DREDGING PROPOSAL AT PELICAN ROCKS, SWAN RIVER ESTUARY

REPORT BY THE ENVIRONMENTAL PROTECTION AUTHORITY

SEPTEMBER 1979

DEPARTMENT OF
CONSERVATION & ENVIRONMENT
WESTERN AUSTRALIA

BULLETIN Nº 77

REPORT BY THE ENVIRONMENTAL PROTECTION AUTHORITY ON A DREDGING PROPOSAL AT PELICAN ROCKS, SWAN RIVER ESTUARY

SEPTEMBER 1979

Department of

Conservation and Environment

Western Australia

Bulletin No. 77

ENVIRONMENTAL PROTECTION AUTHORITY
BP HOUSE,
1 MOUNT STREET, PERTH, WESTERN AUSTRALIA 6000
Telephone 322 2477

HON. MINISTER FOR WORKS

Your Ref.
Our Ref. 28/73

PELICAN ROCKS DREDGING PROPOSAL

I wish to advise that the Authority has given further consideration to a proposal promoted by the Yachting Association of W.A., to dredge an area known as Pelican Rocks in the Swan River Estuary.

Following discussions with University researchers, and advice from other people, there can be no doubt that dredging of Pelican Rocks will affect the fishery of the Swan River Estuary, and Melville Water in particular. This will have serious short term implications on the existing users of the Estuary, and may result in long term changes in the use of the river by fish and other fauna.

In view of the significant adverse effects the proposal would have on the estuarine fauna and fishermen, both amateur and professional, the Authority recommends that there should be no dredging of the Pelican Rocks area.

The Authority has further resolved that, as a consequence of its considerations of the likely effects of dredging it was opposed to any dredging of the shallows of the Swan and Canning Estuary unless there were compelling reasons for such a project to be undertaken.

As stated in previous correspondence on this subject, the dredging of this area would provide additional yachting space on the Swan River. However, the proposal is seen only as a short term solution to boating congestion of Melville Water.

A report describing the background and details of the proposal, the evaluation of the various study reports and the effects dredging would have on the biological resources is attached for your consideration.

C. F. PORTER
CHAIRMAN

13 SEPTEMBER, 1979.

CONTENTS

REPORT BY THE ENVIRONMENTAL PROTECTION AUTHORITY ON A DREDGING PROPOSAL AT PELICAN ROCKS, SWAN RIVER ESTUARY

1. SUMMARY

Since 1971, representations have been made to Government Departments to increase the area of navigable water in Melville Water, and particularly at Pelican Rocks, for recreational purposes.

Various studies have been undertaken since 1977, at the request of the Environmental Protection Authority, to determine the likely impact that dredging the shallow bank at Pelican Rocks would have on the estuary, from both physical and biological aspects.

Dredging of the Pelican Rocks shallows will seriously affect the resident fauna of the area and fauna visiting the area. The resident benthic invertebrate fauna at the dredging site will be destroyed and fauna resident in the deeps receiving the spoil will be buried. As a consequence, the resultant reduction in animal numbers will affect a number of fish species, such as black bream, cobbler, Perth herring, mullet, whiting and tailor, all of which use the Swan River Estuary for breeding, nursery and feeding purposes. The dredging operation will result in a reduction in the fish population in the estuary, during the dredging period, and probably for some time after, depending on recovery of the invertebrate fauna.

Any decline in the availability of these fish species will affect catches by commercial and amateur fishermen. The Swan River Estuary is the second most important estuarine fishing area for commercial fishermen in Western Australia. Only Peel-Harvey Inlet has a larger commercial catch. As an amateur fishery, however, the Swan and Canning Rivers are the most important, with over 1,000 fishermen having been surveyed on one evening in 1977.

