

Port Botany Expansion EIS

Landscape Principles and Guidelines



prepared by

LandArc Pty Limited

Landscape, Environmental and Heritage Consultants

Suite 9, 55 Avalon Parade, Avalon NSW 2107

tel: 9973 1330 fax: 9973 1791 email: mail@landarc.com.au

Port Botany Expansion EIS

Landscape Principles and Guidelines

1.1 Introduction

The proposed Port Botany Expansion by Sydney Ports Corporation involves the reclamation of approximately 60 hectares of Botany Bay immediately adjacent to the existing Port Botany Terminal. The proposal would significantly expand port facilities and operations for container handling and includes the following major components:-

- expansion of wharf face to create new berths;
- hardstand areas for container handling;
- core access road (connected by a bridge to Foreshore Road);
- rail sidings and rail corridor connection;
- tug berths and relocated public boat ramp and carpark;
- utilities, services and associated infrastructure.

The following report aims to address the potential impacts of the proposal in relation to the existing landscape and to develop proposed landscape treatments focusing on the public bay-side interface adjacent to Foreshore Road.

The study area extends from the mouth of the Mill Stream near the parallel runway to Penrhyn Estuary adjacent to the existing port facilities. This study includes the public land between the central median strip along Foreshore Road to the foreshore/ beach and estuarine profiles of Botany Bay as identified in the **Public Realm Design**. Adjoining public open space, including Sir Joseph Banks Park and Botany Golf Course are not included in this study.

1.2 Background

For many years, the Foreshore Road/ Foreshore Beach interface and Penrhyn Estuary areas have evolved as marginal and somewhat compromised urban landscapes. The foreshore corridor was the subject of dramatic changes during the late 1970s-80s period. These changes, which included the development of port and road infrastructure, shoreline re-alignment, public open space and broad-

scale landscape rehabilitation, followed previous periods of development. Together they have combined to re-shape and totally modify the landscape character of this location.

The construction of the airport's parallel runway has affected wave patterns along the reclaimed foreshore. As a consequence, concentrated wave energy particularly during storm swells, has resulted in shoreline instability and erosion in a section of the foreshore beach/ foredune area. The associated vegetation has also been negatively impacted by these processes.

A broad range of issues continue to affect the environmental quality and recreational use of this lineal foreshore space. These impacts include run-off from neighbouring urban and industrial sites, poor water quality and estuarine sediments, spread of noxious and environmental weeds, degraded vegetation and poor visual quality, road-side litter, rubbish dumping, public safety and security. Recreational opportunities are closely linked to the quality of the landscape setting. Furthermore, the loss of integrity in this foreshore/ semi-urban context reflects a loss of broad public ownership and stewardship over the land.

The Port Botany Expansion proposal provides an opportunity to address these social and environmental issues in an integrated way. The proposal would provide the impetus to develop and enhance public foreshore areas for appropriate passive/ active recreation. It would promote public access with improved land-based recreational linkages and access for water-based activities such as boating and fishing. Furthermore, the proposal offers substantial environmental benefits in the extensive restoration, enhancement and reinstatement of foreshore dune vegetated areas, inter-tidal sand/ mudflats, saltmarshes and seagrass habitat within the Penrhyn Estuary area.

1.3 Site Context

Reclaimed Foreshore

This northern foreshore section of Botany Bay has been highly modified through past dredging, land reclamation and development of port and airport infrastructure. The existing foreshore and estuarine profiles, native vegetation and fenced dune areas were largely established during landscape rehabilitation and revegetation works in the late 1970s-early 1980s period. The foreshore dune

interface is comprised largely of dredged quartz sand and marine sediments. This narrow strip of land has a generally flattened dune profile set slightly higher than the adjacent road levels (Foreshore Road) with a gentle batter to the beach. The foredune achieves its greatest lateral extent in the eastern portion of the site near Penrhyn Estuary.

Key Environmental Factors affecting Site Vegetation

The vegetation on this site has been shaped by a range of environmental factors (eg. soils, geology, topography, aspect, fire history) and human-induced impacts (eg. disturbance, fragmentation, modification, land reclamation, rehabilitation and weed invasion). This foreshore area is subject to extremes in local weather conditions. The exposed southerly aspect and existing foreshore configuration has tended to amplify storm generated swells and wave action within the central section of shoreline. This area is currently experiencing a high level of beach erosion and dune instability which has created a localised low sea-ward cliff profile.

The existing foreshore vegetation is constrained and modified by the impact of prevailing south-easterly, salt-laden winds. The structure of a coastal dune community typically ranges from low growing salt-tolerant grasses and herbs on the exposed foredune to larger wind-pruned shrubs on the higher mid-dunes/ swales. The community often changes to open forest or woodland in the protected hind-dune leeward side. In this way, the vegetation assumes a more or less contoured profile, depending on the complexity and extent of the dune system. This site's existing simplified and flattened foredune profile however acts as a limiting factor on the opportunities for ecological restoration and enhancement.

Natural Vegetation Community

At the time of European settlement, the northern shoreline of Botany Bay lay within the area now known as Sir Joseph Banks Park. It would have been a complex mosaic of Estuarine and Freshwater Wetlands and Banksia Scrub, known collectively as the Botany Swamps. The soils, topography and drainage patterns have been altered dramatically since this time. The site's reclaimed and elevated foredune presented a set of different opportunities for landscape rehabilitation. It therefore followed that the revegetation approach would be modeled on a Coastal Dune Heath community.

Conservation Status

As part of the EIS process, URS Australia conducted a detailed literature review of NPWS Threatened Flora records for the Botany Bay locality followed by a field survey to determine the conservation significance of previously recorded taxa in this locality. Data from the Parallel Runway EIS was also reviewed. Six Threatened Flora were the subject of a desktop review (ie. species scheduled as either endangered or vulnerable under the *Threatened Species Conservation Act 1995*). These species include *Acacia terminalis* subsp. *terminalis*, *Melaleuca deanei*, *Syzygium paniculatum*, *Caladenia tessellata* and *Tetratheca juncea*. All but one of the species were considered to have a low likelihood of occurrence on the site and one species, *Tetratheca juncea*, is now considered regionally extinct in Sydney.

URS Australia concluded that based on existing habitat, no plant species previously recorded in the locality and scheduled under the *Threatened Species Conservation (TSC) Act* or *Environment Protection and Biodiversity Conservation (EPBC) Act*, would be expected to occur within the study area (refer to *Species Impact Statement*, URS Australia, 2003).

Existing Vegetation Communities

The Field Survey conducted by URS Australia identified three vegetation communities in the study area with a total of 32 species. The communities were divided into the following:-

- *Banksia integrifolia* OPEN SCRUB to LOW WOODLAND (also referred to as Coastal Dune Heath)
- *Sarcocornia quinqueflora* – *Suaeda australis* HERBLAND (also referred to as Saltmarsh Herbland)
- *Avicennia marina* LOW SHRUBLAND to OPEN SCRUB (also referred to as Mangrove Swamp)

The *Banksia integrifolia* OPEN SCRUB to LOW WOODLAND or Coastal Dune Heath community occurring on the reclaimed dune area and public foreshore is the subject of the following discussion. The other two communities are located within Penrhyn Estuary (refer to *Species Impact Statement*, URS Australia, 2003).

