SYDNEY PORTS

Towra Spit Island Avifauna Habitat Review of Environmental Factors

February 2001

Connell Wagner

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Towra Spit island Avifauna Habitat Review of Environmental Factors

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1. Introduction

Connell Wagner has been engaged by Sydney Ports Corporation to assess a proposal to stabilise Towra Spit Island, Botany Bay (refer Figure 1.1). The aim of the proposal is to provide an area of avifauna habitat that would be detached from the mainland and safe from terrestrial predators.

1.1 Need for the Proposal

As a condition of approval for construction of the parallel runway at Sydney (Kingsford Smith) Airport, the Federal Airports Corporation (FAC) was required to examine the feasibility of creating an alternative habitat for Little Terns and migratory waders. The purpose of this proposal is to create alternative habitat in compensation for wader bird habitat lost during the construction of the Parallel Runway by the FAC.

FAC commissioned the Royal Australian Ornithological Union (RAOU) to investigate alternative habitats. The RAOU recommended that the existing little tern and wader habitat at Towra Spit Island be augmented to provide for the loss of habitat from construction of the new runway. Towra Spit Island is on the southern shore of Botany Bay and has been formed recently by highly mobile unconsolidated sand.

The FAC accepted the RAOU's recommendation and engaged Sydney Ports Corporation to design and manage the environmental impact assessment and subsequent stabilisation and augmentation measures.

1.2 Original Proposal

The original proposal as developed for the EIS (prepared by Dames and Moore in 1996), consisted of the following main elements:

- 286m long sand filled geotextile at the western end of Towra Spit
- Two 3m high sand barrier dunes aligned generally east-west along the island
- A 500mm diameter sand filled geotextile offshore berm
- Three short, shore normal sand filled geotextile groynes to stabilise the island
- Extraction of 37,600m^3 of sand from an area east of the groyne at the end of the spit to provide sand for the proposed barrier dunes and sand filled geotextile groynes

The beneficial and adverse effects of the original proposal on the local environment were assessed in the EIS (Dames and Moore,1996) which was placed on public exhibition over August / September 1995.

1.3 Determining Authorities Report

Wide ranging consultation was undertaken during the EIS process to gather the input of the relevant state authorities, local community groups, commercial operators and individuals. Submissions received were considered in the Determining Authorities Report (1997). The four determining authorities for the original proposal were NSW Fisheries, National Parks and Wildlife Service, NSW Environment Protection Authority and Sydney Ports Corporation with National Parks and Wildlife Service as the nominated determining authority.

The Determining Authorities Report stated that the NSW Fisheries considered that the loss of 4.5ha of *Zostera* seagrass as a result of sand extraction would be unacceptable, and as a result they would not be prepared to grant the necessary permits.

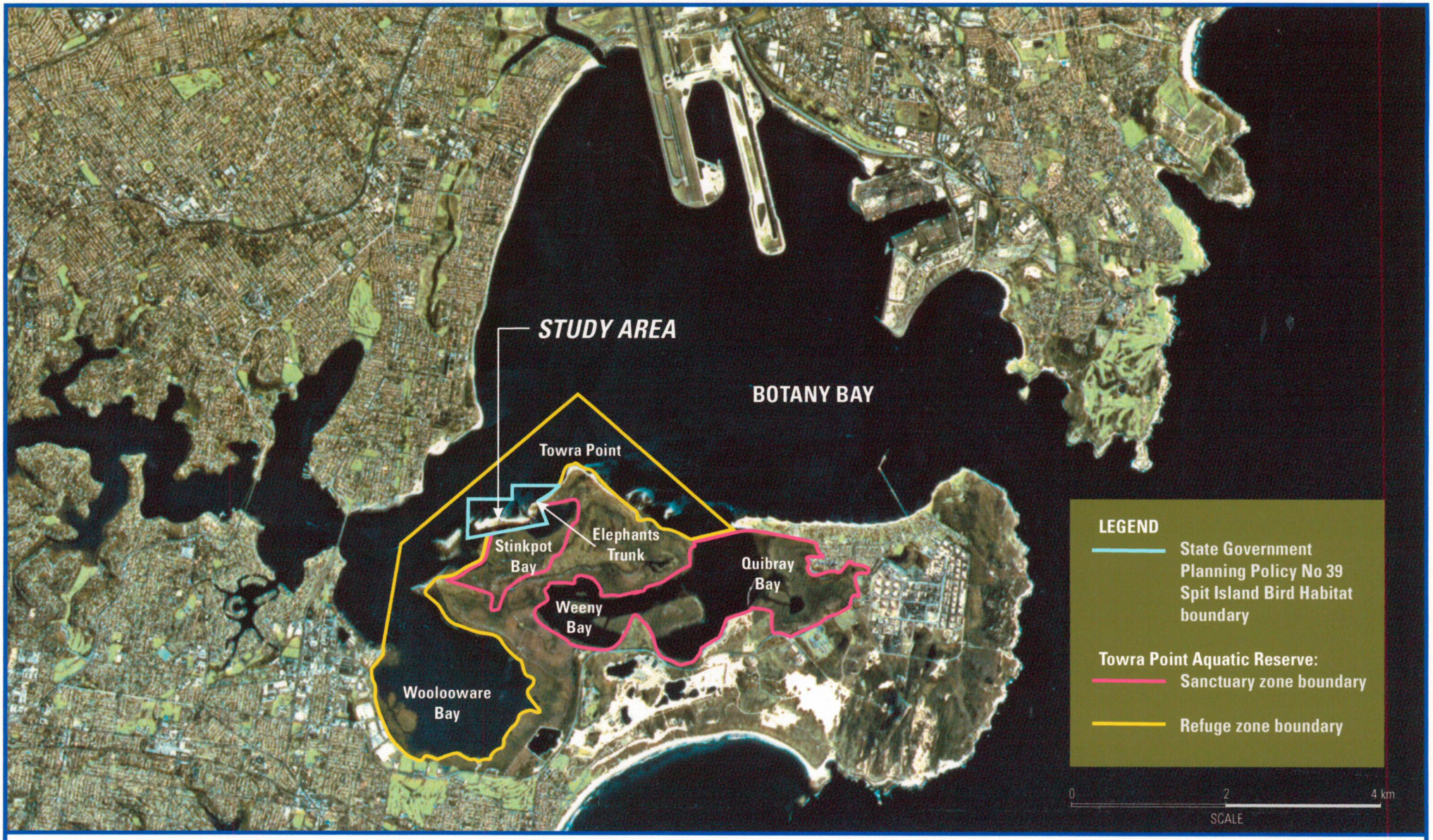

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FIGURE 1.1
STUDY AREA

1.4 Modification of the Proposal

In an attempt to reconcile the issue, options were investigated in 1998 to reduce the impacts on seagrasses. Towra Spit Island is continuing to elongate to the west causing the smothering of seagrass beds and the eastern end is also moving south connecting with the mangroves on the adjacent shore. Prevention of further southward movement and re-establishment of the island is regarded as a high priority. Recent investigations indicate the required controls can be achieved by an option that consists of a 450meter long geotextile barrier to a height of 3m. The barrier would prevent further southward movement and re-establishment of the island as an island, which is seen as the highest priority. It is recognised that this option would not prevent the westward migration and smothering of seagrass to the west of the island, nor ensure the continuation of the existing channel between the island and the end of Towra Spit.

A further option was developed which incorporates a western groyne in the above revised base option. The "Base Revised Option with Western Terminal Groyne" consists of the 450m long barrier and a 2m high 150m long sand filled geotextile terminal groyne located at the western end of the island. Again, this option would not ensure the continuation of the existing channel between the island and the end of Towra Spit, but would prevent westward migration and smothering of seagrass beds to the west of the island.

The final dimensions of the proposed structures have been modified during the detailed design. The proposed barrier structure would be 525m long and up to 3m high and the terminal structure would be 250m long and up to 3.5m high. The barrier was increased in length to provide an effective barrier along the eastern half of the island. The groyne length was increased to provide protection against erosion to the western end of the island. Details of the proposal are given in Section 4.1 of the REF.

Following the rejection of the original scheme as addressed in the EIS the scheme has been modified to have significantly less impact on the marine environment. Sydney Ports has prepares this REF to examine the subsequent changes in environmental impacts if the "Base Revised Option and Western Terminal Groyne" is implemented.

1.5 Objectives

During the preparation of the EIS in 1995 Sydney Ports Corporation developed a series of objectives to be fulfilled in advancing the project. The intent of these objectives is ostensibly the same, however, the manner in which they are to be accomplished will differ due to the modified proposal.

The objectives are presented below:

1. To protect and enhance Little Tern nesting habitat at Towra Spit by:

- Maintaining Towra Spit as an island through stabilisation measures designed to prevent further south-west drift to the mainland;
- Augmenting the existing Little Tern nesting area by importing suitable sand, and enlarging the island to a size of approximately 3 hectares at 3.0m above Lowest Astronomical Tide (LAT)*;
- Reducing wave action on the northern shore of the island to reduce erosion of the Little Tern habitat*.

*These means of meeting Objective 1 have been modified under the revised proposal.

2. To provide alternative roosting and feeding areas for wading birds on Towra Spit Island by:

- Augmenting the existing island to an area of 73 hectares at 3.0m above LAT*;

- Constructing an intertidal sand flat of approximately 3 ha at 0.5m LAT for feeding*.

  *These means of meeting Objective 2 have been modified under the revised proposal.

3. To maintain the channel between Towra Spit (the Elephant's Trunk) and Towra Spit Island to ensure the island is not bridged, to ensure protection of Little Tern nesting sites, and to maintain existing tidal flushing of Stinkpot Bay.

4. To protect and enhance (if possible) surrounding seagrass communities and to protect existing mangrove communities.

5. To ensure the compatibility of habitat replacement options with any future works proposed for erosion control at Towra Beach.

2. Approvals Process

The determination report jointly prepared by Sydney Ports, NPWS, EPA and NSW Fisheries in 1997 stated that the EPA and NPWS considered that the impacts due to the original proposal could be controlled to an acceptable level. NSW Fisheries stated that they would not issue a permit for the removal of marine vegetation and as such the original proposal could not proceed. The revised proposal has been developed with the aim of avoiding disturbance to marine vegetation and as such the new scheme has the conditional approval of the Director of NSW Fisheries (refer Appendix A).

This proposal is subject to State Environmental Protection Policy No. 39 – Spit Island Bird Habitat. SEPP 39 permits development (for the purposes of creating avifauna habitat) to proceed without development consent. The area to which SEPP 39 applies is shown in Figure 1.1.

The proposal is also subject to State Environmental Planning Policy No 4 - Development Without Consent. Clause 11a of SEPP 4 applies to land dedicated as a nature reserve and requires the involvement of Council if the proposed activity is a prescribed development. As the proposed activity is not prescribed a Development Application is not required for the Proposal, and it is to be determined by National Parks and Wildlife Service in accordance with Part V of the Environmental Planning and Assessment Act, 1979 (EP&A Act).

As Sydney Ports Corporation is the proponent for the proposal under Part V of the EP&A Act, Sydney Ports is required to assess the Proposal in terms of the nature and extent of any impacts it may have on the surrounding environment. This Review of Environmental Factors (REF) addresses the matters listed under Clause 82 of the EP&A Regulation 1994 with reference to the key differences between the option assessed through the 1996 EIS and the revised option detailed in Section 5. This REF addresses Sydney Port's environmental assessment obligations under the EP&A Act.

There are four determining authorities for the proposal, namely:

- NSW Fisheries
- National Parks and Wildlife service
- Environmental Protection Authority
- Department of Transport, Marine Assets Division

Section 110A of the EP&A Act provides for the Minister administering the Act to make one of the determining authorities, the nominated determining authority. For this project the National Parks and Wildlife Service has been appointed as the nominated determining authority.

By protecting and enhancing migratory bird habitat and arresting the ongoing loss of seagrass beds to the west of Towra Spit Island, the revised development proposal is consistent with the objectives and purposes of:

- Kurnell Regional Environmental Plan
- Towra Point Nature Reserve
- Towra Point Aquatic Reserve (denoted in Figure 1.1)
- Fish Habitat Protection Plan No. 1

The title to Towra Spit Island and that part of the adjacent bed of Botany Bay within the boundaries of SEPP 39 has been transferred from the Marine Ministerial Holding Corporation to the National Parks and Wildlife Service (Dames and Moore, 1996).

Fisheries Management Act, 1995

Under the Fisheries Management Act, 1995, a Fish Habitat Protection Plan has been developed that is specific to the protection of seagrasses and macroalgae of New South Wales. Where seagrass, 0.1

hectares in this case, is likely to be damaged by construction activities, a permit is required from NSW Fisheries.