As currently envisaged, the dredged material will be discharged into deep water adjacent to Pelican Rocks. This will result in substantial amounts of silt and clay being suspended in the water column. Not only will the increased level of turbidity result in visual discolouration of the water for the duration of the dredging operation, but the suspended solids will affect the estuarine fauna. Filter feeding invertebrates, such as mussels and barnacles, will be seriously affected, while certain important commercial fish species, such as tailor and yelloweye mullet will avoid areas of high turbidity.

Deposition of the spoil in deep water will not only destroy the resident invertebrate fauna, but it will also reduce the area of deep water available to the various fish species which require saline conditions at certain times of the year and during specific stages of development.

There are extensive areas of shallow water (less than 2 m) in the estuary, similar to those of the Pelican Rocks area. These are biologically the most productive part of the estuary because they lie within the photic zone and because invertebrate populations are greatest there. The shallows are essential to the well being of the estuarine ecosystem and any reduction in them will reduce the food and available feeding grounds for both fish and waterbirds.

2. BACKGROUND

In 1971, the Yachting Association of Western Australia began making representations to various government bodies concerning the desirability of dredging certain shallows in the middle and lower sections of the Swan River Estuary to increase the area of navigable waters and hence reduce yacht and boat congestion. The Association considered that that portion of the shallow bank extending from Pelican Rocks in a westerly direction towards Knott, Concrete and Foam Spits should receive the highest priority for dredging.

The Yachting Association requested the Minister for Works to investigate the possibility of dredging the Pelican Rocks area. This preliminary evaluation, which was conducted by the Public Works Department in 1972, indicated that the project would have to be spread over three years at an estimated total cost of $800,000. At this time, it was proposed to dispose of all material into deep portions of the river. An alternative suggestion for disposal by stockpiling and carting away was expected to double the cost of the project. A further possibility of creating two islands at Pelican Rocks with the spoil was proposed by the Swan River Conservation Board.

Following this investigation, the proposal was referred in April 1973 by the Under Secretary for Works, to the Environmental Protection Authority, (EPA). The Authority decided that the Pelican Rocks proposal fell within an area in which its Estuarine and Marine Advisory Committee (EMAC) could investigate and report.

In September 1975, the EPA received and considered the report from EMAC and concluded that the spoil could be distributed into areas where shell had previously been excavated. However, in the absence of detailed data the Authority could not agree to this disposal method. The island alternative was totally opposed by the EPA on the grounds that it would alter the aesthetic appeal of the river and affect river flow patterns. The Authority suggested that :

> "instead of committing substantial funds to a dredging project that will only provide short term relief to river boating and yachting congestion, the Government should consider the merits of expending this amount of money towards the provision of a facility outside the river, or facilities such as well-designed marinas."

As a result of these conclusions, the Minister for Works requested the EPA to outline the data required to alleviate the Authority's concern regarding deep water disposal of spoil. On 1 June 1976, the EPA determined four questions that would need to be answered:

i. Would the three-year dredging programme cause unacceptable visual levels of turbidity?

ii. Would material settle on the Como foreshore with detrimental effects on either the recreation usage or the wading bird habitat?

iii. Does the bottom fauna represent a particularly significant food source for fish?

iv. What impact would dredging of the area have on amateur and professional fishermen?

The Authority suggested that five areas of study could form a basis upon which a judgement on these questions could be made :

a. Composition of material proposed for dredging in relation to its potential for remaining in suspension, and measurement of surface and bottom currents pertaining to the proposed dump areas.

b. Nutrient levels of material in relation to its potential for releasing nutrients during summer periods thus causing plankton and other algal blooms.

c. Importance of the benthic fauna as a food source for fish and crustaceans, and of these fish and crustaceans.

d. Utilisation of the area by amateur and professional fishermen.

e. General utilisation of the river by the community at large.

