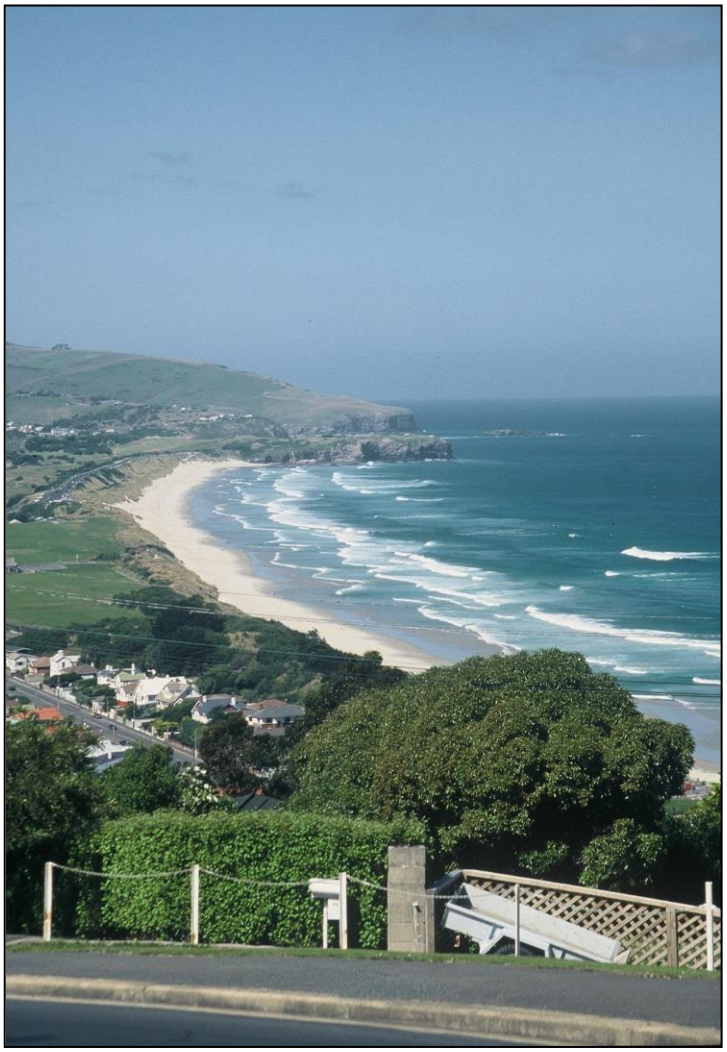
A SUBMISSION ON THE FUTURE MANAGEMENT OF OCEAN BEACH DOMAIN



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Executive Summary

Ocean Beach Domain has a long and chequered history of coastal zone management that dates back to the earliest impacts of Pakeha settlement in Dunedin during the nineteenth century. The documentation of historical and physical change at Ocean Beach Domain provides a compelling and insightful overview of coastal zone management issues in New Zealand and indeed for coastal areas throughout the globe. However, the lessons of historical change to the physical attributes of coastal management have proven to be hard ones to learn.

After more than a century of management, Ocean Beach is in much the same precarious predicament as a major coastal buffer that it was more than a century ago. Moreover, the expanded development of Dunedin as an urban centre has now placed greater pressure on the site as a key physical and ecological barrier to the effects of storm surge and erosion events. In the present sea level rise environment with its projected scenario's of social, economic and environmental impact, urgent attention must be given to protecting the coastal zone for the future security of the city's welfare and those of its citizens. Greater strategic thinking and planning must now be implemented that changes the historical course of Ocean Beach Domain.

Land use and changes in environmental consciousness combined with better geophysical understanding must be made to implement a long term strategic plan that halts the decline in the coastal environment of Ocean Beach Domain. The shift of consciousness must accompany a paradigm shift recreational and social patterns that should not be looked at in isolation to the use of Ocean Beach Domain, but discussed and consulted at a wider strategic level for the entire city. Ephemeral construction, ad hoc reaction to sporadic events and short term planning needs to be abandoned in favour of long term planning for physical, social and environmental change.

With longer term planning there must be longer term funding and development of policies that adjust to the needs of positive coastal zone management. Such funding and policy development should be undertaken in a co-operative state between the Dunedin City Council, Otago Regional Council and the Department of Conservation. The cyclical nature of physical events that impact on the coastal zone, have often been managed too late to create any strategic improvements for the coastal environment of Ocean Beach Domain. This submission concludes that in order for positive change and broader protection of the area that benefits the citizens of Dunedin the following should be undertaken:

- Significant changes in land use and occupation of the Domain and the purchase of areas of private property adjacent to the Domain creating a wider “setback” zone must be explored as a planning instrument within the District Plan and other policies.
- The long term reduction of all building occupations of the formerly active dune environment from between MHWS to Tahuna and Victoria Roads.
- The removal of the Ocean Beach Domain Railway from the formerly active dune area to be repositioned within the existing city rail corridor and creating opportunities for the growth of historical assets like the Gasworks Museum and the Railway Station
- The closure, removal and habitat restoration of Moana Rua Road from the formerly active dune area.
- The removal of the sportsfields and their associated clubs from Kettle Park and part of Hancock Park so that they can be re-established as part of the future Tahuna Park redevelopment.
- A moratorium on the renewal of all occupations on the Domain held under the provisions of the Reserves Act 1977.
- A review of the placement of all infrastructural assets on the reserve and their effects on the broader coastal environment, including the sewerage treatment plant.
- The development and implementation of a distinct coastal hazards programme in conjunction with the Otago Regional Council for Ocean

Beach Domain that creates a meaningful and positive relationship between the two organisations.

