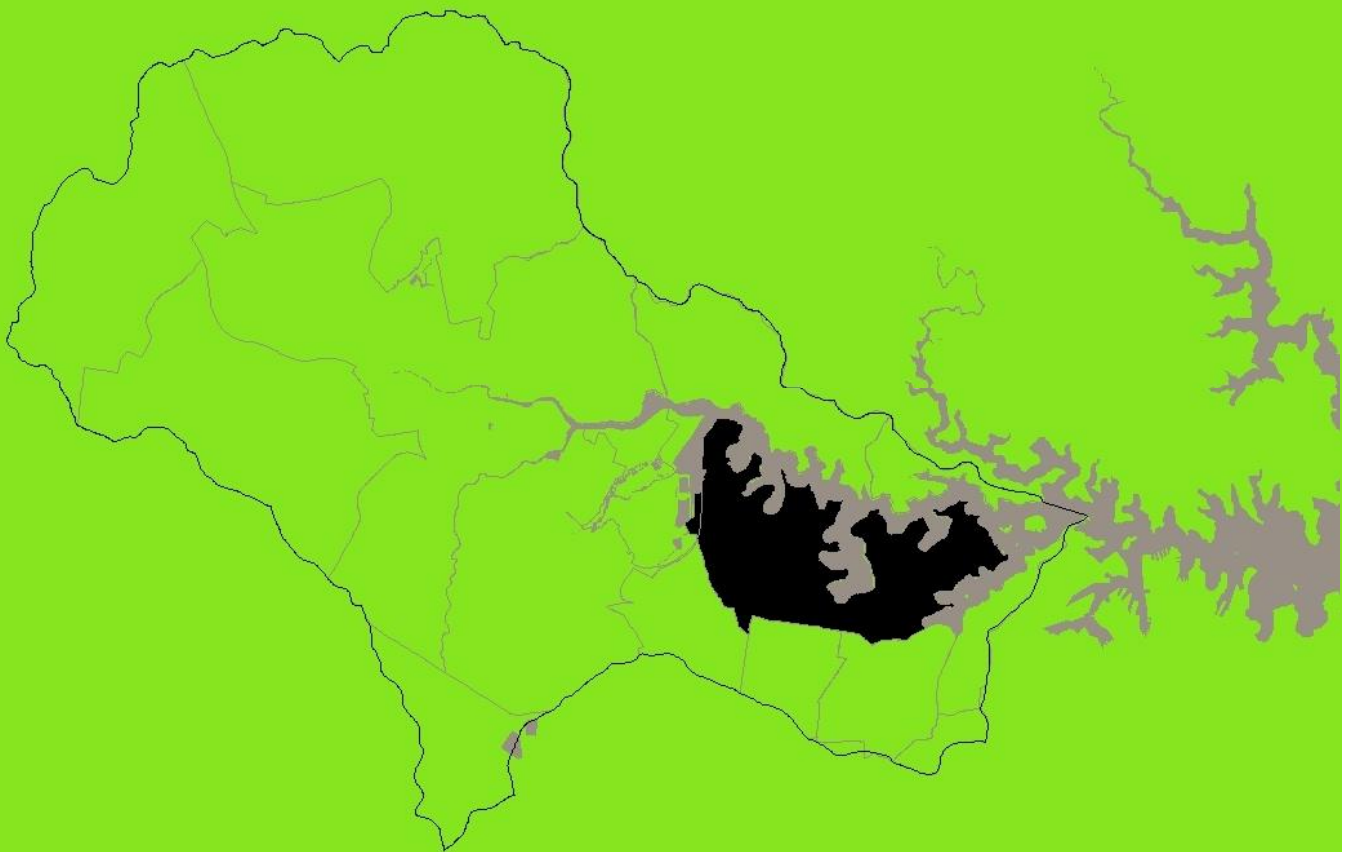


City of Canada Bay LGA



9.4 City of Canada Bay

9.4.1 General Description

The City of Canada Bay LGA contains over 35km of shoreline which is one of the largest foreshore area that any one local government authority is responsible for. Land use is primarily low and medium density residential with significant areas dedicated to public recreation (parks along drainage reserves, golf course, wharves, and foreshore reserves) and special use (infrastructure) areas (e.g. Rivendell Child Adolescent & Family Unit, Concord Repatriation Hospital and "Yaralla House" Dame Eadith Walker Hospital)

The LGA contributes a catchment area of approximately 1,847.6 ha to the estuary study area, its tributaries and embayments, excluding land draining to Homebush Bay and Iron Cove Bay catchments (refer Section 3.0), include the following:

- Iron Cove Bay, downstream to Iron Cove Bridge (28.8 ha);
- River South, Iron Cove Bridge to Five Dock Point (77.9 ha);
- Five Dock Bay (206.1 ha);
- Abbotsford Bay (47.9 ha);
- Hen and Chicken Bay (849.5 ha).
- Kendall Bay, including foreshore land upstream to Breakfast Point, and downstream to Cabarita Point (74.8 ha);
- Majors Bay (215.5 ha);
- Yaralla Bay (76.9ha);
- Brays Bay, including foreshore land west to John Whitton Bridge (85.4 ha); and
- Homebush Bay (75.2 ha)

9.4.2 Stormwater Management and GPTs

The City of Canada Bay Council has installed a number of GPTs in various catchments within the LGA. Table 9-12 provides a summary of waste removed from all GPTs per annum and Table 9-13 lists the types and locations of stormwater devices in the City of Canada Bay LGA.

Table 9-12. Annual volume of waste removed from GPTs in the City of Canada Bay LGA

SoE Reporting Period	Organic Material	Sediment	Litter	Sand/Gravel	Total (tonnes)
2005/2006	38.9	10.1	7.3	0.0	56.3
2006/2007	120.0	36.0	18.1	5.1	179.5
2007/2008	49.0	18.0	9.0	2.5	78.5

* data source City of Canada Bay SoE (2005-06, 2006-07, 2007-08)

Council has indicated that the disuse of 2 traps during 2007/2008 may possibly explain the significant decrease in waste collected within the 2007/2008 reporting period.

Two hundred and ninety two (292) stormwater outlets were identified which discharge directly into the estuary in the Canada Bay LGA. A number of these outlets drain catchments that should be investigated to determine whether gross pollutant control is required (Table 9-14).

Table 9-13. City of Canada Bay LGA Stormwater Devices

Name	Location	Waterway	Waste removed (tonnes)*		
			2005-2006	2006-2007	2007-2008
Sediment Basins	Kokoda Walk, Concord	Brays Bay	no data	no data	no data
Humeceptor	West Cabarita Point	Kendell Bay	no data	3.1	2.4
Ecosol	Barnwell Park Golf Course	Hen and Chicken Bay	no data	1.2	no data
Custom Built	Massey Park Golf Course	Hen and Chicken Bay	13.6	111	no data
Basket Trap	Walton Crescent, Abbotsford	Abbotsford Bay	1.8	12.8	16.7
CDS Unit	Allison Park, Chiswick	Five Dock Bay	3.5	10.6	3.2
CDS Unit	The Esplanade, Drummoyne	Five Dock Bay	2.7	9.6	6.6
Basket Trap	Drummoyne Oval	Five Dock Bay		3.4	8.0
Rocla Unit	Edwin Street, Drummoyne	Parramatta River	5.2	1.7	8.2
CDS Unit	Roseby Street, Birkenhead Point	Parramatta River	7.9	2.6	6.7
Rocla Unit	St Georges Crescent, Drummoyne	Parramatta River	6.5	7.0	2.0
CDS Unit	Barnstaple Road, Five Dock	Iron Cove Bay	6.9	7.6	11.5
CDS Unit	Noble Street, Five Dock	Iron Cove Bay	3.6	6.8	9.2
CDS Unit	Brent Street, Rodd Point	Iron Cove Bay	4.6	2.1	4.3
		Total	56.3	179.5	78.5

* data source City of Canada Bay SoE (2005-06, 2006-07, 2007-08)

Table 9-14. Potential GPT sites upstream of stormwater outlet in the City of Canada Bay LGA

Outlet_ID	Reason
Dobroyd_Canal_025	One of two pipes draining a 24 ha catchment
Dobroyd_Canal_026	One of two pipes draining a 24 ha catchment
Iron_Cove_045	Main pipe draining 20 ha catchment, seagrass habitat
Iron_Cove_065	Seagrass at outlet, larger of two pipes draining 18 ha
Iron_Cove_066	Seagrass at outlet, smaller of two pipes draining 18 ha
Iron_Cove_068	Seagrass at outflow, outlet draining approx. 8ha
Iron_Cove_084	Seagrass at outlet, 2ha catchment including Victoria Road.
Five_Dock_Bay_007	Seagrass loss at outlet, outlet draining 16 ha catchment
Five_Dock_Bay_010	Seagrass at outlet, 1 of 2 pipes in 54 ha
Five_Dock_Bay_011	Seagrass at outlet, 1 of 2 pipes in 54 ha
Kendall_Bay_003	1 of 2 pipes draining large portion of 75 ha
Kendall_Bay_004	1 of 2 pipes draining large portion of 75 ha
Hen_and_Chicken_Canal_01	21 ha catchment
Hen_and_Chicken_009	Seagrass at outlet, 5 ha catchment
Hen_and_Chicken_020	Seagrass at outlet, major sedimentation
Hen_and_Chicken_021	Seagrass at outlet, major sedimentation, 1 of 2 pipes in 32 ha
Hen_and_Chicken_023	Seagrass at outlet, major sedimentation, 1 of 2 pipes in 32 ha
Hen_and_Chicken_024	1 of 2 pipes draining large portion of 59 ha, seagrass
Hen_and_Chicken_025	1 of 2 pipes draining large portion of 59 ha, seagrass
Hen_and_Chicken_033	Large catchment, 28 ha
Majors_Bay_005	2nd smaller outlet in 251 ha catchment
Majors_Bay_009	Main outlet draining 251 ha catchment, mangroves at outlet
Yaralla_Bay_001	Major discharge point for 77 ha, into mangroves
River_South_026	Seagrass no longer evident at outlet, 5 ha catchment
River_South_058	Seagrass at outlet – recently mapped (2009)
River_South_059	Seagrass at outlet – recently mapped (2009)

9.4.3 Seawalls

The City of Canada Bay LGA contains 16.2 km of seawalls of which 75 discrete sections of seawall were assessed (Table 9-15). Assessment details and management recommendations for high priority seawall sections are provided in Table 9-15 and Appendix 3.

Table 9-15. Seawalls assessed within the City of Canada Bay LGA

Asset Name	Location	Condition	Length (m)	Existing Habitat
CAN_S01	Timbrell Park, Iron Cove	Poor	843.8	Mangroves and saltmarsh
CAN_S02	Rodd Point	Poor	79.6	Sandy beach
CAN_S03	Rodd Point	Poor	360.1	Mangroves, saltmarsh, sandy beach
CAN_S04	Barnstaple Rd, Rodd Pt	Poor	99.7	Sessile invertebrates, mangroves
CAN_S05	Henley Marine Drive	Good	58.3	Sparse mangroves and oysters
CAN_S06	Henley Marine Drive	Poor	14.8	Saltmarsh
CAN_S07	Henley Marine Drive	Good	62.7	Sandy beach
CAN_S08	Henley Marine Drive	Good	17.3	Saltmarsh, sandy beach
CAN_S09	Henley Marine Drive	Good	23.4	Sessile invertebrates, mangrove
CAN_S10	Drummoyne Pool	Good	110.0	Sessile invertebrates
CAN_S11	Old Iron Cove Bridge	Poor	27.7	Sessile invertebrates

Asset Name	Location	Condition	Length (m)	Existing Habitat
CAN_S12	Beneath Iron Cove Bridge	Good	20.1	Sessile invertebrates
CAN_S13	Beneath Iron Cove Bridge	Failed	146.6	Sessile invertebrates
CAN_S14	Birkenhead Point	Failed	125.3	Sessile invertebrates
CAN_S15	Peppercorn Reserve	Poor	121.9	Sessile invertebrates
CAN_S16	St George Cr Drummoyne	Failed	92.0	Sessile invertebrates
CAN_S17	Lyons Rd, Drummoyne	Good	11.4	Sessile invertebrates
CAN_S18	Drummoyne Ferry Wharf	Poor	48.2	Sessile invertebrates
CAN_S19	Utz Reserve, Drummoyne	Good	8.7	Sessile invertebrates
CAN_S20	Adj Gladesville Bridge	Good	20.5	Sessile invertebrates
CAN_S21	Old Gladesville Bridge	Good	44.2	Sessile invertebrates
CAN_S22	Five Dock Bay	Good	552.4	Sessile invertebrates, mangroves,
CAN_S23	Five Dock Bay	Poor	1,164.8	Sessile invertebrates, mangroves,
CAN_S24	Adj Chiswick Ferry Wharf	Poor	95.8	Sessile invertebrates, rock platform
CAN_S25	Armitage Reserve	Poor	86.5	Sessile invertebrates, rock platform
CAN_S26	Abbotsford Bay	Good	82.5	Sessile invertebrates
CAN_S27	Abbotsford Bay	Good	38.6	Sessile invertebrates
CAN_S28	Abbotsford Bay	Failed	135.9	Sessile invertebrates, cavities
CAN_S29	Abbotsford Bay	Good	241.5	Sessile invertebrates, sandy beach
CAN_S30	Abbotsford Bay	Good	10.2	Sessile invertebrates, sandy beach
CAN_S31	Adj. Abbotsford Wharf	Good	171.9	Sessile invertebrates
CAN_S32	Battersea Park	Good	284.5	Sandy substrate
CAN_S33	Quarantine Reserve	Good	104.7	Sessile invertebrates
CAN_S34	Henry Lawson Park	Excellent	97.1	Sandy beach
CAN_S35	Wynston Pde, Abbotsford	Good	120.0	Sand, mangroves, mudflat, rocks
CAN_S36	Wynston Pde, Wareemba	Excellent	1,109.8	Sand, mangroves, mudflat, rocks
CAN_S37	Kings Bay	Poor	1,126.0	Mangroves
CAN_S38	Canada Bay	Good	243.9	None obvious
CAN_S39	Canada Bay	Good	281.1	None obvious
CAN_S40	Bayview Park	Good	187.5	Rocky outcrops, oysters on wall
CAN_S41	Exile Bay	Good	143.9	Old age mangrove stand
CAN_S42	Exile Bay	Poor	87.4	None obvious
CAN_S43	Exile Bay	Poor	847.5	None obvious
CAN_S44	Exile Bay	Good	173.6	Mangroves, sandy rocky shoreline
CAN_S45	Exile Bay	Good	56.1	Rocky shoreline, patchy saltmarsh
CAN_S46	Frances Bay	Good	99.0	Sessile invertebrates
CAN_S47	Frances Bay	Good	174.9	Sessile invertebrates
CAN_S48	France Bay	Excellent	6.4	Rocky shoreline
CAN_S49	Regatta Way, Cabarita	Excellent	229.0	Sessile invertebrates
CAN_S50	Kendall Bay	Excellent	57.7	Rock outcrop, isolated saltmarsh
CAN_S51	Kendall Bay	Good	98.7	Mangroves, rock outcrop, beach
CAN_S52	Kendall Bay	Good	285.3	Mangroves
CAN_S53	Kendall Bay	Good	257.6	Sessile invertebrates
CAN_S54	Breakfast Point	Excellent	231.5	None obvious
CAN_S55	Breakfast Point	Good	45.5	None obvious
CAN_S56	Breakfast Point	Excellent	107.3	Rock / rubble substrate

Asset Name	Location	Condition	Length (m)	Existing Habitat
CAN_S57	Breakfast Point	Good	377.2	Sessile invertebrates
CAN_S58	Mortlake Point	Poor	247.9	Rock / rubble and sandy areas
CAN_S59	Mortlake Point	Excellent	169.3	Rock / rubble and sandy areas
CAN_S60	Mortlake Point	Poor	161.7	Sandy shoreline
CAN_S61	Majors Bay	Good	499.9	Dense well established mangroves
CAN_S62	Majors Bay	Failed	405.3	Mangroves, rock outcrops
CAN_S63	Yaralla Bay	Poor	164.9	Dense well established mangroves
CAN_S64	Yaralla Bay	Poor	106.8	Dense well established mangroves
CAN_S65	Yaralla Bay	Poor	14.6	Mangroves
CAN_S66	Concord Hospital	Poor	14.3	Sandy beach, rocky substrate
CAN_S67	Brays Bay	Good	303.8	Mangroves, rocky substrate
CAN_S68	Brays Bay	Poor	298.5	Some mangroves
CAN_S69	King George V Park	Good	18.7	Sandy beach
CAN_S70	Uhrs Point Reserve	Poor	19.6	Rocky substrate
CAN_S71	Uhrs Point Reserve	Good	36.8	Rocky foreshore
CAN_S72	John Whitton Rail Bridge	Good	108.6	Sandy foreshore
CAN_S73	Homebush Bay	Excellent	1,373.3	None obvious
CAN_S74	Homebush Bay	Poor	92.2	Mangroves
CAN_S75	Homebush Bay	Good	397.4	Mangroves
			16,183.2	

Table 9-16 High priority seawalls within the City of Canada Bay LGA

Asset	Length (m)	Cost range for traditional engineered seawall replacement ¹⁸		Habitat Creation Option ¹⁹
		(\$3,000/lineal m)	(\$5,000/lineal m)	
CAN_S60	161.7	\$485,100.00	\$808,500.00	Low profile sill, or artificial reef habitat
CAN_S23	1,164.8	\$3,494,400.00	\$5,824,000.00	Low profile sill, or artificial reef habitat
CAN_S63	164.9	\$494,700.00	\$824,500.00	Riparian establishment
CAN_S66	14.3	\$42,900.00	\$71,500.00	Rock pools, using existing rock platform
CAN_S28	135.9	\$407,723.68	\$679,539.46	Artificial reef habitat, subtidal cave habitat

¹⁸ The cost to install a new seawall or coastal revetment is dependent on a number of factors, including:

- The ground conditions at the site
- Materials required, material availability and whether existing materials can be reused
- Site access
- The required structure profile including slope, crest height and foundation depth
- Hydrodynamic conditions

In light of this variability, an indicative cost of \$3,000-\$5,000 per linear metre of seawall has been adopted for seawalls requiring replacement.