3. DETAILS OF PROPOSAL

A report has been prepared by the Public Works Department on the basis of deep water disposal of the spoil from Pelican Rocks.[1] The current proposal being examined by the PWD is to dredge approximately 107 hectares of shallows at Pelican Rocks to depths of 2 metres and 2.74 metres below mean sea level and to dispose of the spoil in adjacent deep channels. (See Fig. 1). The estimated total project cost is approximately $2.5 to $3 million at December 1978 values. This estimate assumes that no undue constraints are placed on normal dredging practice.

The Yachting Association, as recently as April 1979, has made representations to various groups, such as the Swan River Management Authority, on the proposal to create islands near the Como foreshore. However, the EPA is totally opposed to this proposal, as previously mentioned.

4. STUDY REPORTS

The studies described below are relevant to the assessment of the impact of dredging Pelican Rocks.

4.1 Engineering Investigations

The PWD Report[1] forms a basis for the engineering investigation of the proposal. More precisely, the aims of this engineering investigation were :

- To determine the intensity and pattern of currents in Melville Water and the Pelican Rocks Area particularly, under differing environmental conditions.
- To sample and analyse the riverbed material in both the proposed dredge and spoil areas, in order to estimate its potential to remain in suspension after dredging.
- To take regular baseline turbidity measurements at selected locations in the river for comparison with turbidity measurements taken during and after the dredging operation.
- To estimate possible changes in the intensity and pattern of currents in the Pelican Rocks Area caused by the dredging operation.

The PWD report detailed sediment samples taken in the vicinity of the dredge and spoil areas. A number of these cores did not go to the dredging depth and PWD suggest that further cores should be taken to determine the presence of rock.

Approximately 900,000 m^3 of material will have to be removed to achieve depths of 2 m and 2.74 m. Most of the material is fine to coarse sand, and about 30% is clay. In the spoil locations, the surface material is silt.

Analyses have been conducted to determine the amount of material that will be suspended during dredging operations, and hence the resultant turbidity levels that can be expected. Readings taken throughout the river in late 1976 and mid 1977 indicate that the river is fairly turbid at all times, although more so in winter than in summer. Near the Pelican Rocks site, this summer-winter difference was noticeable, although only two sets of data were taken during early winter. The turbidity readings would be expected to be high in middle to late winter, due to the high level of suspended material.

Turbidity caused by the dredging operation will be most noticeable during summer, and the suspended material could be expected to take approximately 6 hours to settle to a point where the plume was no longer visible above background turbidity. The PWD have suggested that a degree of turbidity control from this dredging operation could be achieved through either discharging in the bottom current regime or erecting a barrier around the discharge outlet.

The current regime in the Pelican Rocks site has been measured, and indicates that there are two types, wind induced and tide induced. Neither is very strong, varying in range from 0-0.33 knots. The tidal current tends to follow the deep channels and splits to the north and south at Pelican Rocks. The report suggests that, following dredging, the magnitude of the tidal currents at the proposed site may be slightly reduced, but generally the dumping of spoil in deep channels will not affect the natural current regime.

4.2 Macrobenthic fauna

A study by Wallace[2] examined the macrobenthic invertebrate fauna of the Pelican Rocks area. The study objectives were as follows:

- Identify the invertebrate species present and determine their preferred habitats.
- Provide an index of their relative abundance.
- Correlate distribution of these invertebrates with physical data including sediment type, water depth, turbidity, salinity and temperature.

As part of the investigation, additional sampling was undertaken in the Swan and Canning Rivers. An analysis of the results showed that the Applecross-Pelican Rocks area had the greatest faunal diversity, while diversity progressively decreased on going upstream in both rivers. An index of numbers of species for each habitat was used to evaluate the various transects taken across the Pelican Rocks area. More species were found in shallow bank habitats than in deep water habitats.

In-shore banks also contain the greatest number of invertebrates per square metre, followed by offshore banks, dredged deep water, and lastly natural deep water. The natural deep water habitat (3 m) supported less than 10% of the individuals found on inshore banks. The slightly larger number found in the dredged habitat was probably due to the proximity of this area to shallow banks, rather than it being a more favourable environment.

