ENGINEERS AUSTRALIA

SYDNEY COASTAL COUNCILS GROUP

NSW GOVERNMENT

Adapting Priority Coastal Recreational Infrastructure for Climate Change

-CASE STUDIES-

Prepared for:

LOCAL GOVERNMENT NSW

ENGINEERS AUSTRALIA

SYDNEY COASTAL COUNCILS GROUP

NSW GOVERNMENT

Cover Photograph: Courtesy of Stuart Young

Document Control

Issue/ Revision	Author	Reviewer	Approved for Issue	
			Name	Date
Draft	Galen Lewis	Steering Committee	Edward Couriel	30/07/18
Draft Final	Galen Lewis	Edward Couriel (Manly Hydraulics)	Edward Couriel	5/9/2018
Final	Galen Lewis	Sarah Joyce (SCCG)	Sarah Joyce (SCCG)	13/09/18

Report No. MHL2635

First published as draft in 07 2018

Manly Hydraulics Laboratory is Quality System Certified to AS

INTRODUCTION

Coastal public recreational infrastructure can be highly vulnerable to the impacts of contemporary coastal hazards that will be exacerbated by climate change. These assets can receive large amounts of funding every year for reactive remediation and maintenance following damage.

Sydney Coastal Councils Group (SCCG) has highlighted the need for proactive evaluation of the condition and vulnerability of this infrastructure to more effectively manage the allocated funding. Further support is also desired in assessing the likely future maintenance and retro-fitting requirements to help manage these important assets with rising sea levels and other impacts of climate change.

NSW Governments' Manly Hydraulics Laboratory (MHL) and Engineers Australia through its National Committee on Coastal and Ocean Engineering (NCCOE) were commissioned by SCCG to prepare an assessment tool which:

- implements NCCOE's guidelines for coastal infrastructure asset management and planning (2012, 2017)
- focuses on climate change vulnerability
- can be used as part of Council's IPRF (Integrated Planning and Reporting Framework) to help define maintenance/renewal costs and to establish triggers based on discounted future costs under a preselected adaptation strategy.

Based on a NSW coastal council survey to assess current management practises and challenges, MHL developed an assessment methodology to design the tool around targeting asset vulnerability to coastal hazards, a holistic approach to asset assessment, support for capital expenditure applications, and an ability to accommodate varying levels of data availability.

Following feedback on the proposed methodology from a multidisciplinary steering committee, the assessment tool was developed incorporating a multi-criteria valuation assessment (MCA), adaptation option decision matrix and future cost calculator.

Outputs from the tool can be used to:

- determine strengths and weaknesses of a coastal recreational asset based on the dimensions of the MCA
- indicate options and indicative costs for various adaptation strategies,
- set trigger levels for future adaptation work
- rank assets against others entered by the user to aid in prioritisation of resources.

An Excel spreadsheet was the platform selected to develop the assessment tool due to the ease of integration with existing management infrastructure with a focus on the functionality of the tool rather than on its look, feel and hosting.

The tool was tested on over 10 recreational infrastructure assets in three different NSW coastal councils to assess their value, affordability, sustainability and the amenity they provide. This process was also used to help calibrate and refine the tool in preparation for public release throughout NSW.

Should this tool be successfully utilised among NSW coastal councils, there are numerous opportunities to expand its scope and useability by migrating it to a web interface, including additional asset types, and expanding the scope outside of NSW. Due to the tool's basis in the NCCOE guidelines, there is also potential for wide-reaching applicability for all coastal assets beyond the recreational assets for which the tool was originally designed.

Contents

FIGURES

1. APCRICC – Case Studies

The assessment tool was put into practice in three NSW coastal councils: two urban and one rural. Feedback from these councils was used to refine and calibrate the tool as well as to be included as training material for rollout of the tool throughout NSW.

The case studies and the feedback from the participating councils has been anonymised to focus on the process of the tool and the data which is likely to be available, rather than the performance of any particular council.

2. Case Study 1 – URBAN ROCK POOL

2.1 Description

Ocean rock pools are some of NSW's most valued recreational infrastructure, providing beach goers with a calmer place to swim or take children. Additionally, many of these pools were constructed in the early years of the 20th century and now hold significant historic value for the local communities they service.

This asset is a somewhat typical NSW urban ocean pool having been constructed sometime in the 1930s on a prominent Sydney beach. Its current design life as designated by Council is 50 years with the last capital works having taken place in 1996. Council had trouble sourcing financial data for their assets due to information being spread over a range of systems and locations, however using information from other similar sites it was estimated that the modern engineering construction cost would be in the order of $8,000,000 with maintenance priced around $50,000 p/a.

