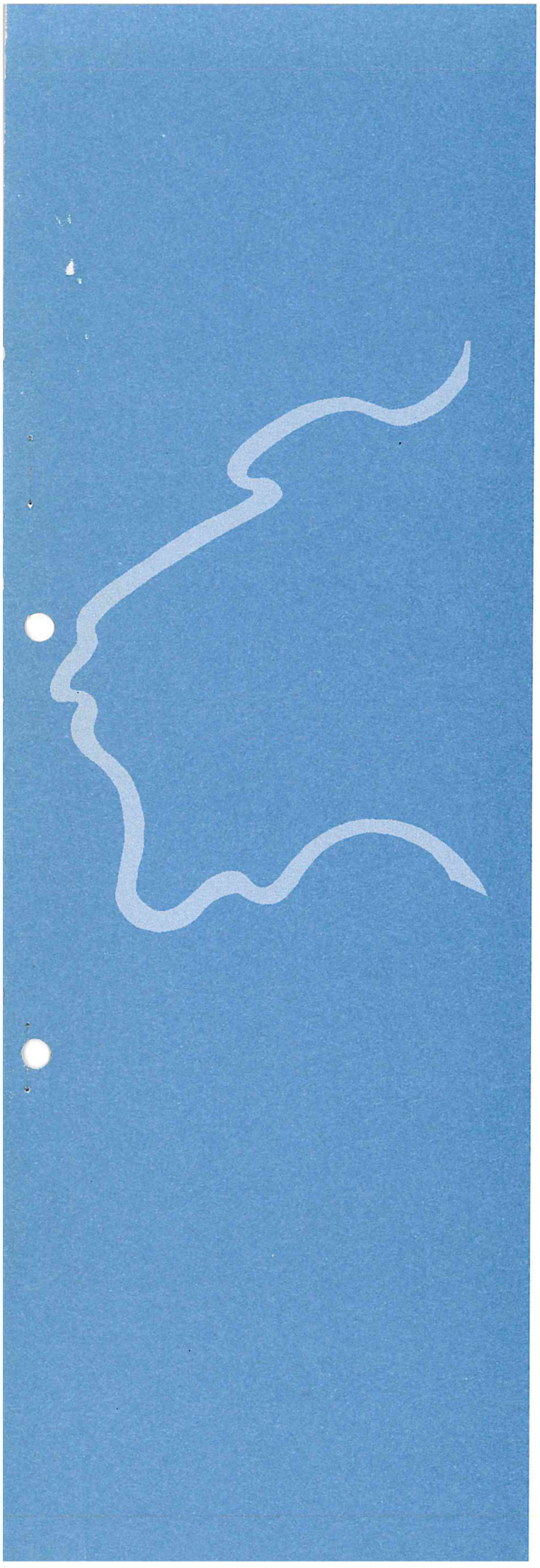
Environmental Protection Authority



Guidance for the Assessment of Environmental Factors

(in accordance with the Environmental Protection Act 1986)

Seagrass Habitat Protection

No. 22

Draft

May 1998

Western Australia

FOREWORD

The Environmental Protection Authority (EPA) is an independent statutory authority and is the key provider of independent environmental advice to Government.

The EPA's objectives are to protect the environment and to prevent, control and abate pollution. The EPA aims to achieve some of this through the development of Environmental Protection Statements for the environmental impact assessment (EIA) of proposals.

In 1992, when the Environmental Protection Act 1986 was reviewed, a key sentiment expressed related to the uncertainty of outcome of the EIA process. The EPA addressed this concern by identifying priority factors for which EPA guidance and position statements needed to be developed to establish the grounds for judging the environmental acceptability of developments in advance of project planning and design.

This document is part of a series of documents being issued by the EPA to address this concern. The series is written to assist proponents, consultants and the public generally to gain additional information about the EPA's thinking in relation to aspects of EIA process. The series provides the basis for EPA's evaluation of and advice on development proposals subject to EIA.

This guidance statement has already undergone a scientific peer review and at this stage the EPA is seeking review specifically from key stakeholders. Later, the EPA will be releasing drafts of this guidance statement for broader public comment.

This draft guidance statement is entitled:

- Seagrass Habitat Protection Guidance (No. 22).