Dredging the Pelican Rocks area will have at least three direct effects. Firstly, the entire fauna at the dredging site will be destroyed, since at least 1 m of sediment will be removed during the operation. Also the deposition of spoil in deep water will probably inundate and destroy the fauna of that area. While the long term effect of this on the invertebrate fauna is difficult to predict accurately, the study found that at Pelican Rocks, faunal recovery following earlier dredging was incomplete after a period of twenty years. The dredging operations along the Como foreshore during the 1950's left holes in which fine sediment replaced sand. Only two species out of eight probably common to the area before dredging had recolonised these holes. Any new substrate in more than 2 m of water will have a less diverse and less abundant fauna that is present in the existing shallows.

A second direct effect could be that the invertebrate fauna in the vicinity of Pelican Rocks would be affected by the greatly increased levels of suspended solids. Filter-feeding animals such as mussels and barnacles, can be expected to be worst affected. Burrowing molluscs and polychaetes, which constituted the bulk of the fauna, would probably be little affected. Some of these species might benefit from the extra particulate organic matter thrown up during the dredging. However, deposition of fine material on the near shore sandy zones would cause a change in the nature of the sediment and would temporarily reduce faunal abundance in that area.

The third effect would be in connection with the reduction in invertebrate fauna abundance. Detailed studies have shown that benthic invertebrates are the major source for many species of fish in the Blackwood River estuary.[3] The same is likely true for the Swan River estuary. Bottom feeding fish, such as whiting, flathead, cobbler, gobies and hardyheads which inhabit the area would lose a food resource at present available to them. The numbers of these species may diminish in the area as a result of decreased invertebrate abundance.

A reserve for the Conservation of flora and fauna, vested in the W.A. Wildlife Authority is situated along the tidal flats adjacent to the Kwinana Freeway foreshore. This reserve is an important habitat for thousands of wading birds, which migrate each year from their breeding grounds in northern Eurasia. The waders feed almost exclusively on the invertebrate fauna provided by the tidal flats.

There has already been a considerable reduction in the wading bird populations of the estuary as the result of human activities and any further reduction in the area of inter-tidal waters can only result in further reducing the numbers of wading birds using the estuary.

4.3 Fish studies

Lenanton,[4] in a publication entitled "Fish and Exploited Crustaceans of the Swan-Canning Estuary", has categorised the majority of fish species caught for commercial and recreational reasons into those that use the Swan and Canning River Estuary as a permanent breeding and nursery habitat and those that use it as a nursery habitat for juveniles.

Species typical of the former group include black bream, cobbler, Perth herring, some flathead and flounder species, river garfish, yellowtail grunter, some of the non-commercial species such as the hardy head, gobbleguts, and some of the gobies. The only commercial crustacean in this group is the greasyback, school or common river prawn.

Fishes in the juvenile nursery group include the bulk of the most important commercial and amateur species. Species typical of this group include the mullets (sea and yelloweye), the whitings (King George, western sand, and trumpeter), silver bream, tailor, mulloway, some of the flatheads and flounders, sea garfish, striped perch (or trumpeter), roach, whitebait and anchovy, and the commercial crustaceans; blue manna crabs and king prawns. Abundant food and shelter both from predators and from the more boisterous marine environment are important factors which encourage the utilisation of the estuaries by the young stages of many of these species. From research in other estuaries such as the Blackwood River Estuary[3], and preliminary work in the Swan River estuary, it is clear that the shallow banks, in particular the seagrass (*Halophila ovalis*) areas, are the most important nursery habitats for these fish. These areas are rich in detritus and benthic invertebrates which are the most important items of food for the majority of the fishes of the estuary. These banks are certainly more productive in terms of abundance of potential fish food than the deeper areas and this is reflected in differences in the abundance and distribution of fishes inhabitating the two areas.

