5 WOORIM SEMP PROVISIONS

5.1 Strategy and Objectives

The SEMP is now informed with the knowledge that the shoreline at Woorim shows a long term recession trend. Also, inputs to the study from the Council, EPA, Woorim SEMP Steering Committee, Woorim Beach Reference Group and community responses to the information presented progressively during development of the SEMP have provided policy direction on the objectives as follows:

- There is demand for restoration and sustainable maintenance of the beach along the whole Woorim shoreline to maintain the natural character and processes of the beach/dune system. This expectation requires a substantial increase in the sand volume in the beach and dune system along about 1 km of beach with associated improvement of the beach and effective dune rehabilitation and management along the whole SEMP project area covering several kilometres of the Bribie Island east coast at and adjacent to Woorim township; and
- There is a demand for protection of the public facilities and residential and surf club development located on the dune behind the beach and dune system.

The cost of works to achieve this is relatively high within normal Council provisions and determination of the best strategy and specific design objectives requires careful consideration of the key issues in order to identify the most feasible and cost-effective options. These objectives and the available options are discussed below.

5.2 Option Feasibility Assessment

Two fundamental approaches may be considered, namely:

- **Reactive action:** Continue forward as before with minimal ad hoc measures in response to erosion problems and adopt a 'wait-and-see' approach with regard to the future condition of the beach; or
- **Implement a planned program of works and management action:** Undertake significant engineering works and management action designed and planned to restore the beach, maintain the dune and provide protection to the properties.

Based on the present understanding of the processes and behaviour of Woorim beach, it is considered most improbable that any improvement in the condition of the beach will occur naturally, although there will continue to be normal fluctuations in the level of the beach from time to time associated with storm erosion and subsequent beach recovery. To the contrary, further degradation will occur as the erosion process continues.

As such, continuing with minimal ad-hoc action would result in the beach and parts of the dune remaining in poor condition such that:

- For substantial periods of time, beach levels will be low and high tides and waves will impinge on the base of the dune scarp, with no usable beach available for access and recreational use by the community. At such times, there is a safety risk particularly for young children;
- The beach and dune will continue to erode over time and the shoreline will recede, threatening Rickman Parade and the adjacent development properties;
- The aesthetic, recreational and environmental value of the beach will continue to be degraded, significantly reducing the economic and social values of the beach for the local and regional community; and
- The shape and function of the dune in trapping sand as a buffer against storm erosion events will be compromised.

While it is not feasible to quantify these risk factors within the scope of this study, it is noted that:

- The value of the housing located along Woorim is approximately $40 million;
- Local residents have purchased their properties on the understanding that the land use controls and zoning are appropriate;
- Bribie Island is a popular tourism focus and Woorim is widely used by the local and regional community for recreation. Many of the houses along Woorim are rented to people who holiday there because of the benefits offered by the beach and its amenity.

The consequences of taking no comprehensive management action and the general considerations outlined in Chapter 4 clearly identify the need to introduce more sand to the beach for beach restoration and protection of the properties. This requires extensive beach nourishment and associated dune rehabilitation action.

As such, it is strongly recommended that the option to implement beach nourishment, with associated appropriate dune management and maintenance measures, be adopted as the primary action to restore and maintain the beach and protect the development. Provision in the SEMP may be needed also for additional action to provide back-up protection to the erosion prone development along the southern section of Rickman Parade, in either the immediate or longer term future, depending on the timing, extent and sustainability of the proposed nourishment. That is, contingency provision in the SEMP is recommended to allow for protection in the form of a seawall to be implemented along only the southern section of Rickman Parade in the event that, for presently unforeseeable reasons, the initial or ongoing nourishment as designed and implemented is insufficient for complete protection.

Table 5-1 sets out a summary assessment the feasible options, based on the general considerations described in Chapter 4. Details of the recommended action are discussed below.

Table 5-1 SEMP Options Assessment

Woorim SEMP Design Philosophy: Beach Amenity/Property Protection
- To preserve the natural character, amenity and environmental values of the beach and dune system.
- To provide protection to the existing development, based on rejection of planned retreat as a feasible option.