¹⁹ Refer section 4.8.1 for explanation of treatments

Asset	Length (m)	Cost range for traditional engineered seawall replacement ¹⁸		Habitat Creation Option ¹⁹
		(\$3,000/lineal m)	(\$5,000/lineal m)	
CAN_S62	405.3	\$1,216,032.44	\$2,026,720.74	Mangrove and riparian establishment, rock pools
CAN_S03	360.1	\$1,080,405.53	\$1,800,675.88	Mangrove establishment
CAN_S04	99.7	\$299,137.20	\$498,562.00	Variable slope seawall
CAN_S06	14.8	\$44,266.30	\$73,777.17	Low profile sill
CAN_S68	298.5	\$895,354.37	\$1,492,257.29	Artificial reef habitat, or potential step style seawall with saltmarsh establishment
CAN_S37	1,126.0	\$3,377,995.71	\$5,629,992.85	Artificial reef habitat, mangrove establishment
CAN_S64	106.8	\$320,535.82	\$534,226.36	Mangrove and riparian establishment
CAN_S16	92.0	\$276,106.32	\$460,177.20	Artificial reef habitat, rock pool
CAN_S14	125.3	\$375,941.24	\$626,568.73	Seawall surface treatment
CAN_S18	48.2	\$144,453.14	\$240,755.23	Artificial reef habitat

9.4.4 Foreshore Erosion

Fourteen areas of foreshore erosion were found within the City of Canada Bay LGA (Table 9-17). Assessment details and management recommendations for high priority foreshore areas are provided in Table 9-18.

Table 9-17 Foreshore erosion in the Canada Bay LGA

Asset name	Locality	Length (m)	Condition
CAN_NS01	Henley Marine Drive, Iron Cove	65.1	Poor
CAN_NS02	Henley Marine Drive, Iron Cove	265.0	Poor
CAN_NS03	Adjacent Gladesville Bridge Marina	45.5	Good
CAN_NS04	Blackwall Point Reserve	185.2	Good
CAN_NS05	Wynston Parade, Abbotsford	133.3	Good
CAN_NS06	Roberts Road, France Bay	18.3	Good
CAN_NS07	Kendall Bay, Cabarita	101.1	Good
CAN_NS08	Mortlake Point	126.9	Good
CAN_NS09	Majors Bay	253.1	Good
CAN_NS10	Yaralla Bay	281.8	Poor
CAN_NS11	Concord Hospital, Yaralla Bay	142.1	Poor
CAN_NS12	Concord Hospital Watergate, Rocky Point	142.1	Failed
CAN_NS13	Brays Bay	377.8	Poor
CAN_NS14	Homebush Bay, Liberty Grove	190.6	Good
		2,327.9	

Table 9-18 High priority areas of eroding natural foreshore within the Canada Bay LGA

Priority	Asset name	Erosion description	Remedial technique
1	CAN_NS12	Sandy shoreline with rocky outcrops and landscaped grassy slope behind. Erosion scarp >500mm.	Seawall (CAN_S66)
2	CAN_NS01	A large erosion scarp, approx 500mm. The crest appears to be slumping due to loss of material at the toe.	Low profile sill
3	CAN_NS02	A large erosion scarp, approx 500mm. The crest appears to be slumping due to loss of material at the toe.	Low profile sill
4	CAN_NS11	A small, approximately 200mm, erosion scarp is present at the base of the earthen bank. A number of casuarinas have collapsed, probably due to high salinity levels.	Riparian establishment
5	CAN_NS13	The entire foreshore is exposed to passing vessel wash and has a large erosion scarp present. The rest of the foreshore, vegetated with mangroves, is in poor condition with fine material lost from pneumatophores.	Seawall (CAN_S66)

9.4.5 Foreshore Facilities

Twenty eight facilities were assessed along the foreshore adjacent to the Auburn LGA (Table 9-19). Management recommendations for high priority facilities are provided in Table 9-20, and assessment details are provided in Appendix 3.

Table 9-19 All facilities assessed within the Canada Bay LGA

Asset Name	Location	Facility Type	Condition
CAN_F01	Henley Marine Drive	Informal dinghy storage	Good
CAN_F02	Henley Marine Drive	Informal dinghy storage	Good
CAN_F03	Henley Marine Drive	Timber wharf, informal dinghy storage	Failed
CAN_F04	Queen Victoria St. Drummoyne	Informal dinghy storage	Good
CAN_F05	Wrights Point	Informal dinghy storage	Poor
CAN_F06	Five Dock Bay	Formal and informal dinghy storage	Good
CAN_F07	Five Dock Bay p	Concrete two lane boat ramp	Good
CAN_F08	The Esplanade, Five Dock Bay	Informal dinghy storage	Good
CAN_F09	Five Dock Bay	Public swimming baths	Good
CAN_F10	Five Dock Bay	Informal dinghy storage	Poor
CAN_F11	Abbotsford Bay	Informal dinghy storage	Poor
CAN_F12	Battersea Reserve, Abbotsford	Informal dinghy storage	Good
CAN_F13	Henry Lawson Park, Hen and Chicken Bay	Informal dinghy storage	Good
CAN_F14	Wynston Parade, Abbotsford	Informal dinghy storage	Good
CAN_F15	Wynston Parade, Wareemba	Informal dinghy storage	Good
CAN_F16	Wynston Parade, Wareemba	Concrete single lane boat ramp	Poor
CAN_F17	Canada Bay	Timber landing and launching facility	Good

Asset Name	Location	Facility Type	Condition
CAN_F18	Bayview Park, Burwood Road	Concrete three lane boat ramp	Good
CAN_F19	Exile Bay	Informal dinghy storage	Good
CAN_F20	Exile Bay	Timber footbridge	Excellent
CAN_F21	Exile Bay	Timber landing/boardwalk	Good
CAN_F22	Hen & Chicken Bay	Informal dinghy	Good
CAN_F23	Kendall Bay, Cabarita	Concrete single lane boat ramp	Excellent
CAN_F24	Mortlake Point	Timber landing/lookout structure	Good
CAN_F25	Mortlake Point	Informal dinghy storage	Good
CAN_F26	Brays Bay	Timber boardwalk and lookout structure	Good
CAN_F27	King George V Park, Rhodes	Informal dinghy storage	Good
CAN_F28	John Whitton Rail Bridge, Rhodes	Concrete, single land boat ramp	Poor

Table 9-20 High priority facilities within the Canada Bay LGA

Asset Name	Description
CAN_F03	<p>Timber wharf and sea stairs supported by timber piles, with dinghy's tethered to the structure. Structure is in poor condition with severe deterioration of timber. The wharf has been abandoned with signage on land indicating that it is unsafe for public use (although no seaward signage). Although abandoned, it appears the wharf is still used for dinghy storage.</p> <p>Signage should be installed at the seaward end of the structure. Eventually the structure should be removed. Dinghies that are tethered to the structure should be relocated / formalised storage provided.</p>
CAN_F11	<p>Informal dinghy storage along rocky shoreline with vessels tethered to old steel fence. Dinghies are launched via old steel stairs. No formal storage structure present. Fence that dinghies are tethered to is collapsing. Steel fence has barbed wire hanging loose amongst dinghies. Old steel stairs are severely corroded and not properly attached to rocks.</p> <p>It is recommended that dinghies are either relocated or formal dinghy storage and launching facilities are installed.</p>
CAN_F05	<p>Informal dinghy storage with vessels tethered to trees and timber atop a rocky shoreline at the end of Drummoyne Avenue. A large storm water outlet is also present at this location. No formal storage facility. Vessels are launched/retrieved via the adjacent rocky shoreline.</p> <p>It is recommended that dinghies are either relocated or formal dinghy storage and launching facilities are installed.</p>
CAN_F16	<p>Concrete single lane boat ramp. No trailer parking facility is present. Concrete is cracking and weathered. The front face of the ramp has been undermined. Boat ramp does not extend to low tide extent and sandstone blocks have been placed for vehicle access.</p> <p>The boat ramp requires modification to extend the toe beyond low tide level. If this does not occur it is recommended that the boat ramp be decommissioned.</p>

Asset Name	Description
CAN_F28	Concrete, single lane boat ramp and nearby informal trailer parking is available. Small sandstone block seawalls are located on either side of the boat ramp. The concrete has cracked and failed at the western corner of the ramp. The rest of the ramp is in good condition with minor weathering and fouling observed.
CAN_F10	<p>Informal dinghy storage along sandy/rocky shoreline with vessels tethered to connections in cliff. No formal storage structure present. Vessels are tethered to cliff and are resting on tyres. Vessels are launched/retrieved via adjacent sandy/rocky shoreline. This would be difficult at high tide.</p> <p>It is recommended that dinghies are either relocated or formal dinghy storage and launching facilities are installed.</p>

9.4.6 Estuarine Vegetation

Estuarine vegetation was investigated for the preparation of the City of Canada Bay Estuary Vegetation Management Plan (Earth Tech 2008) upon which many of this current study's reporting guidelines has been based. To this end, ground-truthing of intertidal estuarine vegetation (excluding seagrass) was not required as part of the study's scope of works. The following investigations comprise the assessment conducted for the City of Canada Bay LGA:

- Boat-based field inspections of seagrass, and seaward observations made of mangrove and saltmarsh communities;
- Opportunistic field observations were noted during land-based inspections for other aspects of this study; and
- Desktop analysis (of vegetation cover) using 2005 and 2009 aerial photography.

9.4.6.1 Seagrass

92.6% of confirmed seagrass habitat within the study area is found in waterways adjacent to the City of Canada Bay LGA, which equates to approximately 8.6 ha. Mapping conducted by West and Williams (2008) indicated approximately 8.0 ha of seagrass habitat in the waterways adjacent to the City of Canada Bay LGA. Field investigations for this study confirmed the following:

- 7.6 ha verified as present;
- 0.3 ha unable to be verified;
- Less than 0.01 ha verified as not evident; and
- 0.3 ha newly mapped seagrass: specifically 3,344 m² of monospecific stands of *Halophila* were found to the north east of Brays Bay within the river channel, and within the northern most zones of Yaralla Bay and Majors Bay in close proximity to the river channel (refer Section 7.4: Seagrasses for further detail).

9.4.6.2 Intertidal and Riparian Vegetation

Estuarine vegetation located within the City of Canada Bay LGA includes approximately 19.5 ha of mangroves, 0.07 ha of saltmarsh (including small areas of the vulnerable *Wilsonia backhousei*), and 9.2 ha of estuarine riparian vegetation (including the endangered ecological communities Swamp-oak floodplain forest and Turpentine iron-bark forests). Table 9-21 to Table 9-25 summarises the various communities in the LGA and their potential to migrate upslope in response to sea level rise (i.e. landward migration). Landward migration refers to the potential for vegetation to migrate naturally upslope unimpeded. Limited landward migration is typically where obstacles are present in the form of structures, development, and in some cases natural topography (elevation or geology) restricts upslope establishment.

Table 9-21. Estuarine vegetation in the City of Canada Bay LGA

Community	Landward Migration		Total (ha)
	Limited	Potential	
Mangrove	8.74	10.74	19.48
Saltmarsh	0.20	0.50	0.70
Coastal sandstone gully forest	n/a	n/a	0.08
Coastal sandstone ridgetop woodland	n/a	n/a	0.49
Sydney turpentine-ironbark forest	0.0	4.49	4.49
Swamp-oak floodplain forest	1.1	3.0	4.14

Table 9-22. Mangroves in the City of Canada Bay LGA

Location	Landward Migration Potential	Area (m ²)	Area (ha)
Iron Cove Bay	Limited	7,376.0	0.74
Five Dock Bay	Limited	2,692.4	0.27
Kendall Bay	Limited	2,248.0	0.22
Hen and Chicken Bay	Limited	4,788.8	0.48
Abbotsford Bay	Limited	119.0	0.01
Majors Bay	Limited	41,731.4	4.17
Yaralla Bay	Limited	864.2	0.09
Brays Bay	Limited	17,632.2	1.76
Homebush Bay	Limited	9,989.9	1.00
	Subtotal Limited	87,441.9	8.74
Hen and Chicken Bay	Potential	1,666.0	0.17
Brays Bay	Potential	62,565.6	6.26
Yaralla Bay	Potential	43,214.0	4.32
	Subtotal Potential	107,445.7	10.74
	Total	194,887.6	19.48

Table 9-23. Saltmarsh in the City of Canada Bay LGA

Location	Landward Migration Potential	Area (m ²)
Iron Cove Bay	Limited	1,944.5
Kendall Bay	Limited	131.9
Hen and Chicken Bay	Limited	4.6
Brays Bay	Limited	14.3
	Subtotal Limited	2,095.3
Hen and Chicken Bay	Potential	601.1
Majors Bay	Potential	117.4
Yaralla Bay	Potential	3,169.5
Brays Bay	Potential	1,210.3
	Subtotal Potential	5,098.3
	Total	7,193.6

Table 9-24. Swamp-oak floodplain forest in the City of Canada Bay LGA

Location	Landward Migration Potential	Area (m ²)	Area (ha)
Brays Bay	Limited	3,852.5	0.39
Iron Cove Bay	Limited	2,394.4	0.24
Majors Bay	Limited	1,016.7	0.10
Yaralla Bay	Limited	4,570.7	0.46
Hen and Chicken Bay	Limited	70.6	<0.01

Location	Landward Migration Potential	Area (m ²)	Area (ha)
Iron Cove Bay	Limited	204.7	0.02
	Subtotal Limited	12,109.5	1.21
Brays Bay	Potential	11,461.9	1.15
Hen and Chicken Bay	Potential	2,647.1	0.26
Majors Bay	Potential	7,298.4	0.73
Yaralla Bay	Potential	9,236.1	0.92
	Subtotal Potential	30,643.5	3.06
	Total	42,753.0	4.27

Table 9-25. Turpentine-ironbark forest in the City of Canada Bay LGA

Location	Landward Migration Potential	Area (m ²)	Area (ha)
Brays Bay	Limited	1,770.4	0.18
	Subtotal Limited	1,770.4	0.18
Majors Bay	Potential	28,235.9	2.82
Yaralla Bay	Potential	9,685.8	0.97
Brays Bay	Potential	5,197.4	0.52
	Subtotal Potential	43,119.1	4.31
	Total	44,889.5	4.49

9.4.7 Management Recommendations

The management recommendations provided by Earth Tech (2008) are paraphrased here and supplemented with additional management options where relevant and based upon more recent investigations.

Stormwater Management:

Earth Tech (2008) indicated the following sub-catchments for targeting of investigation and consideration for future stormwater management incentives and/or funding projects:

- Majors Bay;
- Yaralla Bay;
- Kendall Bay; and
- Hen and Chicken Bay (eastern shore).

Additional investigations relating to the efficacy of existing GPTs and their maintenance requirements should be undertaken in the following locations:

- Custom built sediment basins within Brays Bay, as per Earth Tech (2008);
- All GPTs and stormwater drainage systems in the Five Dock Bay catchment, which exhibits evidence of poor water quality (i.e. loss of seagrasses, very poor water quality, excessive algal growth and fine sediments on substratum); and
- All GPTs and stormwater drainage systems in the lower Iron Cove Bay catchment (as per recommendations made in Section 3.0: *Stormwater and GPTs* of this study).