During the last two years, an investigation, under the joint supervision of Professor Potter (Murdoch University) and Mr. Lenanton (Department of Fisheries and Wildlife) has been undertaken to study the ecology of the fish fauna of the Swan-Avon system. While this investigation has not yet been completed, the main findings are listed below:

- The Swan River Estuary supports a very abundant and diverse fish fauna.

- The juveniles of many species, including several of commercial and recreational importance utilize mainly the shallow areas where they are particularly abundant during the summer months.

- The deeper regions are occupied by the older stages in the life cycle and also during the winter by the young stages of species requiring saline conditions.

- The school prawn is found in large numbers on the banks during much of the year, but is most abundant in this region in September-November, after which time it moves to deeper water to spawn. By contrast, the number of king prawns reach peak numbers on the shallows between November and February.

- Important species of fish in Melville Water, which includes Pelican Rocks, are the essentially estuarine species such as black bream, Perth herring and yellowtail grunter. Even more important, however, are the basically marine species, such as sea mullet, yelloweye mullet, trumpeter whiting, tailor, flathead and mulloway which utilise this area heavily when they move upstream during the spring and summer months. Estuarine populations of cobbler have also been found in large numbers of Melville Water.

  To emphasize the importance of Melville Water it should be noted that catches of about 10,000 juvenile fish in a single 35 m beach seine were common in this area during the summer months.

- Because of the broad expanse of shallows in Melville Water, particularly at Pelican Rocks, the fish in these areas are relatively undisturbed by the activities of larger, deeper keeled vessels. For this reason professional fishermen are able to operate such regions without boats disturbing their fishing activities and damaging their nets.

- Areas in Melville Water, which are open to commercial fishing, provide consistently good catches of fish throughout the year. They can thus be regarded as an important and essential area for professional fishermen.

4.4 Utilisation of the Pelican Rocks area

The Swan and Canning Rivers Activity Study[5] has delineated the density and popularity of use of the estuary and foreshore and highlighted the existing conflicts between various user groups and within user groups, as well as foreshadowing future areas of conflict.

While this study aimed at measuring broadscale recreational pressures along the waterway, a number of its findings can readily be applied to Pelican Rocks, and dredging of those shallows. Additional information about the utilisation of the estuary resources is given in a recent Swan River Conservation Board publication.[6]

Yachting

All of the principal yacht clubs situated in Melville Water have courses which run to the South Perth foreshore. In 1975/76, they had a total membership of 8,000 which represents approximately 70% of all club members based on the Swan. Yachting is the most popular organised aquatic recreation on the Swan, and it is the sport which requires the most navigable water.

Fish resources

a. Professional fishery

In the 1976 licensing year there were 33 professional fishermen owning 41 licensed fishing boats, operating in the Swan and Canning Rivers.

The most important species include sea mullet, cobbler, tailor, mulloway, flathead, crabs and prawns, which are all utilised mainly as food; yelloweye mullet and Perth herring which are caught mainly for rock lobster bait; and whitebait which are mostly sold as angling bait.

The Swan-Canning Estuary system is the second most important estuarine fishing area for commercial fishermen in W.A. Only Peel/Harvey Inlet has a larger commercial catch.

b. Recreational fishery

An illustration of the recreational fishing pressures on the estuary is that a survey undertaken on a typical week-end evening in summer found 186 fishing parties comprising a total of 950 persons, at 70 selected locations. Total activity within the study area would almost certainly exceed 200 parties and 1,000 persons per week-end evening in summer. During the summer months, crustaceans - blue manna crabs, school and king prawns are also intensively fished by amateurs. A Swan River Conservation Board survey of prawning parties in 1975 found an average of 150 groups on a typical summer week-end evening, falling to about one third of this number on a week night. The 1976/77 Rivers Activity survey confirmed that the number of groups and total number of people engaged in prawning was only marginally less than the number fishing.

Other Activities

Other recreational pursuits which use the Pelican Rocks area are water-skiing, speed boats, and hang gliders. These activities use the beach on the west of Mill Point.

