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PETROLEUM DIVISION

ENVIRONMENTAL PRACTICE

GUIDELINES FOR ONSHORE SEISMIC OPERATIONS IN WESTERN AUSTRALIA

DEPARTMENT OF MINES
WESTERN AUSTRALIA

ENVIRONMENTAL PRACTICE

GUIDELINES FOR ONSHORE SEISMIC OPERATIONS IN WESTERN AUSTRALIA

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1. INTRODUCTION

These guidelines are designed to help the petroleum industry to establish suitable standards to minimise environmental damage. In this way the industry will make a positive contribution to maintaining environmental quality for the future. It is essential that, prior to carrying out exploratory work, the industry ensures full liaison between all concerned parties, including advance notice to land-owners of the nature and timing of such exploration.

2. THE GUIDELINES

Copies of these guidelines should be made available to all personnel involved in operations so that they are aware of their responsibilities. In this regard it is the duty of an operator to provide specific guidance to staff, agents and contractors, explaining the manner in which their activities impact on the environment and to inform them of approved methods for conducting their operations.

Observance of the guidelines will ensure that:

(i) operations are organised and conducted with due regard to good oil field and exploration practice thus minimising any disturbance to wildlife, livestock, flora and sites of natural, historical and cultural significance; and

(ii) as soon as practicable after completion of operations, all disturbed tracts are rehabilitated in a manner which will encourage natural restoration to their original state.

While these guidelines refer chiefly to the Carnarvon Coastal Plain (refer to Appendix 2, p. 15) they are applicable to most Western Australian landscapes. Specific modifications may however be deemed necessary when operations occur under special or unusual landform and environmental conditions. It is therefore the intention of the Petroleum Division, in conjunction with the Department of Agriculture, to incorporate further information as it becomes available concerning other environments.

3. PETROLEUM OPERATIONS ON PRIVATE LAND OR PASTORAL LEASES

The relationship between a permittee/licensee, private land-owner and the lessee of a pastoral lease is dealt

with fully under the Petroleum Act 1967, Part II, General Ss 6-25 to which reference should be made (see also Appendix 1).

Briefly a Permit to Explore for Petroleum entitles the permittee to carry out all operations necessary to search for petroleum on both private land and pastoral leases. However, prior to commencing any operations, the permittee is obliged to consult with the owner of the land or lease holder in order to arrive at an amicable agreement under which the operations may be carried out.

In the unlikely event that the land owner and permittee are unable to reach agreement, then the Act specifies that the local court shall determine the amount of compensation (if any) to be paid. In the case of a pastoral lease any compensation awarded by the court is limited to improvements on the leased land and not for the loss or damage to land which is considered to belong to the Crown.

4. OPERATIONAL MANAGEMENT

4.1 The design of a seismic grid, access roads, camp sites and a possible airstrip should include measures that minimise adverse effects to the environment. The first step is to initiate and maintain liaison with all landholders and regional land management authorities affected by the exploration activities. The scope of the exploration plan should be discussed with them and its position indicated on maps and/or air photographs.

4.2 The plan should incorporate methods for conducting operations in a manner such that, where practicable, no lasting evidence of activities persist. Particular attention should be paid to:

- reference to topographic and survey maps, aerial photos and literature relevant to the region;
- consultation with pastoralists, alternate land users or government and shire organisations responsible in the region;
- recognition of land systems or location sensitivities and their potential for environmental damage;

- maintenance and recovery of service tracks, seismic lines, existing roads and sites of occupation used during an operation; and

- a programme of restoration and rehabilitation on affected land.

While the impact of an intrusion is generally only temporary, activities may be expected to involve -

- vegetation and topsoil disturbance;

- alteration to drainage;

- interference to existing land use;

- an opportunity for enhanced wind and water erosion;

- disturbance to native fauna;

- the potential for pollution; and

- sites of historical and heritage significance.