Coastal Dune Heath/ Open-scrub Community

Coastal Dune Heath/ Open-scrub is typically dominated by *Monotoca elliptica*-*Banksia integrifolia*-*Leptospermum laevigatum*. It occurs on more recent 'marine' sands of Holocene age compared to the older

aeolian soils of the Eastern Suburbs Banksia Scrub. Coastal Dune Heath/ Open-scrub is often found in association with a low woodland of *Angophora costata* and *Eucalyptus botryoides* on the sheltered slopes of steeper dunes (*Benson & Howell, Natural Vegetation of the Sydney Area Vegetation Map Series, 1994*).

On this site the foreshore berm and lower foredune areas contain a mix of planted and colonising species. The introduced Marram Grass (*Ammophila arenaria*) and native Hairy Spinifex (*Spinifex sericeus*) were originally planted to stabilise the dune reclamation works. A number of other common native grasses and herbs (eg. *Isolepis nodosa*, *Sporobolus virginicus*, *Carpobrotus glaucescens* and *Tetragonia tetragonioides*) and exotic groundcovers (eg. *Melinis repens*, *Erharta erecta*, *Hydrocotyle bonariensis* and *Senecio madagascariensis*) have colonised the modified foredune.

This open, low tussock grass vegetation to 50cm in height changes to predominantly shrubby species up to 5-7 metres in height along the upper foredune area adjacent to Foreshore Road. The structure varies from open to moderately dense shrubs with a sparse groundcover of grasses and herbs. Native shrub/ small tree species include the following:-

Botanical Name	Common Name
<i>Acacia longifolia</i> var. <i>sophorae</i>	Coastal Wattle
<i>Leptospermum laevigatum</i>	Coastal Tea-tree
<i>Melaleuca armillaris</i>	Bracelet Honey-myrtle
<i>Melaleuca ericifolia</i>	Swamp Paper-bark
<i>Banksia integrifolia</i>	Coastal Honeysuckle
<i>Banksia serrata</i>	Saw-toothed Banksia
<i>Dodonaea triquetra</i>	Common Hop Bush
<i>Allocasuarina distyla</i>	Scrub She-oak
<i>Casuarina glauca</i>	Swamp Oak
<i>Westringia fruticosa</i>	Coast Rosemary

Management Realities

The original planting palette used in the rehabilitation works was very restricted due to nursery availability and procurement issues at the time. An important component shrub species of these communities, *Monotoca elliptica* is absent from the site. Plants were generically sourced so that much of the existing shrubby vegetation is unlikely to contain local genotypes. Another important issue is the aging and

fragmentation of this community under the existing management regime. A large component of the shrub stratum including *Leptospermum laevigatum*, *Acacia longifolia* var. *sophorae* and *Melaleuca armillaris* is now senescent. The existing vegetation community displays a somewhat simplified species composition and structural characteristics compared to the diversity of species found in a naturally occurring coastal dune complex.

Nevertheless, this project developed for the MSB (now Sydney Ports Corporation) by *Bruce MacKenzie and Associates* was a significant milestone in developing a new methodology in reconstructed dune rehabilitation and revegetation. It should be recognised that at the time of implementation, this kind of native landscape rehabilitation was in its infancy. There were practical limitations which allowed little opportunity for using a broad palette of native species or indeed locally-sourced indigenous species (ie. use of local genotypes).

This constructed vegetation community has inherent weaknesses with respect to long term durability and ecological resilience. A number of management issues need to be addressed in such landscape rehabilitation initiatives. These include weed control and feral animal (eg. rabbit) management, ongoing ecological enhancement (eg. successional phasing), establishment of an appropriate fire regime and control of visitor tracking and trampling.

There has been no further restoration or enhancement planting since the initial re-vegetation program. Over the past 20-25 years, the vegetation community has developed largely under no specific maintenance regime to form a community with the following characteristics:-

- narrow lineal corridor with extensive edge conditions;
- fragmented mix of native/ exotic dense thickets and patchy scrub interspersed with open, exotic grassland;
- degraded, aging and senescent dune scrub community with low durability and low resilience;
- limited genetic integrity of shrub stratum;
- limited habitat values and ecological connectivity (no threatened species present);
- most areas have no fire history and no manipulation of ecological fire regimes;
- exotic weeds are a major component of the community (particularly Bitou Bush in the Penrhyn Road area);

- natural recruitment of native seedlings is largely restricted to herbs and short-lived, colonising shrub species such as *Acacia longifolia* var. *sophorae*;
- colonisation by some common native grasses, sedges, forbs and twiners;
- tendency towards high levels of Bitou Bush recruitment (seedlings) in any open/ disturbed or burnt areas;
- large local rabbit population limiting native seedling establishment.

Exotic Weeds

The native foreshore vegetation is severely impacted by invasive exotic weed species (ie. noxious and environmental weeds) which are advantaged by the high level of site disturbance and modification. The dominant invasive shrub species on the site include the following noxious species scheduled under the *Noxious Weeds Act 1993*:-

Noxious Weed Description	Category
Bitou Bush (<i>Chrysanthemoides monilifera</i> ssp. <i>rotunda</i>)	W3
Pink and Red Flowering Lantana (<i>Lantana camara</i>)	W2
Blackberry (<i>Rubus fruticosus</i>)	W2
Pampas Grass (<i>Cortaderia</i> sp.)	W2

An extensive range of introduced scramblers, grasses, annuals and perennials have colonised much of the ground stratum of the site. These environmental weeds include Pennywort (*Hydrocotyle bonariensis*), Panic Veldtgrass (*Erharta erecta*), Dune Red Grass (*Melinis repens*) and Turkey Rhubarb (*Acetosa sagittata*) and many other species. Notably, the Western Australian Wreath Wattle (*Acacia saligna*), a garden escape, is colonising much of the dune area. In recent years, this species has become a major weed in disturbed sites in the Sydney area.

These exotic weed species are highly competitive and tend to inhibit or exclude opportunities for natural regeneration. Bitou Bush was first introduced in NSW by the Soil Conservation Service for dune stabilisation programs during the 1950s-early 1970s. This species forms dense impenetrable thickets up to two metres in height. It has developed as a virtual monoculture around the existing boat ramp/ carpark area and much of the Penrhyn Estuary dunes. Bitou Bush is

now the target of a broad-scale NPWS initiative which aims to control this species.

Implications for Future Management

The narrow, lineal nature of the site ensures a high edge to area ratio (ie. the area has extensive boundaries compared to its relative size thus amplifying edge conditions and their negative impacts). The combination of relative small size, configuration, fragmentation, simplification and unstable structural characteristics of this vegetation community have management implications. The following landscape principles and guidelines identify an appropriate strategy for restoration, enhancement and reinstatement to address these management issues.