- The creation of a new Ocean Beach Domain Board to implement a strategic operational plan and deliver policy as required for the management of the Ocean Beach Domain.
- Development and funding of a public dune care organisation that represents the public in dune protection activities and education that is overseen by the Ocean Beach Domain Board.
- The development of a new Ocean Beach Domain Management Plan under the auspices of the Reserves Act 1977.
- The long term re-establishment of vegetated fore and rear dune plant assemblages that use the width of the formerly active dune between the MHWS and Victoria and Tahuna Roads.
- Remove all fill material from the end of the St Clair sea wall to Middle Beach.
- The re-profiling and replanting of all fore dune areas between the St Clair sea-wall and Lawyers Head to assist in the creation of new incipient dune formations.
- The closure and redevelopment of access points to the coast that are sustainable for long term use and meet the recreational requirements of the changes in use of the reserve.
- The redevelopment of Lawyers Head as a scenic area that creates physical linkage to the coastal area and the city.

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1 New Zealand's Coastal Environment

New Zealand's 18,200 kilometres coastline is diverse and compact with significantly varied geology. The diversity of the coastline encompasses subtropical to sub-Antarctic flora and fauna (Rouse *et al*. 2003). Active dune-lands have diminished significantly in New Zealand from around 129,000 hectares in the 1900's to about 39,000, a 70% reduction, by the 1990's. The disturbance of dune-lands occurred rapidly after European settlement due to stabilisation and afforestation of active dunes, agricultural development, sand mining, urban development, and grazing (Hilton *et al*. 2000).

The introduction of invasive plant species also altered the morphology of dunes and their associated native plant assemblages (Figure 1.1). The rapid expansion of *Ammophila arenaria* has displaced *Desmoschoenus spiralis* along with a suite of other indigenous sand-binding species in New Zealand dune-lands. The extensive rhizomatous root system of *Ammophila* out-competes indigenous species for water and nutrients. This, coupled with an ability to form pyramidal shadow dunes that bury adjacent plants in its lee has allowed *Ammophila* to dominate the dune landscape (Hesp, 1991; Hilton *et al*. 2000; Duncan, 2001; Dixon *et al*. 2004).

Plant species are important in dune morphological development which depends on plant density, distribution, height, and cover. The densely packed taller *Ammophila* tussock, which now dominates many New Zealand dunes, has created higher hummocky peaked dunes whereas historic *Desmoschoenus* dunes were lower and much less hummocky (Hesp, 2000; Hesp, 2002).

Figure 1 The steep fore-dune face of an *Ammophila arenaria* dune eroded by high tide and surge (a) The comparative dune morphologies of *Ammophila* fore-dunes (b) and the lower flatter *Desmoschoenus spiralis* dune (c) (Photographs, Paul Pope)

2 The Coastal Dune Environment and Dune Formation

Coastal dunes form from sand on the shore that has dried out and been blown to the back of the beach. Here it meets obstacles and vegetation that allows it to accumulate and build dunes. The growth and shape of dunes are related to the source of the sand and the patterns of onshore and offshore winds. Onshore winds sweep sand from the beach to the backshore. Vegetation reduces the shear stress of winds and creates a surface roughness that allows sand to be deposited and accumulate. As the backshore develops into an incipient fore-dune the volume of moving sand is reduced as the slope increases and the finer particles are deposited behind the fore-dune development (Moreno-Casasola, 1986; Bird, 2000). Hesp (1983) found in fore-dune formation in Australia, the density of vegetation was more important than the vegetation type, and increasing vegetation density increased the surface roughness, and consequent decrease in wind speed near the dune surface. Where vegetation density is high, the sand is trapped more effectively and causes the dune to grow more vertically (Arens, 1996).

Sand movement can create micro-climatic variations within dune complexes, affecting the degree of shelter or proximity to ground water, and allowing plant species to inhabit specific areas within the dune landscape. The localised variability in vegetation cover and conditions will affect the morphology of dunes because of variables in the types of conditions that dunes will create. Sand movement also has the effect of supplying and increasing the level of available nutrients as well as aerating substrate and surface layers around plants. The variations in dune types will vary the assemblages of plant communities from fore-dune to rear dune assemblages due to changes in the level of environmental stresses found on plants within their area of the dune they inhabit. Plant colonisation will accelerate the development of dunes and erosion where plants

have been lost is also accelerated due to the lack of vegetation cover (Moreno-Casasola, 1986).

Salt spray, burial, inundation by water; wind exposure, nutrient deficiencies, and salinity create a harsh and difficult environment for plants to grow in. Adaptations to these stresses include tightly rolled leaves and responses to burial and flooding, or in plant morphology. Physical stress is high in the beach fore-dune environment and will decrease as plants are found a further distance from the beach fore-dune. Transgressive dunes are particularly stressful dunes types because of the consistent movement of substrates (Hesp, 1991).

3 Plant Function & Environmental Conditions – Native or Introduced?

Desmoschoenus spiralis is a sand dune binding species that is found principally on the seaward face of coastal fore-dunes, but can be found considerable distances inland from the fore-dune face. In un-degraded dune systems *Desmoschoenus* forms stable fore-dune shadows that trap sand and build dunes (Nelson, 2000). Studies on the Manawatu coast found that *Desmoschoenus* formed lower, more gently sloping fore-dunes than *Ammophila arenaria* dominated dunes, and this may relate to the density of vegetation and wind shear (Esler, 1978; Hesp, 1991). The distribution of *Desmoschoenus* in the dune landscape is dependent on the east and west dune orientation in relation to climate, and other factors such as pH levels, fertility, elevation, and moisture. Nitrogen levels are extremely low in fore-dunes and in stabilised or semi fixed dunes, and this is a limiting factors on distribution (Sykes, 1987; Nelson, 2000).