This document is subordinate to the overarching (or generic) Benthic Primary Producer Habitat Guidance (No. 29) (BPPHG) from which it is derived. It is still statewide in scope but will refer specifically to habitats dominated by seagrasses. It is important that this document is reviewed in conjunction with the BPPHG. It is proposed to develop similar subordinate guidance statements for corals, mangroves and algae (see Figure 1 in BPPHG). Subsequently, local annexes of these documents will be developed, on an as needs basis, to provide more specific guidance in relation to localised issues.

This document is entitled "Draft" in that it is being developed by the EPA and is released for stakeholder review for six weeks.

I am pleased to release this document and encourage you to comment on it.

Bernard Bowen

Bernard Bowen
CHAIRMAN
ENVIRONMENTAL PROTECTION AUTHORITY

22 May 1998

ENVIRONMENTAL PROTECTION AUTHORITY GUIDANCE FOR THE ASSESSMENT OF ENVIRONMENTAL FACTORS

DRAFT GUIDANCE No. 22: SEAGRASS HABITAT PROTECTION

How to comment on this document

This document is released for stakeholder comment for a period of 6 weeks. Your comments are welcome.

Please send your comments by 6 July 1998 to:

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FIGURES

APPENDICES

Guidance No. 22

Guidance for Seagrass Habitat Protection

Key Words: coastal waters, marine habitats, primary producers, seagrass ecosystems, seagrass meadows.

1. PURPOSE

The purpose of this guidance statement is:

"To maintain the ecological integrity and biodiversity of marine ecosystems of Western Australia"

2. OBJECTIVE

The objectives of this guidance statement are:

(a) to protect the environment as defined by the Environmental Protection Act 1986 (EP Act 1986) with a focus on state coastal waters in the context of activities which may directly or indirectly affect seagrass habitats;

(b) to address the factor of uncertainty of outcome of the EIA process as raised in 1992 during the review of the EP Act 1986;

(c) to present to developers, proponents who have proposals subject to environmental impact assessment (EIA) and the general public, the Environmental Protection Authority's (EPA) position on activities which may directly or indirectly affect seagrass habitats;

(d) to assist in fulfilling the Western Australian Government's commitments to environmental protection as outlined in the State Conservation Strategy for Western Australia (DCE 1987), which is consistent with the objectives of the National Conservation Strategy for Australia (1984) and the World Conservation Strategy (1980), to:

* maintain essential ecological processes and life support systems;
* preserve genetic diversity; and
* ensure the sustainable usage of species and ecosystems.

(e) to ensure consistency of approach with the National Strategies for: Ecologically Sustainable Development (1992) and the Conservation of Australia's Biological Diversity (1996).

3. PREAMBLE

3.1 Broad scale distribution of seagrasses and their diversity

Western Australia has over 12,000 km of coastline extending from the cool-temperate waters of the Southern Ocean at 35°S through to the warm-tropical waters of the Timor Sea at approximately 14°S. Marine ecosystems, and the seagrass habitats within them, differ considerably in extent and composition from north to south in relation to changing geology, climate, tidal range, water temperature, wave exposure and other factors.

By world standards, Australia has the most extensive seagrass beds with a high degree of endemism. Approximately 18 species of all known seagrasses are endemic in Australia. The degree of speciation in the Australian group of seagrasses is also high, with at least eight species represented within one genus (*Posidonia*) alone.

In Western Australia there are at least 25 different species of seagrass represented in 11 different genera. The broad-scale distribution and diversity of the State's seagrass beds are depicted in relation to other regions in Australia in the map shown in Figure 1. A broad cut-off between sub-tropical and warm temperate seagrasses on the west coast occurs at about 25°S.