The rock pool itself has an oceanward face of ~50m, bed level at 0.4m AHD with walls at 1m AHD. This data as entered into the tool is presented in **Figure 2.1**

Asset Data

Info	Characteristic	Value	Unit	Comment
	Year of construction	1930		
ⓘ	Cost of initial construction		$	
ⓘ	Design life	50	yrs	
ⓘ	Today's construction cost	$ 8,000,000		
ⓘ	Annual maintenance cost	$ 50,000	$	
ⓘ	Date of last capital works (partial/full reconstruction)	1/06/1996		
ⓘ	Cost of last capital works		$	
ⓘ	Current condition	3		

Physical Characteristics

Info	Characteristic	Value	Unit	Comment
ⓘ	Length	50	m	
ⓘ	Representative height	1	m	
ⓘ	Oceanbed level	0.4	m	
ⓘ	Sheltered/Exposed	Exposed		
ⓘ	Coastline angle	80	° TN	

Figure 2.1 – Preliminary data for the urban rock pool

Council contacted their local Aboriginal Land Council (ALC) to discuss the cultural significance. According to the ALC the site on which this asset is located holds no cultural significance for them.

2.2 Cultural and heritage value

Due to the age of the site, Council members deemed that the asset rates a 3 on the provided scale. As this criterion is a combination of cultural *and* heritage value, the heritage significance can supersede the lack of perceived cultural significance and be chosen for the asset's current heritage score.

Since only two parties were consulted for this asset, the tool determined that this score comes with an orange confidence flag. Confidence in this section can be increased by acquiring additional opinions about the heritage value of this asset to reduce subjectivity. Ideally, at least one person from each stakeholder group should be contacted to have input into each asset as this is a good exercise to identify who all the relevant stakeholders might be.

2.3 Replaceability

For replaceability, the rock pool's $8,000,000 construction cost is normalised against the various LGA specific economic indicators to determine the relative ability of a Council to replace the asset given their means. Due to the pool's position within the community and the impracticality of relocating it to another location, these options were rejected for consideration by Council.

The tool determined that given the relative wealth of the LGA and the long design life of the asset, that it was fairly easy to replace with a score of 4/5. This is done by taking the cost of the asset over its design life and dividing it by each of the economic indicators shown in **Figure 2.2** to produce a range of scores. Each score is then compared to a scale to determine whether it is 'expensive' or not. Council felt that the replaceability of 4/5 was too high and reduced the replaceability score to 3. As a result, more work is being done to fine tune what an 'expensive asset' is in the context of coastal recreational infrastructure by using case study data to adjust the scaling from 'scores' to 'recommended values' as presented in **Figure 2.2**. Addition of Council revenue and annual asset budgets into the tool could also help to justify this score further if Council were using the tool to apply for capital works funding. These additions would also raise the confidence from an orange to a green flag in the tool.

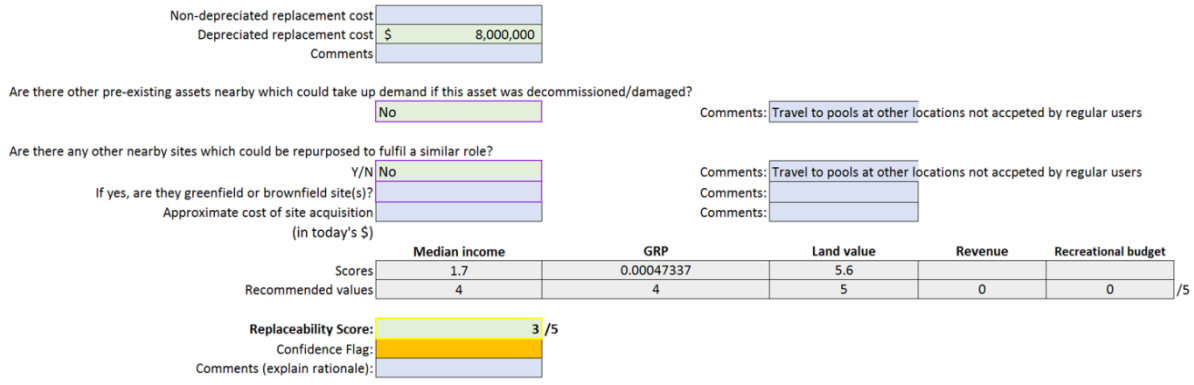

Figure 2.2 – Replaceability of the urban rock pool

2.4 Policy alignment

Council recorded a total of 5 policy objectives for this asset, 4 of which it was compliant with. This garnered a score of 4.3 which was passed on to the policy score. 5 policies result in an orange confidence flag which could be increased by including more relevant policy objectives. **Figure 2.3** below shows this section of the tool.

