

Appendix G

Cost benefit analysis assumptions

Cost Benefit Analysis Assumptions

Vegetation management

Vegetation management is generally part of Council's ongoing operations. There will be a greater need for vegetation management with pathway 1 and 2. The extent is uncertain. The costs are expected to be modest compared to some other measures.

Reconfiguring infrastructure

The freight rail line (section just south of Rollinson Rd) may require a bridge construction of approximately 500 metres. Costs may be between \$2 and \$27 million¹³. It is assumed to be required between present day and 2070 (say 2040) at a total cost of \$17 million.

The Esplanade in Rockingham would need to be reconfigured to enable all dwellings to be accessible (for as long as they can be safely occupied). There would be a need to purchase land and make road access via the back of the properties. Global cost estimate is anywhere between \$1 and \$10 million, say \$5 million. Expected to be required between present day and 2070 (say 2040).

Raising infrastructure and hardening banks

The estimated cost of raising roads by 0.5 to 1m is approximately \$3,000 per metre. The roads to be raised are:

- Robb Rd between (from Rollinson Rd to Mc Taggart Cove) to be required between present day and 2070, say 2050. Road length: 1 to 1.5 km, say 1.3 km. Total cost \$3.9 million.
- Sutton Rd from the naval Shacks south to and adjacent to Alcoa to be required between present day and 2070, say 2050). Length: 700-800m, say 750m. Total cost \$2.25 million.
- Rockingham Beach Rd from Wells Park to Railway Terrace in Rockingham to be required between 2070 and 2110, say 2090. Length: 3.5 km for pathway 2 and 1 km for pathway 3. Total cost \$10.5 million for pathway 2 and \$3 million for pathway 3.
- The Esplanade (Rockingham) to be required between present day and 2070, say 2050. Length: 1.5 km. Total cost \$4.5 million.

Beach nourishment

The estimated cost for nourishment is \$50 per meter beach per annum (BMT WBM, 2014). The lengths of beach to be nourished are:

- Bathers Beach 200m; \$10,000 per annum
- Northern section of CY O'Connor Reserve 400 m; \$20,000 per annum
- Rockingham Beach, east of grain terminal 800 m; \$40,000 per annum
- Palm Beach 1,000 m; \$50,000 per annum
- part of unofficial dog beach 700 m; \$35,000 per annum

Other assumptions:

- For pathway 2: nourishment costs in Rockingham will increase from approximately \$70,000 at present day to the above assumed costs by 2040. The other locations the annual costs are as per above from present day
- For pathway 3: nourishment costs will commence from 20 years past the construction of the artificial beaches, from 2050

¹³ Melbourne – Brisbane Inland Rail Alignment Study – Working Paper No. 11: Stage 2 Capital Works Costings

Upgrading coastal structures

The estimated annual costs for upgrading existing coastal structures are as follows¹⁴:

- Groynes (x6) \$150,000
- Offshore headlands (x9) \$135,000
- Boatramps (x5) \$75,000
- Breakwaters (x10) \$2,500,000

These costs are applicable to both pathway 2 and 3 to maintain existing coastal structures.

Artificial, engineered beaches

The artificial, engineered beaches are assumed to cost \$5,000 per meter beach¹⁵. The works are assumed to be required by 2030.

Estimated and assumed costs per beach are as follows:

- Bathers Beach: 200 m, \$1 million
- South Beach in Fremantle: 200 m, \$1 million
- CY O'Connor Beach in front of new residential development just south of the Fremantle border, near Rollinson Rd (Cockburn): 400 m, \$2 million
- The South Fremantle Power station site: 500 m, \$2.5 million
- Rockingham Beach east from the CBH Grain Terminal: 800 m plus 1 groyne (\$500,000), \$4.5 million
- Palm Beach, Beach in front of Bells and Churchill parks: 1,000m plus 1 groyne, \$ 5.5 million
- Part of unofficial dog beach east of Palm Beach: 700 m plus 1 groyne, \$ 4 million

Sea walls

The sea walls are assumed to cost \$5,000 per meter beach¹⁶.