Option	Pros	Cons	Conclusions/Recommendations
DO NOTHING	• Low cost • Natural processes allowed to occur	• Severe shoreline erosion will occur • Established road, residential and public development infrastructure will be eroded within years to decades • Woorim residents will lose homes • Large social and financial cost of with problems arising	• 'Do nothing' with planned retreat is not an acceptable option
1. Sand Replacement by nourishment of beach	• Adds sand and beach width • Provides protection to property • Increases recreational / visual amenity • Address sand differential (loss)	• Not permanent without ongoing maintenance or other works because shoreline experiencing progressive erosion • Some minor disturbance to beach and nearshore environment/ecology	• Recommended as essential component of the SEMP • Council commitment to 'in perpetuity' funding of maintenance nourishment needed • Immunity from erosion threat to property provided may depend on other works (eg seawall) in some local areas
1A Sand sourced from PBC dredging from shipping channel or seabed adjacent to Woorim.	• Convenient (local dredging operator) • PBC experienced and set up for it • Cost effective (minimal establishment cost) • Sand is available • Short term environmental disturbance	• Subject to PBC agreement & priorities • Uncertainty about timing and extent of future channel dredging • Any sourcing of sand from non-channel dredging may need extra approval (environmental constraints).	• Recommended as favoured option • Negotiation with PBC needed re: o Quantity o Duration o Cost • Consider larger quantity as initial beach rehabilitation followed by 'top up' possibly from other source(s) – refer 1B & 1C.
1B. Recycle sand from Skirmish Point by dredging	• Convenient (local source) • The sand is there with no net gain/loss i.e. Maintains 'status quo' (recycles sand). • Could be permanent system – cost effective • Under Council management and control • Integrate with and supplement PBC dredging supply	• Possible environmental constraints (refer Chap 2 of report) • Distance / Cost (booster pump needed) • Trucks not feasible • Long time of disturbance to beach	• Recommended as potentially effective option • Rejected by DPI as area zoned as fish habitat • Recommend that Council continues to investigate feasibility and options for this as a supplementary sand source.
1C. Sand sourced by dredging from onshore area within 1.0-1.5km from Woorim	• Convenient (local source) • Could be permanent system – cost effective • Under Council management and control • Integrate with and supplement PBC dredging supply	• Possible environmental constraints • Distance / Cost (booster pump possibly needed) • Trucks not feasible • Long time of disturbance to beach	• Recommended as potentially effective option • Requires further investigation to confirm source and quantity • Requires environmental assessment
2. Seawall along section within 'immediate' storm erosion threat zone	• Protection of property 'ensured' (insurance) • Provides 'peace of mind'. • Could be buried (provided there is also beach nourishment) • Could be lower standard/cost when combined with nourishment • Could be lower standard if located further landward • Possible to build only where and when needed	• Cost will take money away from funds for sand nourishment • Detrimental to long term beach if no nourishment • Alters/damages dune dynamics if exposed on dune face • Construction involves disturbance to dune	• Recommend constructing initially only along zone under immediate threat at southern end of Rickman Parade • Extend to other areas only when erosion reaches road. • 'Immediate hazard' distance assessed to be approx 15m from toe of dune • Needs costing and provision set aside for contingency funding for parts built when threatened with erosion • 'Immunity' level relates to beach amenity needs (insurance of beach) • Consider buried sand bag wall (cheaper if further landward / lower design standard).
3. Groyne(s) / Headland	• Provides protection and stability to local beach area within its length. • Provides 'stability' to (updrift/north) beach alignment (nourishment more cost effective) • Can be designed to benefit where needed • Less disturbance to dune/beach	• Shifts negative differential to south • More intrusive (amenity/visual) • Detrimental to south if no nourishment • Takes money from nourishment • Uncertainty about process / design / effectiveness • Limited length of influence (groyne field likely to be needed)	• May stabilise beach alignment north of Surf Club if several groynes used, but REJECT because of: o Visual and beach access impairment o Doesn't reduce the need for or quantity / cost of nourishment. o Cost impost additional to nourishment o Exacerbates downdrift erosion even with nourishment o Provides no protection from storm erosion
4. Breakwaters / Artificial Reefs	• Provides 'stability' to (updrift/north) beach alignment (nourishment more cost effective) • Can be designed to widen beach and provide shelter from waves where needed • Less disturbance to dune/beach than groynes • Less visual impairment than groynes	• High cost • Limited length of influence (breakwater field likely to be needed) • Further investigation needed for design (could exacerbate erosion to the south).	REJECT because of: • High cost / low cost-effectiveness • Uncertain adverse effects due to longshore tidal current • Adverse impact on surf / surfing

5.3 Beach Restoration by Nourishment

5.3.1 Overview

Restoration of the beach will require the importation of additional sand. Potential sources and quantities of the sand are discussed in Chapter 4 and specified below. It is recommended that the sand be placed predominantly along the beach and nearshore area between the Surf Club area and around Fourth Avenue and allowed to disperse both alongshore and across-shore under the prevailing waves and currents. As such, the sand will be integrated into the normal active system and the beach will adopt its natural dynamic shape, subject to normal erosion and accretion cycles associated with storm erosion and subsequent beach recovery.