Seawalls, erosion and facilities:

As per recommendations in preceding Sections: 9.4.3; 9.4.4; and 9.4.5, but including consideration of:

- The location of estuarine vegetation (particularly saltmarsh adjacent seawalls, pathways and other infrastructure) and ensuring appropriate mitigation measures are in place to protect estuarine vegetation during construction and maintenance activities;
- Rehabilitation of eroded foreshore areas to consider the use of revegetation (particularly mangroves) and placement of temporary protective barriers during establishment) as opposed to the use of seawalls or revetments; and
- Intertidal habitat and/or provision of landward migration opportunities for vegetation should be incorporated into the design of seawalls requiring replacement.

Seagrasses:

The extensive area of foreshore (approximately 35 kms of shoreline), in combination with its location on the southern shores of the Parramatta River, and the presence of extensive bays (which are more protected from winds, wave energy and large watercraft activity), results in the shallow water environment adjacent to the City of Canada Bay LGA providing more opportunity and ambient conditions for seagrass habitat to subsist.

To this end the management of stormwater, particularly improved gross pollutant trapping controls and their maintenance, will be critical to the longer term preservation of existing seagrass.

Additional management options recommended by Earth Tech (2008) and this study include the installation of seagrass friendly moorings, use of mesh decking on jetties, the provision of formalised launching areas for dinghies, surf skis, etc, and educational programs. Areas prioritised for seagrass friendly moorings are summarised in Table 9-26:

Table 9-26. Seagrass friendly mooring locations in the City of Canada Bay LGA

Habitat	Area (m ²)	Location	Priority
Halophila and Zostera	5,074.7	Iron Cove Bay, Half Moon Bay to Rodd Point	1
Zostera	5,005.3	Five Dock Bay	2
Zostera	4,560.6	Five Dock Bay	3
Halophila	6,888.2	Hen and Chicken Bay, opposite France Bay	4
Halophila and Zostera	18,189.5	Hen and Chicken Bay, opposite Exile Bay	4
Zostera	124.9	Drummoyne Bay	4
Halophila and Zostera	1,099.2	Hen and Chicken Bay, France Bay	5
Halophila	98.6	Hen and Chicken Bay, opposite France Bay	5
Halophila	182.3	Hen and Chicken Bay, opposite France Bay	5
Halophila	2,175.1	Five Dock Bay	5
Zostera	2,668.5	Five Dock Bay	5
Halophila and Zostera	164.7	Iron Cove Bay, Sisters to Half Moon Bay	5
Halophila and Zostera	862.6	Iron Cove Bay, Half Moon Bay	5
Halophila and Zostera	368.5	Hen and Chicken Bay, France Bay	6
Halophila and Zostera	280.7	Hen and Chicken Bay, France Bay	6
Halophila and Zostera	232.8	Hen and Chicken Bay, France Bay	6
Zostera	96.3	Hen and Chicken Bay, north east shoreline	6
Zostera	105.2	Hen and Chicken Bay, north east shoreline	6
Zostera	487.8	Hen and Chicken Bay, north east shoreline	6
Zostera	263.8	Hen and Chicken Bay, north east shoreline	6
Zostera	598.7	Hen and Chicken Bay, north east shoreline	6
Zostera	52.4	Drummoyne Bay	6
Zostera	76.3	Drummoyne Bay	6
Not evident	72.8	River, northwest of Birkenhead Point	6
Halophila and Zostera	67.7	Iron Cove Bay, Half Moon Bay to Rodd Point	6
Halophila and Zostera	1,667.4	Hen and Chicken Bay, France Bay	7
Halophila	2,447.7	Hen and Chicken Bay, Exile Bay	7
Not evident	21.7	River, northwest of Birkenhead Point	7
Halophila and Zostera	1,043.1	Iron Cove Bay, Half Moon Bay to Rodd Point	7
Halophila and Zostera	98.1	Hen and Chicken Bay, France Bay	8
Halophila and Zostera	286.6	Hen and Chicken Bay, France Bay	8
Halophila and Zostera	195.9	Hen and Chicken Bay, north of France Bay	8
Halophila and Zostera	51.7	Hen and Chicken Bay, France Bay	8
Halophila and Zostera	320.1	Hen and Chicken Bay, France Bay	8
Halophila and Zostera	390.0	Hen and Chicken Bay, France Bay	8
Halophila and Zostera	54.2	Hen and Chicken Bay, France Bay	8
Halophila	468.2	Hen and Chicken Bay, Exile Bay	8
Halophila	33.4	Hen and Chicken Bay, opposite France Bay	8
Unable to verify	98.8	Five Dock Bay	8
Zostera	120.7	Five Dock Bay	8
Zostera	840.4	Five Dock Bay	8

Habitat	Area (m ²)	Location	Priority
Zostera	49.5	Drummoyne Bay	8
Unable to verify	30.1	Drummoyne Bay	8
Zostera	28.7	Drummoyne Bay	8
Zostera	31.5	River, northwest of Birkenhead Point	8
Halophila and Zostera	782.7	Iron Cove Bay, Half Moon Bay	8
Halophila and Zostera	71.3	Iron Cove Bay, Half Moon Bay to Rodd Point	8
Halophila and Zostera	44.0	Hen and Chicken Bay, France Bay	9
Halophila and Zostera	7.2	Hen and Chicken Bay, France Bay	9
Zostera	24.8	Five Dock Bay	9
Unable to verify	8.5	Iron Cove Bay, Sisters to Half Moon Bay	9

Mangroves:

Approximately 40% of mangroves occurring within the LGA have limited potential for landward migration as sea level rise eventuates. There are a number of areas within the LGA's foreshore in which mangroves expansion or colonisation is evident. Some expansion or colonisation of mangroves is evident in front of seawalls and is considered beneficial, whereas other areas of expansion / colonisation are considered potentially detrimental, i.e. within saltmarsh and mudflats (the latter providing local and migratory wader bird habitat).

Additional management issues within the LGA include vandalism (in Iron Cove Bay and Five Dock Bay) and the ad hoc storage of non-motorised watercraft. Management recommendations include:

- Establishment of mangroves as a stabilisation method in areas of erosion,
- Mangrove propagules and seedlings removed from designated bird habitat areas should be grown on to more advanced stock for use in rehabilitation projects;
- Formalisation of dinghy storage areas,
- Ongoing policing of mangrove damage and penalising offenders, while difficult, is necessary in order to discourage further vandalism, or
- Alternatively, the resilience of mangroves to pruning could be experimentally investigated in collaboration with I & I NSW (as a potential management solution in areas where repeat tree vandalism offences occur).

Saltmarsh:

Saltmarsh within the LGA is limited by both elevation and landuse adjacent the foreshore. 35% of the estimated 0.7 ha of saltmarsh within the LGA, has no potential to migrate landwards as sea level rise eventuates. The potential for landward migration of the remaining saltmarsh (65%) will require a level of negotiation for potential offsets of existing areas presently used as open space or for recreation, while some areas will require a level of management intervention to ensure that land upslope of existing saltmarsh is both reserved and suitable for this purpose.

Other management issues within the LGA include: access management (trampling impacts and storage of dinghies); landscape activities (mowing impacts); and interspecific competition (weed infestations, and encroachment of *Casuarina glauca*, mangroves and brackish aquatic species).

Management recommendations include:

- Target control of salt-tolerant introduced species and encroaching native species (e.g. mangroves and *Casuarina glauca*),
- Reservation of upslope land for future natural migration of saltmarsh,
- Educational programs, fencing, or other forms of physical edging between mowing sites and saltmarsh, and the capture of lawn clippings or other preventative measures to reduce lawn clippings entering saltmarsh,
- Formalisation of dinghy storage and launching areas,
- Fencing; track closure, relocation, or replacement (i.e. with raised boardwalks); and education signage should be considered to mitigate existing access impacts on sensitive saltmarsh areas, and
- Careful removal of existing isolated saltmarsh species in non-viable habitat areas and nursery advancement of plant materials for rehabilitation projects.

Estuarine Riparian Vegetation:

By virtue of expansive foreshore open space areas within the LGA, areas of riparian vegetation (e.g. Swamp-oak Floodplain Forest and Sydney Turpentine-Ironbark Forest) are afforded more opportunities for landward migration in comparison to other LGAs within the study area.

The primary management issue affecting riparian vegetation within the LGA is the loss of biodiversity due to maintenance of mown understorey, weed infestations and the use of informal trails and subsequent trampling and edge effects. Management recommendations include:

- Formalisation of walking trails, and location of pathways to allow landward migration,
- Delineation of mowing zones and lawn clippings capture and removal, and
- Weed control and reinstatement of native understorey species.

BRAYS BAY – Earth Tech (2008) recommendations:***Wilsonia backhousei*:**

Approximately <10m² of *W.backhousei* growing on an elevated mound which is precariously located in between *C.glauca* and mangrove growth (photos #1 & #2). Management recommendations include:

- To prevent trampling or other inadvertent damage to *W.backhousei* growth, this area should be delineated with temporary fencing and signage installed to warn of the fragile nature of this species.
- Monitoring is required to determine whether *C.glauca* growth and leaf litter is in fact reducing extent and vigour of *W.backhousei* growth, as this species appears to have some resilience to reduced light levels (pers. comm. K Duchatel 2008).
- Consideration should be given to removing *C.glauca* trees from this area and constructing additional habitat for *W.backhousei* to spread into. Replacement plantings of *C.glauca* could be relocated to outer edges of existing vegetated areas within open space, in combination with other Swamp-oak constituent species.

Terrestrial weeds & mowing:

- Areas in which bush regeneration has been conducted in association with installation of stormwater detention basins, requires maintenance weeding.
- General weed control along perimeter of estuarine vegetation from Lovedale Place to Rocky Point is required.
- Fringing mown areas within Concord Repatriation Hospital land should be delineated to prevent accidental mowing of saltmarsh species (photos #3 & #4).
- Potential to trial salinisation of these areas to promote recovery of native ground covers (refer to Appendix B).

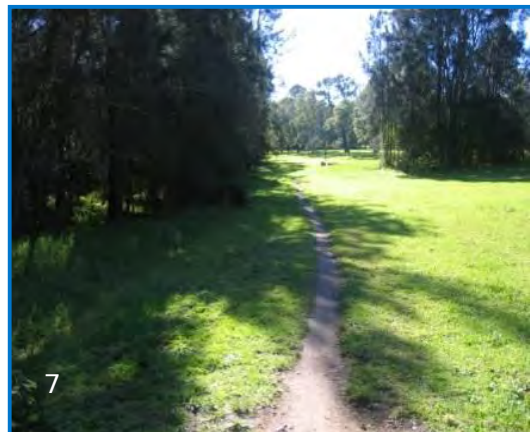
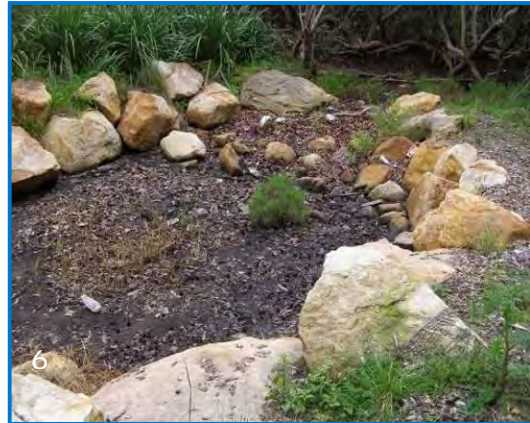
Stormwater management:

Review of existing stormwater basins and their maintenance regimes should be conducted to:

- Determine the efficacy of the basins and whether any adjustment to existing configuration(s) is required (photos #5 & #6),
- Adjust the frequency of maintenance and cleaning of the basins so that gross pollutants remain captured and are not remobilised into the surrounding wetland environments, and
- Allow for transplanting or use for propagation of saltmarsh plants that colonise on sediment and litter captured (photo #6) in the basins

Access management:

- Informal pathway on Concord Repatriation Hospital land meanders into estuarine vegetation in the vicinity of Rocky Point (photo #7).
- Formalised access should be provided at this location. Moving the existing trail inland away from sensitive vegetated areas and providing space in which future migration may eventuate in response to sea level rise.
- Reinstatement of native plantings (potentially saltmarsh creation) within area located between pathway and estuarine vegetation, and reduce the need for mowing.



YARALLA BAY – *Earth Tech (2008) recommendations:*

Alligator weed:

Growth of *Alternanthera philoxeroides* (Alligator Weed) is located on the east shore of the bay (photo #1). Its control should be an utmost priority. Manual and careful excavation of the plant, its stems and roots and disposal of plant matter off-site is recommended. This area should be regularly monitored for regrowth and ongoing control implemented as necessary.

Unleashed dogs:

Widespread unleashed dog activity within the main saltmarsh area of this site (e.g. southern corner of the bay) was evident by way of paw prints with several bird kills also evident (photo #2). Unaccompanied and unleashed dogs must be prohibited from these areas.

Rubbish dumping / litter:

Yaralla Bay is one of many sites within the LGA that contains dumped building rubble and other materials. Litter is also commonly entering the saltmarsh and mangrove communities from the adjacent hospital's garbage receptacles (photo #3).

Consultation with Concord Repatriation Hospital's waste management personnel is recommended to better manage existing waste storage and minimise overflow into the estuarine environment.

Mowing:

Open space areas adjacent to shoreline are maintained by mowing / slashing. In some areas lawn clippings have been dumped into saltmarsh and mangrove areas (photo #4).

Consultation with, or education of, Concord Repatriation Hospital's gardening staff is recommended so that lawn clippings will be disposed of appropriately, and damage to saltmarsh and mangroves (from mowing and lawn clippings waste) is prevented.

Access management:

A number of unformalised trails are used frequently, in particular by off road cyclists (photos #5 to #7). These trails should be closed, with alternate formalised trails located away from sensitive saltmarsh areas. Appropriate educational programs and signage should be included.

Mangrove & Swamp-oak encroachment:

Both mangroves and *C.glauca* are gradually encroaching into saltmarsh zones (photos #5 to #9), note also Kikuyu and other terrestrial weeds encroaching into saltmarsh). Mangrove encroachment is likely to increase albeit gradually as the predicted impacts of climate change take effect. This will be a significant issue within Yaralla Bay and future landward migration of saltmarsh should be planned for where possible. In the interim it is recommended that the existing thinly distributed *C.glauca* trees that about the main areas of saltmarsh be removed, and mangrove seedlings be removed as they emerge.

Stormwater management:

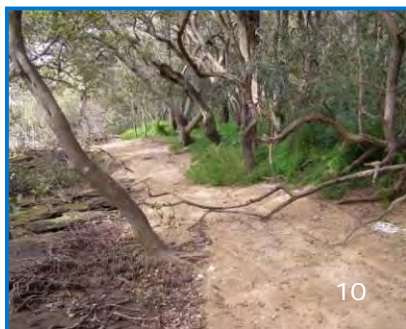
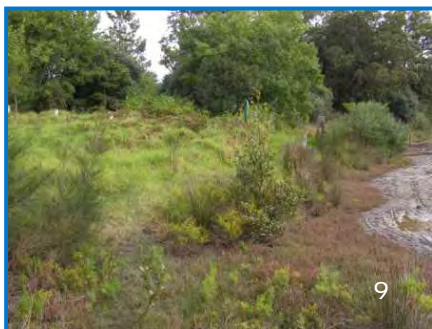
Council's GIS data layers show only one stormwater outlet into the bay, which is located adjacent to the southeast boundary of Concord Repatriation Hospital. This outlet drains a catchment of 77ha, and from available information (at the time of writing the VMP) there does not appear to be any pollution control devices in place within this catchment. The high conservation value of this site warrants prioritisation of future works in response to stormwater management incentives and funding.

Terrestrial weeds:

A number of noxious and environmental weeds have infested the areas fringing the intertidal zone. Blackberry and Lantana are common on land adjacent horse agistment, Lantana and Asparagus fern dominates the understorey of Swamp-oak floodplain forest along the foreshore, Kikuyu and other terrestrial weeds predominate in most areas including Swamp-oak floodplain forest understorey, non-canopied fringing open space adjacent to the intertidal zone, and encroaching into saltmarsh areas (photos #5 to #10). These areas should be progressively rehabilitated. Weed infested areas which lack canopy cover and native estuarine vegetation could be used to relocate existing trails.

Sea level rise:

Areas landward of mangrove and saltmarsh within the southern end of the bay should be retained for future landward expansion of saltmarsh (photo #11). The nature of fill materials and underlying substrate conditions should be investigated to determine the feasibility of recreating saltmarsh within this area as a future grant funded project, in advance of predicted climate change impacts.



MAJORS BAY – *Earth Tech (2008) recommendations:*

Eastern Shoreline:

There is limited opportunity to improve vegetative conditions due to the proximity of residential properties, the existing open space use and landscaped edge within the eastern section of Majors Bay Reserve (including a formalised pathway in close proximity to estuarine vegetation – photo #1).