It appears that predominantly back dune areas of *Desmoschoenus* are more prevalent in Otago, whereas fore-dune areas of *Desmoschoenus* are prevalent in other regions, particularly the North Island of New Zealand (Nelson, 2000). There has been no investigation as to why the rear dune areas of *Desmoschoenus* are

more prevalent in Otago, though it is likely to be due to the domination of the fore-dune by *Ammophila arenaria* (Nelson, 2000). Provenance trials have shown that new plants of *Desmoschoenus* planted in the fore-dune outperformed those planted in back dune areas (Bergin and Herbert, 1994). *Desmoschoenus* requires a regular deposition of sand to keep the rooting zone within moist sand (Courtney, 1983). Regional variance in the climatic conditions that may affect *Desmoschoenus* has not been investigated with the exception of Sykes' (1987) work on the orientation of plants.

4 Ammophila arenaria – Ecosystem Engineer

Ammophila arenaria (L.) Link (marram grass) is naturalised in New Zealand from Western Europe and Great Britain. It is an erect perennial, rhizomatous grass, glaucescent in colour, which forms a compact wiry-leaved tuft. (Huiskes, 1979; Edgar and Connor, 2000). The natural geographical and altitudinal range of *Ammophila arenaria* is confined to almost entirely coastal sand dunes, though it can be recorded in sandy areas inland of coastal dunes. *Ammophila* naturally occurs along all European coasts and parts of North Africa between latitudes 30° - 63° north. The Northern limit of distribution coincides with the 0° January isotherm where vigour of the plant declines (Huiskes, 1979). However, in the southern hemisphere its latitudinal range appears to be 30° - 48° south (Gadgil, 2002).

Ammophila arenaria grows vigorously on the open faces of fixed and mobile dune systems, though there are recorded instances of *Ammophila* being present in inland areas. High pH and wind blown sand which contains phosphorous and nitrogen, play an important role in the supply of nutrients for *Ammophila*. Plants in older stabilised dunes appear to be less robust, with shorter leaves and inflorescences are often absent (Willis, 1965; Huiskes, 1979; van der Putten *et al*. 1988; Dieckhoff, 1992; Fay, 1992). Its robust nature is reflected in the extremes

of temperature, darkness, wind velocity, mobility of sand and low nutrient levels in dune-lands in which *Ammophila* is able to survive. Burial by mobile sand (up to 1 metre per year) activates the rapid production of elongated stem internodes, and its rhizome and root production assists *Ammophila* to stabilise mobile sand. Fay and Jeffery (1992) have suggested the production of elongated stem internodes is a response to nitrogen released from mobile sand as the tussock is buried. *Ammophila* is strongly drought tolerant and survives far above the water table; it exists primarily from rain water and the moisture content within sand associated with organic matter from leaf litter (Ranwell, 1958; Marshall, 1965; Huiskes, 1979; Hesp, 1991; Gadgil, 2002).

5 Summary of Vegetation Importance to Sand Dunes

- Vegetation is a dominant influence on fore-dune formation and the density of that vegetation is more important than vegetation type.
- Increased density increases the ability of plants to trap sand and causes dunes to grow vertically in place (Arens, 1996).
- *Ammophila* dominated dunes are steeper than *Desmoschoenus spiralis* covered dunes and tend to be a higher peaked dune form, which may run the length of beaches as a continuous ridge (Esler, 1970; Hesp, 2000; Hesp, 2002).
- The efficiency of *Ammophila arenaria* as a sand collector and sand binder is due to the upright tillers that stop wind blown sand and contribute to the formation of sand mounds at the base of *Ammophila* tussocks. These characteristics have meant that *Ammophila* has been a primary species for erosion and sand mobility stabilisation in New Zealand and other countries (Hesp, 1991; Gadgil, 2002).
- Formations of *Ammophila* dominant dunes may inhibit the inland movement of sand and salt spray and this may disadvantage the species that rely on this movement (Wiedemann and Pickart, 1996).