In this process, the beach will be widened and, as a reasonable width of dry sand develops, sand will blow back to the dune where, with appropriate management, establishment of Spinifex grass and trapping of sand in the foredune will occur. Management measures to enhance recovery of the natural dune building process are thus integral to the nourishment program.

In the course of gradual assimilation of the new sand into the beach system, it is expected that:

- The sand will be distributed naturally along the beach by the waves and currents and provide benefit to the other parts of the beach to the north and south over time, being the most cost-effective means of distributing the nourishment to the natural beach shape; and
- The placed sand will develop erosion scarp features from time to time. It is important that the community is advised of this and understands that it is part of the design process, and that the sand is not being 'washed away', as is commonly thought. However, it is acknowledged that around 35,000 m^3/yr is naturally transported away to the South.

5.3.2 Beach Nourishment Design Requirements

As a first assessment, the likely minimum quantity of sand required to restore the beach would be about 225,000 m^3. This may be considered in the context that:

- this quantity may be available and within reasonable cost constraints of Council; and
- It represents approximately 5-6 years life of improvement along the key 1km stretch of beach.

It must be recognised that the sand placed on the beach will be integrated into the natural processes of erosion from the beach during storms and subsequent gradual return to the beach by the swell waves. Thus, the sand will be distributed both alongshore and across the profile out to water depths of at least 6-8 metres and the realistic initial benefit of a nourishment quantity of 225,000 m^3 in terms of beach width will probably be around 25-30 metres.

This initial nourishment should have a beneficial effect for up to 5-6 years, although dispersing gradually along the beach. However, progressive loss of sand will occur due to the longshore transport gradient along the beach. Ongoing maintenance nourishment is required to maintain the beach at its improved level. This could be achieved either by annual placement of about 35,000 m^3/yr or regular placements of equivalent volumes every 2-3 years. The former approach would provide the more consistent beach conditions.

The major issues affecting the feasibility and cost of beach nourishment are:

- availability of suitable sand in the quantities needed;
- the source location(s) and constraints on obtaining it (eg environmental / logistics / ownership / cost);
- sand transportation methods (dredging / trucking); and
- cost effectiveness and cost-benefit.

Review of potential sand sources and discussions with PBC indicate that:

- sand derived from onshore sources as part of the PBC channel dredging program offers the most cost-effective solution for the foreseeable future, at a cost significantly lower than would otherwise be feasible using other sources or contracted dredging alternatives; and
- sand recycled from Skirmish Point would be effective and within reasonable cost constraints although possibly twice the cost of the PBC option. However, at present, this option is constrained by the zoning of the potential source area as Fish Habitat Reserve and has been rejected by DPI Fisheries. Nevertheless, it is recommended that this option be further assessed by Council over time as a possible contingency supply should problems arise in obtaining offshore sand.

5.4 Seawall Protection

There may be a need for protective seawall construction along about 150m of the dune scarp at the southern end of Rickman Parade, most particularly the southernmost 50m. This may be required if the timing and/or extent of the nourishment are such that adequate immediate or future protection of the development from major cyclone erosion is not achieved. If required, any such seawall should be located as far landward within the dune as practicable such that it would be covered by the dune under most circumstances except when exposed during severe erosion. This is recommended for inclusion in the SEMP only as a contingency and any seawall construction should be considered only where and when necessary to protect Rickman Parade should the top of the scarp reach within 5m of the road. The cost that would be involved in such action (approximately $0.5 million for about 150m of seawall) should be directed towards the nourishment to the maximum extent possible.