Small highly fragmented patches of saltmarsh are unlikely to remain viable over the long term. Particularly the one located in front of a residential property at the boundary of Majors Bay Reserve (photo #2).



A small area of saltmarsh growing at the end of Kings Street requires a formalised edge against which current mowing practices are limited to a practical extent that prevents damage to saltmarsh plants (primarily *Suaeda australis*).

The open space or easement at the end of Kings Street appears to function as both stormwater conveyance (via surface flow) and buried sewer infrastructure (a number of sewer maintenance manholes evident – Photo #3). Depending on the depth of buried sewer infrastructure and Sydney Water overlying soil heights required above such infrastructure, this area could potentially provide an expansion zone or recreation project for saltmarsh vegetation.

Weed control and protection of existing mangroves and saltmarsh growth is recommended (photos #3 & #4). Growth of introduced vines (e.g. Madeira vine) that have the capacity to smother canopy trees, should in the first instance be targeted within weed control programs.



Western Shoreline:

The western section of Majors Bay Reserve and western shoreline of the bay offers a number of opportunities to improve and increase the area of existing estuarine vegetation, including:

- Removal of existing retaining wall landward of mangroves to increase tidal extent and inundation inland,
- Relocate the existing pathway (which is in poor condition) further inland (photos #5 & #6),

- Undertake bush regeneration and targeted weed control, particularly Lantana infestations (photo #7) which should incorporate staged removal to ensure habitat or shelter for smaller passerine birds and other fauna is gradually replaced, and
- Reinstate terrestrial riparian buffer zone upland of relocated pathway.



MORTLAKE POINT TO CABARITA POINT – *Earth Tech (2008) recommendations:*

Kendall Bay:

Terrestrial weed control within existing saltmarsh (southwest of wharf) is required. As the predominant weed species appears to be Kikuyu grass which is salt intolerant, there is potential to use salinisation on these areas. The proximity, high profile location, and limited available space in which future expansion of saltmarsh can occur, lends itself to be treated as a demonstration patch representative of its endangered ecological community listing with educational signage.

Stormwater management: relatively large catchment draining to bay where mangrove stand exists. This area should be investigated and considered in future Council funded and/or grant funded stormwater management incentive projects.

Cabarita Wharf to Cabarita Point:

Potential for riparian plantings in combination with weed control to enhance existing fragmented canopy species along foreshore. There is little space available to reinstate saltmarsh as a community, however seaward understorey plantings should comprise of saltmarsh species.



Above (left and right): Terrestrial weed control required in saltmarsh adjacent pathway

EXILE BAY – *Earth Tech (2008) recommendations:*

Interspecific competition:

Both *C. glauca* and smaller mangrove seedlings are also encroaching into saltmarsh areas, which require removal and continued monitoring for regrowth.

Weed encroachment:

Terrestrial weeds and grasses are encroaching into the saltmarsh, particularly from turfed areas (photos #1 to #4). Where mowed turf abuts saltmarsh (photo #2), a formalised edge should be installed to prevent accidental mowing of saltmarsh and limit growth of terrestrial species into saltmarsh.

Areas presently maintained by mowing that are located in between the formal pathway and foreshore (photo #3) could be replaced with low growing groundcovers that maintain visual access but provide a physical barrier to saltmarsh areas.



Stormwater management:

Groundwater seepage is entering saltmarsh in Prince Edwards Park at various locations, altering soil salinity and promoting growth of weeds (photo #4) impacting on the saltmarsh.

Access management:

Some areas of saltmarsh, particularly those growing on sandy beach areas are being trampled by pedestrians (photos #2 & #5). Fencing and signage to prevent trampling to existing saltmarsh growth is recommended.



Dinghy storage:

Dinghies are presently stored *ad hoc* underneath mangroves (and/or tied up to trees) located immediately west of Bayview Park, Canada Bay (photo #6). Formalised dinghy storage within, or in close proximity to this area would alleviate impacts to individual trees by concentrating storage to one area, and providing a secure location for boat housing when not in use.

The health of mangroves at this location should be monitored. Signage should be installed for (a) education/interpretation opportunity, and (b) warning of penalties associated with damaging mangroves.

Riparian planting opportunities:

A number of areas exist along the foreshore and within adjacent golf courses in which riparian plantings could be undertaken in collaboration with relevant land managers.

HEN AND CHICKEN BAY: *Earth Tech (2008) recommendations:***Swamp-oak floodplain forest:**

Quarantine Reserve contains remnant Swamp-oak Floodplain Forest which is limited to a mown understorey. Opportunities exist to reduce mowing by way of bush regeneration / reinstatement of understorey species –vs– mown grass, particularly saltmarsh species which tolerate shade (Photo #1: mangroves in forefront, Swamp-oak in background with a grass understorey in between the two).

Mangroves:

Mangroves occur in two key locations: Quarantine Reserve (Photos #1 & #2) and Halliday Park (Photo #3 & #4). Smaller growth or isolated trees (of modest size) are scattered along the foreshore between Halliday Park and Henry Lawson Park.

Mangroves within Quarantine Reserve are relatively even aged and considered old growth within the context of the LGA. Recruitment by seedlings was absent, with only coppicing growth from existing trees evident (Photos #1 & #2). The age, health and viability of the older trees should be ascertained to determine whether management intervention is required to ensure mangrove growth does not become extinct from this location.

A small mangrove stand north of Halliday Park has relatively recently established (i.e. not shown on 2005 aerial photography or mapping). This stand will need to be monitored and an acceptable limit in which growth is allowed to establish adopted (Photos #3 & #4 – smaller growth in foreground, larger stand in background: refer non-vegetated habitat). Any seedlings or propagules removed from this location could be transplanted to other more suitable locations within the LGA.

Scattered mangroves occur along a section of eroding bank adjacent an elevated portion of Wymston Parade. Planting / transplanting could be undertaken along this area of foreshore to increase mangrove extent and protect against wind and wave energy. Alternatively repairs to the eroding bank could incorporate inter-tidal habitat into its design. Note that establishing mangroves at this location will not impinge on residential views to the bay (Photos #5 & #6).

Non-vegetated Habitat:

Hen and Chicken Bay was determined by Hobcroft (2003) to be one of three key habitat areas within the LGA for wader birds. The maintenance of non-vegetated mudflat habitat by active removal of mangrove seedlings and propagules will be required. A review of the location of unleashed dog exercise areas in relation to key wader bird habitat areas should also be undertaken and revised appropriately (photo #7).





Unaccompanied and unleashed dog eyeing off wader birds foraging on mudflat (Hen & Chicken Bay)



FIVE DOCK BAY: *Earth Tech (2008) recommendations:*

Few opportunities exist to enhance estuarine vegetation in Five Dock Bay (and Abbotsford Bay to the west). Estuarine vegetation is limited to subtidal seagrass beds and either remnant patches or scattered growth of mangroves. One stand of mangroves in Five Dock Bay has been subject to tree vandalism for what appears to be the maintenance of residential views. Within the latter area (Photos #1 & #2), mangrove reinstatement should be investigated and implemented in conjunction with community consultation to establish a better understanding of the importance of intertidal communities.

Other areas in front of seawalls within Five Dock Bay would be suitable for increasing the extent of mangroves through transplantation programs, as scattered areas of mudflats and/or shallow areas of inundation occur. As per Hen and Chicken Bay, the potential to gradually replace existing moorings with seagrass friendly mooring facilities should also be investigated.

**SISTERS BAY: *Earth Tech (2008) recommendations:*****Saltmarsh:**

Existing saltmarsh growth is extremely limited in this Bay and is unlikely to be viable as a community over the long term, and more feasibly an understorey component of Swamp-oak Floodplain Forest.

Mangroves:

Protect existing mangroves and encourage natural recruitment of existing seedlings. Regular monitoring of natural recruitment is recommended to determine whether assisted regeneration of mangroves is required over the longer term.

Large numbers of mangrove propagules (Photo #2) may be relocated to more suitable areas within this site to assist in establishment and expansion of mangrove community.

Terrestrial weeds:

Ongoing bush regeneration management of Swamp-oak Floodplain Forest interfacing mangroves (Photo #3), recommend using saltmarsh species such as *Sporobolus virginicus*, *Baumea juncea*, for understorey plantings.

**HALF MOON BAY: *Earth Tech (2008) recommendations:***

Saltmarsh:

Saltmarsh management within Half Moon Bay is to be prioritised over mangrove (whereas the reverse should be considered in Sisters Bay). Present issues include smothering of saltmarsh vegetation by gross pollutants (litter, debris) (Photo #1), and mangrove encroachment. Interspecific competition from mangroves will require removal of seedlings in saltmarsh growth as a regular maintenance task.

Dinghy storage:

Dinghies are presently stored on scattered patches of saltmarsh growing along the foreshore (south of Half Moon Bay) for which formalised storage could be built into the existing sea walls at strategic locations (Photo #2).

**RODD'S POINT: Earth Tech (2008) recommendations:****Saltmarsh:**

Little scope for expanding saltmarsh growth due to the proximity of Henley Marine Drive and foreshore City to Bay shared pedestrian / cycle way (Photo #1).

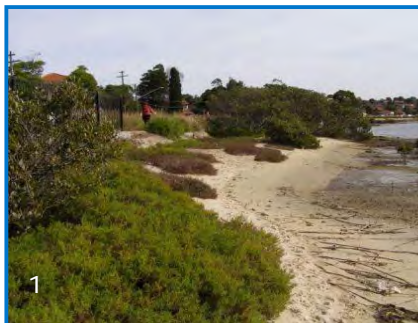
Potential to expand small area of *Suaeda australis* (Austral seablite) isolated from main area of saltmarsh (Photo #2) and join both saltmarsh areas into one larger patch.

As there is limited opportunity for landward migration, it will be imperative to protect the existing saltmarsh, which should include:

- Access management / fencing
- Delineation of mangrove growth and removal of seedlings that encroach into saltmarsh, and
- Weed control (see below)

Terrestrial weed management:

Terrestrial weeds, and to a lesser extent *C.glauca* growth, immediately adjacent the southwestern corner of the Rodd Park car park requires control (Photo #3). Potential to trial salinisation as a weed control method for weed species intolerant of salinity.

**IRON COVE BAY: Earth Tech (2008) recommendations:**

Little opportunities are available to reinstate riparian plantings as the site is predominantly within the Henley Marine Drive road corridor which includes the City to Bay shared pathway. Rodd Park is, for the most part, also topographically unsuitable for reinstatement of estuarine vegetation (including littoral vegetation), and is presently maintained for recreation (which includes a car parking area).

Saltmarsh:

Small pockets of saltmarsh plants are growing on rock edging the south shoreline of Rodd Point. This growth is unlikely to remain viable, and could be transplanted for use in other saltmarsh rehabilitation or recreation areas.

Stormwater management:

multiple small stormwater outlets are housed within seawall in this site (Photo #1). Formalisation of flow paths through minor rock placement to ensure flows are either diverted away from mangrove and saltmarsh growth, or dissipated to allow colonisation of saltmarsh within the flow path.

Interspecific competition:

C. glauca removal from saltmarsh required. Canopy species should be restricted to street tree plantings only within this area of foreshore (Photo #2).

Terrestrial weeds:

grasses and typical road side weeds encroaching into saltmarsh require control. Potential to trial salinisation as a method to control non-salt tolerant weed species (refer Appendix B).

Wader bird habitat:

potential conflicts with establishment of estuarine vegetation and use of area to exercise dogs off-leash. South of Rodd Park, the shoreline exhibits prolific seedling recruitment of mangroves (Photo #3). The area along the eastern shore of Rodd Park is commonly used for unleashed dog exercise.

Both vegetation and dog exercise functions of this shoreline should be assessed against the potential significance of the area for wader birds.

Mangroves:

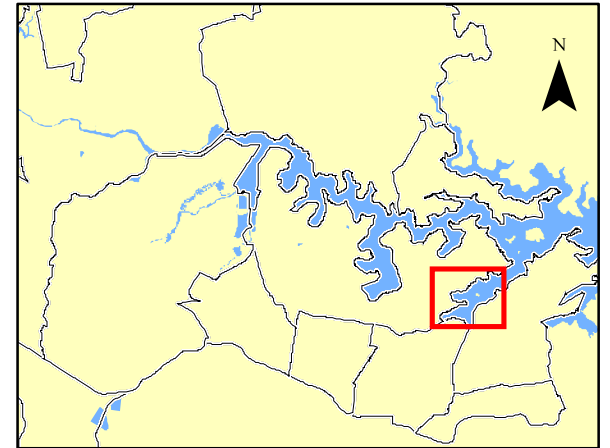
Reinstatement of mangroves where existing die off - potential poisoning has occurred and trial pruning of such to maintain views to adjacent residences in lower elevations may be considered (Photo #4). Alternatively, this area could be used as a trial area for reinstatement of saltmarsh using wrack (dead seagrass) as a growth substrate. Washed up wrack was evident within this site.

Scattered mangrove trees have established adjacent the seawall where Henley Marine Drive heads east (crossing Iron Cove Creek towards Hawthorne Canal). This area of seawall may lend to increasing the extent of mangrove growth within the bay. Although it is likely that advanced stock or otherwise purpose built planting areas would be required for establishment of dense mangrove growth in this location. Eventual repair or replacement of the seawall in this location should incorporate vegetative or other tidal habitat features.





SITE LOCATION



Seawalls

- Excellent
- Good
- Poor
- Failed

- Stormwater outlet
- Potential GPT site
- Existing GPT
- Stormwater drainage
- Canal
- Foreshore erosion

- Facilities
- Moorings

Seagrass & moorings

- Low priority
- Medium priority
- High priority
- Seagrass, no moorings

Vegetation Communities

- Estuarine mangrove
- Coastal saltmarsh (EEC)
- Swamp-oak floodplain forest (EEC)
- Turpentine - ironbark forest (EEC)
- Coastal sandstone communities
- Foreshore parks and reserves

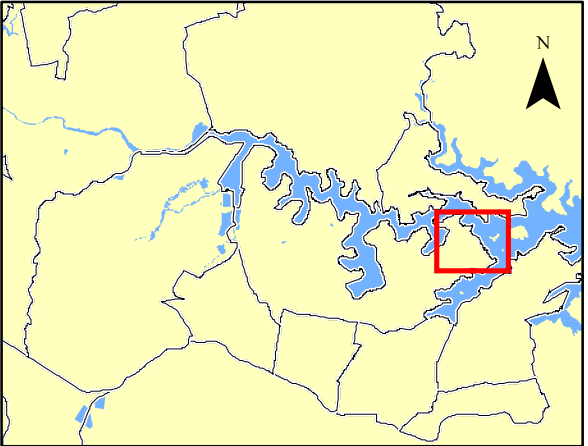
Source:

Seagrass base plan: Industry & Investment NSW (2003)
Seagrass ground truthed: AECOM (2009)
Vegetation base mapping: SMCMA (2007)
Other: refer study section 8.0 (2010)

Coordinate System: GDA94 MGA Zone 56



SITE LOCATION



- Seawalls
- Excellent
 - Good
 - Poor
 - Failed
- Stormwater outlet
- Potential GPT site
- Existing GPT
- Stormwater drainage
- Canal
- Foreshore erosion
- Facilities
- Moorings
- Seagrass & moorings
- Low priority
 - Medium priority
 - High priority
 - Seagrass, no moorings
- Vegetation Communities
- Estuarine mangrove
 - Coastal saltmarsh (EEC)
 - Swamp-oak floodplain forest (EEC)
 - Turpentine - ironbark forest (EEC)
 - Coastal sandstone communities
 - Foreshore parks and reserves

Source:

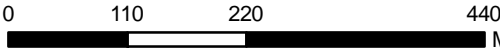
Seagrass base plan: Industry & Investment NSW (2003)

Seagrass ground truthed: AECOM (2009)

Vegetation base mapping: SMCMA (2007)

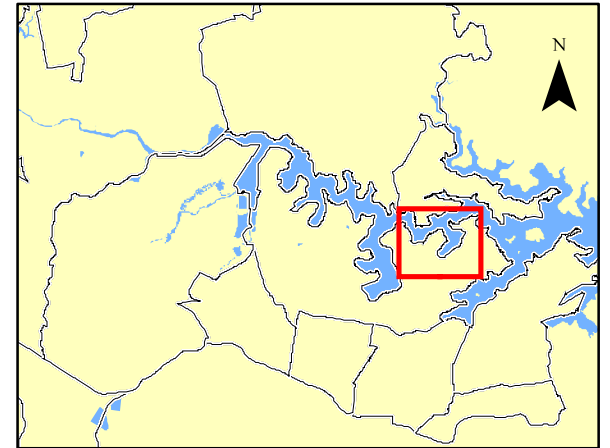
Other: refer study section 8.0 (2010)