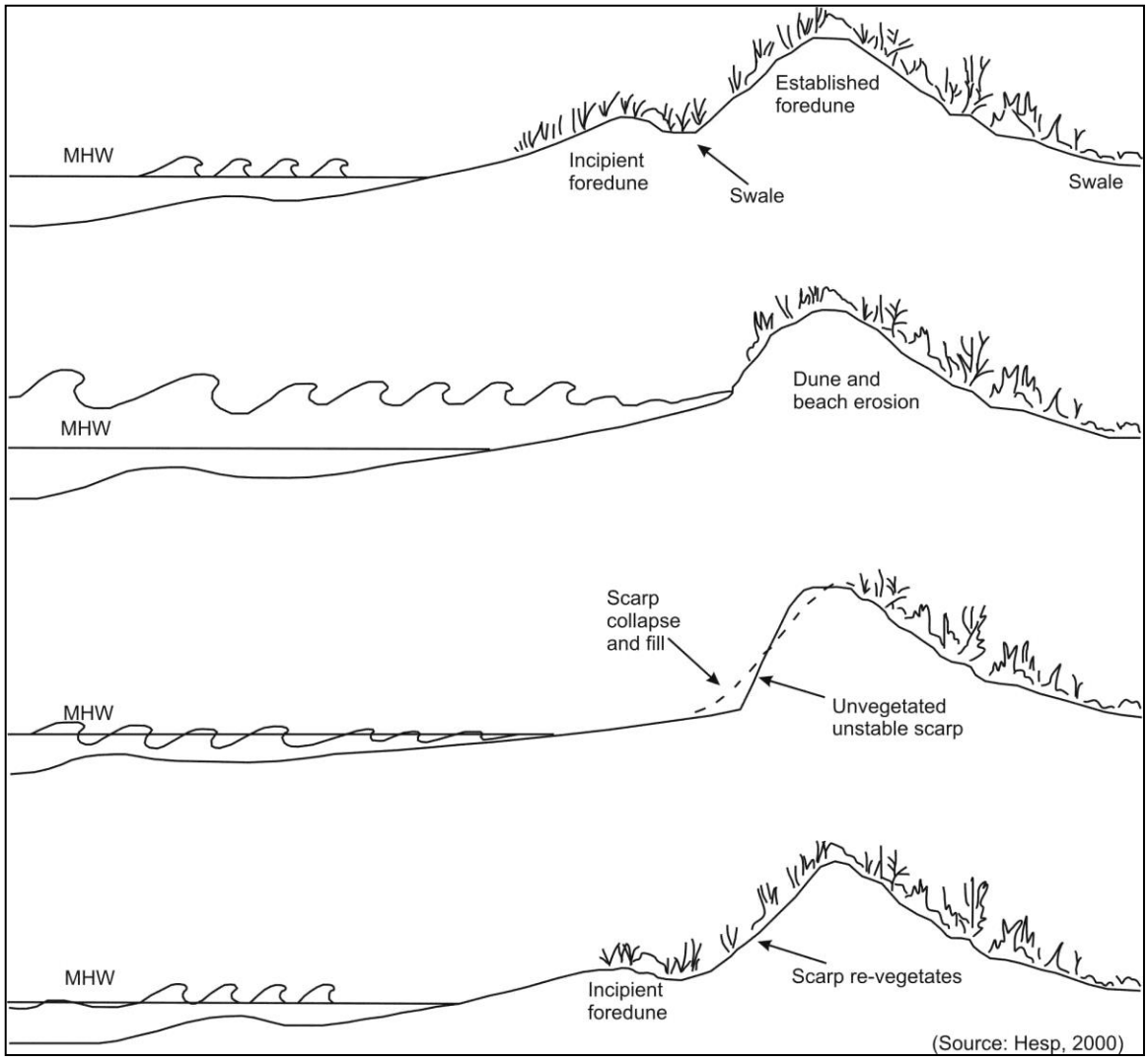

Figure 2 Fore-dune vegetation plays an important role in the development of new dunes and stabilisation of existing ones.

6 Historical Vegetation Changes at Ocean Beach Domain

By 1876, Dunedin City had pushed itself out to the sand dunes on the city's eastern coastline in a brief 28 years. Known today as Ocean Beach Domain, continued sand mining of the dunes to provide fill and building sand and the construction of a railway system around the Domain had done little to appease the locals. Intense public concern over the condition of the dunes that protected the city became a turbulent and eventful period of local history in Dunedin during this period. Early signs of trouble began in 1887 when the un-vegetated sand was blown over roads on the leeward side of the dunes. Worse was to come when several serious breaches in the sand dunes caused widespread flooding of South Dunedin in 1888, 1891, 1894, and 1898 including the virtual destruction of the St Clair Esplanade in 1886 (Youngman, 1862; Morrison, 1955)

Figure 3 Ocean Beach Domain, sand mining and the destruction of the dune habitat created serious flooding by the sea in the 1880's & 1890's and public concern was high. A large dune collapse can be seen in the mid section of this photograph. (Courtesy of the Hocken Library)

In October, 1888 Alexander Bathgate suggested that the sand hills should be reclaimed in the same manner as dunes in France, San Francisco, and elsewhere in the world. Bathgate felt Dunedin would be an appropriate climate to procure suitable grasses and trees that would grow well in the sand hills around Dunedin. It was not the first suggestion that imported plants be used to stabilise dunes in Dunedin. *Ammophila arenaria* had been observed in Australia by a number of correspondents to local newspapers and to the Ocean Beach Domain Board in the 1870's and 1880's (Purnell, 1898).

Bathgate, an early philanthropist and founder of one of New Zealand's earliest conservation organisations, The Dunedin and Suburban Reserves Conservation

Society (now the Dunedin Amenities Society) announced his vision for the dunes at an official function:

"*Let's have a nice bit of land laid out in this neighbourhood where lads and lassies can enjoy themselves and have a dance, also a bowling green for the aged citizens and provide an excellent bathing establishment where we can enjoy the benefit of the Pacific without peril*." (Morrison 1955).

On the 19 October 1888 the committee secretary of the newly formed Dunedin and Suburban Reserves Conservation Society was instructed to write to a Mr Crichton of San Francisco to see whether their plants would be suitable for the planting in the sand dunes of Dunedin. Eleven months later a reply was received and the Society immediately bought £5 worth of *Lupinus arboreus* and *Ammophila arenaria* seed from San Francisco. The seeds did not arrive until 1890 and, although it was in a poor condition, the Society managed to pass this on to the Ocean Beach Domain Board. Following the success of their initial trials and work being undertaken by the Board to reclaim part of the beach, the Society wrote to Judge Kettle in New Plymouth in 1891 and ordered one thousand roots of Lima grass which arrived from Wanganui for a cost of £5 (Morrison, 1955).

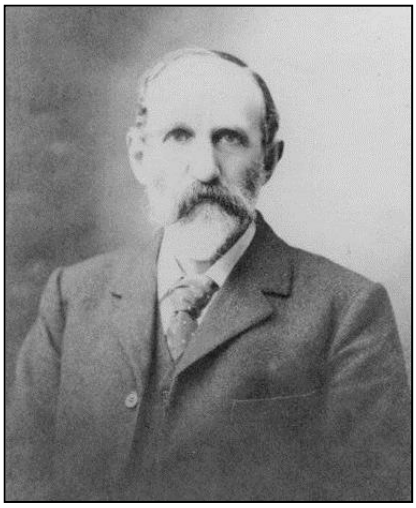

Figure 4 Alexander Bathgate initiated the introduction of *Ammophila arenaria* to Dunedin. His vision was part conservation and part amenity and was based on his experiences from France and the United States. (Courtesy of the Dunedin Amenities Society)

The Ocean Beach Domain Boards' minutes from 1898-1902 reveals that *Ammophila arenaria* was a highly successful invader. The natural spread of the plant and the rapidity of the growth in stabilising considerable areas of the sand dunes between St Clair and St Kilda were enthusiastically noted in the Board

reports. The Board became so successful in stabilising the dunes that other borough councils began requesting quantities of *Ammophila arenaria* seed and rhizome. These were “exported” to areas such as Timaru, Oamaru, and Green Island between 1898 and 1902 by the wagon load (Board 1907; Board 1909; Board 1912; Board 1915). Further requests were made of the Board for *Ammophila arenaria* & *Lupinus arboreus* seed and rhizome for beaches along the north east beaches at Long Beach and Murdering Beach by Thomson in 1896 (Thomson 1922; Thomson 1944). In 1952 the dunes had reached a height of 50-60 feet.

