities, and
- changes in destination where this is specified in the permit.

Should I apply for a very broad permit to cover all the things I might want to do in the future?
No, there is no advantage. Permits will be issued on the basis of what you are now actually doing and what you are definitely planning to do in the near future.

If you have a "one-off" activity that falls outside the conditions of your existing permit you will need to make an application for a permit to cover that activity. A fee may be charged, unless the assessment is minimal.

Will operators still be sent reminder letters when their permits are due for renewal?
Yes, and if you put in your application before your old permit expires you will be charged only the lesser continuation fee because, under the law, your old permit continues until we have assessed your application to renew. If you don't apply in time, the higher "initial fee" will be applied. Please remember that these letters are to help you but you remain responsible for ensuring a renewal application is lodged in time.

GUIDE TO FEES FOR PERMIT APPLICATION ASSESSMENT
(applies for calendar year 1994 only)

Item	proposed activity	initial fee	continuation fee
1	Activity that requires use of an aircraft or vessel having a maximum passenger capacity of:		
	a) less than 25 passengers	$ 410	$ 410
	b) 25 to 50 passengers	$ 580	$ 470
	c) 51 to 100 passengers	$ 1,060	$ 640
	d) 101 to 150 passengers	$ 1,760	$ 940
	e) more than 150 passengers	$ 2,940	$ 1,170
2	a) Activity that requires the use of a facility or structure in the Marine Park	$ 1,290	$ 1,290
	b) Activity that requires a public notice to be given under regulation 9, 13AD or 15B	$ 4,710	$ 1,760
	c) Activity in relation to which a public environment report is to be prepared	$ 23,580	$ 23,580
	d) Continuation of an activity in relation to which a public environment report was prepared in relation to that continuation		$ 2,940
	e) Activity in relation to which an environmental impact statement is to be prepared	$ 63,680	$ 63,680
	f) continuation of an activity in relation to which an environmental statement was prepared - where another such statement is not prepared in relation to that continuation		$ 2,940
3	Activity not referred to in item 1 or 2	$ 410	$ 410

Need more information? Please call 077 818811 and help us to help you.