Furthermore, the type and structure of the vegetation community along the foreshore is a function of the site's environmental constraints (refer to previous section *Key Environmental Factors affecting Site Vegetation*). Past engineering (ie. dredging, landfill and contouring) of the foreshore profiles have also played an important limiting role. The local community places considerable value on the existing "natural setting" afforded by the foreshore vegetation. Consequently, this has been an important consideration in developing a strategy which protects both the existing dune profiles and its existing vegetation. Accordingly, options for developing a more diverse dune structure (including higher dune profiles) and restoration of a Coastal Dune Heath (Open-scrub)/ Coastal Dune Forest (Open-forest) complex are largely precluded as these options would require large scale clearing of existing vegetation and re-shaping of the dune. Nevertheless, opportunities exist for enhancement using local dune heath and mesic species. Some of these shrub and tree species would be used as ornamental and accent plantings in recreational nodal areas (refer to *1.7 Landscape Materials and Finishes – Proposed Planting Palette*).

The overall landscape strategy therefore proposes an integrated weed management approach with specific restoration, enhancement and reinstatement components, using the existing site profiles. Notably, the far western portion of the site is an exception with opportunities to locally modify land profiles and establish a tree canopy within this open space area. This community would be modelled on the species and structural characteristics of the remnant and highly fragmented community described as Kurnell Dune Forest – a low open sclerophyll forest community with distinct mesophyll elements.

Overall, the strategy would aim to restore the degraded vegetation community to a healthier, more durable and stable condition with improved resilience (ie. enhanced opportunities for recovery, recruitment and maintenance). The strategy would also seek to restore ecological processes, enhance biodiversity and ecological connectivity in the area.

1.4 Public Realm Design

The protection and enhancement of foreshore landscape character, environmental quality and recreational opportunities are integral components of the proposed Port Botany Expansion. The proposal increases the size of existing port facilities and re-defines the bay-side setting and its natural/ cultural landscape character. It is therefore important that the landscape treatment will protect and reinforce the natural qualities of the foreshore open space whilst addressing the distinctive identity of the proposed Port expansion. The approach emphasises the interplay between these two elements, providing opportunities for viewing the port facilities and the natural bay/ foreshore setting. Accordingly, the **Public Realm Design** identifies a range of viewing points and view corridors along Foreshore Road, the pedestrian/ bicycle path, elevated viewing platforms, the public boat ramp and the boardwalk. Many of these viewpoints would have interpretive signage to enhance the recreational experience.

1.5 Foreshore Precincts

The foreshore precincts are divided into two separate management zones as follows:-

1. Foreshore Road/ Bay-side Interface (west); and
2. Penrhyn Estuary (east).

These two precincts are defined by distinctive landscape, heritage, environmental and recreational values. The Foreshore Road/ Bay-side Interface would be managed as public open space while the Penrhyn Estuary would become a conservation zone delineated by the rail corridor and the inter-tidal area. A narrow strip of public land would be retained along the northern side of the rail corridor, providing a continuous pedestrian/ bikepath link along Foreshore Road.

Foreshore Road/ Bay-side Interface

It is proposed that the Foreshore Road/ Bay-side Interface would have a passive recreational focus within a natural/ cultural foreshore setting. This lineal corridor would include the following major landscape components:-

- protection, restoration and enhancement of existing foreshore interface and native vegetation buffer;
- proposed elevated lookout/ viewing platform, and native planting (near mouth of the Mill Stream);
- pedestrian/ bikepath multi-use access and enhancement of pedestrian foreshore/ beach linkages;
- improved pedestrian linkages on Foreshore Road including a pedestrian at-grade crossing and pedestrian overpass;
- relocated carpark and multi-lane boat ramp, boarding jetty, public amenities and associated facilities; and
- road-side and median strip landscaping.

Penrhyn Estuary

In contrast with the recreational bay-side emphasis of the western precinct, the Penrhyn Estuary area focuses on the restoration of natural heritage values. This restored landscape of extensive inter-tidal sand/ mudflats and saltmarshes will provide vital habitat for rare and threatened migratory species of wading-birds. Some of these species are protected under State and Federal threatened species legislation and international conservation agreements.

The potential conservation significance of this site would be enhanced through an appropriate management regime. Public access would be restricted and controlled while still providing educational and interpretive opportunities. The design would include construction of a boardwalk and viewing platform linked to the pedestrian/ cycleway and located at the western edge of the proposed inter-tidal sand/ mudflats.

The historic jetty area (piles) would be protected from any modification or disturbance under this proposal. In addition, the rail corridor forms an important physical barrier between the Foreshore Road interface and the Estuary, further reinforcing the restrictions placed on public access in this ecologically sensitive area.

The main components of the proposed Penrhyn Estuary ecological restoration and habitat enhancement would include:-

- expansion of inter-tidal sand/ mudflats habitat (1.5 Ha existing area increased to 12.5 Ha total area);
- expansion of saltmarsh habitat including retention/ transplanting of existing areas and replacement of colonising mangroves (approximately 1 Ha existing area increased to up to 6 Ha total area);
- establishment of a dune scrub community buffer strip along the southern slope of the rail corridor; and
- protection, restoration and enhancement of adjoining foreshore revegetated foredune areas (north-eastern corner), including implementation of an appropriate weed management strategy.

The proposed conservation strategies for Penrhyn Estuary are addressed in other sections of the EIS.

1.6 Landscape Principles and Guidelines

In accordance with the outcomes of the landscape and visual assessment, stakeholder consultation and the overall development strategy, the following general principles for landscape design and ecological restoration and enhancement have been established. The landscape strategy's principles and guidelines aim to be consistent with the City of Botany Bay Development Control Plan No. 32 – Landscape (2002). Accordingly, the strategy aims to minimise any potential negative impacts of the development proposal and to significantly enhance visual, landscape, heritage, ecological and community values.

General Principles (all locations)

To develop expanded port infrastructure whilst ensuring appropriate protection, restoration and enhancement of the foreshore interface and its significant visual, landscape, heritage, recreational and ecological values.

- protect existing foreshore profiles, soils and vegetation;
- protect, restore and enhance natural ecological processes and habitat values where appropriate, including the establishment of inter-tidal sand/ mudflats, saltmarsh and seagrasses in Penrhyn Estuary;
- minimise potential visual and acoustic impacts of proposed port expansion through an appropriately balanced landscape strategy (ie. enhancement of natural/ cultural settings,

roadside planting/ screening, framing of view corridors and installation of acoustic barriers);

- emphasise the interplay between the natural/ cultural foreshore setting and the adjacent expanded port facilities, providing opportunities for viewing a range of bay-side settings and activities;
- improve visual character of the Foreshore Road, including foreshore interface/ median strip plantings;
- develop a palette of materials which relates to the scale and movement along Foreshore Road (ie. motor vehicles, pedestrians and bicyclists);
- enhance appropriate recreational opportunities, public access and linkages within the foreshore corridor – minimise impacts on the natural environment;
- develop strategies to engage the public in interpretation and education particularly with respect to environmental initiatives;
- provide recreational infrastructure and facilities for land-based and water-based activities which are consistent with community values;
- control public access in fragile and sensitive ecological areas;
- ensure a high level of public safety, surveillance and security particularly along pathways, entry points and recreational nodal areas;
- maintain continuity and simplicity in the range of landscape finishes and materials;
- ensure that planting, restoration and enhancement is site-responsive to local microclimatic and altered profile/ soil conditions (eg. wind/ salt exposure, aspect, types of landfill materials, vehicle emissions, etc);
- address bird hazard issues;
- address ongoing management and maintenance issues such as weed management, successional phasing of planting, road litter control, feral animal control, pedestrian access and visitor impacts;
- ensure that landscape components reflect appropriate ESD principles and best practice methods.