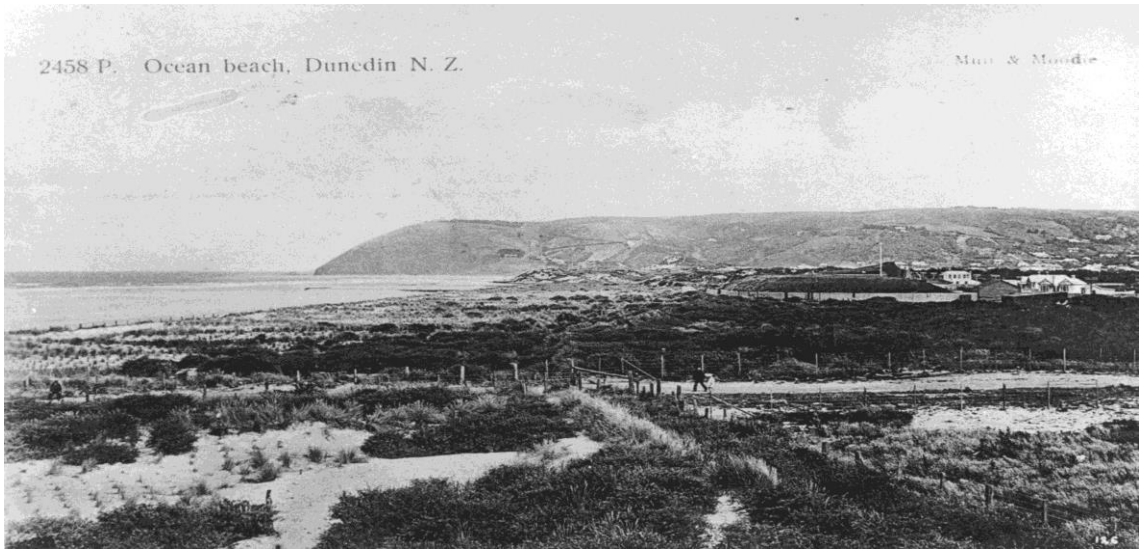

Figure 5 *Ammophila arenaria* and *Lupinus arboreus* became the principal stabilising species used along Dunedin beaches from the 1890’s to the present day. (Courtesy of the Hocken Library)

The historical distribution of *Ammophila arenaria* in Dunedin and the surrounding beaches was a product of the success of the plant’s establishment. Dunedin was not isolated in the break down of dune systems typical of the impacts of agrarian and urban developments in the nineteenth century. The land concerns and need to protect property were equally strong in other regions. Councils and individuals from other regions quickly realised the success of *Ammophila arenaria* as a stabilising species on sand dunes from the Dunedin experience. Dunedin

became an active centre for propagation and export of seed and rhizome material to other local centres.

The “superiority” of the *Ammophila arenaria* as a rapid dune stabiliser in contrast to the native dune species appears to have never been considered by Bathgate, who looked to Europe and the United States for solutions to the “dune wastes” of Dunedin (Morrison, 1955). While some plant introductions to New Zealand have been accidental and others can be described as being a product of colonialism’s “call home syndrome”, the introduction of *Ammophila arenaria* to coastal Dunedin appears to have been a functional reaction that did not consider the impacts on biodiversity or dune landscape forms (Mack 2001).

7 Chronology of Dune Change at Ocean Beach Domain

1890’s - the beach was wider with a flatter dune at the northeast end of the Domain that probably extended as far inland as Musselburgh. Marram planting begins after the breaches in the dune around this time also.

1906-1915 – a high dune existed at the southwest end of the Domain extensively covered in vegetation. The beach began narrowing around this time. Development of Tahuna and Victoria Roads begins.

1920’s – the southwest dune reached its peak volume and the central area of the Domain began to decrease. Housing began to develop in the southwest.

1930’s Groynes were used to limit the narrowing of the beach at the southwest end.

1940’s – Sports-field developments begin at the southwest end of the Domain and a marked decrease in volume and height occur in these areas. The

northeast area increased in volume during this period. Fill begins to be used in the Middle Beach area

1950's – housing development accelerated along with the development of sportsfields and this lead to further erosion and depletion of the active dune areas. In the northeast the dunes vegetation cover was substantial. John Wilson Drive construction begins.

1960's – Kettle Park was almost completed and a narrowing of the beach occurred as further dune volume was diminished along with a loss of vegetation cover. John Wilson Drive is completed with the reduction of the dunes at the northeast.

1970 – 1980's - the southwest continues to narrow and the development of a walking track narrows this section even further. The northwest begins narrowing with erosion and the creation of a steep dune face in front of John Wilson Drive.

1990-2008 – Continued narrowing of the dunes along the full length of the beach. Small incipient development in the northeast. Last filled placed at Middle Beach 1990/1991. Significant storms reduce significant volumes and create a steep erosion scarp. (Kirk, 1979, Kirk, 1991, Townsend, 1997).

