TOONDAH HARBOUR PRIORITY DEVELOPMENT AREA - BASIC QUANTITIES ESTIMATE

KBR
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Element Breakdown with Associated Levels

Element #	Description	Development Stage	Components	Level (1.25mAHD = 0.0mLAT)	Level Reference	Basic Level Calculation / Notes
1	Northern Park / Open Space	Long Term	Reclamation, Bund, Rock Protection	+3m AHD	Queensland Coastal Plan - Coastal Hazards Guideline, 'Determining the Storm-tide Inundation Area' page.13	HAT + 1.5m (accounts storm surge, sea level rise etc.) (HAT @ Toondah = 2.77mLAT / 1.52mAHD)
2	Northern Park / Open Space Expansion	Long Term	Reclamation, Bund, Rock Protection	+3m AHD	Queensland Coastal Plan - Coastal Hazards Guideline, 'Determining the Storm-tide Inundation Area' page.13	HAT + 1.5m (accounts storm surge, sea level rise etc.) (HAT @ Toondah = 2.77mLAT / 1.52mAHD)
3	Recreational Harbour	Long Term	Dredging, Rock Protection, Rockwall or Floating Breakwater	-3.75mAHD (-2.5mLAT)	AS3962-2001 Guidelines for Design of Marinas and advice email P Cummings to RCC	Based on marina code and similar examples
4	Recreational Harbour / Northern Entrance Channel (2 Lane, 30m Wide)	Long Term	Dredging, Rock Protection, Rockwall or Floating Breakwater	-3.25mAHD (Two Lane, 30m Width, -2mLAT Depth)	AS3962-2001 Guidelines for Design of Marinas and advice email P Cummings to RCC	Based on marina code and similar examples. Planned future upgrade to -2.5mLAT.
5	Recreational Harbour Expansion	Long Term	Dredging, Rock Protection	-3.75mAHD (-2.5mLAT)	AS3962-2001 Guidelines for Design of Marinas and advice email P Cummings to RCC	Based on marina code and similar examples
6	Recreational Harbour Expansion Breakwater	Long Term	Rock Wall	+4m AHD	Queensland Climate Change and Community Vulnerability to Tropical Cyclones - Ocean Hazards Assessment, Appendix C Surge Plus Tide Levels	Storm surge + tide + depth limited wave height (inc. runup estimate) -> storm surge plus tide level at Wellington Point, 100 year ARI with sea level rise allowance = 1.91mAHD, + 2m allowance for depth limited wave with runup = approx. +4mAHD breakwater height
7	Mixed Use Pier / Land Reclamation Area	Long Term	Reclamation, Bund, Rock Protection	+3mAHD	Queensland Coastal Plan - Coastal Hazards Guideline, 'Determining the Storm-tide Inundation Area' page.13	HAT + 1.5m (accounts storm surge, sea level rise etc.) (HAT @ Toondah = 2.77mLAT / 1.52mAHD)
8	Mixed Use Pier / Land Reclamation Area Expansion	Long Term	Reclamation, Bund, Rock Protection	+3mAHD	Queensland Coastal Plan - Coastal Hazards Guideline, 'Determining the Storm-tide Inundation Area' page.13	HAT + 1.5m (accounts storm surge, sea level rise etc.) (HAT @ Toondah = 2.77mLAT / 1.52mAHD)
9	Harbour for Passenger and Vehicle Ferry / Swing Basin	Short Term	Dredging	-4.25mAHD (-3mLAT)	AS3962-2001 Guidelines for Design of Marinas and advice email P Cummings to RCC	Based on marina code and similar examples
10	Gradual Straighening of Fison Channel	Short Term	Dredging	-4.25mAHD (Two Lane, 75m Width, -3mLAT Depth)	AS3962-2001 Guidelines for Design of Marinas and advice email P Cummings to RCC	Based on marina code and similar examples
11	Marine Services Area	Long Term	Reclamation, Bund, Rock Protection	+3mAHD	Queensland Coastal Plan - Coastal Hazards Guideline, 'Determining the Storm-tide Inundation Area' page.13	HAT + 1.5m (accounts storm surge, sea level rise etc.) (HAT @ Toondah = 2.77mLAT / 1.52mAHD)
12	Marine Services Area Expansion	Long Term	Reclamation, Bund, Rock Protection	+3mAHD	Queensland Coastal Plan - Coastal Hazards Guideline, 'Determining the Storm-tide Inundation Area' page.13	HAT + 1.5m (accounts storm surge, sea level rise etc.) (HAT @ Toondah = 2.77mLAT / 1.52mAHD)

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Date 26/02/2014
Engineer P. Bayliss
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The following volumes represent an order of magnitude estimate for each development 'element' at Toondah Harbour. They are derived from an approximate bathymetric surface developed from navigational charts and element levels as outlined in the 'Background Information' tab. Refer to the 'Assumptions' tab for contraints and notes