Coordinate System: GDA94 MGA Zone 56





SITE LOCATION



Seawalls

- Excellent
- Good
- Poor
- Failed

- Stormwater outlet
- Potential GPT site
- Existing GPT
- Stormwater drainage
- Canal
- Foreshore erosion

- Facilities
- Moorings

Seagrass & moorings

- Low priority
- Medium priority
- High priority
- Seagrass, no moorings

Vegetation Communities

- Estuarine mangrove
- Coastal saltmarsh (EEC)
- Swamp-oak floodplain forest (EEC)
- Turpentine- ironbark forest (EEC)
- Coastal sandstone communities
- Foreshore parks and reserves

Source:

Seagrass base plan: Industry & Investment NSW (2003)
Seagrass ground truthed: AECOM (2009)
Vegetation base mapping: SMCMA (2007)
Other: refer study section 8.0 (2010)

Coordinate System: GDA94 MGA Zone 56



SITE LOCATION



Seawalls

- Excellent
- Good
- Poor
- Failed

- Stormwater outlet
- Potential GPT site
- Existing GPT
- Stormwater drainage
- Canal
- Foreshore erosion

- Facilities
- ⚓ Moorings

Seagrass & moorings

- Low priority
- Medium priority
- High priority
- Seagrass, no moorings

Vegetation Communities

- Estuarine mangrove
- Coastal saltmarsh (EEC)
- Swamp-oak floodplain forest (EEC)
- Turpentine - ironbark forest (EEC)
- Coastal sandstone communities
- Foreshore parks and reserves

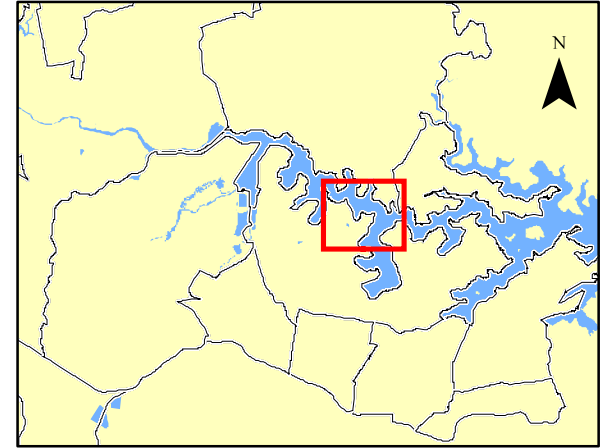
Source:

Seagrass base plan: Industry & Investment NSW (2003)
 Seagrass ground truthed: AECOM (2009)
 Vegetation base mapping: SMCMA (2007)
 Other: refer study section 8.0 (2010)

Coordinate System: GDA94 MGA Zone 56



SITE LOCATION



Seawalls

- Excellent
- Good
- Poor
- Failed

- Stormwater outlet
- Potential GPT site
- Existing GPT
- Stormwater drainage
- Canal
- Foreshore erosion

- Facilities
- Moorings

Seagrass & moorings

- Low priority
- Medium priority
- High priority
- Seagrass, no moorings

Vegetation Communities

- Estuarine mangrove
- Coastal saltmarsh (EEC)
- Swamp-oak floodplain forest (EEC)
- Turpentine - ironbark forest (EEC)
- Coastal sandstone communities
- Foreshore parks and reserves

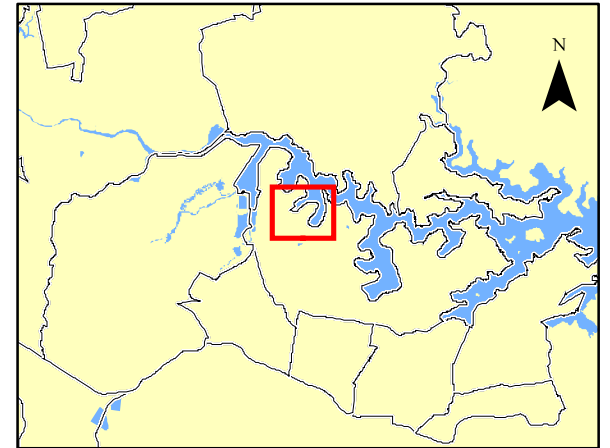
Source:

Seagrass base plan: Industry & Investment NSW (2003)
 Seagrass ground truthed: AECOM (2009)
 Vegetation base mapping: SMCMA (2007)
 Other: refer study section 8.0 (2010)

Coordinate System: GDA94 MGA Zone 56



SITE LOCATION



Seawalls

- Excellent
- Good
- Poor
- Failed

- Stormwater outlet
- Potential GPT site
- Existing GPT
- Stormwater drainage
- Canal
- Foreshore erosion

- Facilities
- Moorings

Seagrass & moorings

- Low priority
- Medium priority
- High priority
- Seagrass, no moorings

Vegetation Communities

- Estuarine mangrove
- Coastal saltmarsh (EEC)
- Swamp-oak floodplain forest (EEC)
- Turpentine - ironbark forest (EEC)
- Coastal sandstone communities
- Foreshore parks and reserves

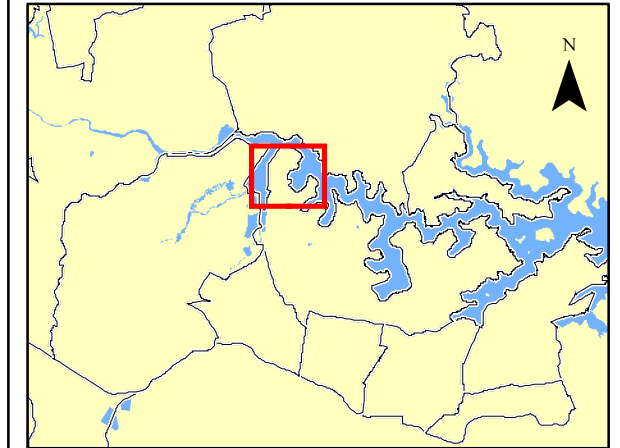
Source:

Seagrass base plan: Industry & Investment NSW (2003)
Seagrass ground truthed: AECOM (2009)
Vegetation base mapping: SMCMA (2007)
Other: refer study section 8.0 (2010)

Coordinate System: GDA94 MGA Zone 56



SITE LOCATION



Seawalls

- Excellent
- Good
- Poor
- Failed

- Stormwater outlet
- Potential GPT site
- Existing GPT
- Stormwater drainage
- Canal

Foresore erosion

- Facilities
- Moorings

Seagrass & moorings

- Low priority
- Medium priority
- High priority
- Seagrass, no moorings

Vegetation Communities

- Estuarine mangrove
- Coastal saltmarsh (EEC)
- Swamp-oak floodplain forest (EEC)
- Turpentine - ironbark forest (EEC)
- Coastal sandstone communities
- Foreshore parks and reserves

Source:

Seagrass base plan: Industry & Investment NSW (2003)
Seagrass ground truthed: AECOM (2009)
Vegetation base mapping: SMCMA (2007)
Other: refer study section 8.0 (2010)

Coordinate System: GDA94 MGA Zone 56

Appendix 3: Field Assessment Sheets for Priority Sites

SITES IN ORDER OF PRIORITY

All assessment sites are detailed within the project GIS database.

ABBREVIATIONS

Level: metres AHD (m)

Co-ords (MGA): Coordinates Map Grid of Australia

E: easting

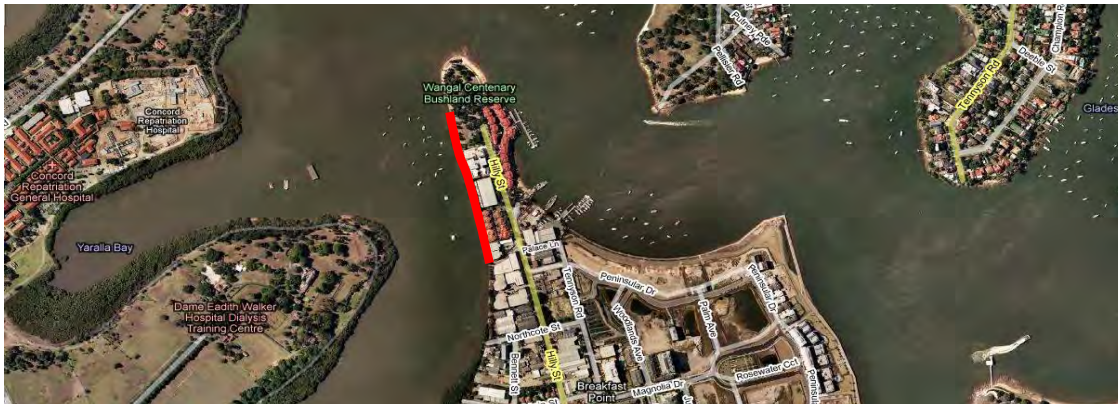
N: northing

Condition:

Excellent	<ul style="list-style-type: none">• No defects observed• Structure is functioning as intended
Good	<ul style="list-style-type: none">• Minor defects observed• Generally good condition• Structure is functioning as intended
Poor	<ul style="list-style-type: none">• Major defects observed• Structure is at risk of failure without remedial action• Reduced functionality
Failed	<ul style="list-style-type: none">• Major defects observed• Structure is no longer functioning as intended• Structure has collapsed

Seawall Inspection Record - CAN_S60

Date	17/08/09	Locality	Mortlake Point, River South	Level	1.13m	LGA	
Time	13:17			People	Mid	Canada Bay	



Co-Ords (MGA)	
Start	
E	324566
N	6254447
End	
E	324604
N	6254290

Seawall Details (Slope, Material, Const. Method, Type):
Grouted, large sandstone block revetment with a single row of vertical medium sandstone blocks at the crest. A sandy shoreline is present in front of the structure. The northern extent of the structure is in Wangal Centenary Bushland Reserve. The southern extent of the wall has a public footpath and chain fence beyond the crest and continues into private residential property.

Condition Assessment (Slope, Crest, Toe, Backfill):	Excellent	<input type="checkbox"/>
The blocks that make up the slope are weathered with grout missing leaving voids indicating a loss of material from behind the structure. The vertical blocks at the crest are also weathered and missing grout material, some blocks have collapsed.	Good	<input type="checkbox"/>
	Poor	<input checked="" type="checkbox"/>
	Failed	<input type="checkbox"/>

Assets
The structure supports a timber landing facility at its northern extent and is in a poor condition beneath.

Comments:
Photos of structure are CAN_S60-01 to CAN_S60-04.

Photo 1
Typical section of wall showing loss of grout and weathering of blocks.



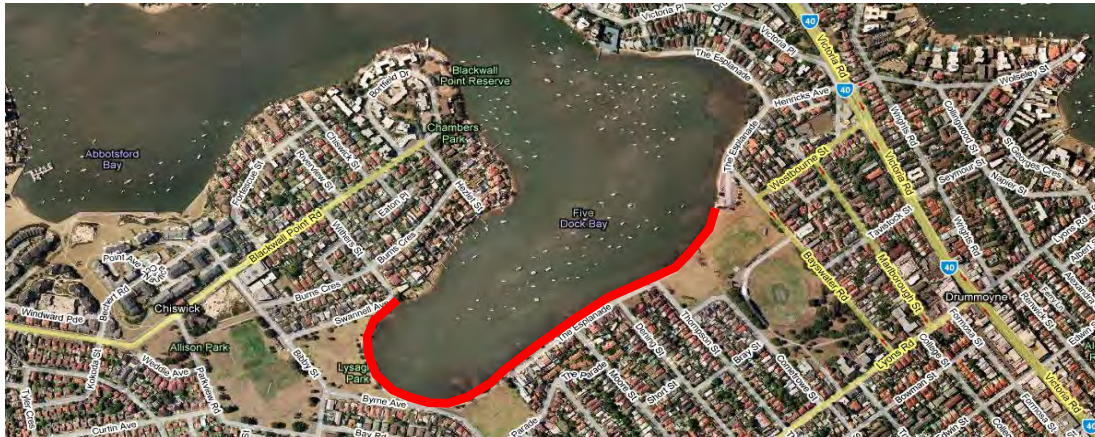
Photo 2
Collapse of blocks at the crest at southern section of structure.



Seawall Inspection Record

- CAN_S23

Date	3/08/09	Locality	Drummoyne/Chiswick, Five Dock Bay	Level	0.88m	LGA	
Time	9:47			Tide	Mid	Canada Bay	



Co-Ords (MGA)

Start

E 328705

N 6253035

End

E 328036

N 6252797

Seawall Details (Slope, Material, Const. Method, Type):

Medium sized, grouted, sandstone block revetment with two rows of vertical blocks at the crest. A public footpath /cycleway and park is located along the crest which was approx. 1.5m above the water level at time of inspection. Midway along the revetment a muddy flat vegetated with mangroves is present. A number of storm water outlets and sea stairs are also located along the wall.

Condition Assessment (Slope, Crest, Toe, Backfill):

Numerous failures were observed where fine material has been lost from behind the revetment creating large cavities causing blocks to slump. Surface weathering, loss of grout material from blocks and sinkholes behind structure crest were also observed.

Excellent

Good

Poor

Failed

X

Assets

The public footpath that runs along the structure has been undermined due to the failures and subsequent loss of fines beneath and may collapse if the revetment is not repaired. The revetment also supports a retaining wall associated with the end of The Esplanade.

Comments:

Photos of structure are CAN_S23-01 to CAN_S23-10.

Photo 1

Typical view of revetment.

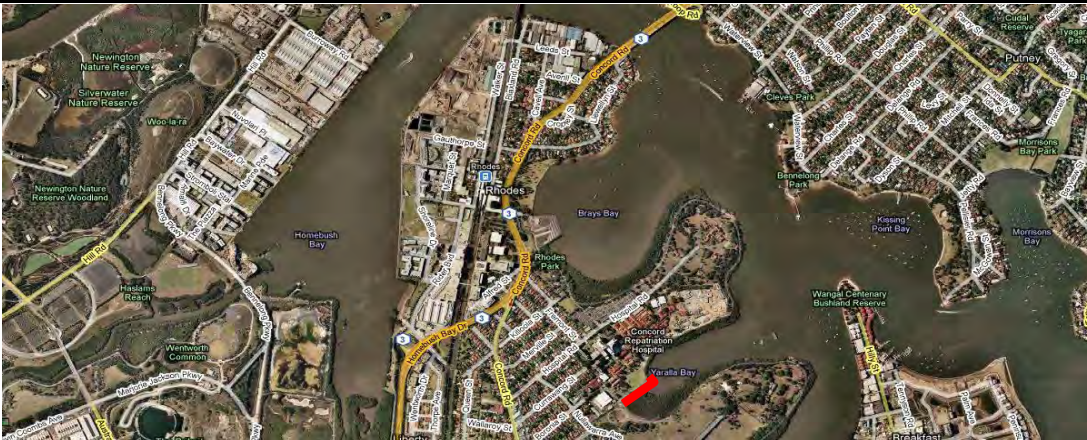
Photo 2

Failure of revetment beneath public footpath.



Seawall Inspection Record - CAN_S63

Date	<u>31/08/09</u>	Locality	<u>Concord West, Yaralla Bay</u>	Level	<u>1.06m</u>	LGA	<u></u>
Time	<u>14:56</u>			Tide	<u>Mid</u>		<u>Canada Bay</u>



Co-Ords (MGA)

Start

E 323601

N 6253973

End

E 323729

N 6254077

Seawall Details (Slope, Material, Const. Method, Type):

Concrete storm water outlet forming seawall. Mangroves are present along the length of the section. The storm water outlet is also used as a public footpath and forms part of the Kokoda Memorial Walkway.

Condition Assessment (Slope, Crest, Toe, Backfill):

Sinkholes are present on the landward side of the structure as are salt scalds indicating inundation during periods of elevated water levels. The opening of the storm water outlet is cracked and weathered with reinforcement and aggregate exposed.

Excellent

Good

Poor

Failed

X

Assets

The structure is used as public footpath and joins to the Kokoda Memorial Track at Rhodes Park.

Comments:

Photos of structure are CAN_S63-01 to CAN_S63-08.

Photo 1

View of structure.

Photo 2

Failure at northern extent of structure.



Seawall Inspection Record - CAN_S66

Date	<u>18/08/09</u>	Locality	<u>Rocky Point, River South</u>	Level	<u>0.61m</u>	LGA
Time	<u>9:50</u>			Tide	<u>Low-Mid</u>	<u>Canada Bay</u>



Co-Ords (MGA)

Start

E 324064

N 6254890

End

E 324052

N 6254899

Seawall Details (Slope, Material, Const. Method, Type):

Small section of grouted, small/medium sized sandstone block seawall adjacent Concord Hospital Watergate.

Condition Assessment (Slope, Crest, Toe, Backfill):

Grout is missing from blocks at the toe. Weathering of blocks also observed. The structure is exposed to vessel wash.

Excellent

Good

Poor

Failed

X

Assets

The structure supports the adjacent grassy slope within the hospitals grounds and is accessible to the public.