8 Chronology of St Clair Sea Wall

1866 –first sea wall built, collapses soon after.

1870's – large scale sand removal operations

1884 – second wall built

1886 – second wall collapses

1894 – wooden groynes constructed at St Clair

1913 – third sea wall constructed

1999 – engineers advise that the sea wall has a 5 – 15 year life expectancy

2000 - 2008 - new wall an end wall design created. Walkway and ramp destroyed during storm events. (Allen, 1999)

9 Present Land Use

In the area between the end of the St Clair sea-wall and the beginning of John Wilson Drive the present land use underutilises the remaining width of the dune environment. All of the back dune protection has been levelled for playing fields or occupied by a variety of recreational clubs, community groups and public housing. Such occupations have had a long historical association with the Domain and are in many respects a self fulfilling prophecy of Bathgate's words discussed in Section 6 of this submission. The lack of width has hampered restorative and protection efforts of the past and the present. Middle Beach in particular has been hampered by this lack of width and the use of fill to "protect" the dune area since the 1950's.

In the area between the beginning of John Wilson Drive and Lawyers Head the dune area has been substantially and irrevocably divided by the construction of John Wilson Drive and the creation of sportsfields. The division of the former dune by the construction of the infilled road and the division of the former rear dune environment by the golf course and Hancock Park has again limited the natural width of the active dune environment to a narrow corridor abutting the steep slope of John Wilson Drive.

10 Changes in Land Use

It is the contention of this submission that in order for the Dunedin City Council to be able to provide a flexible dune buffer that is capable of withstanding erosion events and the effects of anthropomorphic sea level rise significant changes in land use must occur. If the City Council is to protect property and infrastructural assets of its citizens sacrifices in terms of recreational use must be made to allow for the protection of the greater “public good”. This is not likely to be a popular measure but if handled with diplomacy and strategic vision such changes can be achieved in the medium to long term.

10.1 Middle Beach – Kettle Park

Kirk (1979 & 1991) lamented the occupation of the active dune areas by sportsfields and other activities and proposed a programme of:

- Ensuring a broad well vegetated fore-dune through conservation and enhancement
- Developing essential fore-dune height
- Development of a three stage planting concept of fore-dune species, mid dune trees and shrubs and rear dune trees stage that lifts the wind line

above the dune crest thus improving sand accumulation of sand in a seaward direction.

- Creating permeability of the beach and dune environment by removing clay fill and other cap type materials.

In accordance with Kirks recommendations it is proposed in this submission that the entire sports-field area of Kettle Park and portions of Hancock Park be returned to the active dune zone to create a three tier buffer management system as shown in Figure 6 below.

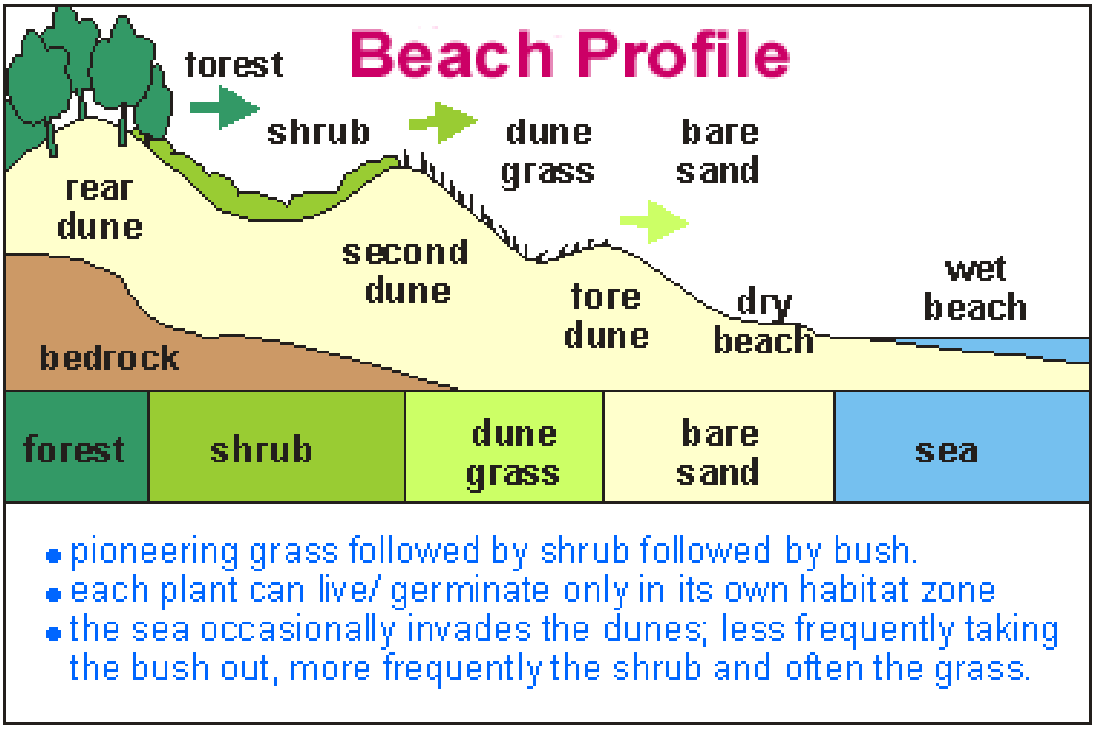

Figure 6 Cross section of proposed dune buffer zones for Ocean Beach Domain**.**

This proposal would recreate the immediate buffer zones of fore-dune and second dune depicted in Figure 6 in the short to medium (3-15 years) and would involve;

- Significant replanting of the two immediate zones with suitable species
- The removal of all impermeable material from St Clair to the St Kilda Surf Club.
- The removal and reshaping of Moana Rua Road

- The removal of the railway line
- Replacing and reshaping of the flat sports-field area at Kettle Park with imported sand to restore the natural dune shape and increase the damaged dune volume.
- Negotiate the relinquishment of the occupations of the Dunedin Rugby Football Club and the other ancillary occupations along Moana Rua Road.