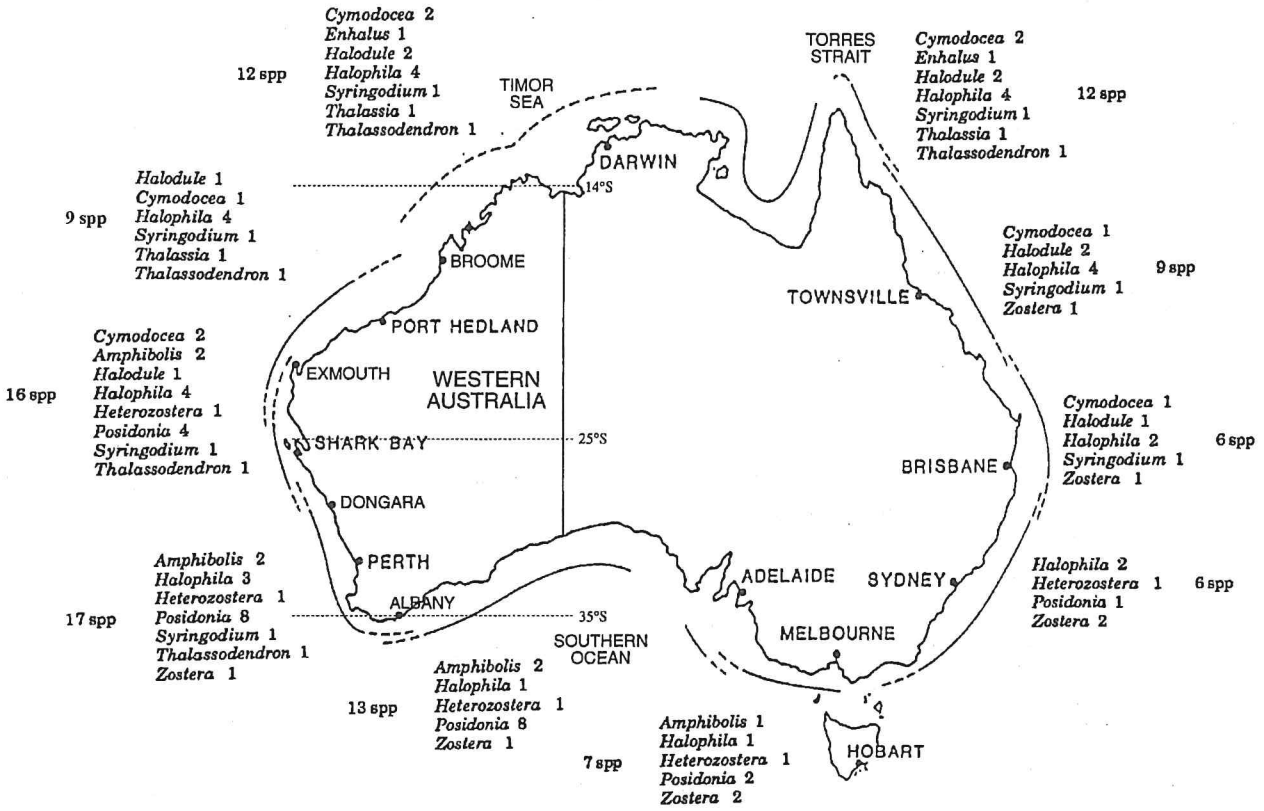

Figure 1. The distribution of seagrass genera around Australia. (Source: Larkum & den Hartog 1989).

(Note: The number of species within genera in the different regions are shown in parenthesis.)

The distribution map (Figure 1) shows the seagrass composition in five broadly defined regions for Western Australia. Some degree of overlap occurs in seagrass distribution from one region to the next. The five regions, from south to north, conform approximately to the following geographic locations:

- WA/SA border (Eucla) west to Albany (13 species)
- Albany north to Dongara (17 species)
- Dongara north to Exmouth (16 species)
- Exmouth north to Broome (10 species)
- Broome north to the WA/NT border (12 species)

3.2 Ecological roles and functions of seagrass

Over and above their intrinsic value as marine angiosperms, or true flowering plants, seagrasses perform many well-recognised ecological functions that are firmly established as central to functioning of the ecosystem of which they are a part.

The main biological and physical functions of seagrasses include:

- Provision of food for diverse marine fauna and fish;
- Provision of habitat and protection for diverse marine fauna and fish;
- Accumulation of calcium carbonate sediment;
- Stabilisation of sediments; and
- Baffling the effects of waves and currents.