		A.	B.	C.	D.	E.	F.	G.	H.	I.	J.
Element #	**Description**	**Bund Volume (m^3)**	**Reclamation / Fill Volume (m3)**	**Breakwater Volume (m3)**	**Dredging / Cut Volume (m3)**	**Rock Armour Volume (m^3)**	**Associated Length (m)**	**Area (m^2)**	**Batter Slope**	**Ave. Existing Level (mAHD)**	**Design Level (mAHD)**
1	Northern Park / Open Space	10,000	15,000	-	-	-	-	11,650	1:2	+0.5	+3
2	Northern Park / Open Space Expansion	16,000	21,000	-	-	-	-	14,690	1:2	-0.5	+3
3	Recreational Harbour	-	-	-	304,000	30,000	-	71,700	1:3	0.0	-3.75
3.1	Southern Rock Breakwater (C.) or Floating Breakwater (F.)	-	-	11,000	-	-	190	-	1:2	-0.5	+4
3.2	Northern Rock Breakwater (C.) or Floating Breakwater (F.)	-	-	7,000	-	-	120	-	1:2	-0.5	+4
4	Recreational Harbour Entrance Channel (2 Lane, 30m Wide)	-	-	-	55,000	-	900	37,800	1:6	N/A	-3.25
4.1	Southern Rock Breakwater (C.) or Floating Breakwater (F.)	-	-	8,000	-	-	130	-	1:2	-0.5	+4
4.2	Northern Rock Breakwater (C.) or Floating Breakwater (F.)	-	-	6,000	-	-	100	-	1:2	-0.5	+4
5	Recreational Harbour Expansion	-	-	-	351,000	26,000	-	104,440	1:3	-0.5	-2.5
6	Recreational Harbour Expansion Breakwater	-	-	29,000	-	-	520	10,520	1:2	-0.5	+4
7	Mixed Use Pier / Land Reclamation Area	20,000	59,000	-	-	-	-	29,400	1:2	0	+3
8	Mixed Use Pier / Land Reclamation Area Expansion	28,000	81,000	-	-	-	-	35,420	1:2	-0.5	+3
9	Harbour for Passenger and Vehicle Ferry / Swing Basin	-	-	-	122,000	-	-	52,010	1:6	N/A	-4.25
10	Gradual Straighening of Fison Channel	-	-	-	199,000	-	-	83,380	1:6	N/A	-4.25
11	Marine Services Area	19,000	31,000	-	-	-	-	17,440	1:2	-0.25	+3
12	Marine Services Area Expansion	42,000	76,000	-	-	-	-	31,950	1:2	-1	+3
		BUND VOLUME (m^3)	**RECLAMATION VOLUME (m^3)**	**BREAKWATER VOLUME (m^3)**	**DREDGING VOLUME (m^3)**	**ROCK ARMOUR VOLUME (m^3)**	**ASSOCIATED LENGTH (m)**	**AREA (m^2)**			
TOTALS		**135,000**	**283,000**	**61,000**	**1,031,000**	**56,000**	**N/A**	**500,400**			

Estimate accuracy of +/- 30 to 40%.

Volume Definitions

Bund Volume: the volume of material required to form a bund to allow a reclamation
Reclamation / Fill Volume: the volume of material required to fill a reclamation
Breakwater Volume: the volume of rock required to form a breakwater
Dredging / Cut Volume: the volume of dredging required to create a harbour / channel
Rock Armour Volume: the volume of rock protection to overlay bunds and dredged embankments