Western section the wall abuts the Concord Hospital Watergate, a heritage listed structure.

Comments:

The natural shoreline to the west (CAN_NS22) is in a poor condition within an erosion scarp present.

Photos of structure are CAN_S66-01 to CAN_S66-03.

Photo 1

Small section of sandstone seawall adjacent Concord

Hospital Watergate.



Photo 2

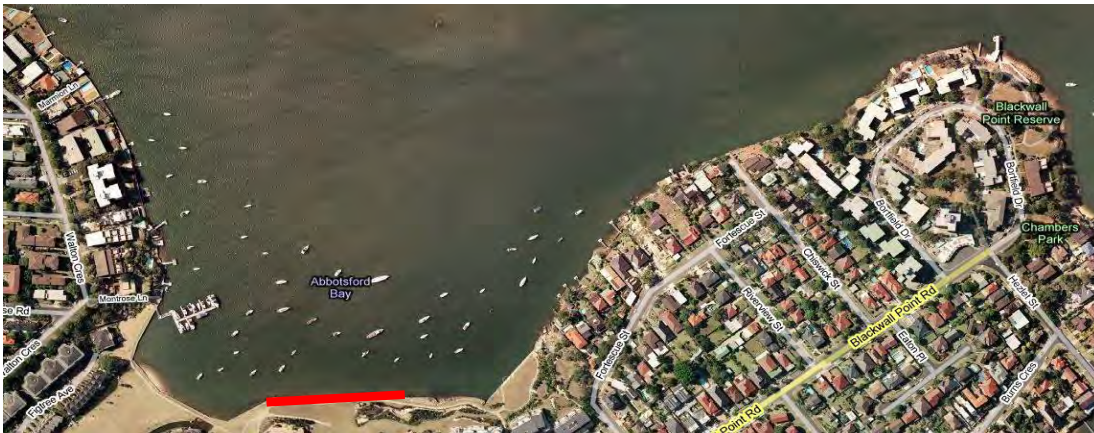
Grout missing from lower blocks of wall.



Seawall Inspection Record

- CAN_S28

Date	<u>3/08/09</u>	Locality	<u>Abbotsford Bay</u>	Level	<u>0.58m</u>	LGA
Time	<u>4:19</u>			Tide	<u>Low</u>	<u>Canada Bay</u>



Co-Ords (MGA)

Start

E 327470

N 6252994

End

E 327334

N 6252991

Seawall Details (Slope, Material, Const. Method, Type):

Small to medium sized sandstone/concrete block seawall with section of concrete slab at the toe. The wall may have been grouted originally.

The land beyond the crest is landscaped and contains a new public footpath, lights and a number of storm water outlets. The crest was approx. 1.5m above the water level at time of inspection.

Condition Assessment (Slope, Crest, Toe, Backfill):

A number of block failures were observed at the toe. Blocks are also severely weathered and there is no grout present causing large voids. Sections of concrete slab are weathered and cracking.

Excellent

Good

Poor

Failed

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input checked="" type="checkbox"/>

Assets

The public footpath that runs along the structure has been undermined due to the failures and subsequent loss of fines beneath and may collapse if the seawall is not repaired.

Comments:

Photos of structure are CAN_S28-01 to CAN_S28-09.

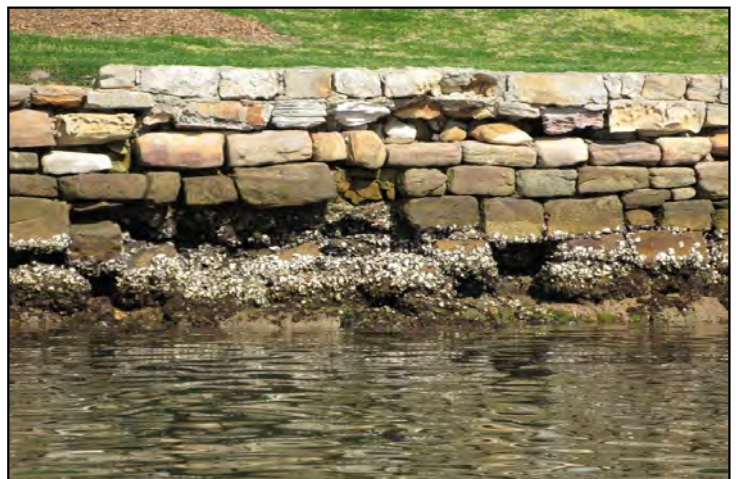
Photo 1

Typical view of wall showing block failure at toe, absence of grout, voids and weathering of blocks



Photo 2

Block failure at toe beneath footpath.

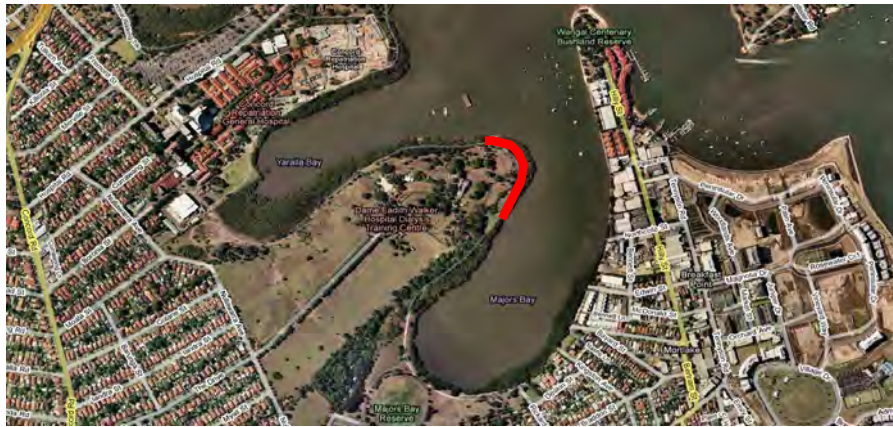


Seawall Inspection Record

- CAN_S62

Date	<u>21/08/09</u>	Locality	Majors Bay
Time	9:48		

Level	1.21m	LGA
Tide	<u>Mid-High</u>	Canada Bay



Co-Ords (MGA)

Start

E	324311
---	--------

N	6253873
---	---------

End

E	324339
---	--------

N	6254196
---	---------

Seawall Details (Slope, Material, Const. Method, Type):

Old partly grouted, medium sandstone block seawall approx 0.5m high. The structure is broken up by bedrock at its northern extent. Mangroves are present in front of the structure. An informal public footpath runs along the wall.

Condition Assessment (Slope, Crest, Toe, Backfill):

The structure is old and appears abandoned. Sandstone blocks are weathered and grout is missing. Many blocks are missing exposing the earth behind which has eroded. Evidence that wall is inundated during periods of elevated water levels.

Excellent

Good

Poor

Failed

X

Assets

An informal public footpath runs along the wall but is not supported by it.

Comments:

Photos of structure are CAN_S62-01 to CAN_S62-11.

Photo 1

Southern extent of wall.

Photo 2

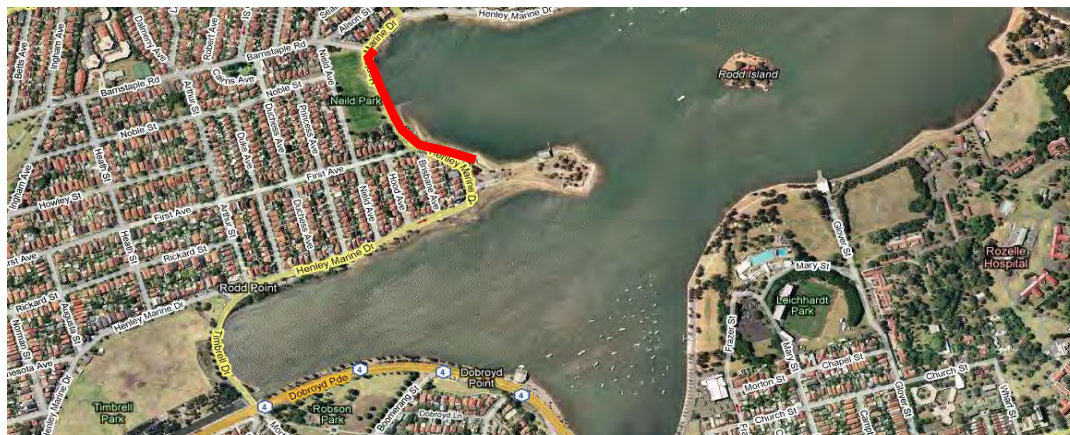
Erosion scarp at northern extent of wall where blocks are missing.



Seawall Inspection Record

- CAN_S03

Date	<u>18/08/09</u>	Locality	<u>Rodd Point, Iron Cove Bay</u>	Level	<u>1.14m</u>	LGA	<u>LGA</u>
Time	<u>15:15</u>			Tide	<u>Mid</u>		<u>Canada Bay</u>



Co-Ords (MGA)

Start

E	<u>328567</u>
N	<u>6251218</u>

End

E	<u>328372</u>
N	<u>6251478</u>

Seawall Details (Slope, Material, Const. Method, Type):

Medium sized grouted sandstone block revetment. A public footpath runs along the crest and the intermittent saltmarsh and mangrove stands are present in front of the revetment. Re-grouting of concrete blocks has been undertaken at discrete locations.

Condition Assessment (Slope, Crest, Toe, Backfill):

Surface weathering and loss of grout from sandstone blocks was observed. Slumping and sinkholes were also observed indicating a loss of fine material from behind the structure. Condition appears to worsen where no vegetation is present in front.

Excellent	<input type="checkbox"/>
Good	<input type="checkbox"/>
Poor	<input checked="" type="checkbox"/>
Failed	<input type="checkbox"/>

Assets

No major issues at present.

Comments:

Photos of structure are CAN_S03-01 to CAN_S03-10.

Photo 1

Typical section revetment showing slumping and loss of grout from blocks.



Photo 2

Block failure of wall due to loss of material from behind.



Seawall Inspection Record - CAN_S04

Date	18/08/09	Locality	Russel Lea, Iron Cove Bay	Level	1.14m	LGA
Time	15:27			Tide	Mid	Canada Bay



Co-Ords (MGA)

Start

E 328372

N 6251478

End

E 328442

N 6251546

Seawall Details (Slope, Material, Const. Method, Type):

Grouted concrete block stepped seawall. A new concrete public footpath has been constructed along the crest.

Condition Assessment (Slope, Crest, Toe, Backfill):

The structure is slumping along its entirety with undermining of the toe, severe weathering of the concrete blocks with aggregate and reinforcement visible and loss of grout observed. The public footpath is cracked in places.

Excellent

Good

Poor

Failed

X

Assets

Public access is available to all levels of the stepped seawall. The steps are uneven and reinforcement is protruding from the weathered concrete blocks.

Comments:

Photos of structure are CAN_S04-01 to CAN_S04-07.

Photo 1

Northern section of wall showing extent of movement of different levels of the wall.

Photo 2

Undermining of the toe and surface weathering of the concrete blocks.



Seawall Inspection Record

- CAN_S06

Date	18/08/09	Locality	Russel Lea, Iron Cove Bay	Level	1.14m	LGA	
Time	15:37			Tide	Mid	Canada Bay	



Co-Ords (MGA)	
Start	
E	328563
N	6251558
End	
E	328578
N	6251558

Seawall Details (Slope, Material, Const. Method, Type):
Grouted sandstone block seawall with large blocks at toe and small blocks at the crest. A storm water outlet is built into the seawall.

Condition Assessment (Slope, Crest, Toe, Backfill):	Excellent	<input type="checkbox"/>
The western extent of the wall has failed with a large void left behind the structure. The rest of the structure is showing signs of weathering and has been undermined at the toe.	Good	<input type="checkbox"/>
	Poor	<input checked="" type="checkbox"/>
	Failed	<input type="checkbox"/>

Assets
A public footpath and cycleway runs along the crest of the wall approximately 1m from the failure. The wall also retains the land behind which supports the footpath and Henley Marine Drive.

Comments:
Photos of structure are CAN_S06-01 to CAN_S06-04.

Photo 1

View of seawall showing failure at western extent in foreground.

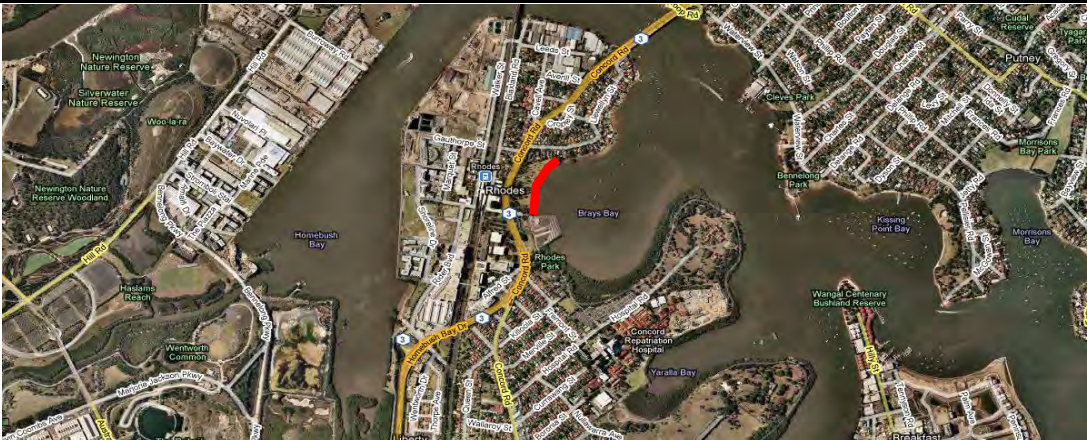
Photo 2

Undermining of structure at toe.



Seawall Inspection Record - CAN_S68

Date	<u>18/08/09</u>	Locality	<u>Rhodes, Brays Bay</u>	Level	<u>0.61m</u>	LGA
Time	<u>10:10</u>			Tide	<u>Low-Mid</u>	<u>Canada Bay</u>



Co-Ords (MGA)

Start

E 323206

N 6254871

End

E 323306

N 6255135

Seawall Details (Slope, Material, Const. Method, Type):

Sandstone boulder revetment specially placed and grouted. A concrete strip runs along the crest. A number of old sandstone sea stairs and storm water outlets are located along the revetment. Mangroves are present in front of the structure at its northern extent.

Condition Assessment (Slope, Crest, Toe, Backfill):

Minor loss of grout, surface weathering of blocks, and undermining of the toe was observed. A failure has occurred at the southern end adjacent to a storm water outlet.

Excellent

Good

Poor

Failed

X

Assets

No major issues observed.

Comments:

Photos of structure are CAN_S68-01 to CAN_S68-04.

Photo 1

Typical section of revetment showing minor weathering of blocks and loss of grout.

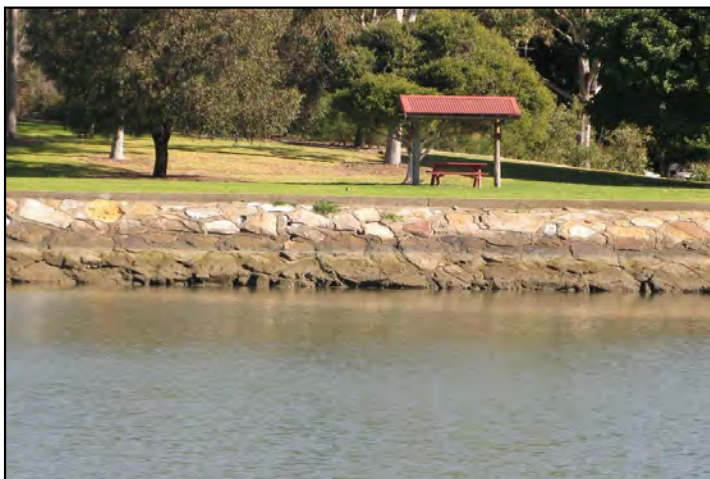


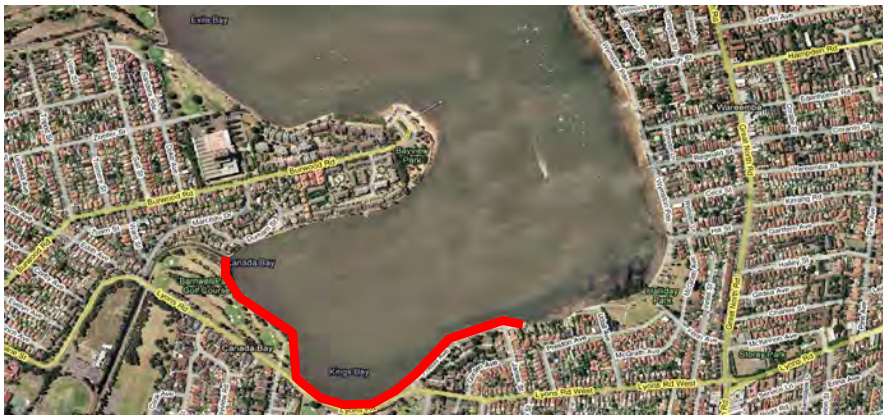
Photo 2

Failure and loss of grout adjacent to storm water outlet.