The relative significance of the different ecological roles of seagrass in maintaining the overall ecological integrity of coastal marine ecosystems is not fully understood scientifically. Information at the species level is particularly lacking. Consequently, there are considerable gaps in knowledge about how seagrass populations and species are regulated and maintained, how the plants interact with other components of their environment and about how resilient they are to disturbances, natural or otherwise. These gaps in our understanding affect the confidence with which short- and long-term implications of disturbance to seagrasses can be accurately assessed with respect to maintaining ecological integrity. In that context, a conservative and cautious approach is usually invoked in environmental impact assessment in order to minimise the likelihood that activities, however outwardly benign, might lead to negative changes that are either difficult to repair within reasonable timeframes or are irreversible.

3.3 Special features of seagrasses important to environmental impact assessment

In protecting the state's seagrass assets, the relevant factors with respect to assessing human-induced disturbance to seagrass ecosystems are:

(a) The degree to which possible degradation or loss of seagrass as a result of direct or indirect disturbance will influence long-term maintenance and survival of surrounding local and wider seagrass populations, and the life which these plants or habitats support;

(b) The ability, or otherwise, of seagrass species, or seagrass habitats, to repair themselves or to recover following disturbance, degradation or loss within reasonable timescales (resilience to disturbance); and

(c) The ability of seagrasses to be restored within acceptable timeframes using proven restoration techniques.

In addressing the above, it is important to recognise that "seagrass" is a collective term for all flowering plants that grow in the ocean, but the inherent characteristics of each species of seagrass may differ markedly. Thus, despite the recognised common roles and properties of seagrasses, closely related species may display similar or very dissimilar reproductive or structural characteristics. As such they respond differently to disturbance and have differing capacities for recovery or repair.

A summary of the main features of individual seagrass genera that are of potential importance in assessing impacts of disturbance is shown in Appendix A. Though not exhaustive, the list highlights important features to be considered in assessing potential effects of disturbance with focus on reproductive characteristics of the plants, such as propagule production, dispersal, dormancy, recruitment and establishment.

In addition, features such as whether or not the plants have fast rhizome elongation rates will influence the degree of susceptibility to sediment movement, initiated through storms or through human-induced perturbation. Damage by smothering is generally a lesser threat for seagrasses with fast rhizome elongation rates and particularly for species where the leaf growing points are located above the sediment surface (eg. *Amphibolis*). Rhizome elongation rates are not yet well documented for the range of species that occur in Western Australia's coastal waters but this information will be important in better determining the anticipated time to re-establish naturally or to create new seagrass beds in restoration programmes.

Thus, seagrasses such as some species of *Halophila* that are shallow-rooted, produce copious seeds and are capable of establishing new populations from seed each year, are far less susceptible to long-term meadow damage than species such as *Posidonia* or *Thalassia* that are generally acknowledged as slow growing and recognisably difficult to restore in short timeframes through planting programmes.

4. GUIDANCE

This guidance has been developed to conform with the overarching "Benthic Primary Producer Habitat Guidance No. 29" (BPPHG) of the Environmental Protection Authority (EPA). The relationship between the BPPHG and the subordinate statewide guidance statements for individual primary producer habitat types (eg. this Seagrass Habitat Guidance) is shown in Figure 2.

This guidance should be read in conjunction with the BPPHG and provides information to assist in applying the BPPHG in the evaluation of proposals which may impact directly or indirectly on seagrass meadows or the habitats they form.

The time-scale of response of different species to disturbance is a key determinant in the evaluation procedure outlined in the BPPHG and a distinction is made between "reversible" and "irreversible" change. Definitions for these terms, and an evaluation scheme with cumulative impact criteria, are provided in the BPPHG. This scheme is based on cumulative changes within a defined 'ecosystem' or 'management unit' and includes determining the relative areal extent of seagrass habitat (i) prior to all disturbance, (ii) existing at the time of the proposal and (iii) remaining after implementation of the proposal.