Commonwealth Environmental Protection and Biodiversity Conservation Act, 1999

The EPBC Act commenced on 16th July 2000. Under this Act, the proponent is required to assess the impacts of the proposal on matters of National Environmental Significance. The matters for consideration are:

- Declared World Heritage Areas
- Declared RAMSAR wetlands
- Listed threatened species and ecological communities
- Listed migratory species
- Nuclear actions
- The environment of Commonwealth marine areas

The study area lies within Towra Point Nature Reserve which is a declared Ramsar wetland. A number of the birds frequenting the site (refer Table 5.1) are listed as migratory species under the Act and the Little Tern is a scheduled threatened species. As such, consideration must be given to whether the proposal would significantly affect these matters of national environmental significance.

As the proposal would have a positive impact on the wetland by stabilising the landform and restoring the original hydrological regime, and would also be beneficial for the native species dependent on the wetland, it is considered that the proposal would not be likely to have a significant impact on a Ramsar wetland.

The proposal would protect the behavioural requirements of the Little Tern and other migratory species that utilise the island, increase the area of habitat available and provide protection from terrestrial predators. The primary objective of the proposal is to provide and protect habitat for these birds. As such, it is considered that the proposal would not be likely to have a significant impact on these birds.

The Proposal would not have a significant effect on any of the remaining matters. The proposed works would not encroach upon or have any effect on World Heritage Areas. Nor would the Proposal affect any Commonwealth marine areas and there are no nuclear actions related to the Proposal. The ecological assessment provided in Section 5.1 & 5.2 concludes that the Proposal would not have a significant effect on listed threatened species and ecological communities or listed migratory species.

As the proposal would not be likely to have a significant impact on any matters of national environmental significance, it is considered that Commonwealth approval would not be required. However, as the study area contains features of national environmental significance the proposal will be referred to the Commonwealth (Environment Australia) supported by this Review of Environmental Factors.

3. Consultation with Authorities

Each of the authorities concerned with the proposal has been consulted. The responses obtained are summarised in this section and included in full in Appendix A.

3.1 NSW Fisheries

Correspondence from NSW Fisheries to Sydney Ports (9th June 1998) indicates that Fisheries are supportive of the proposal with the eastern barrier structure to be built first, then monitored for one year before Fisheries supports the construction of the western terminal structure.

Assuming there is no adverse environmental impact due to the barrier structure, Fisheries would be prepared to provide a permit under the Fisheries Management Act for the construction of the terminal groyne with the following conditions:

- Adequate buffer width between the structure and existing seagrasses
- Transplanting of seagrasses affected by the structure
- Long term monitoring of seagrasses
- Provision of an environmental bond

Subsequent correspondence (February 2001) raised a number of points that should be considered in preparing the REF. These include:

- Location of the proposal within an aquatic reserve *(Figure 1.1)*
- Possible impacts on aquatic threatened fauna *(Section 5)*
- Possible impacts on aquatic flora and fauna *(Section 5)*
- Possible impacts on recreational fishing *(Section 5)*
- Cumulative impacts on Botany Bay (Section 5)
- The proposal should be overlaid on recent seagrass mapping *(Figure 5.1)*
- Monitoring details should be provided *(Sections 6 and 7)*

Fisheries also noted that the REF should include:

- A detailed description of the proposal and any impacts of the marine environment *(Section 4)*
- A detailed assessment of any impacts *(Section 5)*
- Details of ameliorative measures and monitoring *(Sections 6 and 7)*
- Necessary approvals *(Section 2)*

3.2 Environment Protection Authority

The EPA has advised that the REF should include details of:

- the estimated volume of sand to be dredged from the Bay and foreshores *(Section 4.1)*
- the design and location of the proposed silt curtains and other mitigation measures *(Section 6)*
- the location and a management of dredge water return (*Section 6)*
- details of the proposed management of acid sulphate soils *(Section 5.5)*

EPA also advised that should dredging of more than 30,000m^2 of sediment be required then an Environmental Protection Licence would be required.

3.3 NSW National Parks and Wildlife Service

NPWS confirmed that relevant comments made in previous correspondence received by Sydney Ports in April 2000 still apply (refer below). Responses to NPWS comments are provided in italics.

- The REF should confirm that the island still lies within the designated SEPP 39 – Spit Island Bird habitat boundary. *The REF still lies within the SEPP 39 boundary.*

- The REF should confirm the island's current geomorphology and take this into consideration any design modifications. *The latest design and proposed works take into consideration the latest survey of the island's topography which does reflect significant movements in sand bodies since the 1996 EIS.*

- The REF should include an Eight Part Test to determine whether the proposal would have a significant adverse effect on threatened species. *An Eight Part Test has been undertaken for threatened avifauna either previously recorded at Towra Point. The test is included as Appendix C of the REF.*

- The REF section relating to environmental impact assessment would have to be undertaken in accordance with DUAP's publication "Is an EIS Required?". *The REF has been prepared in accordance with the stated DUAP publication. A completed checklist, in a preferred NPWS format, for the assessment of environmental impacts has been appended to the REF.*

3.4 Waterways

The Waterways Authority has no major concerns other than the maintenance of safe navigation of the waterways in the area.

Correspondence was also forwarded to Sutherland Shire Council, Department of Land and Water Conservation and Department of Urban Affairs and Planning, however, these authorities have made no comment on the proposal.

4. Project Description

The preferred scheme involves the construction of a sand filled geotextile barrier and a sand filled geotextile terminal groyne.

4.1 Description of the Scheme

The preferred option is for the re-establishment of Towra Spit Island as an island by the installation of a sand filled geotextile barrier structure on the southern face of the island, removal of the sand spit currently linking the island to the mangroves immediately to the island's south and the construction of a sand filled geotextile terminal groyne structure at the western end of the beach, as illustrated in Figure 4.1. This scheme takes into consideration the latest topography of the island as surveyed in June 2000.

To comply with NSW Fisheries request the implementation of the works will be staged. The initial work will involve the construction of the geotextile barrier structure and beach formation in front of the barrier. The performance of the works will then be monitored over a minimum 12month period. During this period, sediment accretion and erosion, little Tern and wader bird species and seagrasses will be monitored. Assuming the monitoring confirms the performance of the works then construction of the terminal groyne will proceed. Seagrasses that would be affected by the groyne works and associated accretion will be transplanted to a suitable site.

4.1.1 Geotextile Barrier Structure

The barrier structure is 525m long with the crest at RL+3.00m. Details of the structure are shown in Figure 4.2.

The geotextile barrier structure consists of a mound of geotextile tubes approximately one metre in diameter installed in triangular prism form. The tubes can vary in size up to 40m long. The structure is constructed by first excavating bed material to the required foundation level. The bottom layer of tubes in the area is constructed first. There are a number of tubes in the bottom layer and these are layed out and filed one at a time. Once the bottom layer is completed in the area the next layer is commenced. Again the tubes are layed out and filled one at a time. This process continues until the top layer has been completed. A volume of 2,900cum of sand will be used in the structure.

A beach with a 10m wide berm at level of RL+2.00m and slope of 1:10 is to be formed in front of the barrier structure. Sand for the beach is to be won from the southern side of the island. This beach will act as a spending beach and will protect the barrier from scour and prevent wave reflections from the structure. The sand volume to be placed in the beach is 7,800cum.

4.1.2 Geotextile Terminal Groyne

The groyne structure is 250m long with the crest at RL+3.00m. Details of the structure are shown in Figure 4.2.

The groyne structure will be constructed in a similar manner to the barrier structure. A volume of 2,000cum of sand will be used in the structure.

4.1.3 Structure Protection

To protect the structures from damage by vandalism and to provide enhanced durability the geotextile tubes are to be coated with a bitumen emulsion and aggregate. The aggregate will be a light colour similar in colour to the existing beach sand.

The bitumen emulsion will be an anionic slow setting bitumen emulsion. This type of emulsion is commonly used in the protection of cuttings and embankments and on dam embankments. The emulsion contains bitumen, water and an emulsifier. The water and emulsifier dry out of the

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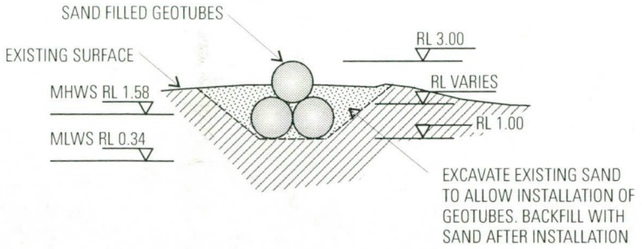
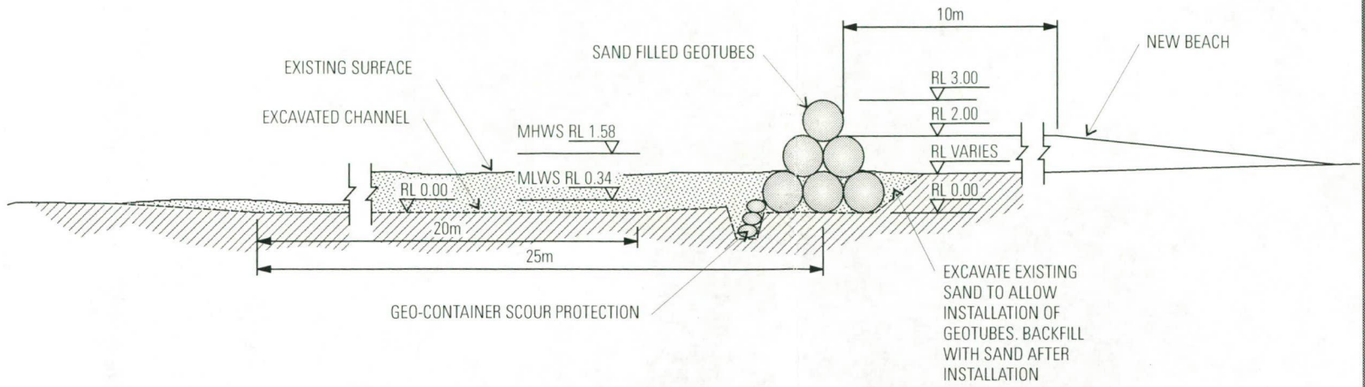
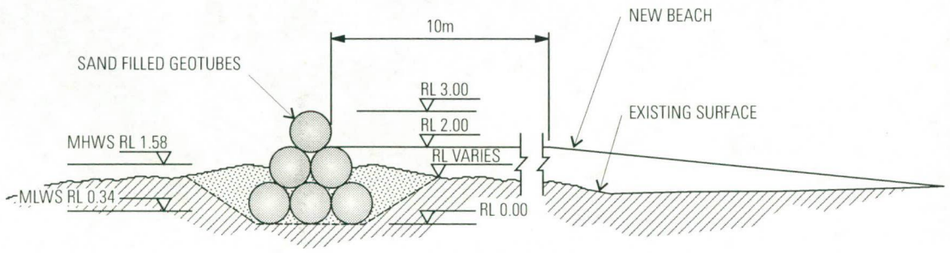
FIGURE 4.1
GEOTEXTILE BARRIER AND TERMINAL GROYNE LAYOUT



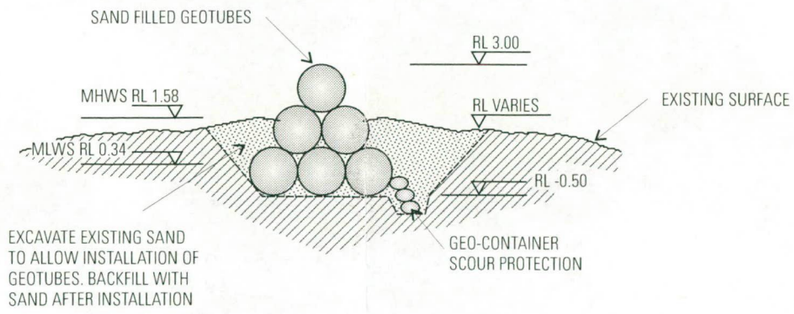
TYPICAL SECTION 2m HIGH BARRIER
NOT TO SCALE



TYPICAL SECTION GEOTEXTILE BARRIER
NEAR MANGROVES



TYPICAL SECTION 3m HIGH BARRIER
NOT TO SCALE



TYPICAL SECTION TERMINAL GROYNE
NOT TO SCALE

FIGURE 4.2
SECTIONS THROUGH PROPOSED STRUCTURES

emulsion leaving a bitumen coating. The emulsion will form an inert coating on the outside of the geotextile structures.

During construction the contractor will be required to apply the emulsion with appropriate environmental protection measures in place to avoid accidental spillage into the waters of the bay or onto the island.

4.1.4 Transport of Materials and Stockpiling

Geotextile materials for the structures will most probably be transported to the site by a small barge or workboat. The materials would be stored either on a barge moored near the island or in a small compound on the island. Any materials stored on the island will need to be placed in an area that does not cause damage to vegetation.