To further the development of the buffer zones and increase the proposed dune volume and area the City Council should in the long term (15-25 years);

- Negotiate the relinquishment of the occupations by recreational and community groups by, Te Whanau Arohanui, the bowling club on the corner of Victoria Road and Moana Rua Road, St Clair Tennis Club and the Scout Hall at the entrance to Kettle Park opposite Forbury Raceway. These areas should be restored into the third zone of tree planting as described by Kirk (1979 & 1991).
- The Ice Rink, Badminton building and railway should also be removed by negotiation in this period for similar restoration of the active dune area.
- The City Council should begin long term financial planning to acquire through purchase and negotiation the private properties at the southeast end of the Domain between the St Clair Surf Club building and the entranceway to southern most to Kettle Park. This area would be restored slowly as opportunities to purchase became available.
- The car-park above the Marlow Park playground should be closed and integrated back into the proposed dune structure. It is probable that the playground could remain along with entrance from John Wilson Drive. However, the occupations of reserve land adjacent to the playground should be relinquished to develop better alternative parking and visitor facilities outside of the fore-dune and mid dune areas.

10.2 Hancock & Chisholm Park

- The landward slope running on the north-western side of John Wilson Drive should be extensively replanted in the second and third stage plantings to improve the stability of the bank and its appearance as part of an artificial landscape form.
- The flat sports-field area should be and reshaped with imported sand and replanted in rear dune coastal forest to protect neighbouring properties from wind and sand and to widen the forest buffer.
- The Golf Club in practical terms should remain, but there should be encouragement to utilise more coastal forest planting to create landscape coherence and biodiversity linkages to the newly created forested areas in the rear dune assemblages.
- Negotiate the relinquishment of the occupations of the Pirates Rugby Football Club and the Squash Club.

10.3 John Wilson Drive

John Wilson Drive acts as major coastal barrier that bisects the natural development of the dunes in this area along the eastern shoreline from the Surf Lifesaving Club to Lawyers Head. It would be unlikely that the removal of the impermeable fill and subsequent restoration of the dunes in this area would be cost effective in the long term. However, the fore-dune and mid dune areas are in poor condition requiring a higher volume of plant density.

- It would be recommended that the area above the fore-dune crest to the road on the seaward side be substantially replanted with tree and shrub species to trap and sand and push the fore-dune development further out.
- More needs to done to ensure that the pipeline construction is not affecting the sand dunes adjacent to the position of the pipe, and this needs constant monitoring and review of the development.

- Lawyers Head should be replanted and utilised as a viewing point ensuring better public safety and aesthetic development that blends structural and vegetation elements into the spectacular views of the ocean and coastal landscape.

The development of active buffer zones into tiers of vegetation types changing the present land use to restore a previous static coastal management zone is a significant departure in thinking for Dunedin. It departs from the use of a narrow strip of coastal vegetation confined by inappropriate activity within the coastal zone and utilises the natural width available for protection. It also changes the city's recreational focus from organised sport to passive and active recreation types and provides opportunities for a different type of recreational experience within the Domain. There would be need for careful planning and adjustment to traditional access points, but the wider nature of the coastal area and the enhanced vegetative development would create better opportunities for focused public access rather than limiting them.

10.4 Dune Vegetation for the Future at Ocean Beach Domain

The decision as to what species are used in the fore dune slope to create stabilized dunes and the retention of sand dune from erosion events is an interesting conundrum. The fast growing nature of *Ammophila arenaria* and its ability to disperse both vegetatively and from seed makes it a very useful dune stabilising species in the Ocean Beach Domain landscape (Pope, 2005). However the steep gradients and over-reaching height also creates weaknesses in the dune structure that during erosion events makes it prone to steeply scarp and collapse, rendering any stabilisation achieved ineffective in the long term to create a suitable dune buffer. Such eroding faces as can be seen at Ocean Beach Domain have not been successful in the longer term. It is most likely that a compromise between the use of *Ammophila arenaria* and *Desmoschoenus*

*spir*alis is the most practical. Creating any initial reshaped fore-dune and using the faster growing *Ammophila* on the fore-dune face is likely to be more cost effective in the short to medium term. We have already seen that in active rear dune assemblages in the South Island there is opportunity for *Desmoschoenus spiralis* to thrive provide it is protected from other vegetative invasion. The later introduction of native dune binding species would require a level of plant control and replanting in suitable areas of the fore- dune to immediately behind the fore-dune crest. The shape of a *Desmoschoenus* dune development is lower and flatter, but such development requires suitable width in the coastal zone to be successful. Mid and rear dune plant species are specified in Table 1 of this submission.

			Habitat			
Species	**Common name**	**Type of plant**	**fore dune**	**estuary edge**	**coastal cliff**	**coastal terrace and rear dune**
Austrofestuca littoralis		Grass	+			
Carex lessoniana		sedge		+		
Carex pumila	sand sedge	sedge		+		
Coprosma crassifolia		shrub			+	+
Coprosma propinqua	mikimiki	shrub				+
Cordyline australis	cabbage tree	tree				+
Corokia cotoneaster	korokio	shrub				+
Cortaderia richardii	toetoe	grass			+	+
Desmoschoenus spiralis	pikao	sedge	+			
Disphyma australe	ice plant	succulent scrambler			+	
Euphorbia glauca	Sea spurge		+			
Griselinia littoralis	broadleaf	tree			+	+
Hebe elliptica	shore hebe	shrub			+	+
Helichrysum aggregatum		shrub				+
Hierochloe redolens	karetu	grass				+
Isolepis nodosa	club rush	rush	+		+	
Hoheria angustifolia	narrow-leaved lacebark	tree				
Kunzea ericoides	kanuka	tree				+
Leptospermum scoparium	manuka	shrub			+	+
Melicytus ramiflorus	mahoe	tree				+
Myoporum laetum	ngaio	tree				+
Olearia avicenniifolia		shrub			+	+
Phormium tenax	flax	tussock herb			+	+
Pittosporum tenuifolium	kohuhu	tree				+
Podocarpus hallii	Hall's totara	tree				+
Podocarpus totara	Totara	tree				+

Pseudopanax crassifolius	lancewood	tree				+
Sophora microphylla	kowhai	tree				+

Table 1 Native species list for coastal conservation planting at Ocean Beach Domain.