Landscape Guidelines:

Foreshore Road/ Bay-side Interface

The following guidelines are in accordance with the objectives of the **Public Realm Design**:-

1. *Foreshore Interface and Native Vegetation Buffer*

- ❖ establish an appropriate landscape strategy in accordance with the City of Botany Bay Development Control Plan No. 32 – Landscape (2002);
- ❖ restore, enhance and reinstate existing native vegetation community including creation of appropriate buffers to address issues of low durability and resilience;
- ❖ establish and maintain a rhythmic or oscillating pattern of vegetation from open low heath with open bay-side views to more enclosed tall heath/ dune scrub;
- ❖ establish small trees where possible, to provide canopy cover for shade and amenity;
- ❖ utilise vegetation to create a comfortably scaled environment and seek to reduce potential visual and acoustic impacts associated with proposed port expansion;
- ❖ construct protective dune/ vegetation fencing around dune restoration areas, as required, to control visitor impacts (eg. multiple tracking/ trampling) in ecologically sensitive areas;
- ❖ provide continuous, identifiable “badging” along the foreshore area, including appropriate directional and interpretive signage to assist in developing a broader sense of community ownership;
- ❖ establish an appropriate maintenance/ management regime which addresses issues of litter control and dumped rubbish, integrated weed and feral animal management and overall visual amenity and integrity;
- ❖ investigate opportunities for enhancing habitat values (eg. fallen logs, nesting holes, etc), vegetative buffers and bio-linkages (both on site and linking to adjoining public open space) using locally-sourced planting material;
- ❖ enhance the road-side environment with clustered ornamental native plantings (eg. Gynea Lily and Beach Lily) along the central median strip of Foreshore Road;
- ❖ provide native accent plantings, utilising mesophyll shrub/ tree elements (ie. local littoral rainforest/ scrub

- species) where possible – cluster plantings near recreational nodal points such as the western foreshore park, pedestrian overpass bridge (south-side), the boat ramp carpark and port entry bridge – address public safety, visibility issues and protection of sight distances;
- ❖ investigate options for establishing an appropriate ecological fire regime;
- ❖ implement a co-ordinated program to control the rabbit population throughout the foreshore area (eg. pindone baiting program) ensuring local community education and awareness;
- ❖ ensure that companion animal issues (eg. off-leash dogs) are addressed – no off-leash dogs in sensitive ecological areas including estuarine and fenced dune areas.

2. *Proposed Foreshore Open Space (western section near mouth of the Mill Stream)*

- ❖ construct proposed elevated lookout/ viewing platform on a landscaped mound near mouth of the Mill Stream (up to 10m LAT);
- ❖ construct rock batter/ revetment at mouth of the Mill Stream to define channel and control beach accretion in this location;
- ❖ establish minimal areas of mown lawn (consistent with Bird Hazard Guidelines) and develop a restored and enhanced Coastal Dune Heath (Open-scrub)/ Coastal Dune Forest (Open-forest) including mixed heath and mesophyll understorey elements;
- ❖ ensure that public safety, security and surveillance issues are addressed in the design – provide adequate lighting and maintain sight lines near entry points and along pathways;
- ❖ provide appropriate connections (foreshore pedestrian/ bikepath network) and controlled access to the beach;
- ❖ protect, enhance and manage public views of the expanded port facilities, airport and bay-side activities.

3. *Pedestrian/ bikepath multi-use access and enhancement of pedestrian foreshore/ beach linkages*

- ❖ construct pedestrian/ bikepath network along the entire length of the foreshore corridor from the Mill Stream (western end) to Penrhyn Road (eastern end) – design of pathway to meander through the corridor rather than follow a lineal;
- ❖ the meandering pattern and movement along the pedestrian/bikepath should reinforce the temporal and spatial changes in the landscape – oscillating from open spaces with expansive bay-side and port views to relatively enclosed spaces within taller foreshore vegetation;
- ❖ pedestrian/bikepath is more confined within the eastern portion of the site due to the proximity of the rail corridor;
- ❖ address public safety issues, security and surveillance and maintain safe distances from road-side traffic;
- ❖ ensure that lighting is adequately spaced and sited for the continuous illumination of pathways and the bay-trail – avoid light spillage/ glare and uplighting which may attract insects/ minimise bird-roosting opportunities (see Bird Hazard Guidelines);
- ❖ provide a network of enhanced public access linkages including the following:
 - controlled access points through dunes to beach (providing appropriate protection to soils and vegetation);
 - access ramp and pedestrian overpass (over Foreshore Road) linking to existing pathways in Sir Joseph Banks Park;
 - access to double boat ramp, carpark area and foreshore areas on rock face wall;
 - at-grade crossing near port entry bridge linking to existing pathways in Sir Joseph Banks Park;
 - optional direct underpass link at port entry bridge; and
 - spur connection to boardwalk over saltmarsh and inter-tidal sand/ mudflats to viewing platform.
- ❖ provide pedestrian crossings/ bike dismount areas at the entrance to the boat ramp carpark and at-grade crossing near the port entry bridge;

- ❖ construct a strong vertical element and integrated structural component of the pedestrian overpass bridge – this element could serve a dual role as a navigational aid (located on the centre main lead line of the channel);
- ❖ develop an integrated signage system to assist visitors in orientation and planning their itinerary, identification of landmarks, environmental issues and initiatives and guiding appropriate low-impact behaviour;
- ❖ provide opportunities to engage the public in community art/ sculptural elements;
- ❖ investigate future connections and linkages for the bay-trail.

4. *Proposed car/ trailer parking area and boat ramp (relocated)*

- ❖ construct a rock face wall, new car/ trailer parking area and double boat ramp, boarding jetty, public amenities, enclosed fish cleaning room and associated facilities;
- ❖ develop an adjoining ports operational area with tug berth wharves, depot and administration building;
- ❖ provide public access/ promenade along the rock face wall (from the pedestrian/ bikepath to a public viewing area);
- ❖ reduce overall pavement areas of carpark (ie. reduce heat island effect and glare) and provide a layered landscaped approach including canopy trees and low groundcovers;
- ❖ provide safe entry/ exit point and set-backs from Foreshore Road and minimise visual impact through appropriate landscaping/ screening;
- ❖ construct trailer bays in a porous natural finish (eg. stabilised aggregate finish or reinforced grass-cel) and drain to open wetland swales planted with native dry wetland grasses/ sedges) – connect sub-surface drainage to stormwater;
- ❖ establish well-maintained landscaped areas at the end of bays, intermediate bays and ancillary spaces using local native trees (incl. local mesophyll species for dense shade up to 8-10 metres high), groundcovers and accents (up to 500-1000mm height) – no open lawn areas are to be established in accordance with Bird Hazard Guidelines and Recommendations;
- ❖ provide appropriately designed lighting (investigate solar options), litter bins and an enclosed fish cleaning room

in accordance with Bird Hazard Guidelines and Recommendations.