- CY O'Connor Beach in front of new residential development just south of the Fremantle border, near Rollinson Rd (Cockburn); \$ 1 million
- South Fremantle Power station site; \$ 2 million
- Rockingham Beach east from the CBH Grain Terminal; \$ 4 million
- Palm Beach, Beach in front of Bells and Churchill parks; \$2.5 million
- Part of unofficial dog beach east of Palm Beach; \$ 2 million

Raising low lying land susceptible to flooding

Under pathway 2 and 3 low lying areas susceptible to flood risks will be filled at the time of (re-)development. This comprises low lying residential areas in Rockingham behind the Esplanade.

Assumptions:

- The assumed average fill is 50cm
- The assumed cost of fill is \$5 per cubic meter
- For pathway 2 works are assumed to be undertaken at around 2070 and to include the area possible and almost certain at risk of inundation by 2110. Total cost is \$350,000
- For pathway 3 works are assumed to be undertaken at around 2070 and to include the area possible and almost certain at risk of inundation by 2070. Total cost is \$56,000

¹⁴ Estimates from BMT WBM (2014)

¹⁵ Estimates from BMT WBM (2014)

¹⁶ Estimates from BMT WBM (2014)

Kwinana industrial area

Under all three pathways the Kwinana industrial area will be protected. The assumptions are as follows:

- Pathway 1, the beaches in front of the industrial area will be nourished at an annual rate of \$50 per meter over 6 km. The nourishment will cease once the area is expected to start retreating, which is assumed to commence in 2050
- Pathway 2, a sea wall will be built over a length of 3 km between Alcoa and BP refinery. This is assumed to occur by 2030 at a cost of \$5,000 p/m, \$15,000,000
- Pathway 3, a sea wall will be built over a length of 6 km between Alcoa and the Kwinana Bulk Jetty. This is assumed to occur by 2030 at a cost of \$5,000 p/m, \$30,000,000

Stormwater drainage

In Rockingham: wider outlets & pipes, retention basin and drainage canals in developed areas. Assumed to be required by 2050 under pathways 2 and 3. Assumed cost is \$1 million.

Assets not reaching end of asset life

For pathway 1 this comprises all assets to be affected by erosion and inundation before 2050. This includes infrastructure, utilities in all Councils and the commercial and residential uses in Rockingham. The net present value of the asset values at risk to 2050 is \$ 12 million.

Loss of land

This involves the permanent loss of land for existing uses due to erosion and inundation risks. It is assumed this loss is evenly spread over time. The annual values of this land are aggregated averages per square meter for the study area.

Urban land in Rockingham

It is assumed to include all the land that is at almost certain and possible risk by 2110 for pathway 1, and land that is almost certain and possible at risk by 2070 for pathway 2.

For pathway 1 the area lost is estimated to be 14 hectares at an average annual value of \$15.6 per sqm.

For pathway 2 the area lost is estimated to be 2.2 hectares at an average annual value of \$18.4.

Park land

The average areas of land lost per annum per Council are as follows:

- Fremantle: 400 sqm
- Cockburn: 7,400 sqm
- Kwinana: 3,100 sqm
- Rockingham: 1,900 sqm

The average annual value of park land is \$4 per sqm.

Under pathway 1, this loss is assumed to occur from present day. With pathway 2 this loss is assumed to occur from 2070 onwards.

Heritage land

The average areas of land lost per annum per Council are as follows:

- Fremantle: 0 sqm
- Cockburn: 4,700 sqm
- Kwinana: 0 sqm
- Rockingham: 1,700 sqm

The average annual value of park land is \$6 per sqm.

Under pathway 1, this loss is assumed to occur from present day. With pathway 2 this loss is assumed to occur from 2070 onwards.

Loss of beaches

All three pathways are able to maintain the values of the beaches to a significant extent. Pathway 1 allows beaches to move landward. Pathway 2 maintains beaches by beach nourishment and sediment management structures, and from 2070 onwards by retreat and letting beaches move landward. Pathway 3 maintains most beaches by providing an engineered solution which will significantly alter the character of the beaches.

Bathers Beach, which is primarily subject to inundation, is expected to be gradually lost with pathway 1 with the loss starting to occur from present day. The total area of the beach is 6,261 sqm and its total annual value is \$35 million.



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