4.3 It is important during planning that a full appreciation of any contentious issues is conveyed to involved parties. A well prepared plan enables an operator to point out where environmental protection is good operating practice and provides evidence that good practices will be employed.

5. CONSTRUCTION OF SEISMIC LINES AND TRACKS

Seismic line construction has the most obvious impact on the landscape and is potentially the most damaging activity. Before construction the contractor should check with landholders and representatives of land management authorities which topographic features require special treatment when traversed. Habitats such as flat sandplains and spinifex may present no problems whereas others such as the Permian outcrops in the Kimberley, Minilya and Gascoyne are extremely friable and erode even with little disturbance.

The following precautions and standards should be adopted:

5.1 All seismic traverses and access routes should be

designed to minimise the removal of soil and vegetation. In some areas it is quite sufficient to cut or roll the vegetation flat without disturbing the soil at all (see 5.6 and 5.7 below). Seismic lines should be restricted to a maximum width of six metres and no wider than that necessary to allow a service vehicle to pass an operating vehicle. (Fig. 1)

5.2 Steep cuts and fills which may cause landslides, erosion or slump problems and the oblique traversing of sand dunes should, where practicable, be avoided, i.e. dunes should be approached at right angles. (Fig. 2)

5.3 Line layout should be designed to avoid unnecessary erosion and interference to natural drainage patterns and should permit effective rehabilitation work to be carried out. Care should be taken not to plug drainage ways or culverts with road fill. Existing drainage patterns should be maintained and clearance of vegetation along stream banks or deep gullies avoided.

5.4 Isolated trees and significant stands of vegetation should be left standing wherever possible, especially in the vicinity of drainage channels.

5.5 Mound springs and surface seepages, together with any associated vegetation should be avoided wherever possible.

5.6 Towed rollers and/or stickrakes should be used where practical and blading with heavy earth moving equipment, such as bulldozers, avoided particularly in silcrete, gibber plain and claypan environments. (Fig.3)

5.7 The construction of service tracks parallel to seismic lines is to be avoided. Where possible the surface should be cleared to one side, then re-distributed by one return blading. Road works should be kept to a minimum using at most superficial blading for removing vegetation and filling surface irregularities leaving root stock and most top soil with its seed load intact (particularly on sands and friable surfaces). (Fig.4)

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5.8 Unnecessary traffic in dune fields, the margins of drainage ways and around salt lakes and other wetlands should be restricted. Vehicular traffic should be confined to marked roadways. The disturbance of windward dune slopes and the removal of vegetation should be kept to a minimum (see 4.7).

Fig. 1 Line cut with minimum removal of topsoil.

Fig. 2 Crossing a sand dune.

Fig. 3 Line stick-raked with areas for passing.