4.1.5 Method of Construction

The structures would be constructed from land. Barges and work boats would provide support for transport of labour and materials. The following primary on-site resources are expected:

- One 30 tonne, 1.5cum bucket, tracked excavator
- Small cutter suction dredge or jet-pump system
- Labourers as required

Construction would commence with excavation of footings to the design level by the excavator. Labourers and divers would place the geotextile tube on the excavated footing. Initially water only is pumped into the geotextile tube. The dredge/jet pump excavator would then remove sand from the south side of the island and then pump it into the tube.

It is likely that construction staging will mean that barrier construction starts at the western end of the barrier and then moves in an easterly direction. The terminal groyne will commence construction near the south western corner and progress in a north easterly direction.

4.1.6 Staff

Construction crews for structures would include a supervising engineer/surveyor, an engineer/surveyor's assistant and a foreperson. There are likely to be three labourers however the number would depend on the contractor

One team of divers may also be required during groyne construction.

4.2 Construction Schedule

The total duration for construction of the geotextile barrier project has been estimated to be 14 weeks.

The total duration for the construction of the terminal groyne would be 10 weeks

Construction of the structures is sequential and the periods have been calculated assuming that between two and three geotextile tubes are filled in position each working day.

A mobilisation period of 4 weeks is allowed for all activities at each structure.

Construction would consist of the following activities:

- Site establishment. This would include establishment of floating plant for construction access and supply of plant and materials. Stockpile areas on the island or permanently moored barges would also have to be set aside for storage.

- Excavation of loose sand to design foundation level and placement of geotextile tube on the seabed and filling with sand to the required profile.
- Taking sand from behind the barrier structure (southern face) and placing it on the northern face to form a beach.
- Following completion of the barrier structure the construction contractor will demobilise.
- Monitoring of the works will take place over a 12 month period
- Site establishment for groyne construction
- Transplanting of seagrasses
- Excavation of loose sand to foundation level for the terminal groyne, placement of geotextile on the bed and filling with sand to the required profile.
- Demobilisation from the site.

4.3 Rehabilitation and Aesthetics

Where excavation is required to facilitate the structure foundations the excavation area will be limited to the immediate area of the work. Backfilling will commence as soon as the construction permits.

All structures will have a crest height of RL+3.00m. At Mean Sea Level of +0.93m the groynes will protrude out of the water by approximately 2.1m.

The height of the island behind the barrier structure varies between RL+3.00m and RL1.00m. The beach in front of the barrier will be placed up to RL+2.00m. Approximately 1m of the structure will be visible above the beach.

The bitumen emulsion sprayed on the geotextile will be topped with an aggregate coating to reduce any colour differential with the existing beach sand.

4.4 Maintenance

The structures are to be constructed from sand filled geotextile materials. The outer surface above RL+0.50m is to be coated with a bitumen emulsion covered with aggregates to provide protection against vandalism and degradation from UV rays. Over time there will be some storm damage and localised damage to the coating that will require occasional maintenance.

Regular inspection of the structures will be required to evaluate the integrity of the coating, regular survey of the performance of the structures and re-filling, patching or relocation. The bitumen emulsion will undergo oxidation and after approximately 6 to 10years it will be necessary to re-apply the emulsion and re-coat with aggregate.

5. Environmental Assessment of Modified Proposal

5.1 Marine Environment

Seagrass Beds

The original proposal to stabilise Towra Spit Island and create Little Tern habitat was rejected by NSW Fisheries on the grounds that the removal of 4.5 hectares of seagrass beds was unacceptable. The revised proposal has been developed to avoid any direct removal of seagrass beds.

Using a combination of recent aerial photography and ground truthing, the distribution of seagrass beds surrounding Towra Spit Island was most recently mapped in February 2001 (refer Figure 5.1). Ground truthing involved two divers with experience in marine ecology verifying the boundaries of the seagrass beds and confirming the species of seagrass present. The communities in the immediate vicinity of the proposed works comprise entirely of the species *Zostera capricorni.* From this mapping exercise the impact of the revised proposal on these seagrass beds has been assessed. Minor modifications to the design and location of the proposed structures have been made to minimise disturbance to the seagrass beds.

Predicted Impacts and Proposed Mitigation measures

The proposed locations of the terminal groyne and the barrier structure have been positioned to avoid the need for direct removal of any seagrass beds. The terminal groyne would be sited to take advantage of existing extensions of unvegetated sand into the seagrass communities (refer Figure 5.2). Following the placement of the terminal groyne, it is expected that sand would accrete to the east of the groyne. The area that would be affected by this accretion of sand contains approximately 0.1ha of scattered *Zostera capricorni* seagrass beds. The removal of this limited area of seagrass is considered preferable to the ongoing loss of seagrass to the west of the island.

The terminal barrier would arrest the western migration of the island that is currently estimated to be advancing at 8m per year. This western advance represents a gradual shift of approximately 0.1ha a year of subtidal habitat to intertidal habitat to terrestrial habitat. This shift in habitat type represents a direct loss of seagrass beds and their habitat. This migration of sands and associated loss of seagrass habitat is clearly visible across two aerial photographs of the island taken in 1995 and 1999, presented in Figure 5.2. The proposed terminal structure would serve to prevent the smothering and loss of approximately 0.1ha of seagrass beds per year.

The barrier structure on the island's eastern spit would be placed over an existing sandy unvegetated substrate. This structure would not have any immediate or long term adverse effect on seagrass beds.

The removal of 0.1 hectares of seagrass beds due to the planned accretion of sand to the east of the terminal structure is considered an acceptable loss when taking into account the ongoing protection the structure will afford seagrass beds to the west of the island. Seagrass beds play a vital role as nursery habitat for a range of fish species that comprise the principle diet of the Little Tern. As the main objective of this proposal is to safeguard and augment the habitat of the Little Tern, it is considered appropriate to develop a scheme that also offers ongoing protection to the habitat of its food source.

In keeping with NSW Fisheries policy, any areas of seagrasses that would be directly affected by the proposal would be transplanted. The technique used would be consistent with previous transplanting exercises conducted for the restoration of Lady Robinsons Beach in which a mechanical "Dugong" was used to extract large squares of seagrass and relocate them to a recipient habitat. The primary area under consideration for receiving the seagrasses is an area to the east of the third runway. The previous transplanting exercise in this area was assessed by Dr Phillip Gibbs and it was concluded that the project represented the first large scale successful transplanting of *Zostera capricorni* on the Australian east coast.

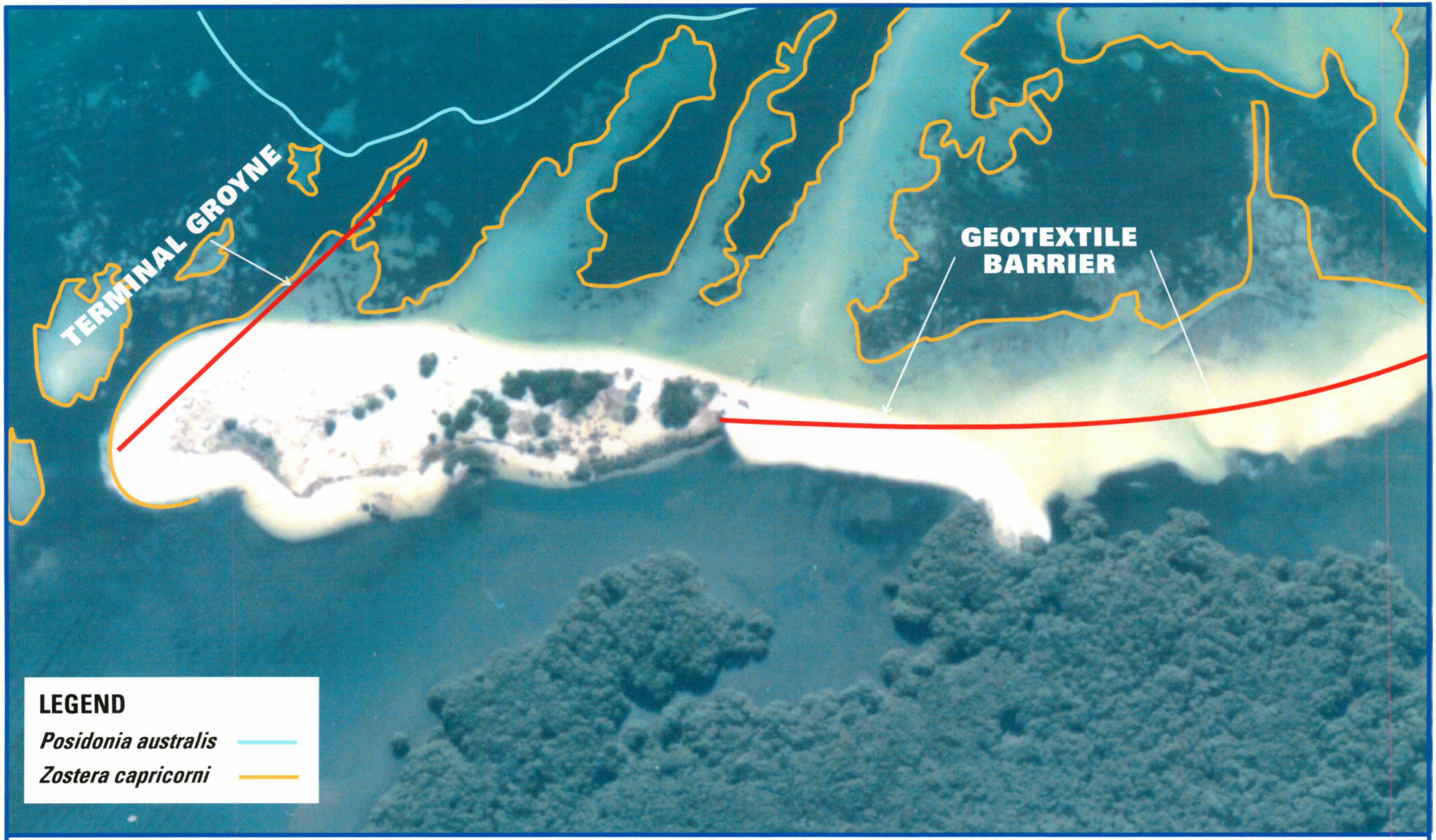


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FIGURE 5.1
BOUNDARY OF SEAGRASS BEDS

AERIAL PHOTOGRAPH 1999

AERIAL PHOTOGRAPH 1995

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FIGURE 5.2
RELATIVE POSITIONS OF ISLAND
1995 / 1999

Mangroves

The southward advance of Towra Spit Island of approximately 70m since 1995 has lead to the smothering and death of mangroves (*Avicennia marina*) to the south of the island. Figure 5.3 clearly demonstrates the southward shift of the island's southern shoreline into the mangroves. Plate 1 shows an area of mangroves of approximately 300m^2 that has been smothered and killed as a result of this shift. The proposed barrier structure on the island's eastern spit would stabilise the spit and prevent further movement of sand into the mangroves. Under the proposal, an area of recently deposited sand would be relocated from south of the barrier structure to the north of the structure. This would restore the channel to the south of the island and prevent further encroachment on the mangrove community. In the interest of the Little Tern, maintaining this channel is important for excluding terrestrial predators such as rats and foxes from the island. Isolating the island from mature mangroves is also important, as such vegetation can provide roosting opportunities for predatory birds that may represent a threat to the Little Tern.

Benthic Infauna

An investigation undertaken by Kinhill in 1992 found that per sample Towra Beach had comparable diversity and biomass of benthic invertebrates as a food resource for wading birds as Botany Beach and Runway Beach. Under the revised proposal the area of suitable sediment on Towra Spit Island available for benthic infauna would be stabilised rather than continue to diminish as under the present circumstances. The area of sand accretion and loss of suitable infauna habitat to the east of the proposed terminal groyne would be approximately 0.1ha. This area is approximately one third of the area of intertidal and subtidal habitat that is annually smothered due to the westward migration of the island. Stabilisation of the island would prevent this ongoing loss of benthic habitat. The terminal groyne would overlie an area of approximately 0.08ha that would be lost for future benthic colonisation.

The construction of the barrier structure and associated relocation of sand would result in the same balance of intertidal and subtidal habitat along the island's eastern spit. However, the barrier structure would overlie an area of approximately 0.1ha that would be lost for future benthic colonisation. The relocation of the sand would be expected to only have a temporary adverse effect on the diversity and abundance of invertebrate species in both the borrow and disposal areas. A temporary reduction in invertebrate counts could be expected to be followed by rapid recolonisation (AMBS, 1979). Fauna transported in dredge slurry have been reported to survive hydraulic pumping and colonise the area of deposition (Anink and Low, 1984 & Jones, 1982). Studies (Maurer et al, 1981) also indicated that benthic infauna are commonly able to survive burial under sediment up to one metre deep. Given these findings, it is expected that benthic colonisation of the new beach north of the barrier structure and the accreted sand to the east of the terminal groyne would proceed. Post-construction monitoring of benthic infauna would be undertaken to determine the extent of recolonisation.