1.7 Landscape Materials and Finishes

The following guidelines are provided for the development of appropriate landscape materials, finishes and planting palettes. All components must comply with the provisions of the Building Code of Australia and relevant Australian/ Industry and Best-Practice Standards:-

- **Concrete Paving or Asphalt** (multi-use pathways and pedestrian linkages) – options for a durable, broom-finished tinted/ natural colour concrete or continuous asphalt finish. Options for colour/ texture banding (concrete finishes) at recreational nodal points and/or community paving artworks (eg. mosaics).
- **Paving Aggregates** – selected porous or permeable paving aggregates in specific locations (eg. stabilised and compacted decomposed granite finishes).
- **Lookout/ viewing platform** (western end of foreshore area) – selected paved finish and large dimension, recycled (eg. wharf/ jetty timbers) or plantation timber components with safety hand-rails.
- **Low Boardwalk and Viewing Platform (saltmarsh and inter-tidal sand/ mudflats)** – robust, large-scale plantation timber components.
- **Car/ trailer parking bays** – selected porous, stabilised aggregate finish or reinforced grass-cel draining to open swales planted with native dry wetland species (grasses/ sedges) and sub-surface drainage connected to stormwater lines.
- **Signage** – establish a hierarchy of information in a consistent, bold colour and simple format (including graphics) in durable and vandal-resistant finishes.
- **Lighting** – selected pole mounted fixtures and/ or bollards in strong, durable/ vandal-resistant, contemporary styling, powder-coated or marine grade alloy finishes.

All lighting must be consistent with Bird Hazard Guidelines.
Provide anti-bird roosting devices on top of all pole mounted fixtures and light deflectors/ diffusers to minimise uplighting affects and attraction to insects (and birds).
Ensure that public safety, visual identification and visitor security are not compromised by these requirements.

- **Outdoor Furniture** – robust, sturdy design and vandal-resistant finishes:-

Recycled seating – customised maritime elements such as large wharf/ jetty timbers, wharf structures re-configured for seating, barriers, bollards, etc.

Bench seats, Picnic table/ seats and Picnic setting tables, Bicycle racks, bollards and bubblers – commercially available furniture must be vandal resistant, suitable for bay-side conditions and consistent with Council's requirements.

Litter bins – robust, easy to use, visually integrated (not obtrusive) with recycling options and consistent with Bird Hazard Guidelines and Recommendations for bird-proofing (ie. bin lids with an automatic closing mechanism). Regular maintenance/ removal of litter are essential.

- **Dune Protection/ Beach Access**

Pathway on flat upper dune profile – selected concrete finish or asphalt or compacted stabilised decomposed granite finish with timber (treated plantation pine) edging.

Timber Board and Chain Walkway on foredune seaward face linking the path to the beach – graded to max. 1:14 slope, slatted timber battens (wide dimension) and close spacing secured to galvanised steel chain-link and anchored to dune.

Protective Dune/ Vegetation Fencing – nominal 1.4 metres height treated pine posts and structural corner bracing (top rail/ diagonal brace) with 4-strand tensioned galvanised wire.

- **Composts and Soil Conditioners** – selected recycled products such as Greenlife Mulch and Compost, Botany Humus Mix and Nitro-Humus to be used in all garden beds and hind-dune restoration areas.

Proposed Planting Palette – Landscaped Areas:

(Note: For dune restoration strategy planting refer to Schedule of Species for Restoration, Enhancement and Reinstatement)

General landscape planting should enhance the visual and environmental quality of recreational nodal areas, the pedestrian/ bikepath corridor and the road-side corridor. It should also reinforce planting within the restored dune areas. This planting should create a repetition of form, texture, colour and balance reinforcing the public foreshore identity. This planting should be restricted to a simple palette suited to site-specific requirements with a relatively low maintenance regime.

- **Road-side and Median Strip Planting**

Accents:	Gymea Lily (<i>Doryanthes excelsa</i>) Beach Lily (<i>Crinum pedunculatum</i>)
Groundcovers:	Spiky-headed Mat-rush (<i>Lomandra longifolia</i>) Poa blue-grey form (<i>Poa labillardieri</i> var. <i>Eskdale</i>)

- **Planting in Car/ Trailer Parking Area and general recreational nodal areas**

Trees:	Bangalay (<i>Eucalyptus botryoides</i>) Tuckeroo (<i>Cupaniopsis anacardioides</i>) Port Jackson Fig (<i>Ficus rubiginosa</i>) Coastal Honeysuckle (<i>Banksia integrifolia</i>) Broad-leaved Paperbark (<i>Melaleuca quinquenervia</i>)
Accents:	Gymea Lily (<i>Doryanthes excelsa</i>) Beach Lily (<i>Crinum pedunculatum</i>)
Groundcovers:	Flax Lily (<i>Dianella caerulea</i>) Fine-leaf Dwarf Lomandra (<i>Lomandra longifolia</i> var. <i>Tanika</i>) Poa blue-grey form (<i>Poa labillardieri</i> var. <i>Eskdale</i>)

Automatic Irrigation

Automatic irrigation with approved back flow prevention devices, controllers (in vandal resistant boxes), appropriate zoning and pop-up sprinkler heads or drippers are to be installed in car/ trailer parking garden beds and planting within recreational nodal areas. Investigate options for storm filtration and water storage system for

re-use of site rainwater/ run-off for irrigation and establishment of dune restoration areas.

Grassed Areas

Open grassed areas are to be minimised in accordance with the Bird Hazard Guidelines. Mown grassed verges adjoin the pedestrian/ bikepath, Foreshore Road and other open spaces. The turf would preferably be a native cultivar with good coverage and quality, low maintenance and drought-tolerant and to some degree, salt-tolerant:-

Native Cultivars (for low to medium pedestrian traffic areas):

Sporobolus virginicus cv. Nathus Green

Sporobolus virginicus cv. Nioaka

Introduced Cultivars (for higher pedestrian traffic areas):

Couch *Cynodon dactylon* (selected cultivar)

Refer to *Schedule of Species for Restoration and Enhancement Strategy*.

1.8 Landscape Maintenance

Principles:

Landscapes continue to change and evolve over time. Modified natural landscapes are inherently unstable systems requiring considerable resources to develop to maturity. The public foreshore interface area and Foreshore Road require a long term commitment to providing a quality maintenance regime. This management approach should aim to engage the public and encourage a greater sense of public ownership.