Estimate Assumptions

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	Assumption / Note	Comment / Potential Effect
1	No allowance made for stripping of poor quality natural base material	Before a reclamation can take place, poor natural base material may need to be stripped off to produce required engineering properties of the reclamation
2	No allowance made for settlement of natural base material	When breakwaters, bunds and reclamations are made the natural surface may settle, meaing a greater volume is required. A percentage allowance could be added to volumes to account for this.
3	All material has been assumed 'dredgeable' and 'reclaimable'	The geotechnical conditions are unknown - there may be areas of rock / very stiff clay which are not easily dredged or usable in a reclamation.
4	Material bulking / settlement factors have not been applied	In reality, dredged materials will increase in volume and reclamation volumes will consolidate. Bulking / settlement factors may be applied in a more detailed estimate.
5	Element 3 and 4 breakwater rock has not be recycled for use once the development expands	In reality, this rock would be removed when the harbour expansion is taking palce and could be used elsewhere.
6	Bund materials are not specified	Likely to be gravel core, with geotextile and rock armour bund
7	Breakwater volume is all rock (no gravel core)	Estimated rock size approx. d50 of 0.85m. Due to required length of breakwaters and rockwalls a good detailed design will provide efficiencies, this may include core construction / filter layers etc.
8	Volumes rounded up to the nearest 1000	
9	Lengths and areas rounded up to the nearest 10	
10	Northern channel expansion daylights to the nearest -2mLAT countour	
11	The near future dredging and straightening of Fison Chanel has not been accounted for in its dredging volume	
12	No allowance for geotextile has been made	Geotextile is likely required on all bund walls and breakwaters
13	Element item 3.1, 3.2, 4.1 and 4.2 refer to a volume if a rock breakwater is to be constructed or a length if a floating breakwater is to be used	
14	Breakwaters and bunds have 3m crest widths	This allows for end tiping construction and a reasonable size machine / vehicle access. The width will also depend on the intented future use on top of the breakwaters - e.g: for pedestrian access only or vehicle access / car parks to service marina berths.
15	Element 10 to be merged (outside the PDA) with the planned straightening works of Fison Chanel	
16	In practice the seaward sides / ends of elements 2, 8 and 12 will have rock wall heights of +4m AHD to match the breakwater (element 6) and provide protections from storm surge + sea level rise + wave overtoppping. These volumes have not been included at this stage	The +4mAHD rock wall sides / ends will be integrated into the reclamation / bund levels of +3mAHD
17	Element 4 Northern Channel continues until it daylights at -2mLAT	
18	The reclamation levels interaction with the existing land has not been considered	It is likely that transition sections will be required
19	Estimate accuracy of +/- 30 to 40%	The accuracy of the estimate is largely affected by the accuracy of the developed bathymetric surface since a full survey was not available. It is based on the effect on volumes if the bathymetric surface were to be up to 0.5m above or below the estimated surface.

Further Considerations / Uncertainties

1 A hydrographic survey of the priority development area would improve the accuracy of the estimate
2 Settlement and consolidation allowance
3 Gather geotechnical data to inform decisions about proportions of 'useable' material and settlement estimates

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	Volume m3										26/02/2014
	ZONE	Volumes Fill Bund (m3)	Volumes Fill (m3)	Volumes Breakwater Fill (m3)	Volumes Cut (m3)	Volumes Rock Armour (m3)	Length (m)	Area (m2)	Batter	Ave Existing Level (AHD)	Design Level (AHD)
01	Northern Park / Open Space	9920.492	14148.01					11650.00	1:3	0.50m	3.00m
02	Northern Park / Open Space Expansion	15128.2	20967.46					14690.00	1:3	-0.50m	3.00m
03	Recreational Harbour				-303388.852			71696.95	1:3	0.00m	-3.75m
	Breakwater 1A - Pontoon in Recreational Harbour (South)			10260.14			190	2602.25	1:2	-0.50m	3.00m
	Breakwater 1B - Pontoon in Recreational Harbour Entrance (South)			7020.78			130	1985.00	1:2	-0.50m	3.00m
	Breakwater 2A- Pontoon in Recreational Harbour (North)			6480.1			115	1596.00	1:2	-0.50m	3.00m
	Breakwater 2B - Pontoon in Recreational Harbour Entrance (North)			5400.22			100	1530.00	1:2	-0.50m	3.00m
	Recreational Harbour (Rock Protection)					29600.387	1045		1:3	-0.50m	
04	Recreational Harbour Entrance Channel				-33779.823		330	17515.40	1:3	-0.50m	-3.25m
	Recreational Harbour Entrance Channel Extension (15m Wide)				-12746.728		454	13328.479	1:6		-3.25m
	Recreational Harbour Entrance Channel Extension (30m Wide)				-20896.32		454	20137.418	1:6		-3.25m
	Recreational Harbour Entrance Channel (Rock Protection South)					1492.48	123		1:3	-0.50m	
	Recreational Harbour Entrance Channel (Rock Protection North)					1328.025	110		1:3	-0.50m	
05	Recreational Harbour Expansion				-350188.093			104433.44	1:3	-0.50m	-3.75m
	Recreational Harbour Expansion (Rock Protection)					25845.928	1508		1:3	-0.50m	
06	Recreational Harbour Expansion Breakwater			28080.45			515	10520.00	1:2	-0.50m	4.00m
07	Mixed use Pier / Land Reclamation Area	19494.37	58618.36					29395.30	1:3	0.00m	3.00m
08	Mixed use Pier / Land Reclamation Area Expansion	27055.66	80223.28					35420.00	1:3	-0.50m	3.00m
09	Harbour for Passenger and Vehicle Ferry / Swing Basin				-121573.329			52007.50	1:6		-4.25m
10	Gradual Straightening of Fison Channel				-198267.629			83374.10	1:6		-4.25m
11	Marine Services Area	18525.1	30992.72					17439.00	1:3	-0.25m	3.00m
12	Marine Services Area Expansion	41796.81	75384.4					31945.00	1:3	-1.00m	3.00m