5.2 Terrestrial Environment

Vegetation

The proposed scheme would have no adverse effect on the terrestrial vegetation of the island. The stabilisation of the island would arrest the ongoing loss of ground cover due to the retreat of the northern shoreline of the island. Plate 2 illustrates the undercutting and subsequent death of *Acacia sophorae* along the island's northern shore. The vegetation on the island plays an important role in preventing sand loss through wind erosion. In terms of the habitat requirements of the Little Tern the preferable vegetation structure is for low ground cover rather than shrubs. Under a proposed program to monitor the condition and composition of vegetation on the island following the proposed works it may be recommended that the shrub species be sequentially removed and replaced with lower ground cover species (*Cakile edentula, Spinifex sericeus*).

The southward progression of the island and accumulation of sediment in the channel to the south has enabled the establishment of a salt marsh community and some juvenile mangroves along the island's southern shore. Under the proposal the channel would be re-opened. The impact of the re-opening on

Plate 1: Smothering of mangrove community by southward advance of island

Plate 2: Undercutting of *Acacia sophorae* along northern shore of island

the mangroves and salt marsh community would be monitored under a program addressing the condition and composition of vegetation on the island. In the event that the small stand of juvenile mangroves prosper under the altered hydraulic regime there may be a requirement to remove them to reduce the availability of roosting habitat for potential predators of the Little Tern.

No threatened species or plant communities (Schedule 1 and 2, TSC Act 1995) or species of significance in terms of geographic distribution or localised populations were recorded in the study area and as such the Eight Part Test under section 5A of the Environmental Planning and Assessment Act, 1995, was not required for flora.

Fauna

A range of threatened bird species has been previously recorded on Towra Spit Island or are predicted to rely on the habitat resources of the study area. The proposal has been developed with the primary objective of securing and expanding the availability of habitat for the Little Tern and wading birds in Botany Bay. The accretion of sand east of the terminal structure would provide an increased area of suitable habitat for nesting of Little Terns. The barrier structure and re-opening of the channel to the south of the island would ensure that the island remains isolated form the mainland and inaccessible to predators such as foxes, cats, dogs and rats. By opening the channel and distancing the island from mature mangroves, the Little Tern habitat would also be more remote from the potential roosting sites of predatory birds.

It is possible, however, that during the construction of the barrier and terminal structures, certain activities may disturb or disrupt the behavioural patterns of these birds. As such the eight test criteria provided in section 5A of the Environmental Planning and Assessment Act, 1995, have been applied as an aid to determine whether there is likely to be a significant effect due to the proposal on the habitat of any scheduled species which could be predicted to frequent the site. The application of the test criteria with reference to the species previously recorded in the locality is given in Appendix C.

Table 5.1: Species Previously Recorded In the Study Area (NPWS Wildlife Atlas Database, 2000)

Common Name	Scientific Name	TSC Act Schedule*
Pied Oyster Catcher	*Haematopus longirostris*	2
Sooty Oyster Catcher	*H. fuliginous*	2
Mongolian Plover+	*Charadrius mongolus*	2
Large Sand-Plover+	*C. leschenaultii*	2
Terek Sandpiper+	*Tringa terek*	2
Black-tailed Godwit+	*Limosa limosa*	2
Great Knot+	*Calidris tenuirostris*	2
Sanderling+	*Calidris alba*	2
Broad-billed Sandpiper+	*Limicola falcinellus*	2
Little Tern+	*Sterna albifrons*	1

*1 denotes Schedule 1 – endangered species, 2 denotes Schedule 2 – vulnerable species
+ denotes Migratory Species under the EPBC Act

With regard to the revised scheme currently under consideration, based on the criteria assessed through the eight part test the proposal is not likely to significantly affect any populations or individuals of Schedule 1 or 2 species. As such a Species Impact Statement is not required with respect to fauna.

5.3 Commercial & Recreational Fisheries

The impacts due to the revised proposal on commercial and recreational fishing activities will be comparable to those effects due to the original proposal with the exception that there would be a substantially reduced effect on seagrass beds under the revised scheme.

Botany Bay has considerable significance as a nursery area for commercial fish species. In particular, the *Zostera* seagrass beds of the bay provide important nursery habitat for juvenile species. Each of the major commercial species listed below either directly or indirectly relies on the seagrass habitats of Botany Bay at some stage in their life history.

Major commercial species recorded in the bay include:

- Dusky Flathead (*Platycephalus fuscus*)
- Sand Whiting (*Sillago ciliata*)
- Trumpeter Whiting (*Sillago maculata*)
- Tailor (*Pomatomus saltatrix*)
- Yellowtail (*Trachurus mccullochi*)
- Silver Trevally (*Caranx georgianus*
- Silver Biddy (*Gerres ovatus*)
- Yellow -Fin Bream (*Acanthopragus australis*)
- Australian Snapper (*Chrysophrys auratus*)
- Tarwhine (*Rhabdosargus sarba*)
- Luderick (*Girella tricuspidata*)
- Flat -Tail Mullet (*Liza argentea*)
- Sand Mullet (*Myxus elongatus*)
- Large-Toothed Flounder (*Pseudorhombus arsius*)
- Yellow-Finned Leatherjacket (*Meuschenia trachylepsis*)

A number of oyster leases are located in Botany Bay off Towra Point and along the lower reaches of the Georges River, however, no active leases are located in the vicinity of the proposed works.

A 100m wide exclusion zone around the island has been proposed with implementation to be either all year round or during the summer months only. If this proposal were adopted then commercial fishing or netting in the waters encompassing the island would be prohibited.

If the exclusion zone is not implemented then commercial fishing and netting activities would be permitted to continue. The construction of the barrier structure to the east of the island would restore a hauling ground that has been lost through erosion in the last five years. The associated re-opening of the channel to the south of the island would also allow gill-netting to re-continue as it was prior to the closure of the channel due to the southward drift of the island. Stinkpot Bay to the east of Towra Spit Island would continue to be a sanctuary zone in the Towra Point Aquatic Reserve (refer Figure 1.1) and as such all commercial and recreational fishing would continue to be prohibited in this area.

The revised scheme is considered beneficial for the nursery habitat of commercial fishery species as it represents the saving of 4.5 hectares of seagrass beds as well as the prevention of the ongoing westward progression of the island affecting more seagrass beds.

5.4 Sediment Quality

The sand to be relocated from the south of the proposed barrier structure to the north of the barrier structure would comprise of recently deposited sands that have accumulated over the past five years. These sands range from R.L. 1.5m to R.L. 0. The barrier structure and terminal groyne would be located at R.L.– 0.5m and as such would require varying depths of excavation depending on the existing surface levels. Along the length of the proposed barrier structure the excavation is expected to be into recently deposited clean sand. The excavation for the terminal structure would be through sand and silt.

The Soil Conservation Service (1995) *Botany Bay acid sulphate soil risk map* was used to determine the presence of Acid Sulphate Soils (ASS) within the excavation areas. These maps predict the distribution of ASS based on an assessment of the geomorphic environment through aerial photo interpretation, fieldwork and analysis of soil samples. The maps however should be used as a guide only, as extreme variations in the nature and distribution of ASS can be expected and the depth to the ASS layer can be highly variable due to the broad-scale mapping and procedures used. Botany Bay is mapped as being estuarine bottom sediments and the probability of encountering PASS/ASS is described as high.

Sediment cores from the study area were collected and analysed for Potential Acid Sulphate Soils and found to not contain sufficient chemical levels required for the generation of Acid Sulphate Soils (Douglas and Partners, 1996). The excavation will be in recent sand sediments deposited in the last 30 years and consequently there is unlikely to be any Acid Sulphate Soils. Although there is a very low risk of Acid Sulphate Soils occurring within the boundaries of the study area, further visual monitoring would be conducted during excavations. The contractor would be required to prepare an Acid Sulphate Soils Management Plan for inclusion in the EMP.

5.5 Water Quality

The revised proposal represents a significant reduction in the potential risk to the quality of water due to construction activities. The original scheme involve the dredging of over 30,000m^3 of sand from Towra Beach and excavation for the construction of groynes with associated risks to water quality through the generation of a sediment plume. Under the revised proposal there would be relocation of the sand that has recently closed the channel to the south of the island. There would also be excavation for the placement of the barrier and terminal structures. The relocation of the sand will involve recently transported clean sand compared with the sediment earmarked under the original proposal. Also a greatly reduced volume of sediment would be relocated, approximately 4700m^3 for the structures and 2100m^3 for the new beach.

The contractor would be required to prepare a Water Quality Management Plan detailing safeguards, including:

- Silt curtains would be employed at all times during sand relocation activities and construction of the structures

- Construction and sand relocation activities would only be conducted during suitable weather conditions.

A program of water quality monitoring would be conducted prior to, during and after construction to track whether the works are having any adverse effects on local waters and whether there is a need to modify management techniques.

5.6 Coastal Processes and Geomorphology

The coastal hydrodynamics and geomorphology of Towra Spit Island were addressed in the EIS. Th island was formed in about 1990 when the end of Towra Spit known as the "Elephants Trunk" was breached and a channel formed into Stinkpot Bay between the spit and the island. The source of sediment for the growth of the island is thought to be the erosion of nearshore shoals along Towra Beach and off to Towra Point. It is envisaged that the Island will continue to grow with sand from these shoals into the foreseeable future.

The EIS identified that the island is increasing in size and is migrating to the southwest. The western end had migrated 250m west and 80m south. As wave energy decreases to the west the rate of

movement was expected to decrease over time and the size of the island likely to increase over time. Rates of westerly movement identified in the EIS indicate the island is migrating at a rate of 25m/year. Comparison of aerial photos between 1995 and 1999 confirm the island has continued to migrate to the southwest. The southerly movement has resulted in the island being linked to the mangroves south of the island by an intertidal spit. The western end has continued to move in a westerly direction at a reduced rate with the total distance being approximately 40m over this five year period.

The wave climate within Botany Bay consists of both local wind waves and longer period swell waves. At Towra Spit Island the longer period swell waves are the dominating influence on sediment movement. Studies for the EIS established annual average (energy weighted) wave heights and directions. Annual average wave directions are approximately 30 degrees with the exception of a site near the western end of the island where the direction is 17 degrees. The large change is due to local bathymetry effects. Assessment of beach profiles from a number of surveys between 1973 and 1993 indicated the annual average transport rate is of the order of 7,000m^3. The current general alignment of the northern face of the island as shown in the 2000 aerial photography is similar to that in earlier photos. The wave climate and longshore sediment transport rates will consequently be similar to those documented in the EIS.

5.7 Recreation

The revised proposal would have similar implications for the recreational opportunities of the general public. The island would continue to remain a restricted area for the general public. There is currently a fine of up to $100,000 for interfering with areas identified as habitat of the Little Tern. A number of signs are currently erected across the island alerting the public of this restriction to the island.

The changes to the use of the waters around the island by the boating public would be consistent with those changes affected by the original proposal. Both the terminal and barrier structures would represent incursions into surrounding waterways to a similar extent as the groynes and berms proposed in the original scheme.

The original proposal included a recommendation for a speed reduction zone within 100m of the island. This recommendation would also be applicable under the revised scheme. A further recommendation for a complete exclusion zone within 100m of the island is also under consideration.

5.8 Aboriginal Archaeology

The sand deposits of the island are recent (30 years) hence it is not possible for the island to contain Aboriginal sites. A search undertaken by Dames and Moore for the 1996 EIS indicated that no Aboriginal sites are recorded at the location.

5.9 Visual

With respect to the original proposal, the revised scheme would have a reduced visual presence from view points on the western shore of Botany Bay and from passing boats. The original scheme involved four groynes and the creation of two dunes. The current proposal would require only two structures that will be partially submerged during the tidal cycle. The island is over one km from the nearest fixed visual catchment between Dolls Point and Rocky Point and would have a maximum height of 1.4m above mean high water therefore the visual impact due to the proposal would not be significant.

A coloured aggregate coating would be applied to the completed structures to reduce any colour differential with the existing island sands.

5.10 Noise

The noise levels from the revised proposal would be expected to be less than those predicted for the original proposal. The noise levels from construction works for the original proposal were forecast to be

less than the EPA's recommended outdoor background noise levels at the closest residence at Dolls Point (Dames and Moore, 1996). As the revised proposal would involve substantially less sand extraction than the original scheme, then the generation of noise due to construction plant would be reduced. The plant to be used would be likely to include a cutter suction dredge or jet pump excavator, an excavator and work boats.

The works would be restricted to between 7.00am and 6.00pm Monday to Friday and from 8.00am to 1.00pm on Saturdays. Work outside these hours could only be undertaken with approval from the EPA. The construction period would be over ten weeks which is comparable to that for the original proposal.