The potential for reversibility of change for seagrass or seagrass habitats is determined as follows:-

(a) Identify the component species of seagrass beds present. In mixed beds, identify the dominant species; and

(b) Identify from Appendix A whether or not the dominant seagrass species has (have) high or low potential for population regrowth and has (have) high or low restoration potential. For the purposes of this guidance, reversible impacts would be equated with seagrasses with, among other characteristics, high regrowth potential (e.g. fast rhizome elongation, a residual seed resource in the sediment, fast and deep root penetration and short propagule development periods). To be deemed as an irreversible impact, affected seagrasses would have features such as low regrowth potential (e.g. slow rhizome elongation rates (requiring long timeframes for re-establishment), no dormant phase to seed development and long propagule development periods). This evaluation has been done at the genus level to indicate the principles which should be employed in environmental impact assessment in relation to seagrass reversibility/irreversibility.
(Appendix A).

This scheme is applicable only after all alternatives to either direct removal or indirect loss of seagrasses or seagrass habitat have been properly evaluated.

4.1 Evaluation of alternatives

Seagrass habitats generally occupy a relatively small proportion of coastal ecosystems (often < 20 %), with the remainder comprised of relatively low productivity/diversity habitats (eg sand and mud). As such, there is generally quite wide scope to design proposals to avoid or minimise impacts on these corner-stone communities. The EPA places great importance on protecting seagrass habitats and expects that proponents will conduct a thorough appraisal of all options that would avoid affecting these communities before presenting a proposal for evaluation that would involve the direct or indirect loss of these key ecosystem components.