Figure 5-1 Section requiring short term seawall protection

Where seawall protection of the development is required, an objective should be to achieve a design standard similar to that illustrated in Figure 5-2, providing for:

- An adequate height of structure to about RL+3.5m (AHD);
- A flexible structure that may adapt its shape to the conditions;
- A toe foundation embedded soundly in the upper beach such that it will not be significantly undermined during severe wave attack;
- A backing filter layer (or layers) of either fine rock (gravel) and/or geotextile fabric over the sand, grading up to the larger armour rock in such way that neither the sand nor the finer rock may be lost through the structure during wave attack;
- Two layers of armour rock (or geotextile bags filled with sand) placed to minimise wave uprush and act to absorb the wave energy;
- A suitable design for the ends to protect against 'out-flanking' by erosion.

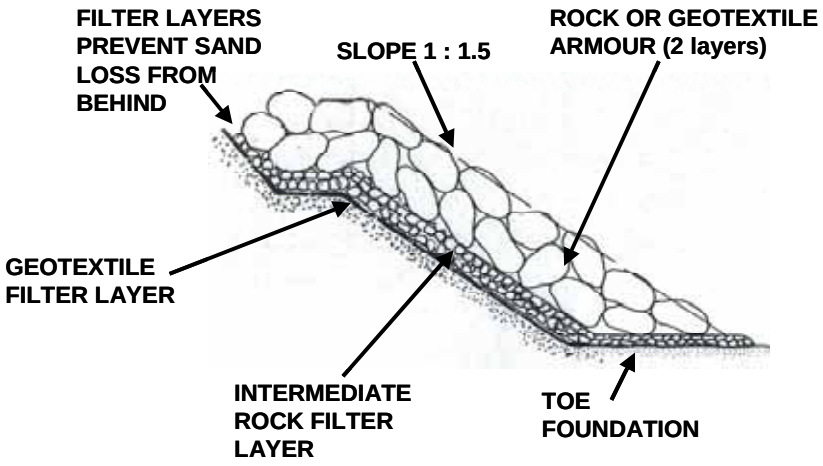


Figure 5-2 Typical Seawall Design Section. Rock material may be replaced by sand filled geotextile units to suitable equivalent design

The seawall should be constructed as far landward within the main dune as is practicable to maximise the natural movement of the sandy beach and foredune system. It is recommended that the seawall be located at the base of the main dune scarp such that no more than 5m width of dune crest exists between the top of scarp and the road edge (refer Figure 5-3). Seawall construction may be facilitated by the temporary installation of sheet piling to hold the dune face sand while excavation and construction take place. The seawall may then be covered with sand such that it is exposed and acts to limit erosion only during severe storm erosion events.

5.4.1 Dune Rehabilitation and Management

While the northern part of the dune system is in relatively good condition, the dune along the more southern parts of the beach at and near the surfclub is in poor condition in that extensive areas are eroded with a bare sand dune scarp and no space for foredune development. The native dune plants there are degraded or non-existent as a result of one or more of the following:

- Continued erosion because nourishment there to date has been insufficient to build the beach;
- Inadequate beach width to dry and act as a source of wind-blown sand;

- Inadequate control of pedestrian access;
- Location of pedestrian control fencing too close to the base of the main dune erosion scarp.

The existing foredune needs to be managed and the highly degraded areas rehabilitated and managed to facilitate the natural dune processes. This requires adequate space and suitable conditions for vegetative cover, protected from excessive pedestrian interference. This will restore and maintain their function in trapping wind-blown sand in a manner consistent with the natural processes. Accordingly, it is recommended that:

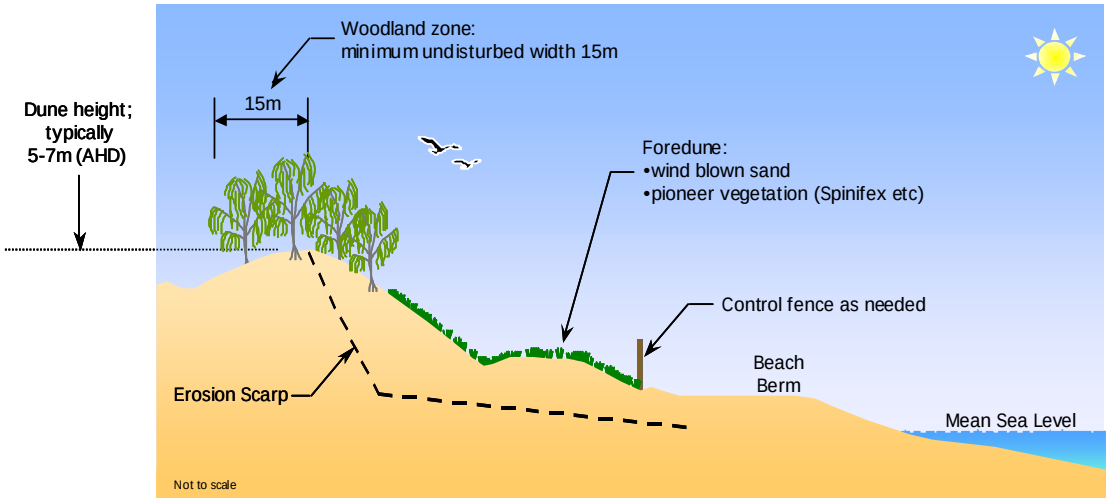
- the existing dune and vegetation status be assessed and action taken as part of the nourishment works and subsequent natural action to provide sand into the foredune and to establish and maintain suitable native plants in accordance with EPA guidelines; and
- incipient foredunes that develop along the beach be managed in accordance with EPA guidelines to establish and maintain suitable native vegetation (eg Spinifex) to prevent wind erosion problems as the nourishment works contribute to increased sand along the upper beach.

The conceptual guidelines for management of the dune system are illustrated in Figure 5-3. This shows the natural system protected as appropriate by control fencing as well as the interim action needed both as part of the initial nourishment works and following major erosion events, indicating the nature and location of control fencing, vegetation development and surface mulching that may be involved.

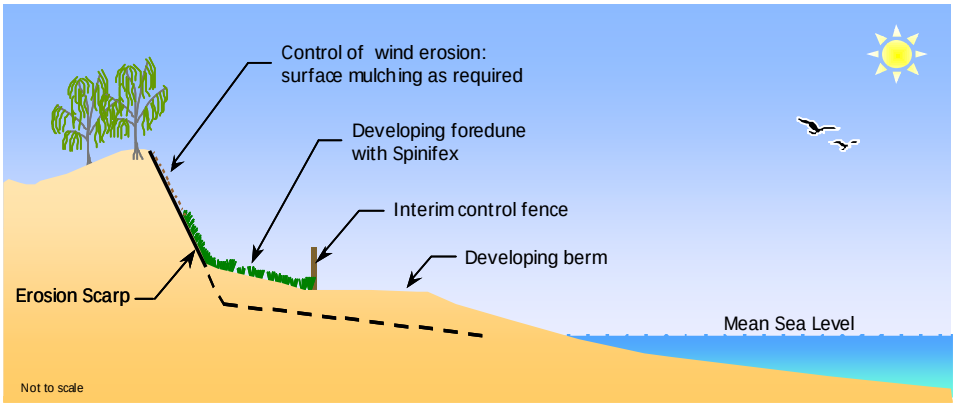
5.5 Impacts of Climate Change and Sea Level Rise

Over time (future decades), Woorim will experience the effects of climate change and sea level rise. The shoreline will erode more quickly and beach conditions will tend to become worse, primarily due to sea level rise. The ongoing nourishment program will overcome this problem, but will need an increased quantity of sand in the future re-nourishment works to provide long-term sustainability. There remains considerable uncertainty about the rates and impacts of future accelerated sea level rise. As such, the preferred most cost-effective option at this stage is to maximise the initial nourishment quantity to the extent feasible, within cost constraints, and then monitor the future needs.