6. Environmental Management

6.1 Preparation of an Environmental Management Plan

An Environmental Management Plan (EMP) would be prepared to detail the procedures to be carried out and to manage the construction and operational stage impacts of the proposal. The EMP would identify parties to be responsible for all required actions and would form an important part of the quality plan that would be required of the Contractor appointed to construct this project. The EIS (Dames and Moore, 1996) and this REF provide the basis for the preparation of the EMP by identifying the issues to be addressed and commitments made by Sydney Ports that are to be implemented.

6.2 If the Project is Approved

Should the project be approved, the following activities would be carried out by Sydney Ports:

- The local community, particularly the boating and fishing community, would be notified of the decision via newspaper notices. This would include an indication of the anticipated timing and staging of construction works and contact details.
- A suitable contractor with a proven record of applying environmental management systems to be appointed for construction of the barrier structure.
- A detailed EMP would be prepared by or on behalf of Sydney Ports prior to the construction phase of the project.
- Monitoring of the performance of the barrier structure

Subject to the monitoring of the performance of the barrier structure, a contactor would be appointed for the construction of the terminal groyne.

6.3 Content and Structure of the EMP

The EMP would form the basis for environmental contract requirements and would therefore become the reference document that ensures commitments for environmental protection and management given in the EIS and this REF are fulfilled. The EMP would also ensure subsequent approvals are fully implemented by Sydney Ports.

The EMP also serves as the framework for confirming the accuracy of impact predictions assessed and for measuring the effectiveness of these actions and procedures. The EMP would be prepared to be relevant to the key stages of construction, dealing with specific areas and/or management issues as priorities dictate. A post construction environmental plan would also be subsequently prepared by Sydney Ports to co-ordinate ongoing monitoring and maintenance of the island.

The main features of the EMP would include:

- *Obligations*: a full account of the statutory and other obligations which Sydney Ports would be required to fulfil during the project implementation, including all approvals and consultations required with authorities and their stakeholders. The draft EMP would be issued to relevant authorities (eg. EPA, NSW Fisheries, Council) for comment before the final adoption by Sydney Ports.

- *Environmental Monitoring*: a regime of inspections, monitoring and testing would be defined in the EMP. For each main environmental management issue, the EMP would define the management objective, the performance criteria, the specific tests and protocols, their frequency and location. Monitoring would be required for 12 months following the construction of the barrier and prior to construction of the terminal groyne and then again for a period following construction of the terminal groyne.

- *Audits*: to be assured that the environmental system is working, a qualified and independent person would conduct audits in accordance with a schedule nominated in the EMP.

- *Reporting*: this is an important part of any quality system and requirements would be included in the EMP.

- *Communications and Environmental Training*: workforce awareness and responsibilities for environmental management are a key component in achieving good performance and the EMP would detail suitable induction and training for all contractors and Sydney Ports employees.

6.4 Summary of Mitigation Measures

The EMP would be based on the summary of environmental management commitments, principles and objectives identified below. Where appropriate, specific controls or management plans would be prepared to address key environmental issues.

6.4.1 Acid Sulphate Soils

The recently accreted sand to the south of the island would be relocated in order to keep the island from encroaching on the mangroves to the south. As this sand has only recently accumulated the probability of the occurrence of potential acid sulphate soils (PASS) in this area is extremely unlikely. In the event that any sediments resembling acid sulphate soils are encountered work would immediately cease in that area. The contractor would be required to prepare an Acid Sulphate Soils Management Plan for inclusion in the EMP. This would detail the procedure in the event that PASS are encountered.

6.4.2 Erosion / Sedimentation / Water Quality

The contractor would be required to prepare a Water Quality Management Plan detailing safeguards, including:

- Silt curtains would be employed at all times during sand extraction activities, construction of the geotextile barriers and while sand relocation on the island is taking place.

- Construction activities would only be conducted during suitable weather conditions.

- All machinery would be inspected at regular intervals for possible leaks

- A program of water quality monitoring would be conducted prior to, during and after construction to track whether the works are having any adverse effects on local waters and whether there is a need to modify management techniques.

6.4.3 Noise

A noise control section would be prepared by the contractor for inclusion in the EMP. Given the remoteness of the site, the risk of disturbance to the community is very low.

- Construction activities would generally be restricted to the hours between 7.00am and 6.00pm Monday to Friday, and 8.00am and 1.00pm on Saturdays.

- Plant and equipment would be selected and operated with appropriate mufflers and noise controls and where practical work practices and plant selection would be considered so as to minimise noise impacts.

6.4.4 Flora and Fauna

- No native terrestrial vegetation would be affected under the proposal, however, approximately 0.1 hectares of seagrass would be lost through the accretion of sand to the east of the proposed terminal groyne. Therefore the contractor would be required to obtain a permit to cut, remove, damage or destroy seagrass or macroalgae under Section 205 of the Fisheries Management Act, 1994. Any areas of seagrasses that would be directly affected by the proposal would be transplanted to an area to the east of the third runway (refer Section 5.1).

- Construction would be scheduled to occur between May and September in order to avoid disturbing the Little Tern. Construction personnel would be required to keep a minimum distance from any occupied roosting sites of any wader or shore bird species.

6.4.5 Landscape and Visual Environment

- Protection of existing vegetation from damage during construction.

- The coated geotextile fabric to be used for the barrier and terminal groyne would be of a similar colour to the sand of Towra Spit Island.

6.4.6 Social and Business Effects

- The contractor would be required to set up a system for handling complaints from the community. A contact phone number would be provided for community access.

- Commercial fishing operators would be informed as to the nature and duration of the construction activities.

6.4.7 Spoil, Waste and Hazardous Material

- The contractor would prepare a Waste Management Plan as part of the EMP.

- Storage areas located on the mainland away from the island would be surrounded by bund walls to retain any spills of more than 110% of the volume of the largest container.

- Controlled sanitary and washdown facilities would be installed at appropriate non-sensitive locations away from the island.

6.4.8 Post-Construction Environmental Management

Sydney Ports would also develop a plan for environmental monitoring following construction. The following environmental matters would be considered for a minimum period of 12 months following the conclusion of works:

- island stability would be monitored through the survey of shoreline profiles

- the extent of recolonisation by benthic infauna and seagrass beds would be monitored through sampling and mapping exercises, respectively

- monitoring of health and distribution of seagrass beds (in situ and transplanted beds)

- monitoring (for 3 years) of avifauna populations would continue under the supervision of NPWS.

7. Maintenance and Monitoring

A range of recommendations made in the EIS regarding maintenance of the island and monitoring programs would still be applicable under the revised scheme. An outline of each of these programs is provided below.

Groyne / Barrier Maintenance
Despite the protection of the structures with bitumen, they may be damaged through vandalism, wind or erosion. The condition of these structures would be maintained through:

- regular checks to maintain the integrity of the bituminous coating
- regular survey to ensure the position of the structures has not altered
- re-filling, patching and coating of the structures

The contractor's EMP would describe the source of the sand if any re-filling is required and the proposed method of patching and re-filling.

Water Quality
Monitoring water quality in the vicinity of the construction area would be undertaken to ensure that EPA water quality (ie turbidity) limits are not exceeded. Any turbid water generated by construction activities would be controlled through the use of appropriate control measures such as the use of silt curtains.

Little Terns
In 1993 FAC commissioned a monitoring program to assess the success of the relocation of the Little Tern and wading birds to the proposed alternative habitat at Towra Spit Island. The existing monitoring program would be extended for a period of three years beyond the completion of works. The monitoring program would involve the following tasks:

- monitoring of the numbers, distribution and behaviour (including feeding, nesting and roosting) of Little Terns and wading birds utilising the newly created habitat at Towra Spit Island.
- monitoring of numbers, distribution and behaviour of wading birds using the remaining portions of Botany Beach and Penrhyn Estuary
- assess the success of the program to provide an alternative habitat for the Little Tern and wading birds at Towra Spit Island
- estimate the breeding success of the Little tern at Towra spit Island by monitoring the number of pairs nesting, the number of nests, the number of eggs laid, the number of eggs hatched and the number of chicks fledged
- provide expert input with respect to the suitability of the habitat and recommend measures to address any identified problems

The existing nesting area for Little Terns and its importance would be identified within the contract documents for construction works. This area would be clearly delineated with restricted access during construction. Input from NPWS would be sought prior to construction to mark the current nesting area. Works would be timed to fall outside the September to May nesting season.

Over-wintering Wading Birds
The monitoring program for Little Terns would include a component examining the use of Towra Spit Island by over-wintering species. During extremely high tides, all construction works would be restricted to one end of the island, leaving a reasonable distance (approximately 100m) between the working area and roosting birds. The establishment of a maintenance program for terrestrial vegetation would ensure that the conditions on the island would remain suitable for roosting wading bird species.

Revegetation
Revegetation works should be undertaken to stabilise newly deposited material to minimise sand loss through wind and water erosion. A maintenance program would be established to review the condition

of terrestrial vegetation on the island, ensuring that it is not colonised by tree species that would create unfavourable conditions for nesting terns.

Gull Control

In the interest of protecting the eggs and young of Little Terns, Silver Gulls should be discouraged from roosting on the island. Monitoring of the usage of the island by Silver Gulls should be undertaken to determine whether a threat to Little Terns occurs. Previously, baiting programs have been undertaken to reduce Silver Gull numbers. Given the ethical and cruelty considerations associated with the poisoning of a native species (protected under the National Parks and Wildlife Act, 1974) for the sake of another it is recommended that the baiting program be stopped and alternative means of deterring gulls be developed. Given the enormity of the population of gulls in the Sydney metropolitan area, baiting techniques would only result in a small count of gull mortality with no overall reduction in the threat of Silver Gull predation. Methods of discouragement to be investigated should specifically target gulls rather than other shore birds.

Benthic Invertebrates

A monitoring program would be implemented following the completion of works to quantify colonisation of invertebrates within the intertidal wading bird feeding area. The objective of this program would be to track the re-establishment of the benthic infauna in order to gauge the availability of a food source for wading birds. It has been recommended that the monitoring program be undertaken for a period of three years after the completion of works.

Seagrasses

The distribution and health of seagrass beds to the north and west of the island should be monitored at the completion of construction of the terminal structure and annually for the following three years. The actual impacts or benefits due to the stabilisation work would then be compared with the predicted effects to ensure the scheme is working effectively. Mapping the distribution of seagrass beds would be undertaken with the aid of aerial photography. Any turbid water generated by construction activities will be controlled through the use of appropriate control measures such as silt curtains.

The expertise of NSW Fisheries in the area of seagrasses and seagrass transplanting is recognised and Sydney Ports is willing to consider any proposed sites that Fisheries may regard as suitable for transplanting. The current plan is for the affected *Zostera* to be transplanted to an area on the eastern side of the third runway. The previous transplant plots in this area have been successful and would be expanded.

Coastal Processes

Rates of sand deposition/erosion on the island should be monitored annually for five years after the completion of works. In particular, the following areas should be examined:

- accretion to the east of the terminal groyne
- reduction in rate of migration of the western spit of the island
- stability of the eastern spit with respect to the mangroves to the south

This work would be undertaken with the aid of aerial photography.

8. Consideration of Clause 82 Factors

As part of its obligations under Section 111 of the Environmental Planning and Assessment Act, Sydney Ports Corporation is required to take into account to the fullest extent possible, all matters likely to affect the environment as listed under Clause 82 of the EPA Regulations. These matters are addressed below.

(a) *Any environmental impact on a community*

Towra Spit Island is remote from any communities on the foreshore of Botany Bay hence its suitability as a site for creating wader bird habitat.

(b) *Any transformation of a locality*

Towra Spit Island is currently advancing to the south and south west. Under the proposal the island would be stabilised through the use of sand filled geotextile barriers / groynes. This would cause accretion of sand and a subsequent increase in the size of the island.

(c) *Any environmental impact on the ecosystem of the locality*

The proposal would have a positive impact on the terrestrial vegetation of the island. Currently, the southern and westward migration of the island is leading to the undercutting of the northern shore of the island with an associated loss of vegetation including a stand of Acacias. The proposed terminal groyne will stabilise the northern shore of the island thereby protecting the substrate and vegetation in this area from undercutting. The accretion of sand to the east of the terminal groyne will provide an increase in suitable habitat for the further establishment of native vegetation.

The migration of the island to the west at a rate of 8m per year is smothering *Zostera* seagrass beds in this area. The proposed terminal groyne will stop this westward progression and arrest the ongoing loss of seagrass beds to the west of the island, estimated to be approximately 0.1ha per year. The accretion of sand to the east of the terminal groyne will take place over five years and will affect approximately 0.1 hectares of *Zostera* seagrass beds. This adverse effect is considered to be acceptable given the long term benefits to seagrass beds west of the island.