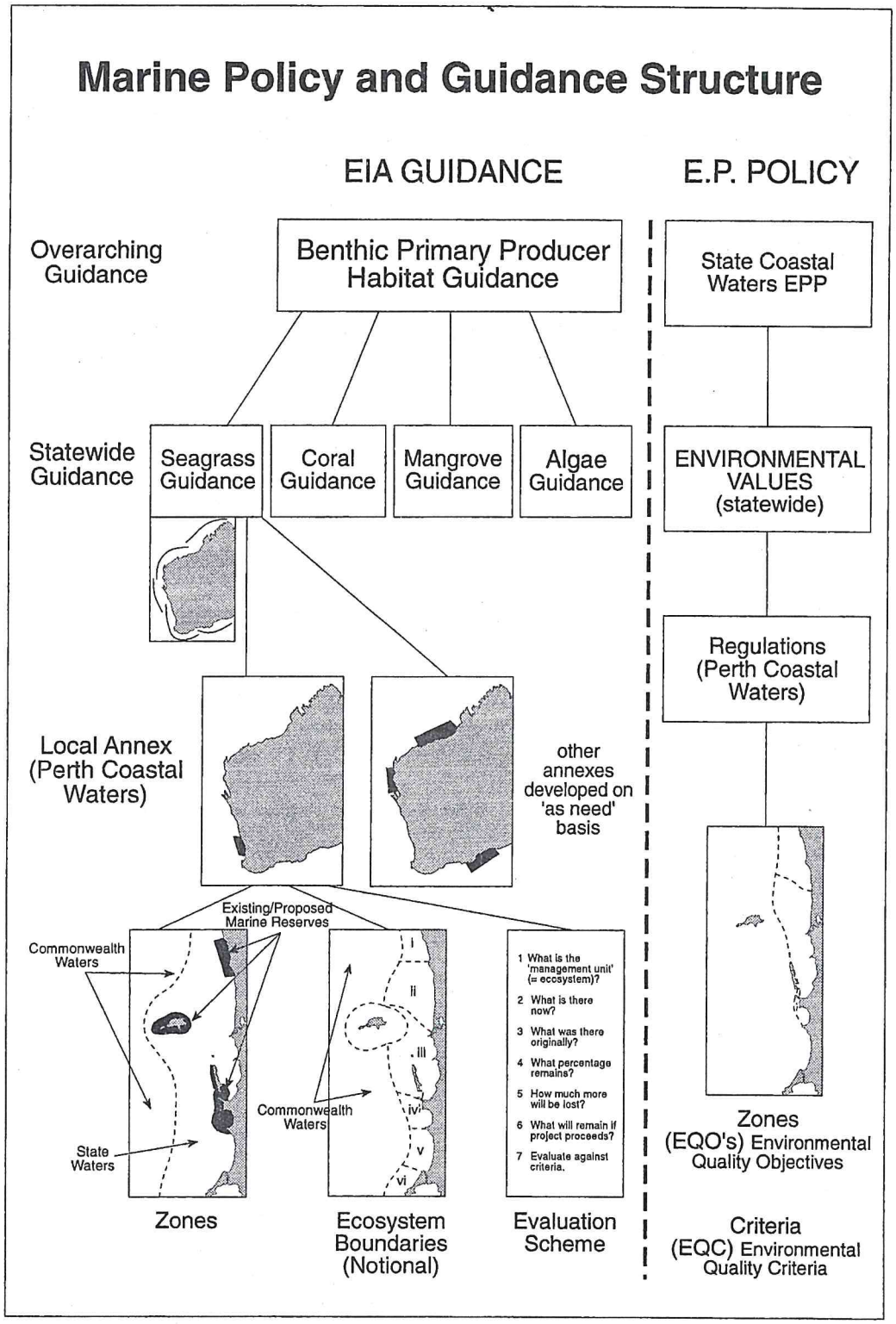

Figure 2. Schematic representation of the hierarchical relationship of the Benthic Primary Producer Habitat Guidance Statements for Environmental Impact Assessment.

(Note: The parallel structure for the proposed State Coastal Waters Environmental Protection Policy (EPP), which deals with waste discharges is also shown.)

5. GUIDANCE FOR NEW PROPOSALS

5.1 Categories of protection

Three categories of protection are recognised in the State's coastal waters with respect to seagrass habitats. The following is a brief description of those categories and the EPA's operational (environmental) objectives for those areas with respect to the seagrass habitats.

5.1.1 *Category A*

Category A: Areas of extremely high conservation significance; areas not designated category 'B' or 'C'. Existing or proposed marine nature reserves and sanctuary zones in marine parks would be examples of Category A areas.

"The operational objective of the EPA is that no development should take place in this area, nor should there be any development elsewhere that would cause a direct or indirect loss of seagrass habitat or ecological integrity of this area."

5.1.2 *Category B*

Category B: Areas of high conservation significance; areas not designated category 'A' or 'C'. The majority of zones in existing or proposed marine parks and marine management areas would be examples of Category B areas.

"Development proposals should conform with the operational objectives of minimum indirect disturbance and no loss of seagrass habitat.

5.1.3 *Category C*

Category C: Areas of moderate conservation significance; areas not designated category 'A' or 'B'. Areas within State jurisdiction such as ports or industrial complexes and not identified as having a high conservation significance would be examples of Category C areas.

"Development proposals should conform with the operational objectives of preventing the avoidable destruction of seagrass habitat, and cumulative (total) losses should be kept within strict limits (see Table 1 of the BPPHG), whilst recognising uses designated prior to the formulation of this guidance."

6. APPLICATION - AREA AND TERM

6.1 Application area

This guidance applies to proposals within the coastal waters of the state of Western Australia, nominally the areas within three nautical miles seaward of the territorial baseline, and landward from the territorial baseline to the mouths/entrances of rivers and estuaries.

6.2 Term of application

The guidance may be changed by the EPA at any time without notice and will be reviewed within five years.

7. RESPONSIBILITIES

7.1 EPA responsibilities

The EPA will apply this guidance in making decisions about whether or not to assess any proposal for use which could impact upon Seagrass Habitat, and in any assessment of such proposals.

The EPA will recommend to the Minister the imposition of these requirements following its assessment of the proposals for which it is a relevant factor.

7.2 DEP responsibilities

The Department of Environmental Protection will assist the EPA in applying this guidance in environmental impact assessment and conduct its own functions under the Environmental Protection Act in accord with the guidance.

7.3 Proponent responsibilities

Where proponents demonstrate to the EPA that these guidance requirements are accountably and enforceably incorporated into proposals, the assessment of such proposals is likely to be facilitated.

8. LIMITATIONS CLAUSE

This guidance for environmental impact assessment statement has been prepared by the Environmental Protection Authority to assist proponents and the public. While it represents the contemporary views of the Environmental Protection Authority, each proposal which comes before the Environmental Protection Authority for environmental impact assessment will be judged on its merits. Proponents who wish to deviate from the contents of this document should therefore provide justification for the proposed departure.

In addition to the objective with respect to seagrass habitats, the EPA will also have objectives for other factors that would need to be considered before the assessment can be completed.