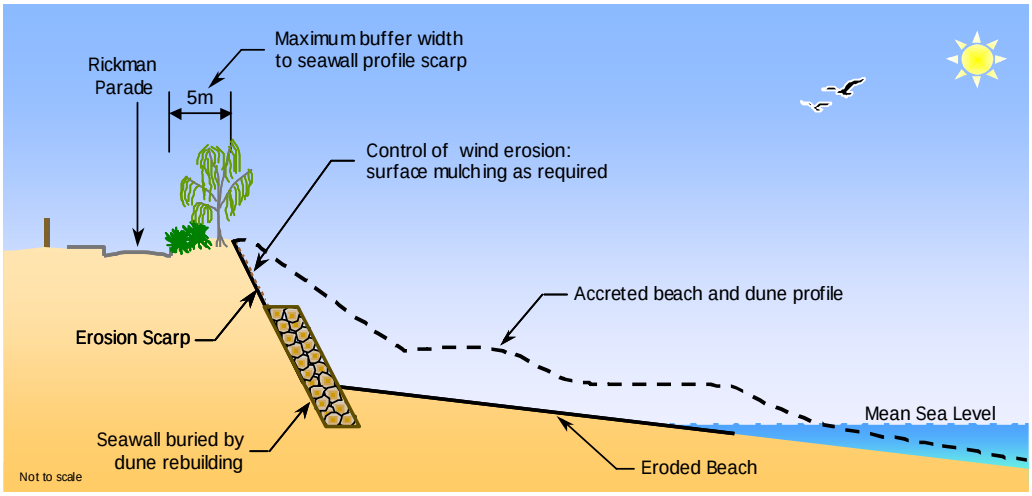
This highlights the need for continued monitoring and regular review of the SEMP provisions in terms of the recommended nourishment quantities. As such, the quantities set out herein should be considered minimum requirements that may need to be increased in the future as the effects of climate change manifest.



A. Natural Dune



B. Post-Erosion Management Action



C. Seawall Section

Figure 5-3 Dune Management Guidelines

5.6 Beach Nourishment Works Program

5.6.1 Beach Restoration

To overcome the erosion problem at Woorim by beach nourishment works, two specific actions are needed:

- to restore the beach, the sand previously lost must be replaced. The minimum volume of sand required is considered to involve 225,000 m^3 distributed along about 750m of the beach.
- to maintain the beach in its improved state, providing for the present trend of erosion and impacts of sea level rise, involving regular ongoing maintenance nourishment at an average annual rate of at least 35,000 m^3/yr .

In the short term, assistance of the Port of Brisbane Corporation (PBC) has been identified as a suitable source of the initial quantity of sand as an adjunct to of its channel dredging program. This initial nourishment might involve placing the available sand both on the beach and nearshore out to a depth of up to 6-8m along about 750m extending north from the surf club and allowing the natural wave action to distribute it further along the beach (Figure 5-4). Thus, it must be expected that the initial beach width formed by the dredging will erode and reshape over time as the beach establishes its new equilibrium shape.

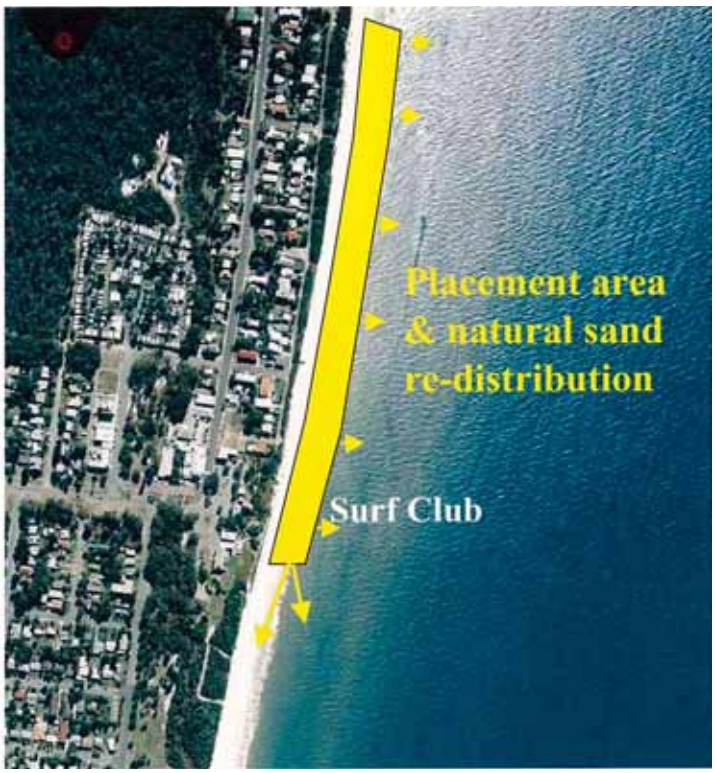


Figure 5-4 Conceptual Design Placement of Sand

5.6.2 Ongoing Maintenance Nourishment

The future maintenance requirement associated with ongoing sand loss from the beach is likely to be a minimum of 35,000 m^3/year. A greater amount may be needed if monitoring indicates that ongoing

progressive net loss of sand is occurring, particularly with the effects of sea level rise in increasing shoreline erosion. The most cost-effective way to achieve that requires both:

- Negotiation with PBC about their continued involvement in beach nourishment. Discussions undertaken as part of this study have confirmed their intention to continue assistance for the foreseeable future and this can be within existing licences and approval conditions; and
- Investigation of options to obtain sand from onshore sources. Recycling sand from Skirmish Point offers the most feasible and effective option, but is considered not acceptable by DPI Fisheries because of its fish habitat status, despite being accreted coastal land above high water mark. The possible impacts with respect to RAMSAR may also need to be investigated. It is recommended that Council continue to assess this option in liaison with approval agencies.