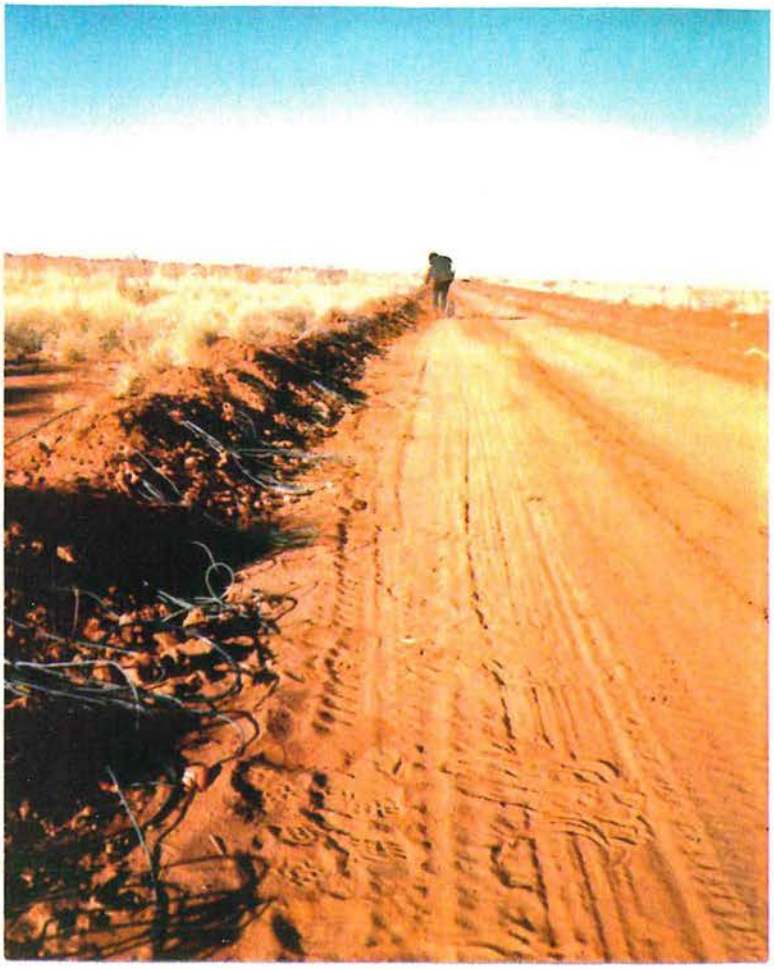

Fig. 4 This line has been cut too wide and consequently windrows are too high and will need levelling.

5.9 Clay or gravel used for capping dune crests to facilitate vehicle crossings should have drainage bars with spur drains to prevent gully erosion.

6. USE OF EXPLOSIVES

6.1 All operations involving the use of explosives shall be in accordance with the Explosives and Dangerous Goods Act 1961-1984 and Explosives Regulations 1963.

6.2 All shotholes should be drilled off the cleared part of the seismic line. (Fig. 5)

6.3 A shothole cap is to be placed immediately above the highest explosive charge and the shothole backfilled and tamped to surface. (Fig. 6)

6.4 The Department of Mines is to be notified immediately of any hydrocarbons or artesian water intersected in drilling shotholes or resulting from the use of explosives.

6.5 Above ground blasting should not be within 150m of any perennial surface water, residence, well or spring development.

7. REHABILITATION

The preventive measures noted above in sections 5 and 6 are far more resource effective in terms of time, costs, labour, equipment and impact on the environment than being obliged to return later and artificially re-surface and re-vegetate the disturbed areas. Prevention is better than cure.

7.1 Seismic Lines, Tracks and Locations

7.1.1 As far as is practicable, lines should be concealed and rendered inaccessible to the public, unless otherwise specifically requested by the land owner or authority in whom the land is vested.

7.1.2 Lines constructed over salt lakes, salt flats, claypans and the adjacent dunes should, where practicable, be rehabilitated to encourage rapid natural restoration of the environment. Special care should be taken to minimise disturbance of the natural drainage pattern.

Fig. 5 Falling into a shothole drilled on-line, see fig. 6.

Fig. 6 An example of poor practice where no shothole cap was used and tamped back to surface.

7.1.3 Clayed tracks and ramped dunes on lines no longer required for access should be rehabilitated to re-establish drainage and encourage restoration of the topography. Deep cuts in dunes should first have their sides battered and then covered in a dense mat of brushwood to avoid wind-scour. The brushwood should be obtained from that removed by the line clearing.

7.1.4 Borrow pits no longer in use should be left in a neat condition, with sides battered to a slope of at least 1 in 5 to allow regrowth and prevent entrapment of stock and wildlife.

7.1.5 Windrows should be levelled, by back grading on to the cleared line taking care to preserve survey markers.

7.1.6 Where soil and overburden must be stripped, topsoil should be retained in a separate stockpile and respread over the exposed surface.

7.1.7 To prevent erosion of the soil, where appropriate as on slopes, construction of check banks and spur drains should be undertaken.