9. DEFINITIONS

Algae	Group of single-celled, filamentous, or fleshy non-flowering aquatic plants
Angiosperms	Flowering plants which produce seed bearing fruit from fertilised ovaries.
Annual	A plant that completes its life cycle, from propagule germination to senescence and death within a single season.
Anthropogenic	Created by humans.
Apical	At the tip of the stem, root or branch of a plant
Assemblage	Recognisable grouping or collection of individuals or organisms.
Bathymetry	The measurement of ocean depths to determine the sea floor topography.
Benign	Harmless.
Benthic	Living upon or in the sediment of the sea.
Biodiversity	The variety of all life forms: the different plants, animals and micro-organisms, the genes they contain and the ecosystems they form. It is often considered at three levels: genetic diversity, species diversity and ecosystem diversity.
Biota	The plants, animals and micro-organisms of a region.
Community	Ecologically, any naturally occurring group of different organisms sharing a particular habitat.
Dioecious	Plants with male and female reproductive organs borne on different individuals.
Dormancy	A resting condition in which the growth of the organism is halted and the metabolic rate is slowed down.
Ecological integrity	The physical, chemical and biological components of an ecosystem and the interactions between these components, being in a sound, undiminished and unimpaired state.

Ecosystem	Unit including a community of organisms, the physical and chemical environment of that community, and all the interactions among those organisms and between the organisms and their environment.
Endemic	'Native' species confined to a given region.
Environmental quality objectives (EQOs)	The long-term goals of an environmental management programme in relation to the maintenance of ecological and societal values of natural systems.
Environmental quality criteria (EQC)	The scientific benchmarks upon which a decision may be made concerning the ability of an environment to maintain certain designated environmental quality objectives.
Epiphyte	A plant attached to another plant, not growing parasitically upon it but merely using it for support.
Genus	A group of organisms consisting of a number of similar species.
Habitat	The natural home of a plant or animal.
Intercalary	At the base of nodes on rhizomes
Intergenerational equity	Availability to future generations of at least the range of natural resources and opportunities available to the present generation.
Mersitem	Localised region of active plant cell division from which permanent tissue is derived.
Monoecious	Plants with male and female reproductive organs borne on the same individuals.
OECD	Acronym for the "Organisation for Economic Co-operation and Development."
Perennial	A plant which continues its growth from year to year.
Photosynthesis	A process, operating in chlorophyll containing plants, which uses solar energy to convert carbon dioxide and water into carbohydrate.
Primary Producers	Organisms (largely green plants) which can which can manufacture organic substances (food) from simple inorganic substances
Propagule	Any part of a plant or animal capable of growing into a new organism.

Recruitment	The addition of new individuals to an existing population or habitat.
Rhizome	Underground stem.
Seagrass	Submerged flowering plants that mainly occur in shallow marine areas and estuaries.
Sedentary	Confined to one spot.
Species	Generally regarded as a group of organisms that resemble each other to a greater degree than members of other groups and that form a reproductively isolated group that will not normally breed with members of another group.
Substrate	The layer immediately underneath something or to which it is attached.
Vegetative propagule	Some part of a plant body which detaches and grows into a new individual.
Viviparous seedlings	Seedlings which develop while attached to the parent plant and later detach.

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Index

Status

Not signed-off by EPA at this stage.

Citation

This draft EPA guidance statement cannot be cited at this time but is used by the EPA for the purposes of environmental impact assessment (EIA) with respect to this factor.

Acknowledgments

The EPA would like to acknowledge the independent peer reviewers who have contributed to the refinement of this guidance statement and the W.A. Branch of the Australian Marine Sciences Association for assistance in updating Appendix A.

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Appendix A

Attributes of seagrass genera occurring in Western Australia that influence assessment of effects of disturbance and potential for recovery.

Explanatory notes for column descriptors in Appendix A.

Season of propagule production.

The season of propagule production must be considered in relation to environmental conditions which effect plant establishment. If the season of propagule development for any seagrass under consideration coincides with conditions conducive to plant establishment then loss of that seagrass habitat is more likely to be considered reversible (e.g. when prevailing wind and wave conditions are such that propagules tend to persist in potential seagrass areas rather than being washed ashore).

Seed Dormancy.