5.6.3 Investigation and Review Program

There is a need for further investigations and monitoring in order to:

- gain more basic knowledge of the beach processes at Woorim, and
- monitor the response to the proposed restoration works to assess their performance and guide future action.

A program of ongoing investigation and beach monitoring as discussed below should be implemented by Council to monitor beach behaviour and response to works as a basis for future action planning. Some of the beach monitoring work to add to the available knowledge of how the beach behaves can be implemented immediately at low cost, while location of the sand source and more comprehensive monitoring surveys require allocation of significant Council funds.

Low Cost Beach Monitoring

It is feasible to undertake simple but effective low cost beach monitoring using the previously implemented COPE procedures. This would involve input from Council staff, surfclub members or volunteer residents, with minimal technical knowledge or expertise, prepared to undertake daily observations. Typically, it would include:

- Volunteer daily observations of waves, currents and sand transport at Woorim using established observation techniques for reasonable accuracy (Patterson & Blair 1983), involving about 20-30 minutes each day.
- Regular (say monthly) survey of selected beach cross-sections using simple techniques.

Comprehensive Monitoring Surveys

Comprehensive monitoring needs to be undertaken by appropriately qualified and experienced specialists, with a view to quantifying the processes taking place and the overall response of the beach system to the nourishment works, providing accurate and defensible data for consideration and assessment in any future action. This would involve detailed beach and offshore level surveys, initially six (6) monthly and subsequently less regularly, along the whole Woorim unit to quantify both the cross-shore sand movements (offshore dispersion of the nourishment and storm erosion) and the performance of the beach nourishment works

5.7 Recommended Planning and Regulatory Controls

5.7.1 Woorim Beach and Dune Management

Apart from the need for restoration of the beach and rehabilitation of the dune as discussed in detail in this report, the present management practices undertaken by Council along the developed part of Woorim appear generally suitable. Key aspects that require continuing attention include the following:

i. No sand is to be removed from the beach/dune system (onshore and offshore);

ii. Where erosion has cut back to the toe of the main dune scarp, the developing foredune area should be protected from pedestrian access by control fencing in the heavily used parts of the beach, particularly near the surfclub, to promote conditions for vegetation establishment, consistent with Figure 5-3;

iii. The existing dune vegetation is to be protected from excessive pedestrian access as appropriate to prevent wind erosion and enhance native vegetation diversity and the natural dune ecology along the dune system, consistent with Figure 5-3;

iv. Should new building be undertaken within Woorim township, consideration should be given to excavating sand from the development site and placing it in the beach system, with building fill being imported as needed from outside the beach/dune system;

v. Controlled public paths and/or stairs should be provided at suitably spaced locations to ensure convenient and safe access to and from the beach.

5.7.2 Activities in Undeveloped Dune Areas

It is recommended that Council develop guidelines to regulate works and activities within potential erosion prone areas along those presently undeveloped parts of the Woorim SEMP project area. This may involve integration with relevant state planning provisions. The dune system should be managed in accordance with the methods and procedures recommended by EPA. Such management may include planting and protection of native dune vegetation, clearing of weed species and provision of controlled access across the dunes.

General regulations to protect the natural dune system could include:

i. No structures may be erected or interference caused within the erosion prone dune, beach or nearshore areas. Such structures and interference includes buildings, roads, carparks, facilities, services, seawalls or other equivalent works as well as direct removal of sand or damage to dune vegetation causing wind erosion;

ii. No sand is to be removed from the beach system (onshore and offshore);

iii. No sand is to be removed along the dune system and the dune vegetation protected as needed to prevent wind erosion;

iv. No subdivision of land to provide additional building lots which lie wholly or partially within the erosion prone area will be permitted unless it can be shown that the buildings provided for in the subdivision can be located wholly outside the erosion prone area.

v. Should new development be approved over areas with beach quality sand, consideration should be given to excavating sand from the development site and placing it on the beach system, with building fill being imported as needed from outside the beach/dune system.