Guidelines:

- establish a long-term commitment to landscape restoration, enhancement and management which is consistent with ESD principles and addresses day-to-day issues of litter control, rubbish dumping and anti-social behaviour;
- ensure that all areas are kept neat and tidy at all times and free of food and litter (especially at the boat ramp and carpark area) to reduce potential issues with bird hazards;
- implement appropriate maintenance and cleaning of all public landscaped areas, including public amenities, recreational facilities, the boat ramp and carpark and other public areas;

- ensure regular removal of wind-blown road-side litter which may accumulate against fences, in planting beds and within the dune vegetation;
- provide automatic irrigation to all planting beds within the foreshore open space (eg. car/ trailer parking area and entry/ nodal points and western parkland) and allow for watering/ phased establishment within dune restoration areas;
- landscape restoration, management and general maintenance must be an integrated exercise undertaken by qualified bush restoration/ regenerators, horticulturists, landscape and building services contractors (incl. weed management, pruning, insect/ pest control, feral animal control, mulching, watering, repairs, etc); and
- continue to develop co-operative strategies between the various managing bodies and stakeholders (eg. Sydney Ports, Botany City Council, Randwick City Council, NPWS, NSW Fisheries, RTA, Waterways, SACL and Port lessees).

1.9 Conclusions

There is a demonstrated need to address the broad range of social and environmental impacts which continue to affect the quality and integrity of existing public open space along these foreshores. These issues include beach and dune erosion, water quality, weeds, visual quality, road-side litter, rubbish dumping, public safety and security. The loss of integrity in this landscape reflects a broader loss of public ownership and stewardship over the land.

It is therefore important to recognise the opportunities provided by the proposed Port Botany Expansion. The proposal would provide the impetus to address these social and environmental issues in an integrated way. The proposed landscape treatment would protect and reinforce the natural qualities of the foreshore open space whilst addressing the distinctive identity of the proposed Port expansion. The approach would emphasise the interplay between these two elements, providing opportunities for viewing the port facilities and the natural bay/ foreshore setting.

Moreover, the quality of the broader foreshore and estuarine areas would be dramatically transformed by environmental initiatives including extensive restoration, enhancement and reinstatement of foreshore dune vegetated areas, inter-tidal sand/ mudflats, saltmarshes and seagrass habitat. This transformation of

environmental, landscape and visual qualities would establish the basis for improving recreational opportunities.

The proposal would provide a range of opportunities to revitalise and enhance the public foreshores for appropriate passive/ active recreation. Public access would be promoted with improved land-based recreational linkages and access for water-based activities such as boating and fishing. The pedestrian/ bikepath linkages including overpass and underpass connections and at-grade crossings, elevated viewing platform, boat ramp facilities, carparking area, boardwalk and interpretive facilities would substantially increase recreational opportunities. These public areas would be designed and maintained in a way which would significantly enhance environmental and visual qualities, engaging the public and encouraging a greater sense of public ownership.

Schedule of Species for Restoration, Enhancement and Reinstatement:

Vegetation Communities:

Coastal Dune Heath/ Open Scrub

Coastal Dune Forest

The promotion and maintenance of genetic integrity is a key principle of the restoration, enhancement and reinstatement components of the program (ie. use of local genotypes of species rather than introducing genotypes from different unrelated areas). However, the approach should not simply limit species selection to existing current site species and assemblages. Diversity in species composition and overall structural characteristics are to be promoted with the aim of developing long term durability and resilience.

Botanic Name	Common Name
Foredune areas:	
Grasses, Herbs and Twiners	
<i>Spinifex sericeus</i>	Beach Spinifex
<i>Atriplex semibaccata</i>	Half-berried Salt-bush
<i>Carpobrotus glaucescens</i>	Pig-face
<i>Isolepis nodosa</i>	Knobby Club-rush
<i>Sporobolus virginicus</i>	Sand Couch
<i>Tetragonia tetragonioides</i>	Warrigal Cabbage
Mid-dune areas:	
Shrubs:	
<i>Acacia longifolia</i> var. <i>sophorae</i>	Coastal Wattle
<i>Allocasuarina distyla</i>	Scrub She-oak
<i>Allocasuarina littoralis</i>	Black She-oak
<i>Banksia ericifolia</i>	Heath Banksia
<i>Breynia oblongifolia</i>	Common Breynia
<i>Dodonaea triquetra</i>	Common Hop Bush
<i>Leucopogon ericoides</i>	
<i>Leucopogon parviflorus</i>	Coast Beard-heath
<i>Leptospermum laevigatum</i>	Coastal Tea-tree
<i>Melaleuca armillaris</i>	Bracelet Honey-myrtle
<i>Monotoca elliptica</i>	Tree Broom-heath

Botanic Name	Common Name
Mid-dune areas (continued):	
Grasses, Herbs and Twiners	
<i>Billardiera scandens</i>	Apple-berry
<i>Hibbertia scandens</i>	Climbing Guinea Flower
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush
<i>Opercularia aspera</i>	Common Stinkweed
<i>Tetragonia tetragonioides</i>	Warrigal Cabbage
Sheltered hind-dune areas:	
Medium Trees:	
<i>Angophora costata</i>	Smooth-barked Apple
<i>Eucalyptus botryoides</i>	Bangalay
Small Trees:	
<i>Banksia integrifolia</i>	Coastal Honeysuckle
<i>Banksia serrata</i>	Saw-toothed Banksia
<i>Cupaniopsis anacardioides</i>	Tuckeroo
<i>Glochidion ferdinandi</i>	Cheese Tree
Shrubs:	
<i>Acacia longifolia</i> var. <i>sophorae</i>	Coastal Wattle
<i>Allocasuarina littoralis</i>	Black She-oak
<i>Breynia oblongifolia</i>	Common Breynia
<i>Clerodendrum tomentosum</i>	Hairy Clerodendrum
<i>Dodonaea triquetra</i>	Common Hop Bush
<i>Elaeocarpus reticulatus</i>	Blueberry Ash
<i>Endiandra sieberi</i>	Corkwood
<i>Leucopogon ericoides</i>	
<i>Leucopogon parviflorus</i>	Coast Beard-heath
<i>Leptospermum laevigatum</i>	Coastal Tea-tree
<i>Melaleuca armillaris</i>	Bracelet Honey-myrtle
<i>Monotoca elliptica</i>	Tree Broom-heath
<i>Notelaea longifolia</i>	Large Mock Olive
<i>Pimelea linifolia</i> ssp. <i>linifolia</i>	Slender Rice-flower
<i>Pittosporum revolutum</i>	Yellow Pittosporum
<i>Polyscias sambucifolia</i>	Elderberry Panax
<i>Pomax umbellata</i>	Pomax
<i>Rapanea variabilis</i>	Muttonwood

Botanic Name**Common Name**

Sheltered hind-dune areas (continued):**Grasses, Herbs, Forbs and Climbers**

<i>Actinotus helianthi</i>	Flannel Flower
<i>Billardiera scandens</i>	Apple-berry
<i>Cissus antarctica</i>	Native Grape
<i>Cissus hypoglauca</i>	Five-leaf Water Vine
<i>Clematis aristata</i>	Old Man's Beard
<i>Clematis glycinoides</i>	Old Man's Beard
<i>Dianella caerulea</i>	Flax Lily
<i>Dichondra repens</i>	Kidney Weed
<i>Eustrephus latifolius</i>	Wombat Berry
<i>Geitonoplesium cymosum</i>	Scrambling Lily
<i>Hibbertia scandens</i>	Climbing Guinea Flower
<i>Lepidosperma laterale</i>	Variable Sword-sedge
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush
<i>Maclura cochinchinensis</i>	Cockspur Thorn
<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass
<i>Opercularia aspera</i>	Common Stinkweed
<i>Oplismenus aemulus</i>	Soft-leaved Creeping Grass
<i>Pandorea pandorana</i>	Wonga Vine
<i>Parsonsia straminea</i>	Common Silkpod
<i>Pteridium esculentum</i>	Common Bracken
<i>Sarcopetalum harveyanum</i>	Pearl Vine
<i>Smilax australis</i>	Austral Sarsaparilla
<i>Stephania japonica</i> var. <i>discolor</i>	Snake Vine