7.1.8 Site access roads should by-pass or minimise traversing long slopes.

7.1.9 Windrows on sensitive areas should be respread.

7.1.10 Any compacted soil should be ripped up to provide seed and water catchment for native vegetation.

7.1.11 Clay or gravel capping of dune crests should be ripped along the contour when the line is abandoned.

7.1.12 Any damage to landholder improvements should be reported promptly. Repairs should be effected without delay.

7.2 **Shot-holes and Other Damage Caused by Explosives**

7.2.1 Shot-holes and cave-ins or damage caused by explosives used should be suitably plugged with unconsolidated fill and the disturbed area restored as near as possible to the original state. (Particular attention should be paid to areas frequented by livestock).

7.2.2 Any groundwaters encountered must be protected from contamination or waste by adequate down-hole cementing.

7.2.3 Disturbance around water courses should be minimised and entry of slurry, chemicals or sediment into surface or groundwater prevented.

7.2.4 Shot-holes should be deep ripped with a large chisel tyne and covered with a mound of soil particularly in areas of clay and duplex soils (sand over clay areas). Rehabilitation of shot-holes should be undertaken immediately after detonation.

7.3 Site Clearance

7.3.1 Practise good "housekeeping". Seismic lines should be cleared of all litter such as fuel and oil drums, used grease cartridges, detonator wires, explosives cases and reels.

7.3.2 Litter, rubbish and other wastes should be removed from camp sites within one week of abandonment and the sites left in such a condition as to ensure rapid rehabilitation.

7.3.3 Rubbish dumps (which should first be burnt) and sewage drains, etc. should be filled to ensure a minimum overburden depth of 1 metre. This should be done in such a manner as to restore the original land surface, and to avoid surface contamination and disturbance by animals.

7.3.4 A final inspection should be made with the landholder of all roads, gates, fencelines, campsites and operational sites to ensure that they have been left in an acceptable condition.

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APPENDIX 1

LEGAL ASPECTS

A permittee's/licensee's attention is drawn to various Acts outlining a number of requirements relating to land usage which need to be observed by those engaged in seismic operations -

Aboriginal Hertiage Act 1972-1980
Aboriginal Affairs Planning Authority Act 1972
Aboriginal Communities Act 1979
Petroleum Act 1967-1981
Soil and Land Conservation Act 1945-1982. Section 4, Section 19A and Section 32
Directive of Geological and Geophysical Surveys dated 1.7.82 (with particular reference to Clauses 5 and 6 which cover the protection of the environment and special conditions governing geological and geophysical surveys.

These Acts outline the responsibilities of land users for any action of theirs which will interfere with the intention of the particular Act as well as making clear the rights of holders of petroleum exploration permits.

Excerpts of immediate relevance to petroleum exploration include the following:

1. **Petroleum Act 1967**

21. (1) Where a permittee or licensee has by himself, his agent or employee in the exercise or purported exercise of any of the powers conferred by or under this Act or by reason of any operation conducted or other action taken by him or any of them caused damage to any improvements on land leased for pastoral purposes under the provisions of the Land Act 1933, he is liable, subject to the provisions of section 24 of this Act, to pay compensation to the lessee of the land so leased for the damage and for any damage which the lessee may in the opinion of the Local Court suffer as a consequence of the damage to the improvements.

24. (1) Except where and then only to the extent agreed to by the parties or authorized by the Court compensation is not payable under the provisions of this Act to the lessee of land leased for pastoral purposes under the provisions of the Land Act 1933 -

(a) for deprivation of the possession of the surface of the land or any part of the surface;

(b) for damage to the surface of the land;

(c) where the lessee is deprived of the possession of the surface of any land, for severence of the land from any other land of the lessee;

(d) for surface rights of way and easements;

(e) for any diminution of or interference with the right of the lessee to the reasonable comfort and enjoyment or the peaceful and quiet occupation of the homestead or any other structure on or in the land; or

(f) for any disturbance of cattle, sheep or other stock whatsoever or any damage suffered by the lessee as a consequence of the disturbance.