Reversibility is enhanced in seagrass genera capable of producing seeds which lie dormant in the sediment and can germinate in response to perturbation of established beds.

Position of leaf meristem.

Plants with apical meristems tend to display greater ability for lateral development into bare sand areas than plants with intercalary meristems.

Rhizome elongation rate.

Plants with fast rhizome elongation tend to spread and recolonise faster than plants with slow rhizome elongation rates.

Rhizome with dormant buds.

Reversibility is enhanced in seagrasses which possess rhizomes with dormant buds as they are more likely to recolonise by rhizome proliferation after perturbation than species which have a need for continually active shoot meristems. In addition rhizomes with dormant buds have potential as vegetative propagules for managed restoration projects.

Root penetration depth.

Plants which produce roots which can quickly and deeply penetrate the sediment will have a better chance of persisting.

Propagule development period.

Propagules which develop over time scales of months as opposed to years, and in relatively large numbers, provide a good reserve from which rapid responses to perturbation can occur.

Mature canopy height.

Seagrasses which take a relatively long time to establish full canopy height might be considered irreversible. For example a seagrass which took 50-100 years to fully establish would be considered irreversible for the purposes of this guidance statement (see BPPHG Sect. 4.3.3.).

Life Form.

Annual plants are better able to respond quickly to perturbation due to their having evolved to develop over short (<1 year) time frames.

Appendix A. Attributes of seagrass genera occurring in Western Australia that influence assessment of the effects of disturbance and the potential for recovery.

Genus	Season of propagule production	Seed dormancy	Position of leaf meristem	Rhizome elongation (cm/y)	Rhizome with dormant buds	Root penetration depth (cm)	Propagule Development period	Mature canopy height (cm)	Life form	Potential for seagrass replacement using restoration techniques	"Reversible" (R) or "Irreversible" (IR) impacts on basis of key seagrass features
Amphibolis	July-Nov	No, VS	Ap	20-50 (moderate?)	No?	0-3 (reef); 10-20 (sediment)	2-3 years (long)	40-100	P	Not fully tested: probably low to moderate	IR
Cymodocea	Jan-May	7-8 mths	I	160-260[1,2] (fast)	No?	?	?	7-15	P	Not fully tested: probably low to moderate	IR
Enhalus	All year?	No	I	?	?	10-20	?	30-150	P	Not tested	IR?
Halodule	Oct-Jan	3 years	I	292[4] (fast)	No	7-10 (shallow)	?	5-20	P	Relatively high based on overseas experience	R
Halophila	summer (temperate)	Yes?	Ap	70-335 (fast)	Yes	4-7 (shallow)	2-3 months	3-12	A/P (different species)	High based on overseas experience	R
Heterozostera	Seeds late summer; VP Jan-March	Yes?	I	100-200 (fast)	?	4-10 (shallow)	3-4 months	7-25	P	Not fully tested: probably moderate to high	R
Posidonia	Nov-Jan	No	I	2.6[3] -20 (slow)	Yes/No?	15-25 (P. coriacea deep)	4-6 years? (slow)	40-100	P	Not fully tested; low to moderate and with long timeframes for returns based on work with a Mediterranean species	IR
Syringodium	Feb-Mar in WA	?	I	38-200[4,5] (mod. - fast)	Yes	4-7	?	7-30	P	Relatively high from overseas experience	R
Thalassia	? in WA; July-Nov in Qld	No	I	36 - 117[2,6,7]	Yes?No?	?	?	10-40	P	Low with long time frames from overseas experience; analogous to Posidonia in Australia	IR
Thalassodendron	Oct-Dec?	No, VS	Ap	5-10 (slow)	Yes	0-3 (reef)	?	10-20	P	Not tested	IR
Zostera	Seeds: Aug-Dec	Yes	I	?	Possibly	5-10	3-4 months	2-50	A/P (different species)	Moderate to high in low energy settings overseas	R

Source note. Modified from Clarke & Kirkman 1989). Restoration potential is based on a recent review of the outcomes of restoration projects using different species (after Gordon 1996).
Key over page.

Key to Appendix A

Ap: apical;
I: intercalary;
A: annual;
P: perennial;
VS: viviparous seedlings;
VP: vegetative propagules
?: unknown or incomplete information

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