The Swan and Canning Rivers Activity Study examined various future conflicts of demand for the river's resources that might arise. One of those that it discussed was the suggested dredging of portions of the estuary to relieve boating pressure. The study concluded that:

> Dredging to open up additional areas of water for boating must to some degree disturb wildlife and possibly also other recreational pursuits such as prawning, fishing and swimming. It could be that a limited amount of dredging would greatly increase boating opportunities with minimal environmental disturbance. On the other hand, particularly with the rapid increase in the number of boats, dredging could provide only a temporary respite to congestion, require continual maintenance, and result in considerable environmental disruption. Any dredging, because it reduces the amount of shallows, has an adverse impact on fisheries and wildlife. The most obvious result is a decrease in fish and bird populations and reduced opportunities for recreational fishing and prawning.

5. ANTICIPATED EFFECTS OF DREDGING PELICAN ROCKS ON FISH AND CRUSTACEAN POPULATIONS

The Swan estuary is a system that has shallow areas of high productivity, high species diversity and juvenile abundance and is constrasted with deeper waters of low species abundance and adults of marine or freshwater intolerant species.

During winter flooding fresh water slides over these deep areas and the water is not diluted. Consequently, species requiring normal sea salinity use the deeps as a winter refuge. The proposal will lead to a significant reduction in the area of shallow water and an associated change in the environment of the deep water, leading to an unacceptable alteration in the biological characteristics of the estuary.

The dredging of Pelican Rocks and depositing the spoil in adjacent deep waters is likely to have the following impacts:

i. It will remove from the Swan Estuary an important large area for the juvenile stages of many species of fish. This is likely to have a serious effect on the numbers of later stages in the life cycle of

important commercial and recreational fish such as the mullets, tailor and mulloway. It will disrupt the lower levels of the food webs, such as the essential plant and invertebrate food supplies of fish.

ii. The removal of Pelican Rocks would also firstly limit the habitats available to the very important recreational school prawn, and secondly, increase the 'fishing' pressure on this species in other areas of Melville Water. In view of the steady increase in the number of people prawning, the above two factors are likely to pose a threat to the size of the prawn population in the Swan Estuary.

iii. Deposition will reduce markedly the quality of the available habitats for those species which utilise and, in many cases, are dependent on the properties of deeper waters.

iv. Changes brought during the dredging operations can also be anticipated as likely to have an effect on the migratory patterns of such fish as the two species of mullet, mulloway and tailor.

v. Marked changes at Pelican Rocks will result in the destruction of an important environment for those fish species which are forced out of Perth Water and the Canning River by the fresh water flowing in winter.

vi. The creation of deeper areas near the shore will increase boat activity in these regions and thus almost certainly lower the density of the resident fish fauna.

REFERENCES

1. Public Works Department of Western Australia (1977). Harbours and Rivers Branch, Coastal Investigations Section. Swan River Pelican Rocks Dredging Investigations. Report No. CIS 77/2.