References

- Australian Local Government Association (2000). *National Local Government Biodiversity Survey*.
- Avifauna Research & Services (2001). *Bird Assessment for Proposed Foreshore Beach Boat Ramp, Botany Bay* for Sydney Ports Corporation.
- Avifauna Research & Services (2002). *Proposed Port Botany Expansion – Assessment of Bird Hazards to Aircraft* for Sydney Ports Corporation.
- Beadle, N, Evans, D, Carolin, R and Tindale, M (1982 revised ed.). *Flora of the Sydney Region*.
- Benson, D and Howell, J (1998). Ecology of Sydney plant species Part 6: Dicotyledon family Myrtaceae *Cunninghamia: A Journal of Plant Ecology* Volume 5(4): 799-988.
- Benson, D and Howell, J (1994). The natural vegetation of the Sydney 1: 100 000 map sheet *Cunninghamia: A Journal of Plant Ecology* Volume 3(4): 677-1004.
- Benson, D and Howell, J (1990). *Taken for Granted: The Bushland of Sydney and its Suburbs*. The Royal Botanic Gardens Sydney.
- City of Botany, (2002). Development Control Plan No. 32 – Landscape (Draft).
- Cripps, E, Binning, C and Young, M (1999). *Opportunity Denied: Review of the legislative ability of local government to conserve native vegetation*. National R&D Program on Rehabilitation, Management and Conservation of Remnant Vegetation, Research Report 2/99, Environment Australia, Canberra.
- Department of Local Government (2000). *Practice Note No.1 – Revised: Public Land Management*.
- Land & Environment Planning and Environs Australia (Fallding, M, Kelly, A, Bateson, P and Donovan, I (2001), *Biodiversity Planning Guide for NSW Local Government*, prepared for the NSW National Parks & Wildlife Service under the NSW Biodiversity Strategy.

National Environmental Defenders Office Network (2000) *Disappearing Acts – A Guide to Australia's Threatened Species Law*.

National Parks & Wildlife Service (1997) *Biodiversity: Draft NSW Biodiversity Strategy*.

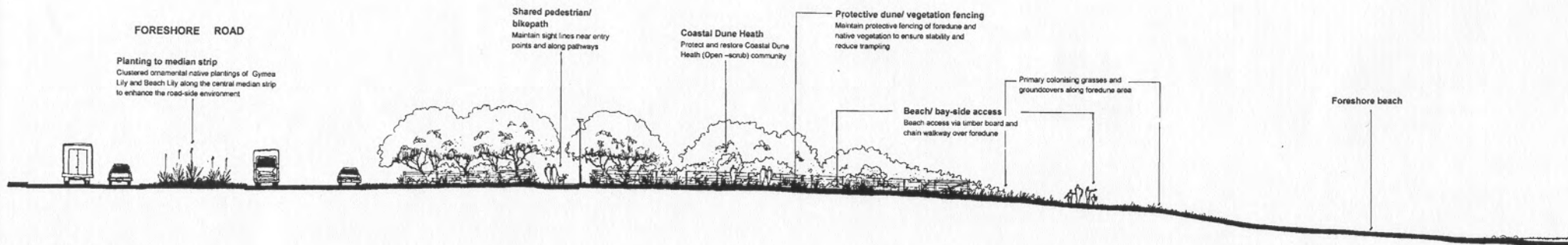
Nature Conservation Council of NSW (2001) *Bushland or Buildings? The Dilemma for Biodiversity Conservation in Urban Areas*. (ed. Newton, S) Proceedings of the 2001 Conference in Sydney.

New South Wales Scientific Committee (2000) *Threatened Species Conservation Act 1995, Schedules 1,2 and 3*.

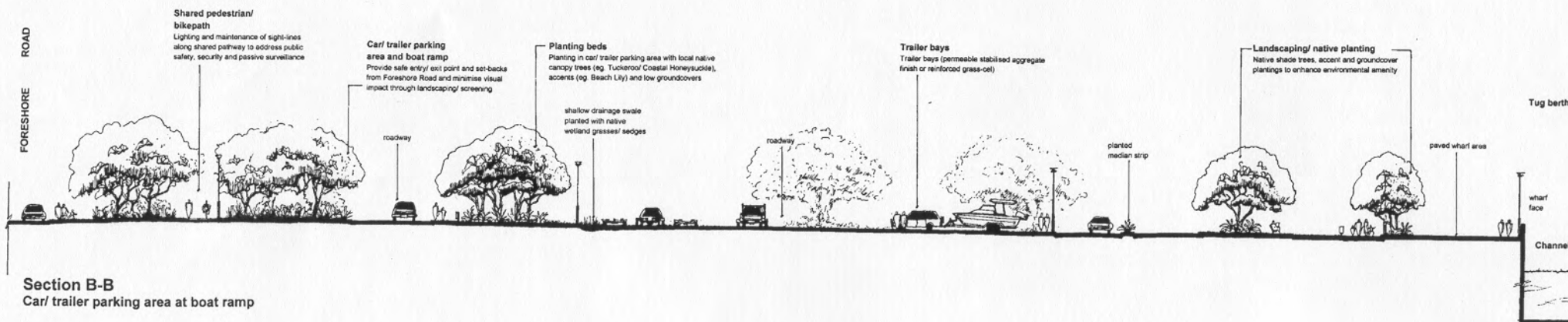
New South Wales Scientific Committee (2002) *Final Determination f990129a Kurnell Dune Forest in the Sutherland Shire and the City of Rockdale as an Endangered Ecological Community in Part 3 of Schedule 1 of the Threatened Species Conservation Act 1995*.

Ruting, N. 1979: *The Management and Rehabilitation of Littoral Rain Forests on the NSW North Coast*, Unpublished thesis, University of NSW.