(d) *Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality*

The construction of the two structures would detract from the existing natural appearance of the island, particularly at low tide. This is considered to be an acceptable impact given the broader ecological and scientific benefits such as the creation of wader habitat and the protection of seagrass beds. Public access to the island is already prohibited and this would remain the case.

(e) *Any effect on a locality, place or building having aesthetic, cultural, anthropological, architectural, historical, scientific or other special value for present or future generations*

The island has no particular aesthetic, cultural, anthropological, architectural, historical, scientific or other special value other than as habitat for migratory bird species. The proposal would protect and enhance this value.

(f) Any impact on the habitat of any protected fauna within the meaning of the National Parks and Wildlife Act 1974.

The objective of the proposal is to create habitat for protected and endangered fauna, specifically the Little Tern and wader species.

(g) *Any endangering of any species of animal, plant or other form of life whether living on land, in water or in the air*

The proposal would not endanger any species of animal, plant or other form of life whether living on land, in water or in the air

(h) *Any long term effects on the environment*

The proposal would result in the long term stabilisation of Towra Spit Island and the provision of wader bird habitat.

(i) *Any degradation of the quality of the environment*

The quality of the environment would not be significantly degraded by the proposal. A range of mitigation measures is proposed to reduce potential impacts during construction.

(j) *Any risk to the safety of the environment*

Both proposed structures would extend into the waters of Botany Bay along the line of existing sand shoals and as such would not be a hazard to maritime traffic.

(k) *Any reduction in the range of beneficial uses of the environment*

There would be no reduction in the beneficial uses of the environment.

(l) *Any pollution of the environment*

A range of mitigation measures is proposed to reduce potential impacts during construction. All waste generated during construction would be either re-used or disposed of at an appropriate waste management facility.

(m) *Any increased demands on resources (natural or otherwise) that are likely to become in short supply.*

There would not be any increased demands on resources that are or are likely to become in short supply.

(n) *Any cumulative environmental effects with other existing or likely future activities*

The stabilisation of the island and creation of habitat would represent a positive contribution to the wetland habitat of the Towra Point Nature Reserve. By stopping the westward migration of the island the ongoing reduction of the cover of seagrass beds in Botany Bay due to this process would be curbed.

9. Conclusion

The purpose of this proposal is to create alternative habitat in compensation for wader bird habitat lost during the construction of the Parallel Runway by the FAC. The original proposal (refer section 1.2) to stabilise Towra Spit Island and create Little Tern habitat was rejected by NSW Fisheries on the grounds that the scheme required the removal of 4.5 hectares of seagrass beds which NSW Fisheries considered unacceptable. The revised proposal avoids any direct removal of seagrass beds.

The impact assessment of the current proposal looked at the full range of issues under Clause 82 of the EP&A Act, however, given the NSW Fisheries rejection of the original proposal the main area of interest was the impact on the marine environment, specifically seagrass beds.

The coastal processes studies undertaken in the Dames and Moore EIS (1996) found that the proposed scheme would provide the required level of stability to secure and augment suitable habitat for the Little Tern. The influence of the proposal on coastal processes would be confined to Towra Spit Island and would have no significant adverse effect on the earlier beach restoration works or other sensitive environments of the bay.

The ongoing erosion of Towra Spit Island has created a highly dynamic environment with a constantly changing shoreline. By providing a relatively stable shoreline an opportunity exists to arrest the smothering of seagrass beds to the west of the island. The structures have been sited to minimise disturbance to seagrass beds, however, the accretion of sand following the construction of the terminal structure groyne would affect a small area (0.1ha) of scattered seagrass. The impacts on seagrass beds due to this revised scheme are relatively minor with respect to the 4.5ha of seagrass beds affected under the original scheme. A range of environmental controls would be in place during construction to protect water quality and to avoid any potential adverse effects on the adjacent marine life.

Sampling and analysis of the sediments of Towra Spit Island has shown that the sand to be relocated can be used without potentially harming the health of the local marine ecosystems.

The principles of ESD played an integral part in the design and siting of the structures and the development of environmental control measures. It is considered that the proposal is justified on the basis of the social, ecological and economic considerations and in accordance with the principles of ecologically sustainable development.

Based on the investigations detailed in this REF, it is considered that the revised proposal for the island stabilisation and habitat creation project would not have a significant impact on the environment. The stabilised island would provide suitable habitat for the use of Little Terns and a range of wading bird species.

10. References

AMBS (1979) *A Post-impact Monitoring Study of Benthic Fauna in Areas Dredged for the Third Parallel Runway in Botany Bay.* Report for Federal Airports Corporation.

Anink and Low (1984), *Narrabeen Lagoon Experimental Dredging Project.* SPCC Report.

Dames and Moore (1996), EIS for the Creation of Little Tern and Wading Bird Habitat, Towra Spit Island, Botany Bay, NSW. For Sydney Ports Corporation

Department of Land and Water Conservation (1995) *Guidelines for the Use of Acid Sulphate Soil Risk Maps.*

Douglas Partners (1996) *Report on Sediment Sampling Towra Spit Island, Botany Bay.* Prepared for Sydney Ports Corporation.

Environment Protection Authority (1999), Information extracted from the Environment Protection Authority web page.

Federal Airports Corporation (1994), *Environmental Management Plan for Botany Bay.*

James D. and Gillespie R. (1997) *Economic Effects and Evaluation in Environmental Impact Assessment,* prepared for Department of Urban Affairs and Planning.

Jones A.(1982), *Effects of Dredging and Spoil Disposal on the Benthic Invertebrates in the Hawkesbury Estuary.* Aust. Mar. Sci. Assoc. NSW Branch Publication. 83/1.115 - 118

Kinhill Engineers Pty Ltd (1990) *Proposed Third Runway Sydney (Kingsford Smith) Airport, Draft Environmental Impact Statement*, prepared for Federal Airports Corporation.

Kinhill Engineers Pty Ltd (September 1991) *Proposed third runway, Sydney (Kingsford Smith) Airport, supplement to the draft environmental impact statement.* Ultimo, NSW.

Kinhill Engineers (1992) *Invertebrate Fauna of Three Sand Beaches in Botany Bay.* Prepared for Federal Airports Corporation Technical Group.

Maurer D., Keck R., Tinsman J., Leathem W.(1981), *Vertical Migration and Mortality in Benthos in Dredged Material.* Part I: Mollusca . Mar. Environs. Res. 4:299-319

NPWS (1984a) *Monitoring of Little Tern Sterna albifrons in Botany Bay.*

NSW NPWS, NSW EPA, NSW Fisheries, Sydney Ports Corporation (1997), *Determination Report – Towra Spit, Creation of Little Tern and Wading Bird Habitat.*

Register of the National Estate Database (Australian Heritage Commission)

Soil Conservation Service (1995) *Botany Bay acid sulphate soil risk map.* SCS, Sydney, NSW.

State Environmental Planning Policy No. 39 – Spit Island Bird Habitat

State of Botany Bay, July 1998

State Pollution Control Commission (1979) *Effects of Dredging on Macrobenthic Infauna of Botany Bay*

State Pollution Control Commission (1981) *The Ecology of Fish in Botany Bay – Biology of Commercially and Recreationally Valuable Species, Environmental Control Study of Botany Bay.*

Sydney Ports Authority (1993). *Sand Island Habitat Stabilisation. Investigation and Preliminary Design of Options.* A Report for the Federal Airports Corporation

Watford F.A. and Williams R.J. (1998) *Inventory of Estuarine Vegetation in Botany Bay, with Special Reference to Change in the Distribution of Seagrass*, NSW Fisheries Office of Conservation, Cronulla.

Appendix A

Authority Responses

Our ref: TowraSpit26201

26 February 2001

Mr Shaun Lenehan
Connell Wagner
PO Box 538
NEUTRAL BAY NSW 2089

Dear Mr Lenehan

Re: Towra Spit Avifauna Habitat - REF

Thank you for your letter requesting REF requirements from NSW Fisheries for the proposal cited above. The information listed below may be of some assistance in the preparation of the REF for this proposal.

Important points relevant to this proposal include:

- That this proposal lies within an aquatic reserve and therefore the proposal will be considered closely.
- Possible impacts on aquatic threatened species.
- Possible impacts on aquatic flora and fauna and mitigation measures including recommended compensation if there are unavoidable impacts.
- Impacts on recreational fishing in the vicinity.
- Cumulative impacts, particularly regarding sedimentation/erosion processes around the Bay and adjacent shores and the ongoing proposal to dredge and replenish sand on the island itself.
- An overlay of the proposal, all groynes and beach nourishment, on the seagrass map by Watford and Williams (1998) to determine the full extent of the impacts.
- Details of monitoring that is proposed.

The remaining information is our general requirements.

Definitions

The definitions given below are relevant to these requirements:
Fish means any part of marine, estuarine or freshwater fish or other aquatic animal life at any stage of their life history (whether alive or dead). Fish include oysters and other aquatic molluscs, crustaceans, echinoderms and beachworms and other aquatic polychaetes.
Marine vegetation means any species of plant that at any time in its life must inhabit water (other than freshwater).

HEAD OFFICE
Cronulla Fisheries Centre
202 Nicholson Parade, PO Box 21, Cronulla, NSW Australia 2230
Telephone: (02) 9527 8411 • Facsimile: (02) 9527 1565

Waters refers to all waters including tidal waters below mean high water mark as well as flowing streams, irregularly flowing streams, gullies, rivers, lakes, coastal lagoons, wetlands and other forms of natural or man made water bodies on both private and public land.

Useful Information

To help you in the preparation of an REF, the publication "*Guidelines for the Assessment of Aquatic Ecology in EIA*" (Draft 1998) produced by the Department for Urban Affairs and Planning may prove useful in outlining appropriate procedures and methodologies for conducting aquatic surveys.

Matters to be Addressed

1. Description of proposal

The REF must include the information outlined below:

Details of the proposal must be provided, including (where relevant):

- details of the location of all component parts of the proposal, including any auxiliary infrastructure;
- the timetable for construction of the proposal;
- details of various phases of construction (eg clearing, earthworks, temporary structures, diversions, cofferdams);
- the size of the area affected (both surface area and/or stream length, as relevant) either directly or indirectly, and;
- aspects of the management of the proposal, both during construction and after completion, which relate to impact minimisation.

A topographic map of the locality at a scale of 1:25 000 should be provided. This map should detail the location of all component parts of the proposal, any areas locally significant for threatened species (such as aquatic reserves), and areas of high human activity (such as townships, regional centres and major roads).

A plan of the study area must be provided. This plan should show:

- an appropriate legend, a scale, orientation marks and a reference point marked in a recognised co-ordinate system;
- land tenure details for all land parcels within the study area;
- the locations and types of land uses present within the study area;
- the locations of all streams and all other water bodies within the study area, and;
- recognised commercial and recreational fishing grounds, aquaculture farms and/or other waterway uses.

For each freshwater body identified on the plan, the plan should include, either by annotation or by an accompanying table, hydrological and stream morphology information. This includes flow characteristics, including any seasonal variations, bed substrate, bed width, existing water use and occurrence of ground water.

A recent aerial photograph (preferably colour) of the locality (or reproduction of such a photograph) should be provided, if possible. This aerial photograph should clearly show the subject site and indicate the scale of the photograph.

Dredging and reclamation activities

- Purpose of works
- Type(s) of marine vegetation in the vicinity of the proposed works
- Distance of adjacent marine vegetation from the outer boundary of the proposed works
- Method of dredging to be used
- Duration of dredging works
- Time of dredging works
- Dimension of area to be dredged
- Depth of dredging activities
- Nature of sediment to be dredged
- Method of marking area subject to works
- Environmental safeguards to be used during and after works
- Measures for minimising harm to fish habitat under the proposal
- Spoil type and source location for reclamation activities
- Method of disposal of dredge material
- Location and duration of spoil stockpiling, if planned
- Volume of material to be extracted or placed as fill

Activities that damage marine vegetation

- Type of marine vegetation to be harmed
- Amount of marine vegetation to be harmed
- Reasons for harming marine vegetation
- Methods of harming marine vegetation
- Construction details
- Duration of works/activities
- Measures for minimising harm to marine vegetation under the proposal
- Environmental safeguards to be employed, if necessary
- Method and location of transplanting activities or disposal of marine vegetation

2. Initial assessment

The proposal area must include land or waterways that may be indirectly affected by the proposal, for example, through altered hydrological regimes, soil erosion or pollution. The study area must extend downstream and/or upstream as far as is necessary to take all potential impacts into account.

Previous land and water uses and the effect of these on the proposed site must be discussed. Relevant historical events may include land clearing, agricultural activities, water abstraction/diversion, dredging, de-snagging, reclamation, siltation, commercial and recreational activities.

The presence of different species of aquatic fauna and flora should be assessed in terms of area and density and these details mapped.