Seawall Inspection Record - CAN_S37

Date	<u>17/08/09</u>	Locality	<u>Kings Bay, Hen and Chicken Bay</u>	Level	<u>0.66m</u>	LGA	<u></u>
Time	<u>9:46</u>			People	<u>Low-Mid</u>	Canada Bay	<u></u>



Co-Ords (MGA)

Start

E 326495

N 6251495

End

E 325710

N 6251672

Seawall Details (Slope, Material, Const. Method, Type):

Grouted medium sized sandstone block revetment with two rows of vertical sandstone blocks at the crest. A number of sandstone sea stairs and storm water outlets are located along the seawall. A section of concrete slab seawall is located at the opening of the canal at Barnwell Park Golf Course. A Casuarina stand is present along the western section of the revetment.

Condition Assessment (Slope, Crest, Toe, Backfill):

Block failures at the crest, and transition from sloping to vertical, due to a loss of fine material observed at discrete location along the entire length of the revetment. Surface weathering of blocks and loss of grout was also observed.

Excellent

Good

Poor

Failed

X

Assets

Public access only most of the wall, no structures supported by the revetment

Comments:

Photos of structure are CAN_S37-01 to CAN_S37-10.

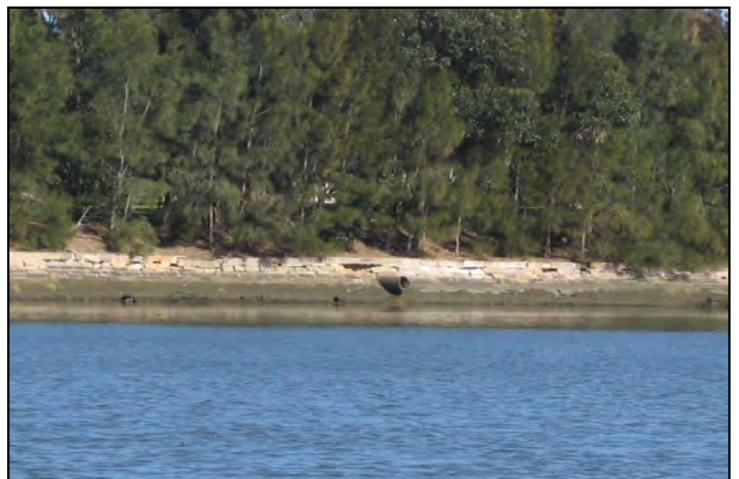
Photo 1

Typical section of revetment showing failure and weathering of blocks.



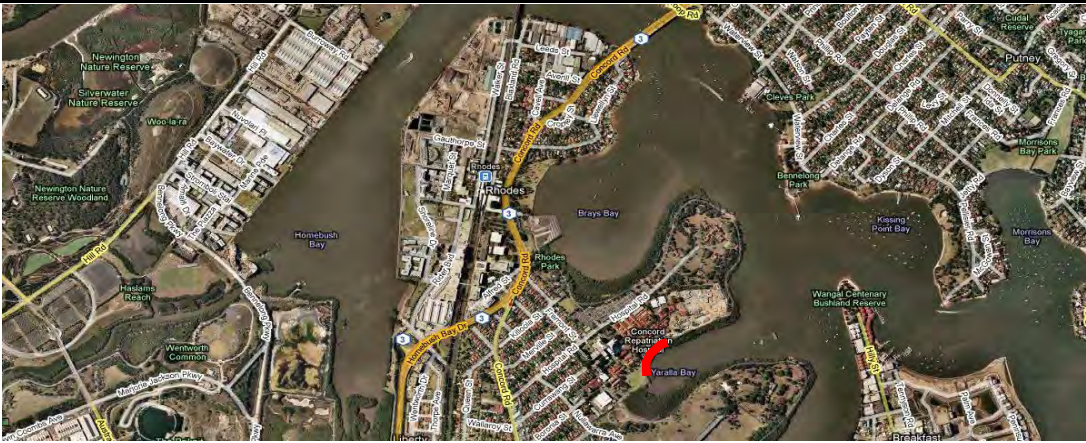
Photo 2

Western section of revetment showing failure, weathering of blocks and Casuarina stand atop crest.



Seawall Inspection Record - CAN_S64

Date	<u>31/08/09</u>	Locality	<u>Concord West, Yaralla Bay</u>	Level	<u>1.06m</u>	LGA	<u></u>
Time	<u>14:56</u>			Tide	<u>Mid</u>		<u>Canada Bay</u>



Co-Ords (MGA)

Start

E 323729

N 6254077

End

E 323718

N 6254174

Seawall Details (Slope, Material, Const. Method, Type):

Medium sandstone block revetment with single layer of vertical sandstone blocks forming the crest. Mangroves are present in front of the structure for its entire length.

Condition Assessment (Slope, Crest, Toe, Backfill):

The structure is old and appears abandoned. A number of blocks have become dislodged creating voids in wall. Sinkholes were also observed along the crest indicating a loss of fine material from behind the wall. The blocks are severely weathered. Salt scalds also present indicating inundation.

Excellent

Good

Poor

Failed

X

Assets

An informal public footpath runs along the length of the structure and joins to the Kokoda Memorial Track at Rhodes Park.

Comments:

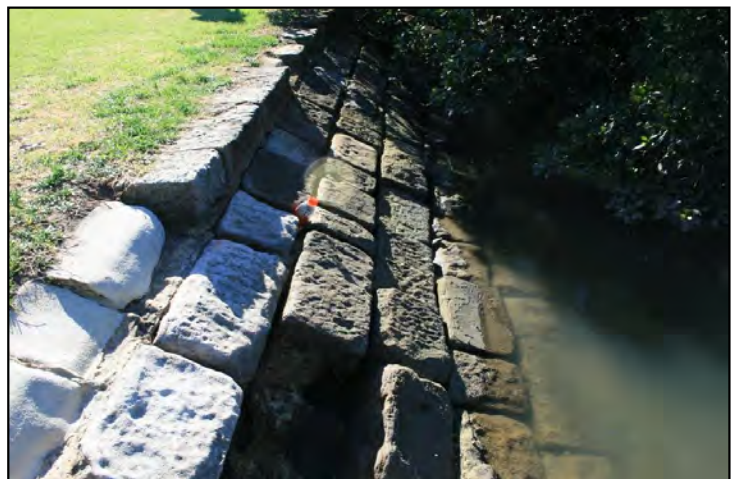
Photos of structure are CAN_S64-01 to CAN_S64-07.

Photo 1

Sinkholes behind structure crest.

Photo 2

Block failure on structure slope.



Seawall Inspection Record

- CAN_S16

Date	<u>3/08/09</u>	Locality	<u>Drummoyne, River South</u>	Level	<u>1.11m</u>	LGA	<u>Canada Bay</u>
Time	<u>8:38</u>			Tide	<u>Mid</u>		



Co-Ords (MGA)

Start

E 329720

N 6252961

End

E 329706

N 6253030

Seawall Details (Slope, Material, Const. Method, Type):

The structure is a vertical concrete seawall with the concrete capping an older small sandstone block seawall. There is no concrete capping of the sandstone blocks on the south east extent adjacent to a public beach (CAN_NS06). A public park is located beyond the wall crest which was approx. 1.5m above the water level at time of insp. A storm water outlet and old boat ramp are also located mid-way along the structure.

Condition Assessment (Slope, Crest, Toe, Backfill):

The concrete capping is weathered exposing aggregate material. Sandstone blocks without concrete capping are failing. Large sinkholes and water logged soil behind the crest were observed which indicate a loss of fine material from behind the wall and inadequate drainage.

Excellent

Good

Poor

Failed

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input checked="" type="checkbox"/>

Assets

The wall is located within a public reserve and there is no structure present to define the wall edge. The boat ramp is accessible to the public. No other structures are supported by this wall.

Comments:

Photos of structure are CAN_S16-01 to CAN_S16-03.

Photo 1

Typical view of seawall showing old boat ramp and storm water outlet.



Photo 2

Sandstone block section of seawall showing failure.



Seawall Inspection Record

- CAN_S18

Date	<u>3/08/09</u>	Locality	<u>Drummoyne, River South</u>	Level	<u>0.85m</u>	LGA	<u></u>
Time	<u>0:00</u>			Tide	<u>Low-Mid</u>	Canada Bay	<u></u>



Co-Ords (MGA)

Start

E 329494

N 6253415

End

E 329458

N 6253441

Seawall Details (Slope, Material, Const. Method, Type):

Concrete wall founded on bedrock with cinder blocks fence on crest adjacent to Drummoyne Ferry Wharf. A public park is located beyond the crest.

Condition Assessment (Slope, Crest, Toe, Backfill):

The concrete is severely weathered with aggregate visible. The mortar connecting the cinder blocks to the wall crest is cracking and some cinder blocks have fallen into the water.

Excellent

Good

Poor

Failed

X

Assets

The seawall supports the ferry wharf structure. Cinder block wall prevents public access to structure edge.

Comments:

Photos of structure are CAN_S18-01 and CAN_S18-02.

Photo 1

Typical section of seawall showing extent of concrete weathering.



Photo 2

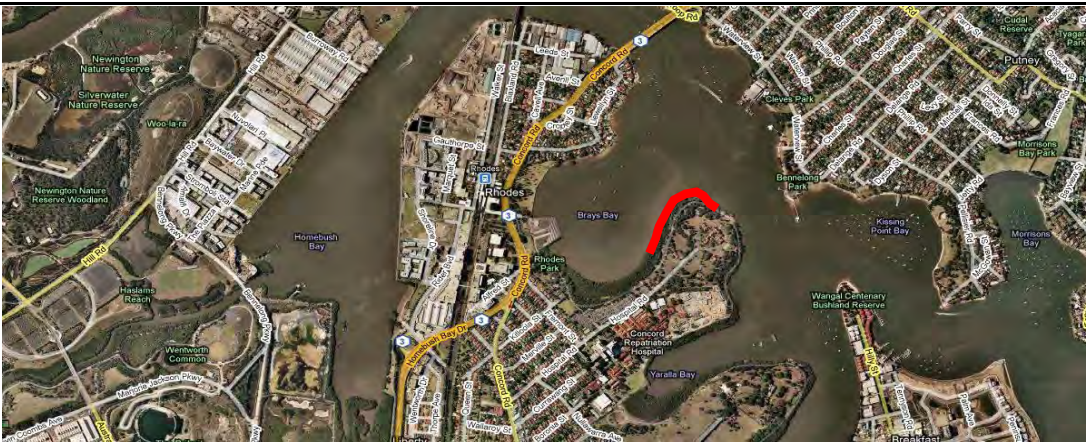
Cracking of concrete and mortar connecting cinder blocks to wall crest.



Natural Shoreline Inspection Record

- CAN_NS12

Date	20/08/09	Locality	West of Concord Hospital Watergate, Brays Bay	Level	0.55m	LGA	Canada Bay
Time	11:36			Tide	Low-Mid		



Co-Ords (MGA)

Start

E	324052
N	6254899

End

E	323795
N	6254843

Details (Vegetation, Slope, Toe):

The eastern extent of the foreshore is open with a rocky foreshore in front of a grassy slope. The rest of the foreshore is heavily vegetated with mangroves. The entire foreshore is exposed to passing vessel wash.

Condition Assessment:

The open section, adjacent Concord Hospital Watergate has a large erosion scarp present. The rest of the foreshore, vegetated with mangroves, is in poor condition with fine material lost from pneumatophores.

Excellent	<input type="checkbox"/>
Good	<input type="checkbox"/>
Poor	<input checked="" type="checkbox"/>
Failed	<input type="checkbox"/>

Assets

The majority of the foreshore is inaccessible except for the exposed section of rocky foreshore adjacent to the Concord Hospital Watergate.

Comments:

Photos of shoreline CAN_NS12-01 to CAN_NS12-10.

Photo 1

Erosion scarp adjacent Concord Hospital Watergate.



Photo 2

Ferry wash at mangrove section of foreshore with absence of fine material from pneumatophores shown.



Natural Shoreline Inspection Record

- CAN_NS01

Date	18/08/09	Locality	Henley Marine Drive, Iron Cove	Level	1.14m	LGA	Canada Bay
Time	15:35			Tide	Mid		



Co-Ords (MGA)

Start

E 328499

N 6251557

End

E 328563

N 6251558

Details (Vegetation, Slope, Toe):

Open foreshore consisting of sandstone fill and building waste. Large sandstone blocks have been placed along shoreline to mitigate erosion.

Condition Assessment:

A large erosion scarp, approx 500mm is present. The crest appears to be slumping due to loss of material at the toe. Sandstone boulders have not been placed to typical engineering detail.

Excellent

Good

Poor

Failed

X

Assets:

The public footpath and road located beyond the crest may be threatened if erosion continues unabated.

Comments:

Photos of shoreline CAN_NS01-01 to CAN_NS01-03.

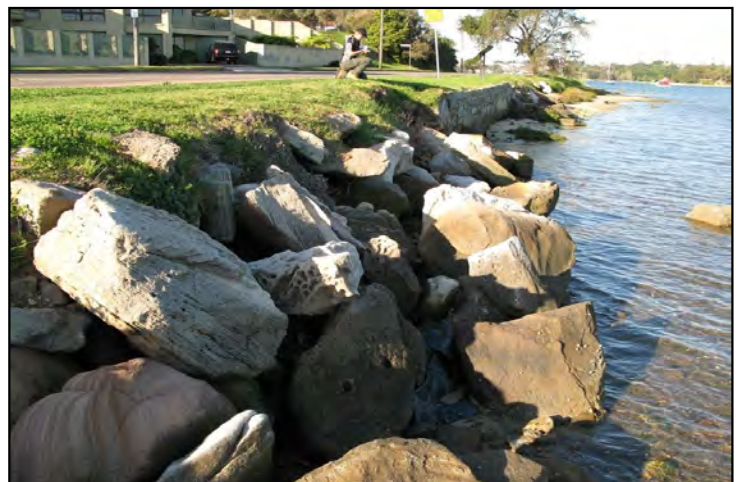
Photo 1

View shoreline showing erosion scarp and sandstone boulders at toe.



Photo 2

Sandstone boulders placed along shoreline to mitigate erosion.



Natural Shoreline Inspection Record

- CAN_NS02

Date	18/08/09	Locality	Henley Marine Drive, Iron Cove	Level	1.14m	LGA	Canada Bay
Time	15:45			Tide	Mid		



Co-Ords (MGA)

Start

E 328578

N 6251558

End

E 328829

N 6251606

Details (Vegetation, Slope, Toe):

Open foreshore consisting of sandstone fill and building waste. Large sandstone blocks have been placed at discrete locations along shoreline to mitigate erosion. A sandy strip and bedrock outcrops are present in front of the shoreline which is vegetated with saltmarsh.

Condition Assessment:

A large erosion scarp, approx 500mm is present. The crest appears to be slumping due to loss of material at the toe. Sandstone boulders have not been placed to typical engineering detail and fine material appears to still be being lost. The adjacent footpath is cracking.

Excellent

Good

Poor

Failed

X

Assets:

The public footpath is located approximately 1m from the erosion scarp. If erosion continues unabated the footpath, and eventually Henley Marine drive, would be threatened.

Comments:

Photos of shoreline CAN_NS02-01 to CAN_NS02-04.

Photo 1

View shoreline showing erosion scarp and rubble at toe.



Photo 2

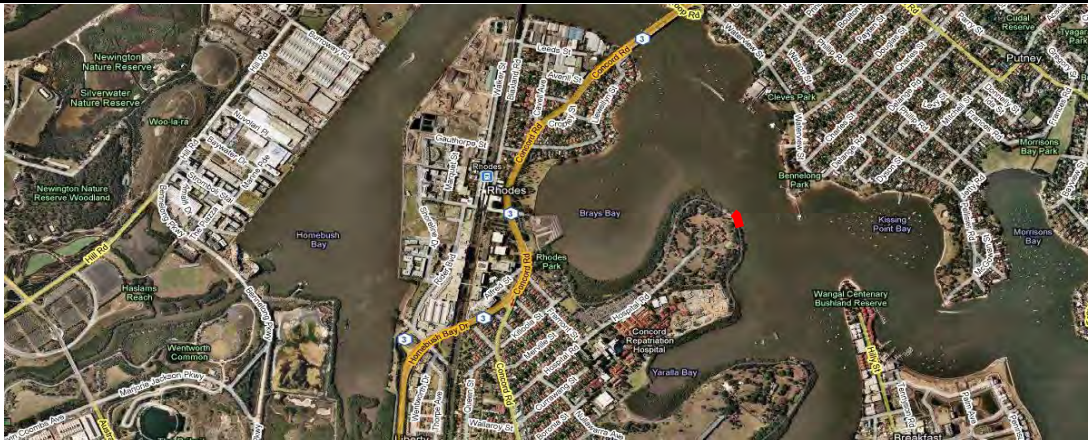
Saltmarsh stand at toe of erosion scarp.