5.8 Recommended SEMP Program and Cost Estimate

A summary of the recommended coastal engineering and management actions for Woorim is set out in Table 5-1, including a summary of likely costs.

It can be seen that the planning, works, monitoring and project management for the initial beach restoration would cost about $1.48 million, on the basis that PBC can assist with the nourishment. PBC has indicated that this will be practicable and feasible. This would then need to be followed by ongoing maintenance expenditure of about $430,000 per year for nourishment and dune management, plus about $70,000 per year for survey monitoring and project management. It is likely that the monitoring survey costs could be reduced over time. The actual costs of implementing the works may vary somewhat from those depending on the adopted scope, circumstances and timing of the works and activities undertaken.

Additionally, should circumstances evolve requiring a section of seawall be necessary along about 150m of Rickman Parade, a cost of about $0.5 million could be involved, equivalent to a quantity of about 100,000 m^3 of nourishment sand. Careful consideration of the need for such a seawall should be undertaken in the context of the feasibility of directing those funds to nourishment, affected potentially by (for example) availability of suitable nourishment sand at reasonable cost.

It should be noted that non-action, or works inconsistent with the recommended SEMP strategy, may be inefficient and involve greater cost in the long run. As an example, construction of a protective seawall without sand nourishment will be detrimental to the beach and may involve considerably greater future socio-economic losses and expense on seawall maintenance than would be needed with the beach restored.

Table 5-2 Summary of recommended restoration and management actions

The Problem	Long term progressive beach erosion.	Ongoing nourishment.	Dune vegetation management	Limited records of beach processes and behaviour.	Project management to ensure satisfactory completion.	Protective seawall (if required)
Do Nothing	Woorim would continue to be starved of sand; erosion would continue with reduced beach area and erosion threat to Rickman Parade and property.	Sand volumes will not provide enough protection to withstand storm events or cater for sea level rise.	Continued weed growth smothering and over growing struggling native plants.	A collection of anecdotal observations of beach behaviour lacking quantified data.	Responsible use of public funds must have milestones of achievement	Rickman Parade threatened with erosion: • South end immediate • North end within 5-10 yrs
Proposed Action	Initial nourishment 225,000m^3 .	Maintenance renourishment 35,000m^3/yr from Offshore and/or onshore sources	Woorim dune rehabilitation and vegetation management	Woorim monitoring	Project Management	Initial limited seawall construction south from 2nd Ave. Any further construction only as needed
The Outcome	Sand dredged onto Woorim to provide sufficient sand to restore the beach, provide property protection and form an incipient dune.	Provide sufficient sand to maintain the improved beach.	Dune vegetated with native species to provide stability from wind erosion, sand trapping capacity and natural dune habitat	Records of beach before and during accretion in correlation to the works being undertaken.	Scheduled tasks completed on schedule and on budget to the satisfaction of the community, council and EPA..	Protection of southern end of Rickman Pde and property subject to immediate erosion threat
Cost Estimates (based on 2007 costing, future years need to allow CPI increases)	$0.2M design and approvals $1.25M works	Ongoing program at $0.35M/yr	Ongoing program at $10k/yr	5 year Monitoring program $0.25M at $50k/yr	5 year Project Management $0.1M at $20k/yr	Initial works $0.5M Possible future works up to $2.0M if nourishment is inadequate
Timing	2007/08 – 2008/09	2009/10 - ongoing	2007/08 - ongoing	2007/08 - 2011/12	2007/08 - 2011/12	2008/09-2009/10
Funding Sources	Council allocation with EPA support	Council allocation with EPA support	Council allocation with EPA support	Council allocation with EPA support	Council allocation with EPA support	Council allocation with EPA support

2007/08	**$0.27**	$0.2M			$50k	$20k	
2008/09	**$1.26M**	$1.13M		$10k	$50k	$20k	$ 50k
2009/10	**$0.88M**		$0.35M	$10k	$50k	$20k	$ 0.45M
2010/11	**$430k**		$0.35M	$10k	$50k	$20k	
2011/12	**$430k**		$0.35M	$10k	$50k	$20k	