A list of threatened species, endangered populations and endangered ecological communities likely to occur in the area must be provided. In determining these species,

consideration must be given to the habitat types present within the study area, recent records of threatened species in the locality and the known distributions of these species.

A description of habitat such as stream morphology, in-stream and riparian vegetation including the presence of snags, water quality and tide/flow characteristics. The condition of the habitat within the area must be described and discussed, including the presence and prevalence of introduced species. A description of the habitat requirements of threatened species likely to occur in the study area must also be provided.

Please Note: It is recommended that, prior to any field survey activities taking place, those persons proposing to undertake aquatic surveys consider their obligation to obtain the appropriate permits or licences under the relevant legislation. For example:

Fisheries Management Act 1994

- Permit to take fish or marine vegetation for research or other authorised purposes (Section 37)
- Licence to harm threatened (aquatic) species, and/or damage the habitat of a threatened species (Section 220ZW).

Animal Research Act 1985:

- Animal Research Authority to undertake fauna surveys.

3. Assessment of likely impacts

The REF must:

- indicate the location, nature and extent of habitat removal or modification and discuss the potential impacts.
- identify any potential changes in water flows, including run-off, or the introduction of barriers to the movement of fish species and discuss the potential impacts.
- identify existing recreational and commercial fishing grounds, aquaculture farms or other waterway uses in the vicinity and discuss the potential impacts on these uses.
- describe and discuss any other potential impacts of the proposal on fish species or their habitat. This may include, for example, erosion, sedimentation, nutrient and heavy metal levels, potential acid sulphate soils, introduced pests, changes to boat traffic and waterway use, spoil disposal and overshadowing.
- consider cumulative impacts.

For all species likely to have their lifecycle patterns disrupted by the proposal to the extent that individuals will cease to occupy any location within the subject site, the REF must describe and discuss other locally occurring populations of such species. The relative significance of this location for these species in the general locality must be discussed in terms of the extent, security and viability of remaining habitat in the locality.

4. Ameliorative measures and monitoring

The REF must consider how the proposal has been or may be modified and managed to conserve fisheries habitat.

In discussing alternatives to the proposal, and the measures proposed to mitigate any effects of the proposal, consideration must be given to developing long term management strategies to protect areas within the study area which are of particular importance for fish species. This may include proposals to restore or improve habitat.

Any proposed pre-construction monitoring plans or on-going monitoring of the effectiveness of the mitigation measures must be outlined in detail, including the objectives of the monitoring program, method of monitoring, reporting framework, duration and frequency. Detailed monitoring, particularly for baseline studies, are beneficial to both the proponent and the environment.

5. Approvals

All approvals required from the various government agencies should be listed.

In the event of a request for the concurrence of, or consultation with the Director of NSW Fisheries, one (1) copy of the REF should be provided to NSW Fisheries in order for the request to be processed.

It should be noted that NSW Fisheries has no regulatory or statutory role to review draft REFs unless they are accompanied by or are requested as part of a licence application under Part 7A of the FM Act. However, NSW Fisheries is available to provide advice to consent and determining authorities regarding Fisheries' opinion as to whether the requirements have been met if requested, pending the availability of resources and other statutory priorities.

Should you require any further information on these requirements please contact me on (02) 8437 4975.

Yours sincerely

Lesley Diver

Conservation Manager

FAXED 14.04.00

NSW NATIONAL PARKS AND WILDLIFE SERVICE

Mr Max Willoughby
Coastal Manager
Sydney Ports Corporation
PO Box 25
MILLERS POINT NSW 2000

RECEIVED IN
19 APR 2000
Safety & Environment

Dear Mr Willoughby

RE: CREATION OF LITTLE TERN AND WADING BIRD HABITAT, TOWRA SPIT ISLAND, BOTANY BAY

I refer to your letter dated 21 January 2000 in which you indicated that funding is now available to proceed with the assessment and, if approved, construction and maintenance of the proposed avifauna habitat on Towra Spit Island.

The NPWS is supportive of the proposal proceeding subject to the following matters:

1. As stated in its previous letter dated 9/3/99 (attached), the NPWS accepts "in-principle" the concept of the "Net Present Cost" as the basis for a lump sum maintenance payment, however the amount proposed will need to be clarified during the design stage. Initial discussions with T-Corp (Frank Brus) indicated that $160,000 is likely to be a conservative estimate of the net present value. The NPWS is prepared to accept this amount as a minimum figure for discussion pending further review. It is recommended that the REF contain a consideration of maintenance actions required and estimated costs for the structure.

2. The REF include confirmation that SEPP 39 still applies to the proposed development. This is raised as an issue as the Spit Island has moved and may not lie within the designated SEPP 39 area. Confirmation of the application of SEPP 39 will confirm that this proposal should be considered under Part 5 of the EP&A Act, and not Part 4.

3. The REF include an updated assessment of the Island's current geomorphology to determine whether recent sand movements require additional design modifications.

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Rec'd 19/2/01

4. The REF include a consideration of the effectiveness of the proposal in achieving its design objectives should the proposed off-shore breakwater proceed.

5. The REF include an "eight part test" under Section 5A of the EP&A Act in order to consider the significance of likely effects to threatened species. The consideration of an "eight part test" is a statutory requirement which the NPWS as a determining authority will need to satisfy.

6. The REF's section on impact assessment be undertaken in accordance with DUAP's publication "Is An EIS Required?". Once again, this is a statutory requirement for matters that the NPWS must consider as a determining authority. Derek Steller will email a recommended format to you for your consideration.

It would be appreciated if you could provide a timeframe for preparation and completion of the REF for discussion. It will also be necessary to discuss with you at some stage a suitable approach for stakeholder and public consultation.

Please call either myself on 9585 6674 or Derek Steller, Conservation Planning Officer, on 9585 6691, if you wish to discuss the above matters in more detail or need additional advice in order to expedite completion of the REF.

Yours sincerely

Lou Ewins 14.04.00

Lou Ewins
Manager, Conservation Planning Unit
Central Directorate

Your Reference : File 0:\5900\ENVIRONMENTAL\REV
Our Reference : BA1509/02
Contact : John Goodwin

EPA

Sydney Operations

Connell Wagner
Mr S Lenehan
PO BOX 538
NEUTRAL BAY NSW 2089

Dear Mr Lenehan

TOWRA SPIT AVIFAUNA HABITAT – PROPOSED REVIEW OF ENVIRONMENTAL FACTORS

Thank you for the opportunity to provide input to the proposed review. The EPA's main concerns are centred on the potential water pollution arising from the proposed dredging operations.

Your recent letter requesting EPA input is unclear concerning the volume of sand to be dredged during the initial stabilisation works associated with the current proposal.

The EPA administers the Protection of the Environment Operations Act 1997. Schedule 1 of the Act prescribes dredging as an activity, subject to a 30,000 tonnes per annum threshold, that requires an enabling environment protection licence.

Whether an environment protection licence is required or not, the contractor would be required to adopt world best practice for managing silt plumes that may be generated due to proposed dredging. Accordingly the Review of Environmental Factors (REF) should include details of:

- the estimated volume of sand proposed to be dredged from the Bay and foreshores;
- the design and location of the proposed silt curtain and other mitigation measures; and
- the location and management of dredge water return.

Acid sulfate soils may also be exposed during the dredging process. Therefore, the REF must incorporate details of the proposed management of acid sulfate soils in accordance with the current Department of Land and Water Conservation guidelines.

Should you require further information concerning the above comments, please contact Mr John Goodwin on 9995 – 6838, fax 9995 – 6900, or email sydneyops@epa.nsw.gov.au.

Yours faithfully,

18/2/01

ANDREW HAWKINS
Acting Principal Officer Sydney Planning
for Director- General.

Environment Protection Authority
PO Box 668 Parramatta NSW 2124 Australia
Level 7 79 George Street Parramatta NSW 2150
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Waterways

We're with you on the water
44/61-65 Glencoe Street
Cnr Stapleton Ave
SUTHERLAND NSW 2232
Ph: **95454422** Fax: 95453648

12 February 2001

Connell Wagner
Mr Shaun Lenehan
PO Box 538
NUETRAL BAY NSW 2089

Dear Sir

Thank you for your letter of 5 January 2001 concerning the Towra Spit Avifauna Habitat. My office has no major concerns with your proposal other than the maintenance of safe navigation of the waterways in the area.

I have passed your letter to Ms Persephone Rougellis of our Marine Assets Division of the Waterways Authority for appropriate comment also.

Please do not hesitate to contact me if you require further information on this matter.

Yours sincerely

Chris Isted
A/Operations Manager
Botany Bay/Port Hacking

From: **Derek Steller <derek.steller@npws.nsw.gov.au>**
Created: 03/01/01 09:28 AM

To: **"'lenehans@conwag.com'" <lenehans@conwag.com>** Project Code:
cc:
Subject: **Towra Spit Island**

Shaun
As discussed previously, this is to confirm that the NPWS' letter dated 14/4/2000 is still relevant and should be used in response to your recent letter dated 5/2/2001,

Derek Steller
9585 6691

Appendix B

NPWS Checklist

Characteristics of the Activity	Potential Issues
How is the proposal likely to affect natural or community resources?	
1. uses or results in the use of community services or infrastructure including roads, power, water, drainage, waste management, education, medical, social services	N/A
2. uses or results in the use of natural resources including water, fuels, timber, extractive material, minerals, prime agricultural land, etc	The proposal involves the re-use of sand extracted on site for the creation of the barrier and terminal structures.
3. affects future potential of commercial deposits of minerals or extractive material or areas important for fishing, agriculture or forestry	N/A
4. changes the demographics of an area	N/A
5. changes in the transport requirements of an area	The changes to the use of the waters around the island by the boating public would be consistent with those changes affected by the original proposal. Both the terminal and barrier structures would represent incursions into surrounding waterways to a similar extent as the groynes and berms proposed in the original scheme. The original proposal included a recommendation for a speed reduction zone within 100m of the island. This recommendation would also be applicable under the revised scheme. A further recommendation for a complete exclusion zone within 100m of the island is also under consideration.
6. creates a new route alignment for the provision of infrastructure	N/A
7. any other issues	N/A
How is the proposal likely to affect the community?	
1. generates population movements including influx or departure of the workforce	N/A
2. changes the workforce or industry structure of the area/region; affects employment opportunities	N/A
3. affects areas of high population densities or established development patterns	N/A
4. affects or affecting access to an area, building or items of aesthetic, anthropological archaeological, architectural, cultural, historical, scientific, recreational, aesthetic or social significance or other special value for present or future generations	With respect to the original proposal, the revised scheme would have a reduced visual presence from view points on the western shore of Botany Bay and from passing boats. The original scheme involved four groynes and the creation of two dunes. The current proposal would require only two structures that will be partially submerged during the tidal cycle. The island is over one km from the nearest fixed visual catchment between Dolls Point and Rocky Point and would have a maximum height of 1.4m above mean high water therefore the visual impact due to the proposal would not be significant. The revised proposal would have similar implications for the recreational opportunities of the general public as the original proposal. The island would continue to remain a restricted area for the general public.
5. affects the visual or scenic landscape	Refer above
6. affects sunlight or views of another property	Refer above
7. affects the amenity of publicly owned land	The revised proposal would have similar implications for the recreational opportunities of the general public.