Natural Shoreline Inspection Record

- CAN_NS11

Date	18/08/09	Locality	Concord Hospital Watergate, Rocky Point	Level	0.84m	LGA	
Time	9:42			Tide	Mid	Canada Bay	



Co-Ords (MGA)

Start

E 324111
N 6254758

End

E 324067
N 6254888

Details (Vegetation, Slope, Toe):

Sandy shoreline with rocky outcrops and landscaped grassy slope behind. A number of large sandstone boulders have been placed along the shoreline in an attempt to mitigate erosion. The foreshore is exposed to passing vessel wash.

Condition Assessment:

A large, greater than 500mm, erosion scarp is present which abuts the Concord Hospital Watergate. The erosion may be due to vessel wash and/or informal access. Sandstone boulders have been placed along the scarp to little effect and are now strewn along the rocky foreshore.

Excellent
Good
Poor
Failed

X

Assets

Public access is available to the foreshore via the hospital grounds. The erosion scarp abuts the Concord Hospital Watergate, a heritage listed building, and threatens to undermine its foundations.

Comments:

Photos of shoreline CAN_NS11-01 to CAN_NS11-10.

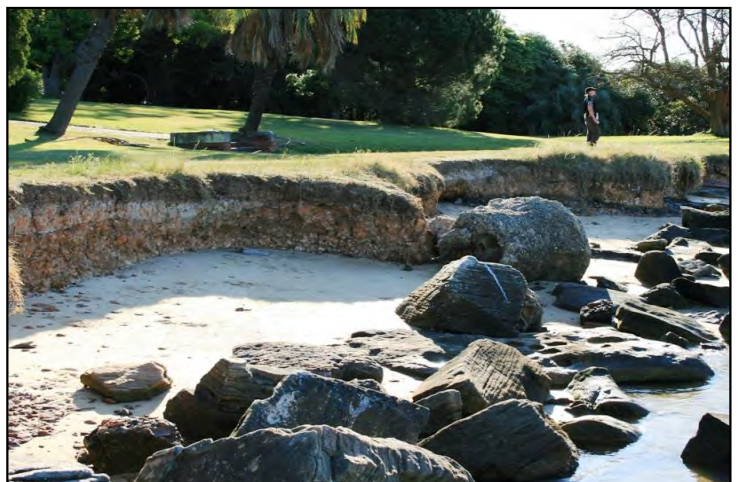
Photo 1

Erosion scarp adjacent Concord Hospital Watergate.



Photo 2

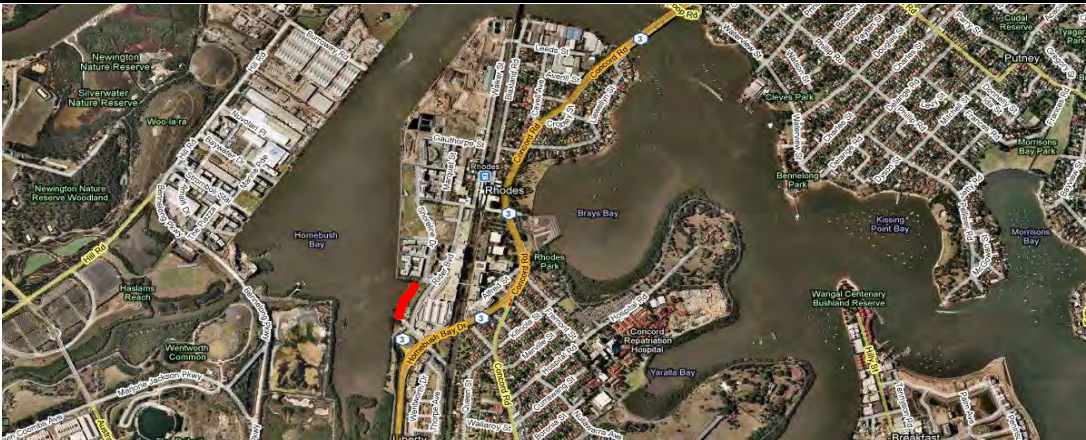
Sandstone boulders strewn along foreshore in front of erosion scarp.



Natural Shoreline Inspection Record

- CAN_NS13

Date	<u>20/08/09</u>	Locality	<u>Homebush Bay, Liberty Grove</u>	Level	<u>0.87</u>	LGA	<u>Canada Bay</u>
Time	<u>9:35</u>			Tide	<u>Mid</u>		



Co-Ords (MGA)

Start

E 322693

N 6254534

End

E 322636

N 6254360

Details (Vegetation, Slope, Toe):

Sandy/muddy low tide terrace vegetated with mangrove saplings and saltmarsh. An earthen bank consisting of anthropogenic fill is present behind the low tide terrace and is vegetated with native and non-native vegetation.

Condition Assessment:

A small, approximately 100-200mm, erosion scarp is present between the low tide terrace and earthen bank exposing fill material.

Excellent

Good

Poor

Failed

X

Assets

The area is inaccessible to the public and no major issues were observed.

Comments:

Photos of shoreline CAN_NS13-01 to CAN_NS13-11.

Photo 1

View of foreshore with mangrove saplings shown.



Photo 2

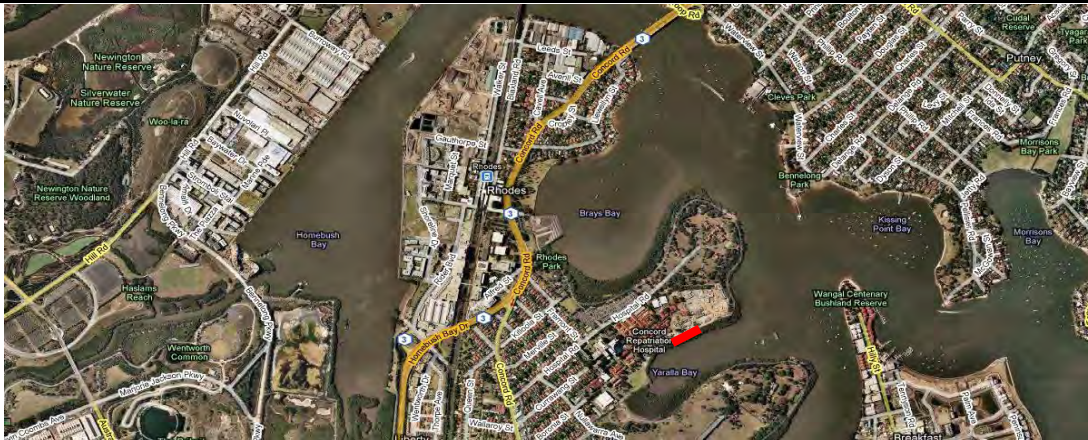
Small erosion scarp at rear of low tide terrace.



Natural Shoreline Inspection Record

- CAN_NS10

Date	31/08/09	Locality	Concord Hospital, Yaralla Bay	Level	1.28	LGA	Canada Bay
Time	15:20			Tide	Mid-High		



Co-Ords (MGA)

Start

E 323718
N 6254174

End

E 323820
N 6254266

Details (Vegetation, Slope, Toe):

Sandy/muddy shoreline with an earthen bank vegetated with grass, casuarinas and weeds. A muddy low tide terrace in front is vegetated with mangroves. Limited public access is available.

Condition Assessment:

A small, approximately 200mm, erosion scarp is present at the base of the earthen bank. A number of casuarinas have collapsed, probably due to high salinity levels.

Excellent
Good
Poor
Failed

X

Assets

There is limited public access to the foreshore. The earthen bank supports a new road and footpath.

Comments:

Photos of shoreline CAN_NS20-01 to CAN_NS20-04.

Photo 1

Erosion scarp between muddy terrace and grassy bank at south western extent of foreshore.



Photo 2

Erosion scarp at base of earthen bank at north eastern extent of foreshore.



Facility Inspection Record

- CAN_F05

Date	<u>3/08/09</u>	Locality	<u>Drummoyne Avenue, Wrights Point</u>	Level	<u>0.88m</u>	LGA	<u>Canada Bay</u>
Time	<u>13:47</u>			Tide	<u>Low-Mid</u>		



Co-Ords (MGA)

Start

E 329192

N 6253726

Facility Details (Usage, Material, Const. Method, Type):

Informal dinghy storage with vessels tethered to trees and timber atop a rocky shoreline at the end of Drummoyne Avenue. A large storm water outlet is also present at this location.

Condition Assessment:

No formal storage facility.

Excellent

Good

Poor

Failed

X

Assets:

Vessels are launched/retrieved via the adjacent rocky shoreline.

Comments:

Photos of facility CAN_F05-01 and CAN_F05-02.

Photo 1

View of informal dinghy storage.



Photo 2

Dinghies tethered to trees atop storm water outlet and rocky shoreline.



Facility Inspection Record

- CAN_F03

Date	<u>4/08/09</u>	Locality	<u>Henley Marine Drive, Iron Cove</u>	Level	<u>1.11m</u>	LGA	<u>Canada Bay</u>
Time	<u>15:25</u>			Tide	<u>Mid</u>		



Co-Ords (MGA)

Start

E 329371
N 6251879

Facility Details (Usage, Material, Const. Method, Type):

Timber wharf and sea stairs supported by timber piles. Dinghy' are tethered to the structure.

Condition Assessment:

Structure is in poor condition with severe deterioration of timber. The wharf has been abandoned with signage on land indicating that it is unsafe for public use.

Excellent
Good
Poor
Failed

X

Assets:

Although abandoned, it appears the wharf is being used for dinghy storage. There is no seaward signage indicating that the wharf has been abandoned. The wharf does not support any other structures.

Comments:

Photos of facility CAN_F03-01 to CAN_F03-03.

Photo 1

View of timber wharf, sea stairs and dinghies.

Photo 2

Dinghies tethered to timber wharf.



Facility Inspection Record

- CAN_F11

Date	3/08/09	Locality	Abbotsford Bay	Level	0.58m	LGA
Time	12:04			Tide	Low	Canada Bay



Co-Ords (MGA)

Start

E 327614

N 6253064

Facility Details (Usage, Material, Const. Method, Type):

Informal dinghy storage along rocky shoreline with vessels tethered to old steel fence. Dinghies are launched via old steel stairs.

Condition Assessment:

No formal storage structure present. Fence that dinghies are tethered to is collapsing.

Excellent	<input type="checkbox"/>
Good	<input type="checkbox"/>
Poor	<input checked="" type="checkbox"/>
Failed	<input type="checkbox"/>

Assets:

Steel fence has barbed wire hanging loose amongst dinghies. Old steel stairs are severely corroded and not properly attached to rocks

Comments:

An old crane is located adjacent to the dinghies. Photos of facility CAN_F11-01 to CAN_F11-04.

Photo 1

View of informal dinghy storage area showing old steel stairs used for access to water.



Photo 2

Barbed wire from old steel fence amongst dinghies.



Facility Inspection Record

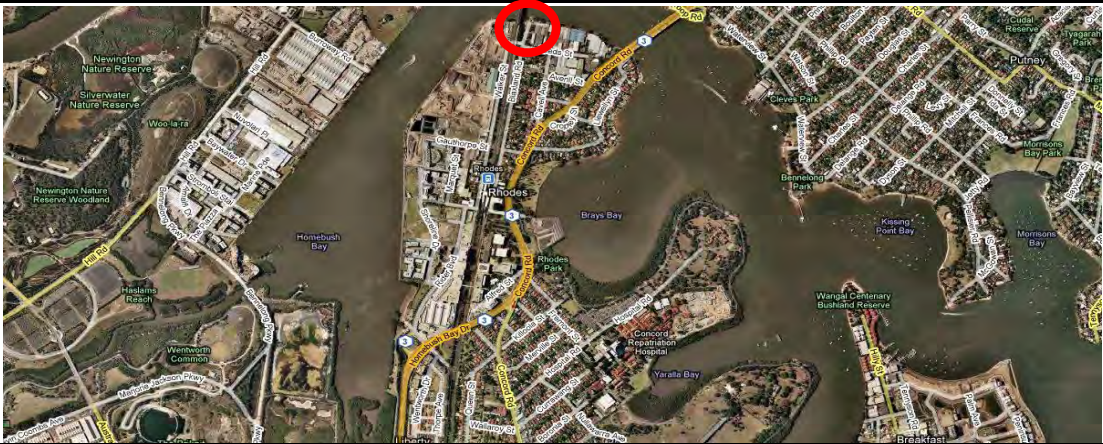
- CAN_F28

Date18/08/09Time10:50

LocalityAdj. John Whitton Rail Bridge, Rhodes

Level0.61TideLow-Mid

LGACanada Bay



Co-Ords (MGA)

Start
E 323162
N 6255834

Facility Details (Usage, Material, Const. Method, Type):
Concrete, single land boat ramp. Informal trailer parking is available. Small sandstone block seawalls are located on each side of the boat ramp.

Condition Assessment:
The concrete has cracked and failed at the western corner of the ramp. The rest of the ramp is in good condition with minor weathering and fouling observed.

Excellent
Good
Poor
Failed

X

Assets:
No major issues noted.

Comments:
Photos of facility CAN_F28-01 to CAN_F28-04.

Photo 1
View of concrete boat ramp.

Photo 2
Failure at western corner of boat ramp.



Facility Inspection Record

- CAN_F16

Date	<u>17/08/09</u>	Locality	<u>Wynston Parade, Waremba</u>	Level	<u>0.66m</u>	LGA	<u>Canada Bay</u>
Time	<u>9:38</u>			Tide	<u>Low-Mid</u>		



Co-Ords (MGA)

Start

E 326840

N 6251977

Facility Details (Usage, Material, Const. Method, Type):
Concrete single lane boat ramp. No trailer parking facility is present.

Condition Assessment:
Concrete is cracking and weathered. The front face of the ramp has been undermined.

Excellent
Good
Poor
Failed

X

Assets:
Boat ramp does not extend to low tide extent and sandstone blocks have been placed for vehicle access.

Comments:
Photos of facility CAN_F16-01 and CAN_F16-02.

Photo 1
View of boat ramp.

Photo 2
Sandstone blocks placed at end of boat ramp for low tide access.



Facility Inspection Record

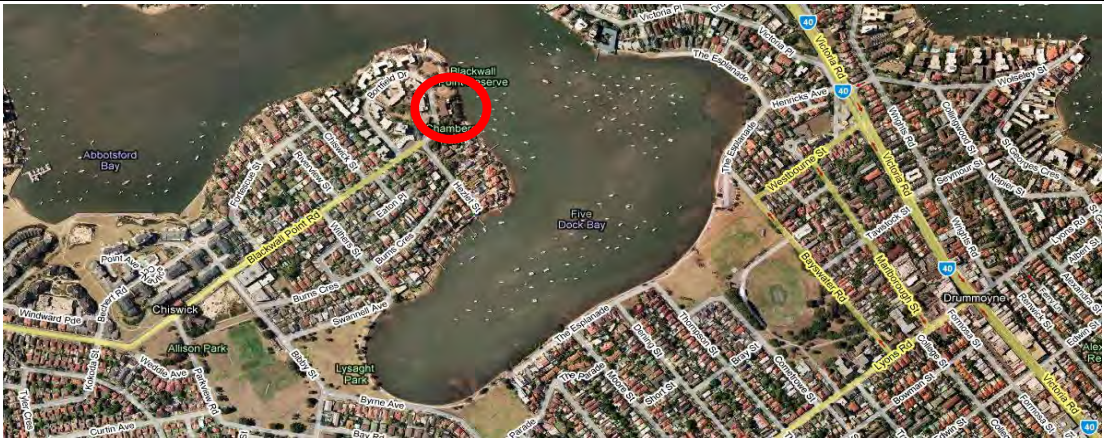
- CAN_F10

Date3/08/09Time10:38

LocalityChambers Park, Five Dock Bay

Level0.73mTideLow-Mid

LGACanada Bay



Co-Ords (MGA)

Start

E328149

N6253249

Facility Details (Usage, Material, Const. Method, Type):

Informal dinghy storage along sandy/rocky shoreline with vessels tethered to connections in cliff.

Condition Assessment:

No formal storage structure present. Vessels are tethered to cliff and are resting on tires.

Excellent

Good

Poor

Failed

X

Assets:

Vessels are launched/retrieved via adjacent sandy/rocky shoreline. This would be difficult at high tide.

Comments:

Photos of facility CAN_F10-01 and CAN_F10-02.

Photo 1

View of informal dinghy storage area.

Photo 2

Vessels tethered to connections in cliff and supported by old tires.