38. A permit, while it remains in force, authorizes the permittee, subject to this Act and the regulations and in accordance with the conditions to which the permit is subject, to explore for petroleum, and to carry on such operations and execute such works as are necessary for that purpose, in the permit area.

Read on its own the emphasized wording in Section 38 may seem to give exploration operators immunity to do as they please. The rights conferred by this permit must however be read in context of the legal injunctions protecting the viability or other resources (refer to Acts listed above and see example below).

2. **Soil and Land Conservation Act 1945-1982**

"Soil conservation" means the application to land of cultural, vegetational and land management measures, either singly or in combination, to attain and maintain an appropriate level of land use and stability of that land inperpetuity and includes the use of measures to prevent or mitigate the effects of land degradation.

"Land degradation" includes -

(a) soil erosion, salinity and flooding; and
(b) the removal or deterioration of natural or introduced vegetation,

that may be detrimental to the present or future use of land.

covenant.

19A. (1) Where the Commissioner is satisfied that compliance with any convenant, condition term or provision of any lease granted under the Land Act 1933 or any mining tenement granted under the Mining Act 1978 would tend to cause land degradation or any land he may so advise the Minister responsible for the particular Act.

(2) Where the responsible Minister has been so advised he may, notwithstanding anything to the contrary contained in the Land Act 1933 or the Mining Act 1978, as the case requires, vary, modify, revoke or add to the convenants, conditions, terms or provisions of the lease or mining tenement as the circumstances require.

(3) The Direction as to Geological and Geophysical surveys dated 1 July 1982 section 5 requires that in the absence of specific regulations or directions operations are where practical to be carried out in accordance with the APEA code of Environmental practice. The latest edition of which is August 1983.

APPENDIX 2

THE CARNARVON REGION EXAMPLE

Landscape: The Carnarvon Region is the plains landscape developed on the Carnarvon geological basin. The region is a 150 km broad coastal plan extending for some 650 km along the central western margin of the continent, between 21° and 27°S, from Onslow south to near the lower Murchison River. The greater part of the region lies between sea level and the 150 m contour.

The plain forms the outwash apron to the drainage off the rugged ranges and broad valleys of the Pilbara. This drainage is seasonal, flooding rapidly after heavy rains, but dry for most of the year with the exception of remnant scattered pools.

The plain is a composite one made up of aeolian, marine, lacustrine and fluvial land and deltaic deposits, with residual tabelands, mesas and dissected ridges forming rises and eminences. Sands mantle large areas of the region mainly in the centre as linear dune fields and in the south as sandplains.

The native vegetation cover is arid wooded grassland with saltbush over large areas, and low heath vegetation mainly on the coast in the southwest where a winter rain regime predominates. The native vegetation, while toughly adapted to the normal droughty conditions which prevail in the arid zone, is sensitive to excessive disturbance and takes a long time to recover.

Climate: The region has an arid tropical maritime climate with two rain periods inland and chiefly winter rains on the coast becoming more pronounced in the Shark Bay area to the southwest.

As the region lies in the zone of overlap between the northern summer rainfall system of tropical origin and the southern frontal system of polar westerlies, over the longterm it experiences two rain periods with two intervening dry seasons in a year. Rains originating from tropical air masses occur sporadically between the months of January and March. These are typically of short duration, either light rains or high intensity falls from isolated thunderstorms which have a high erosive capacity.

A second peak of generally more reliable and longer duration stratiform rains can occur widespread in midwinter. However rainfall in the arid zone is extremely variable in amount, time and place of occurrence - brief interludes in prevailing torrid conditions. Long term rainfall patterns are shown in Figure 7.

Much of the heavy rain and strong winds are from tropical cyclones. Many storms originate in the Timor Sea and move more or less parallel to the coast from the north. Those moving inland commence to fade soon after crossing the coast. Rain from cyclones can be light and restricted to coastal regions or can be extremely heavy affecting a large proportion of the State. In 1898 during a cyclone over Whim Creek 735 mm of rain was recorded during a 74 hours period.