	The island would continue to remain a restricted area for the general public.
8. changes land use from the surrounding uses as a direct or indirect result of the activity; forms a barrier to movement within the community or access to existing properties; leads to a loss of housing	Refer above
9. generates significant volume of traffic	N/A
10. generates nuisance or health or safety risks including air pollution, odour, noise, or vibration, blasting, electromagnetic fields or radiation or releases disease or genetically modified organisms or change the bush fire regime	N/A
11. any other issue	N/A

Characteristics of the Activity	Potential Issues
How is the proposal likely to affect areas sensitive because of physical factors?	
1. coastline and dune fields, alpine areas, deserts, caves, or other unique landforms	The scheme would involve the re-establishment of Towra Spit Island as an island by the installation of a sand filled geotextile barrier structure on the southern face of the island, removal of the sand spit currently linking the island to the mangroves immediately to the island's south and the construction of a sand filled geotextile terminal groyne structure at the western end of the beach.
2. land with high agricultural capability	N/A
3. natural waterbodies, riparian zones, wetlands, drinking water catchments or flood prone areas	The southward advance of Towra Spit Island of approximately 70m since 1995 has lead to the smothering and death of mangroves (*Avicennia marina*) to the south of the island. The proposed barrier structure on the island's eastern spit would stabilise the spit and prevent further movement of sand into the mangroves. Under the proposal, an area of recently deposited sand would be relocated from south of the barrier structure to the north of the structure. This would restore the channel to the south of the island and prevent further encroachment on the mangrove community. The southward progression of the island and accumulation of sediment in the channel to the south has enabled the establishment of a salt marsh community and some juvenile mangroves along the island's southern shore. The impact of the re-opening of the channel on the mangroves and salt marsh community would be monitored under a program addressing the condition and composition of vegetation on the island. In the event that the small stand of juvenile mangroves prosper under the altered hydraulic regime there may be a requirement to remove them to reduce the availability of roosting habitat for potential predators of the Little Tern.
4. groundwater recharge areas or areas with high water table	N/A
5. erosion prone areas, area with slopes of greater than 18 degrees	N/A
6. subsidence or slip areas	N/A
7. areas with acid sulphate, sodic or highly permeable soils	Sediment cores from the study area were collected and analysed for Potential Acid Sulphate Soils and found to not contain sufficient chemical levels required for the generation of Acid Sulphate Soils (Douglas and Partners, 1996). Although the laboratory results indicated that there is a very low risk of Acid Sulphate Soils occurring within the boundaries of the study area, further visual monitoring would be conducted during excavations.
8. areas with salinity or potential salinity problems	The island is located in a marine environment, however, there are no salinity problems.
9. areas with degraded air quality	N/A
10. areas with degraded or contaminated soil area or degraded or contaminated water (ground or	N/A
11. any other sensitive areas	N/A
How is the proposal likely to affect areas sensitive because of biological factors?	
1. corals and seagrass beds, wetland communities (coastal, peatlands or inland), native forests, urban	The migration of the island to the west at a rate of 8m per year is smothering *Zostera* seagrass beds in this

bushland, arid and semi-arid communities	area. The proposed terminal groyne will stop this westward progression and arrest the ongoing loss of seagrass beds to the west of the island, estimated to be approximately 0.1ha per year. The accretion of sand to the east of the terminal groyne will take place over five years and will affect approximately 0.1 hectares of *Zostera* seagrass beds. This adverse effect is considered to be acceptable given the long term benefits to seagrass beds west of the island.
2. habitat/wildlife of endangered terrestrial or aquatic fauna species and or species listed under Japan-Australia Migratory Birds Agreement (JAMBA) and China-Australia Migratory Birds agreement (CAMBA)	No threatened plant species or communities (Schedule 1 and 2, TSC Act 1995) or species of significance in terms of geographic distribution or localised populations were recorded in the study area and as such the Eight Part Test under section 5A of the Environmental Planning and Assessment Act, 1995, was not required for flora. With regard to the revised scheme currently under consideration, based on the criteria assessed through the eight part test the proposal is not likely to significantly affect any populations or individuals of Schedule 1 or 2 species. As such a Species Impact Statement is not required with respect to fauna. The proposal is likely to have a positive effect on eight species listed under JAMBA and CAMBA that have been previously recorded in the study area.
3. habitat/wildlife corridors and remnant vegetation	The proposal would have a positive impact on the terrestrial vegetation of the island. Currently, the southern and westward migration of the island is leading to the undercutting of the northern shore of the island with an associated loss of vegetation including a stand of Acacias. The proposed terminal groyne will stabilise the northern shore of the island thereby protecting the substrate and vegetation in this area from undercutting. The accretion of sand to the east of the terminal groyne will provide an increase in suitable habitat for the further establishment of native vegetation.
4. protected, rare, threatened plant species or inadequately reserved plant communities	The proposal would not endanger any species of animal, plant or other form of life whether living on land, in water or in the air
5. bushfire prone areas	N/A
6. fishing grounds and fish breeding or nursery areas	The revised scheme is considered beneficial for the nursery habitat of commercial fishery species as it represents the saving of 4.5 hectares of seagrass beds as well as the prevention of the ongoing westward progression of the island affecting more seagrass beds.
7. any other sensitive areas	N/A

Characteristics of the Activity **How is the proposal likely to affect areas allocated for conservation purposes?**	Potential Issues
1. national parks and other areas reserved or dedicated under the NP&W Act 1974	The title to Towra Spit Island and that part of the adjacent bed of Botany Bay within the boundaries of SEPP 39 has been transferred from the Marine Ministerial Holding Corporation to the National Parks and Wildlife Service.
2. land reserved or dedicated within the meaning of the Crowns Land Act 1989 for preservation or other environmental protection purposes	N/A
3. world heritage areas	N/A
4. environmental protection zones in environmental planning instruments or land protected under SEPP 14 - Coastal Wetlands or SEPP 26 - Littoral Rainforests	This proposal is subject to State Environmental Protection Policy No. 39 – Spit Island Bird Habitat. SEPP 39 permits development (for the purposes of creating avifauna habitat) to proceed without development consent. The proposal is also subject to State Environmental Planning Policy No 4 - Development Without Consent. Clause 11a of SEPP 4 applies to land dedicated as a nature reserve and requires the involvement of Council if the proposed activity is a prescribed development. As the proposed activity is not prescribed a Development Application is not required for the Proposal, and it is to be determined by National Parks and Wildlife Service in accordance with Part V of the Environmental Planning and Assessment Act, 1979 (EP&A Act).
5 land identified as wilderness under Wilderness Act 1987 or declared as wilderness under NP&W Act	N/A
6. aquatic reserves reserved or dedicated under the Fisheries Management Act 1994	The study area lies within the Towra Point Aquatic Reserve
7. wetland areas dedicated under the RAMSAR Wetlands Convention	N/A
8. heritage items identified on the Register of the National Estate, under the NSW Heritage Act or an environmental Planning instrument	N/A
9. community land under the Local Government Act	N/A
10. Land subject to a "conservation agreement" under the NP&W Act	N/A
11. any other areas	N/A
How is the proposal likely to affect areas sensitive because of community factors?	
1. Aboriginal communities or areas subject to land rights claims	A search undertaken by Dames and Moore for the 1996 EIS indicated that no Aboriginal sites are recorded at the location. No Aboriginal communities or areas subject to land rights claims would be affected by the proposal.
2. communities with strong sense of identity	N/A
3. disadvantaged communities	N/A
4. areas with degraded amenity from noise, traffic congestion or odour	N/A
5. areas or items of high anthropological, archaeological, architectural, cultural, heritage, historical, recreational or scientific value	The revised proposal would have similar implications for the recreational opportunities of the general public as the original proposal. The island would continue to remain a restricted area for the general public.
6. areas or items of high aesthetic or scenic value	Refer to "How is the proposal likely to affect the community" Point 4
7. any other areas	N/A

IDENTIFYING THE ISSUES

Characteristics of the Activity	Potential Issues
How is the proposal likely to affect the physical aspects of the environment or introduce pollution or safety risk factors?	
1. disturbs the topography or above or below ground features including filling, excavation, dredging, tunnelling; involves the disposal of large quantities of spoil	Towra Spit Island is currently advancing to the south and south west. Under the proposal the island would be stabilised through the use of sand filled geotextile barriers / groynes. This would cause accretion of sand and a subsequent increase in the size of the island.
2. affects a natural waterbody, wetland or groundwater aquifer or natural water drainage pattern; affects the quality or quantity of water in the systems	The revised proposal represents a significant reduction in the potential risk to the quality of water in the wetlands due to construction activities. The reopening of the channel to the south of the island will aid the flushing of the waterbody to the south of the island, Stinkpot Bay.
3. uses groundwater or surface water from a natural water body; stores water in a dam or artificial waterbody	N/A
4. changes the flood or tidal regimes or areas to be affected by the flooding or tides	The proposal would have no impact on tidal ranges. The proposal would stabilise the intertidal area of the island.
5. uses, stores, disposes or transports hazardous substances (flammable, explosive, toxic, radioactive, carcinogenic or mutagenic substances); uses or generates pesticides, herbicides, fertilisers or other chemicals which may build up residues in the environment	N/A
6. generates or dispose of gaseous, liquid or solid waste; generates greenhouse gas emissions or releases chemicals which affect the ozone layer or are precursors to photochemical smog; generates of disposes of hazardous waste	N/A
7. emits dust, odours, noise, vibrations, blasts, electromagnetic fields or radiation in the proximity of residential areas or landuses likely to be affected.	The construction of the proposal would not emit dust, odours, noise, vibrations, blasts, electromagnetic fields or radiation in the proximity of residential areas.
8. any other matters	N/A
How is the proposal likely to affect the biological aspects of the environment?	
1. clears or modifies native vegetation	The proposed scheme would have no adverse effect on the terrestrial vegetation of the island. The stabilisation of the island would arrest the ongoing loss of ground cover due to the retreat of the northern shoreline of the island.
2. displaces or disturbs fauna or creates a barrier to fauna movement; clears remnant vegetation to wildlife corridors	The stabilisation of the island and creation of habitat would represent a positive contribution to the wetland habitat of the Towra Point Nature Reserve. By stopping the westward migration of the island the ongoing reduction of the cover of seagrass beds in Botany Bay due to this process would be curbed and habitat for the Little Tern and a range of wading birds would be created.
3. introduces noxious weeds, vermin, feral species or disease or releases genetically modified organisms	The proposed barrier structure and re-opening of the channel to the south of the island would ensure that the island remains isolated form the mainland and inaccessible to predators such as foxes, cats, dogs and rats.
4. undertakes activity which affects revegetation or replenishment of native species following a disturbance	The proposal would have a positive impact on the terrestrial vegetation of the island. Currently, the

	southern and westward migration of the island is leading to the undercutting of the northern shore of the island with an associated loss of vegetation including a stand of Acacias. The proposed terminal groyne will stabilise the northern shore of the island thereby protecting the substrate and vegetation in this area from undercutting. The accretion of sand to the east of the terminal groyne will provide an increase in suitable habitat for the further establishment of native vegetation.
5. introduces high bushfire risk factor or change the fire regime	N/A
6. any other issues	N/A

Appendix C

Eight Part Test

Eight Part Test for Threatened species on Towra Spit Island

The threatened bird species listed in Table 1 have been previously recorded on Towra Spit Island.

Table 1: Species Previously Recorded In the Study Area (NPWS Wildlife Atlas Database, 2000)

Common Name	Scientific Name	TSC Act Schedule*
Pied Oyster Catcher	*Haematopus longirostris*	2
Sooty Oyster Catcher	*H. fuliginous*	2
Mongolian Plover+	*Charadrius mongolus*	2
Large Sand-Plover+	*C. leschenaultii*	2
Terek Sandpiper+	*Tringa terek*	2
Black-tailed Godwit+	*Limosa limosa*	2
Great Knot+	*Calidris tenuirostris*	2
Sanderling+	*Calidris alba*	2
Broad-billed Sandpiper+	*Limicola falcinellus*	2
Little Tern+	*Sterna albifrons*	1

*1 denotes Schedule 1 – endangered species, 2 denotes Schedule 2 – vulnerable species
+ denotes Migratory Species under the EPBC Act

Section 5A of the EP&A Act, as amended by the Threatened Species Conservation Act, lists the factors to be considered when deciding whether there is likely to be a significant effect on threatened species, populations or communities, or their habitats and consequently whether a Species Impact Statement is required.

For the purposes of the TSC Act, and in the administration of sections, 77, 90 and 112 of the EP & A Act, the following eight part test has been applied to decide whether there is likely to be a significant effect due to the proposal on the threatened species listed above. As the island offers the same habitat resources for each of the birds under consideration with respect to their behavioural requirements the test has been applied collectively.

(a) In the case of threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

The primary objective of the proposal is to create alternative habitat in compensation for wader bird habitat lost during the construction of the Parallel Runway by the FAC. This would serve to improve the viability of local populations and reduce the risk of local extinction.

The timing of construction and access across the island during construction would be restricted to protect the birds from any potentially disturbing activities.

(b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

Not applicable.

(c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of know habitat is to be modified or removed.

The proposal will create (rather than remove) wading and roosting habitat for the abovementioned species and arrest the ongoing smothering of seagrass beds to the west of the island.

(d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community,

No known terrestrial or marine habitat used by the subject bird species will become isolated by the proposed development or activities. The island will be severed from an area of mangroves to the south. This action will protect the island's resident bird populations from terrestrial predators.

(e) Whether critical habitat will be effected,

Although Part 3 of the *TSC Act* deals with critical habitat for threatened species and populations, no such critical habitat has been declared or even formally identified for these threatened species.

(f) Whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

None of the subject species is adequately represented in conservation reserves in the region, hence their high conservation status and the need for this proposal.

(g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatened process,

The activity does not constitute a key threatening processes as listed on *Schedule 3* of the *TSC Act*.

(h) Whether any threatened species, population or ecological community is at the limit of its known distribution"

Each of the birds in Table 1 has a seasonal distribution across Australia and as such they would not be at the limit of their known distribution.

Conclusion

It is not considered that there is a requirement for a species impact statement to be prepared for the threatened bird species using the resources of Towra Spit Island as the proposal is being advanced for the purposes of providing and protecting habitat for these birds. The timing of construction and access across the island during construction would be restricted to protect the birds from any potentially disturbing influences.