11 Strategic Planning

Significant changes in land use as proposed within this submission will mean making sacrifices by occupiers of reserve land under tenancy agreement as required by the Reserves Act 1977. There are natural loyalties by clubs who have occupied sites for many years and who have made contributions to their community. A long period of patient consultation and discussion with clubs would be required to resolve the difficulties of being uprooted from “home grounds” and facilities. The wider community would also need to adjust to the changes in familiar occupations on Ocean Beach Domain.

11.1 Tahuna Park – Sporting and Recreation Destination

While clubs will view the changes in occupation with trepidation, the Council needs to look at the situation with a strategic eye to the future of the city’s sporting facilities and to the paramount issue of protecting the city from inundation and the challenges of climate change. It is the submitters understanding that Tahuna Park is an option in the LTCCP for upgrading of its facilities and grounds. The present condition of Tahuna Park leaves much to be desired and the upgrade has probably been a long time overdue. Secondly the presence of the Bowls stadium and golf course seems to be a further strategic opportunity to see the Tahuna upgrade coincide with the changes in occupations by necessity of protecting the dune areas of the Domain. Tahuna is an ample site offering opportunities to create another tier of quality sporting facilities in an area of the city that has in recent years become somewhat dowdy. Combining parking and other facilities with existing clubs in the area makes very sound financial and

recreational sense, and would re-brand Tahuna as a recreational destination. There are compromise positions to be taken on the development of facilities atr Hancock Park also.

A further option would be the purchase of the adjacent motor camp for development of an extended Tahuna Park upgrade on the adjacent space. No matter what the configuration of Tahuna Park, tenants of Ocean Beach Domain and the wider sporting public could benefit significantly by better use of the space at Tahuna Park, while adjusting to the use of their traditional areas for coastal conservation. An alternative to the Tahuna upgrade is the lease or purchase of the Forbury Park Raceway on Victoria Road to develop alterative sporting facilities for those displaced by the coastal conservation programme on Ocean Beach Domain.

11.2 The Railway

The Ocean Beach Railway line has already seen a portion of its track diminished when the area alongside the track at Middle Beach was modified in the early 1990's. Changes in the coastal conservation requirements of Ocean Beach Domain will necessitate the long term removal of the line which will clearly diminish the opportunities for the Railway group to keep running. In broader terms the Dunedin railway is sadly underutilised as an attraction in the city, which is surprising given the proximity of the Early Settlers Museum and the Railway station to one another. The recent rail events that were held at the railway station were a significant tourist and public relations success for the city. Perhaps changes in land use at Ocean Beach Domain may necessitate the development of better opportunities to promote Dunedin and the Society along with other similar organisations as the "railway capital" of New Zealand. Certainly greater promotion and a more prominent place in the City could prove very advantageous to this group. Another organisation that appears to have certain

symmetries with the Ocean Beach Domain Railway is the Gasworks Museum Trust. In recent years it appears to have struggled financially, but that doesn't diminish its importance as a historical organisation presenting and protecting the City's heritage. Opportunities for shared space and facilities needs to be investigated further for these groups, and by bringing the rail group into the city it may thrive and flourish.

12 Legal and Planning Matters

It is the contention of the submitter that Ocean Beach Domain be designated using the District Plan as an area for coastal "setback" limiting development outside of this one (Bernd-Cohen & Gordon, 1999; Environment Bay of Plenty, 2005). Private properties that came under this designation should be purchased at the market value over the long term of the process. In particular the properties adjacent to the St Clair Surf Club to the Kettle Park entrance opposite Forbury Park should be considered as part of this process. There is significant conservation value in this because this where the "end wall" effect is most prevalent. This is where waves are reflected off the walls face and carry sand out to sea and prevent dune recovery. By designating the land adjacent to this part of the Domain opportunities created by width in the dune may assist in limiting this effect.

The Reserves Act 1977 is the predominant legislation dealing with;

- Occupations and tenancy
- Provisions on the introduction of plant species to a reserve
- Development of Reserve Management Plans
- Appointment of a Board to manage a reserve.

It is the submission of the writer that the City Council should implement a new management plan for Ocean Beach Domain so as to ensure a clear direction for the reserve in regards to coastal; conservation and protection from sea level rise.

Further, the City Council should seek approval from the Minister of Conservation to appoint a Domain Management Board. This Board should have representatives from a wide variety of organisations to ensure a co-ordinated approach to the consultation, implementation and policy development.

13 Proposed Information Programme

The proposed information gathering exercise is appropriate given the nature and scope of the site. The proposal in the Council documentation reiterates what Kirk (1979 & 1991) has already suggested that a greater level scientific and monitoring data is required before the project begins.

14 Conclusions

The conservation of Ocean Beach Domain is a priority for the long term protection of Dunedin City. Without protection we run the risk of greater damage to our infrastructural and property assets from inundation due to storm and sea level activity.

The time has come to make hard decisions on our recreational use and occupation of the reserve, so that we can protect and manage the reserve for the wider public good.

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15 Disclaimer

Ocean Beach Domain Dune Conservation Strategy