Average summer temperatures vary between 26 and 32°C, while average winter temperatures vary from 14 to 20°C. Annual temperature range is 46.7°C between the recorded extremes of 1.3°C and 48°C.

Wind velocities capable of eroding and transporting dry, loose, sediments occur year round throughout the region. A larger percentage of stronger winds are experienced on the coast throughout the year than over the inland areas. In summer on the coast 70 per cent of winds with speeds more than 11 kph occur morning (southerly) and afternoon (SW, S), and of these 27 to 30 per cent in the afternoons (5 per cent over 30 kph). In winter on the coast 45 per cent of winds exceed 11 kph in the morning (5 per cent over 30 kph), and 70 per cent in the afternoons (10 per cent over 30 kph). Inland in winter 45 per cent of winds morning and afternoon exceed 11 kph (5 to 6 per cent over 30 kph). Strongest winds are associated with the passage of hurricanes. In March 1958 for example winds gusts of 209 kph were recorded at Onslow during a tropical cyclone.

Land System Maps : An Environmental Guide

The Resource Management Division of the Department of Agriculture use a land system classification identified by a "unit area or group of areas that have a recurring pattern of similar landforms, soils and vegetation that share the same climate".

Those land systems with high inherent susceptibility to erosion by wind/and or water include the following (Table 1 and enclosure).

Table 1. Highly erodible land systems and landforms

Units containg dunes	Units containing friable slopes, soils and drainage
Acacia Sandplain	Acacia Sandplain
BR Brown	Bd Bidgemia
El Ella	Pn Peron
Ly Lyons	Acacia Short Grass Forb
Ya Yalbalgo	Mg Moogooloo

Table 1. cont

Units containg dunes	Units containing friable slopes, soils and drainage
Acacia Sandplain	Acacia Sandplain
Coastal Dune Shrub	Ws Wash
Cs Coast	Yi Yinnietharra
Ed Edel	Bluebush
Li Littoral	Fi Firecracker
Ll Lyell	Wi Winning
Exotic Annual	Hard Spinifex
Tm Tamala	Df Duffy
Hard Spinifex	Mixed Saltbush and Bluebush
Gi Giralia	De Delta
Ke Kennedy	Ge Gearle
Ml Mallee	Saltbush
Ti Taillefer	Ba Barrabiddy
Samphire	* Wa Wandagee
Su Salune	Stony Chenopod
Soft Spinifex	Du Durlacher
Ca Cardabia	* Ji Jimba
* Extremely friable Permian sedimentary outcrops, highly erodable expecially when disturbed.	* Mt Mantle
	Tussock Grass
	Yc Yarcowie

Treatment and Rehabilitation Refer to Text Items	
Treatment 5.2: 5.7: 5.8: 5.9: Rehabilitation 7.1.6: 7.1.8: 7.1.9: 7.1.11: and 7.3	Treatment 5.1: 5.2: 5.3: 5.4: Rehabilitation 7.1.2: 7.1.6: 7.1.7: 7.1.8: 7.1.9: 7.1.10: 7.2.3: and 7.3:

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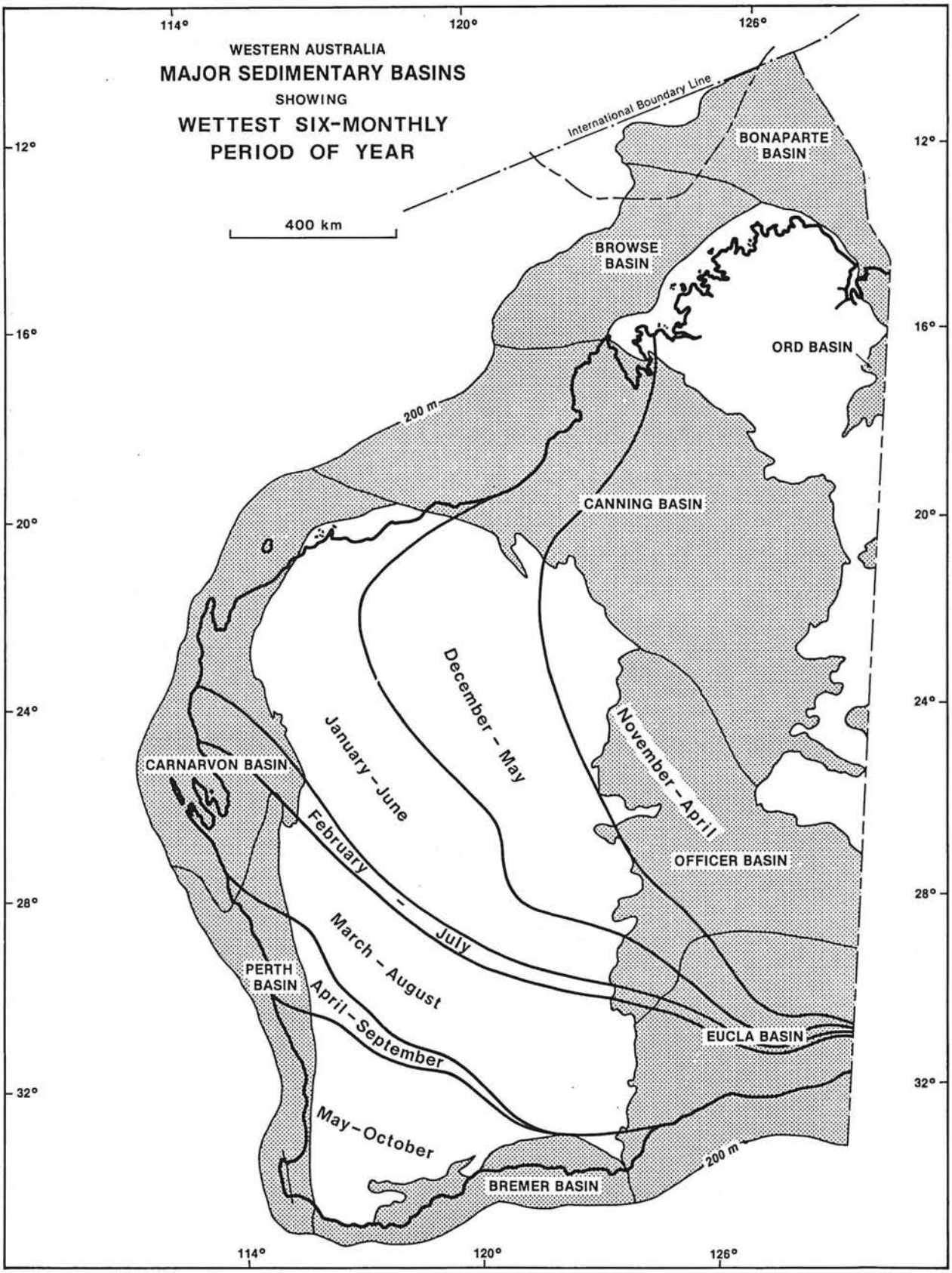
WESTERN AUSTRALIA
MAJOR SEDIMENTARY BASINS
SHOWING
WETTEST SIX-MONTHLY
PERIOD OF YEAR
400 km
International Boundary Line
BONAPARTE BASIN
BROWSE BASIN
ORD BASIN
CANNING BASIN
CARNARVON BASIN
OFFICER BASIN
PERTH BASIN
EUCLA BASIN
BREMER BASIN
200 m
200 m
December - May
January - June
February - July
March - August
April - September
May - October
November - April
114°
120°
126°
12°
16°
20°
24°
28°
32°

Figure 7

MAPS TO BE SUPPLIED BY DEPARTMENT OF AGRICULTURE FOR INCLUSION WITH FINAL COPY