APPENDIX A – LANDSCAPE SECTIONS



Section A-A
Foreshore area (western portion)



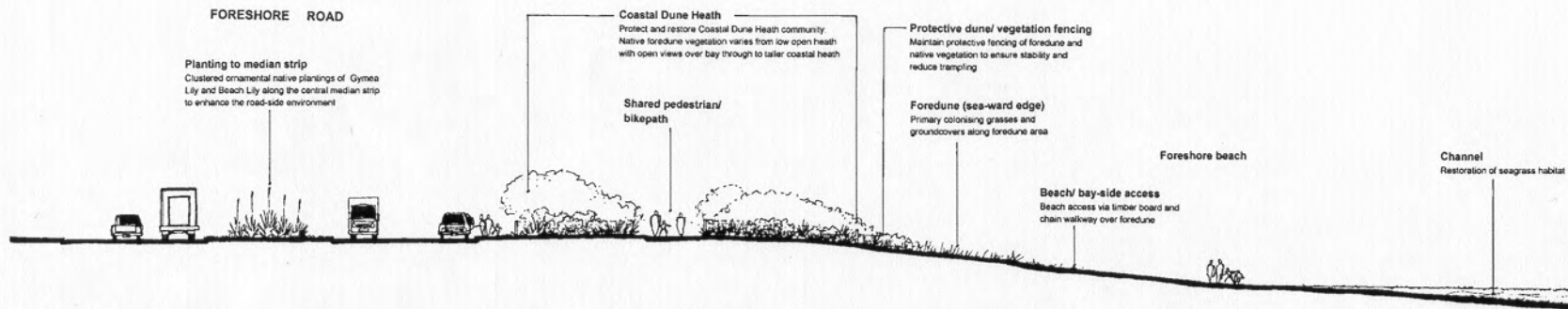
Section B-B
Car/ trailer parking area at boat ramp



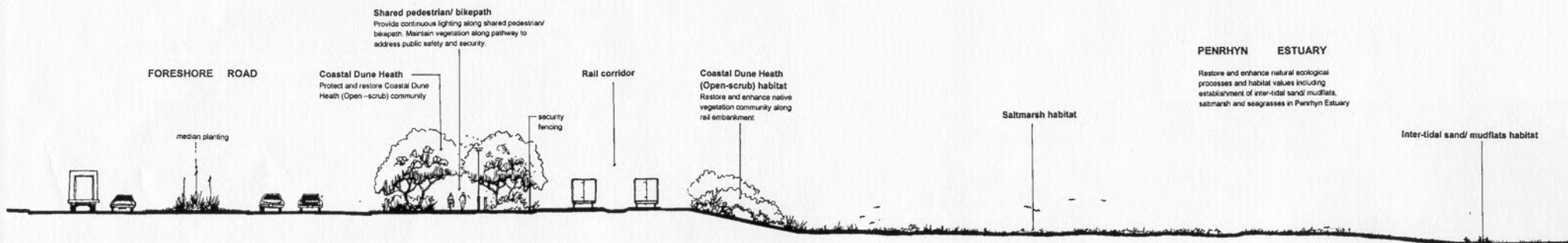
Port Botany Expansion EIS
for
Sydney Ports Corporation



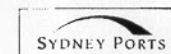
**Public Realm Design:
Landscape Sections**
Scale 1:200 @ A1
Date: 20 March 2003
Prepared by: LandArc Pty Limited



Section C-C
Foreshore area (south-east of boat ramp)



Section D-D
Foreshore area (eastern portion) and Penrhyn estuary



Port Botany Expansion EIS
for
Sydney Ports Corporation



Public Realm Design:
Landscape Sections
Scale 1:200 @ A1
Date: 20 March 2003
Prepared by: LandArc Pty Limited

APPENDIX B – LANDSCAPE PALETTE

Landscape Palette - Selected Images

PORT BOTANY EIS - LANDSCAPING

for

Sydney Ports Corporation

21 March 2003

prepared by LandArc Pty Limited



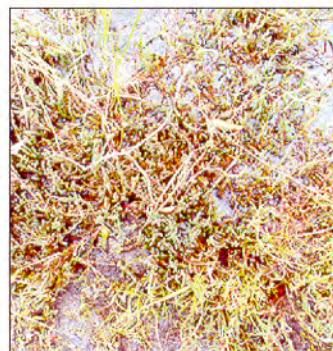
Beach Lily (*Crinum pedunculatum*)



Foredune colonising grasses and groundcovers (dom. *Spinifex sericeus*) [foreground] and Coastal Dune Heath (open-scrub) community [background]



Inter-tidal sand/ mudflats habitat



Saltmarsh community [detail]
Samphire (*Sarcocornia quinqueflora*)



Restoration of sheltered hind-dune areas to include Smooth-barked Apple (*Angophora costata*) and mixed dry and mesic understorey species



Tuckeroo (*Cupaniopsis anacardioides*)
- canopy tree/ shade planting in car/
trailer parking area (nursery specimens)



Gynea Lily (*Doryanthes excelsa*)
- planting in Foreshore Road
median strip and car/ trailer
parking area



Poa 'Blue-leaf Form' (*Poa labillardieri* var. 'Eskdale')
[foreground] and Spiky-headed Mat-rush
(*Lomandra longifolia*) [background]



Broad-leaved Paperbark (*Melaleuca
quinquenervia*) - canopy tree/ shade
planting in car/ trailer parking area



Gynea Lily (*Doryanthes excelsa*)



8 April, 2003

Mr Colin Rudd
General Manager Projects
Sydney Ports Corporation
PO Box 25
Sydney NSW 2000

SYDNEY PORTS CORPORATION

Level 8, 207 Kent Street
Sydney NSW 2000
PO Box 25, Millers Point
NSW 2000 AUSTRALIA
Phone: 61 2 9296 4999
Facsimile: 61 2 9296 4742

Dear Colin

Re: Port Botany Expansion – Channel Capacity

Please refer to our earlier discussions on the above matter.

This is to confirm that the existing navigation channel at Port Botany would have sufficient capacity to handle the expected ship movements to the new container terminal as well as the anticipated future movements to the existing berths at Brotherson Dock, the Bulk Liquids Berth and the Kurnell berths.

It is understood that the new terminal and the existing berths at Brotherson Dock are likely to attract around 1850 container ship visits per year when operating at capacity around 2025.

The above advice is contingent upon the maintenance of the existing navigation channel shown in Chart Aus 199 at a width of 216m (108m on either side of the centre) and the improvements shown on attached drawing No. B-PD-P-058C, being carried out at the time of construction of the proposed new terminal.

It is further understood that the largest vessel likely to call at the container terminals would have a capacity of about 8000 TEU having dimensions of 347 m LOA, 46 m breath and 14.5 m draft. Pilots to be afforded opportunities to gain further experience on ship simulators in order to familiarise themselves with the handling characteristics of these vessels.

Yours faithfully,

Bart Pacheco
Harbour Master

Sydney Water Corporation
564 Princes Highway
ROCKDALE, NSW, 2216
4 April 2003

Mr Robert Durant
Sydney Ports Corporation
PO Box 25
MILLERS POINT NSW 2000

Dear Robert

Re: Proposed Expansion of Port Botany

Meeting 19 February 2003 - Sydney Water / Sydney Ports

Sydney Water has reviewed the proposal submitted by Sydney Ports Corporation for the proposed expansion of the Port Botany terminal.

Based on a proposed increase in terminal area of approximately 65 ha and interpolation of demand figures from adjacent existing port operations it is concluded that between 40 to 45 ML/annum of water would be required for the expansion. The existing 450mm watermain in Penrhyn Road has capacity for the proposed development.

The sewer pumping station (SPS 570) located off Penrhyn Road also has the capacity to cope with the expected flow based on interpolation of flows from adjacent operations.

Water for fire fighting needs will need to be assessed separately.

Developer charges for the expansion are applicable and will be based on usage category, proposed consumption and land area."

If you require any further assistance please contact me on (02) 9551 4475.



Ron Thompson
Southern Area Water Operations