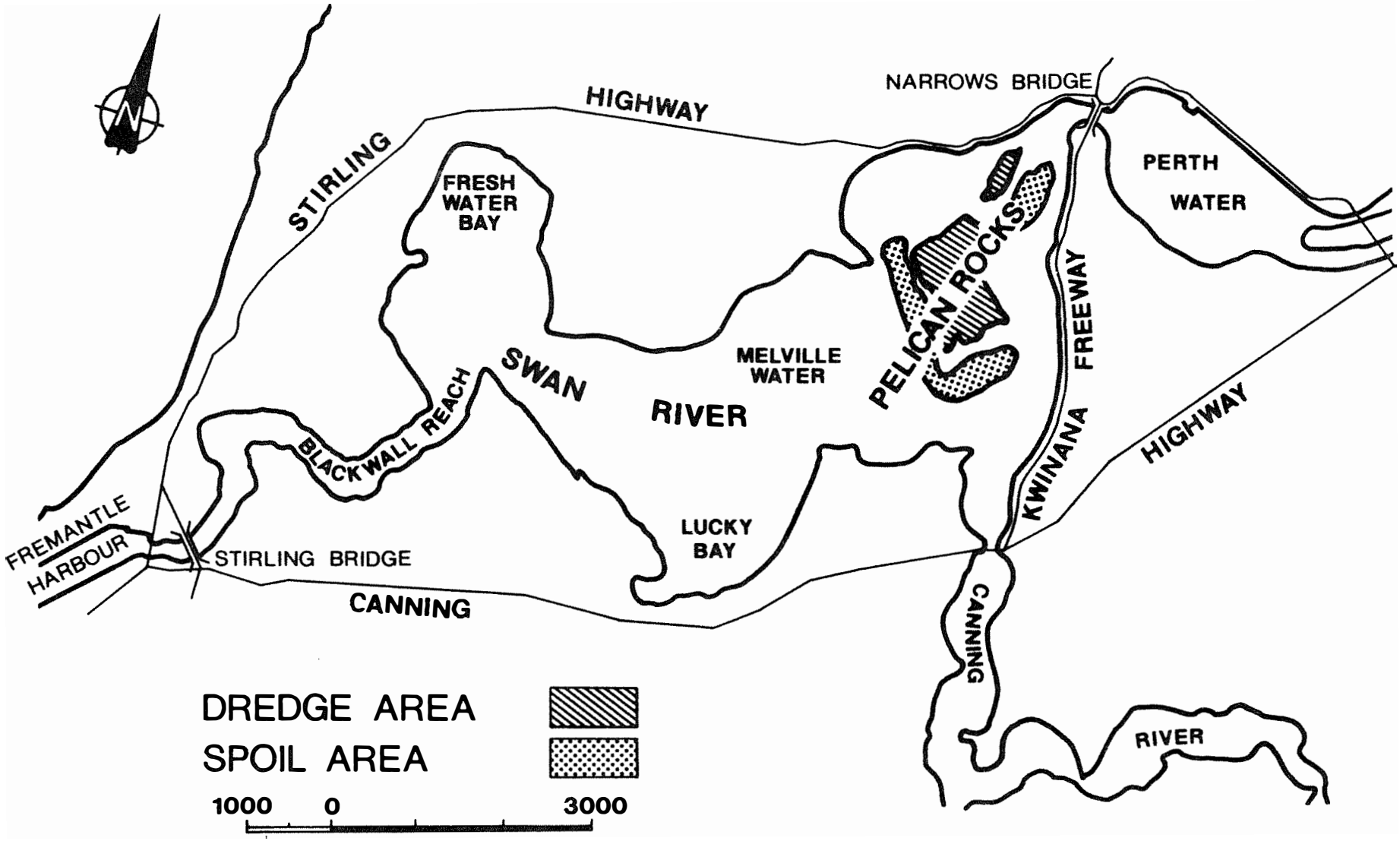
2. Wallace, J. (1977). The Macrobenthic Invertebrate Fauna of Pelican Rocks, March-April 1977. A report to the Department of Conservation and Environment and the Public Works Department.

3. Hodgkin, E.P. (1978). An Environmental Study of the Blackwood River Estuary Western Australia 1974-75. Report No. 1. Department of Conservation and Environment.

4. Lenanton, R.C.J. (1978). Fish and Exploited Crustaceans of the Swan-Canning Estuary. Fish. Rept. West. Aust. 35, 1-36.

5. Forbes and Fitzhardinge (1977). Swan and Canning Rivers Activity Study. A report to the Department of Conservation and Environment.

6. Riggert, T.L. (ed.) (1978). The Swan River Estuary Development, Management and Preservation. Swan River Conservation Board, 1958-1976.



PELICAN ROCKS DREDGING PROPOSAL

Figure 1