	Policy	Complies? (Y/N)	Weight	Comments
1	Adopts strategic plans for adapting to future risks	No	1	
2	Managed acordance with cleaning and maintenance schedules	Yes	2	
3	Managed in accordance with Coastal Lands Plan of Management (2002)	Yes	2	
4	Managed in accordance with CZMP	Yes	2	
5	Heitage Conservation Management Plan for Rock Pools	Yes	1	
6		No	1	
7		No	1	
8		No	1	
9		No	1	
10		No	1	

Recommended Score:	4.3	/5
Policy Score:	**4.3**	**/5**
Confidence Flag:		
Comments (explain rationale):		

Figure 2.3 – Policy objectives for the urban rock pool

2.5 Community value

The utilisation of the pool was estimated at 1000 total visitors (trips) per week which, for an LGA population of over 100,000, garners a community score of 4/5. LGA tourist visitation numbers are unavailable for Sydney councils so this number was not able to be separated into local and travelling visitation. To increase the confidence of this value above a red flag Council would need to perform a survey or study to determine the actual utilisation of the asset and/or a willingness-to-pay study for future works to the asset. The community value section of this case study is presented in **Figure 2.4**, below.

			Comments:
Estimated utilisation per week:		1000	
Utilisation known?		No	Estimated
Required WTP:	$	4.04	
Percentage tourist visitation (of total LGA tourists):		0%	
Average tourists per week:			
WTP from study: ($/person)			
Recommended Value:		4.0	/5
Community Value:		**4**	**/5**
Confidence Flag:			
Comments (explain rationale):			

Figure 2.4 – Community value of the urban rock pool

2.6 Resilience

Due to the asset's exposed location on the open coast, the tool uses a generalised overtopping calculation for a vertical wall from the Coastal Engineering Manual to estimate wave heights which would result in a reduction in serviceability for the asset.

Using a known offshore wave climate frequency distribution based on waverider data collected by MHL, the tool can then calculate the expected number of days per year where the asset would be unserviceable. This is compared with the acceptable serviceability of the asset to determine a resilience (or in this case, serviceability) score.

For the rock pool, an acceptable serviceability of 335 days per year (or 30 days per year of unserviceability) leads to a score of 3/5 based on an expected 25 days of unsafe overtopping exceedance per year. For this example (and indeed in the majority of cases) wave overtopping and hence the asset's level of serviceability is depth limited and is hence very sensitive to small changes in still water level.

In these cases, more detailed study may be required if this is a determining criteria as was the case for this asset. Such a study would be undertaken to determine how often the asset is unsafe on average and how this compares to Council requirements. Calculations for the resilience of this asset are presented in **Figure 2.5.**

Deepwater wave height, ho (m)	2.475343654	
Period, T (s)	8	
Tan B, Beach slope	0.005	
Deepwater wave length, Lo (m)	99.92383947	
hb, stillwater depth at theoretical breakpoint (m) =	3.334208455	
Hb, theoretical breaker height, (m) =	2.224533372	
Yb, breaker index =	0.667184851	
Tm-1,o	7.272727273	
Lm-1,o	82.58168551	
setup	0.024753437	0.247534365
bed depth	0.4	0.4
WL	0.569434206	0.792215135
depth	0.169434206	0.392215135
design wave	0.113043935	0.261679996
steepness	0.001368874	0.003168741
crest	1	
freeboard	0.430565794	0.207784865
h*	0.004151499	0.009610106
h* x Fc/hb	0.015812378	0.007630827
Overtopping	0.074099854	9.999951848

Overtopping Hs	2.5	m
Overtopping ARI	0.038	
(only applies for non-sheltered assets)		
Expected servicability	340	days serviceable per year
Mean-high freeboard	0.5	m
Recommended Value:	3.0	/5

Figure 2.5 – Overtopping and resilience calculations for the urban rock pool

2.7 MCA, CBA results and projections

The results of the MCA give an overall score of 3.5/5 for this asset based on equal weightings for each criterion. An orange flag is given as the overall confidence in this score with areas of community value and resilience particularly requiring more work to increase the reliability of the result. These results also indicate that this asset is fairly well balanced with community, ecological and economic interests all being somewhat represented.

Based on the results from the MCA and the asset data input into the tool several strategic conclusions were provided by the tool which lead to a recommended adaptation measure of accommodation of reduced serviceability due to sea-level rise. These conclusions are presented below in **Figure 2.6.**

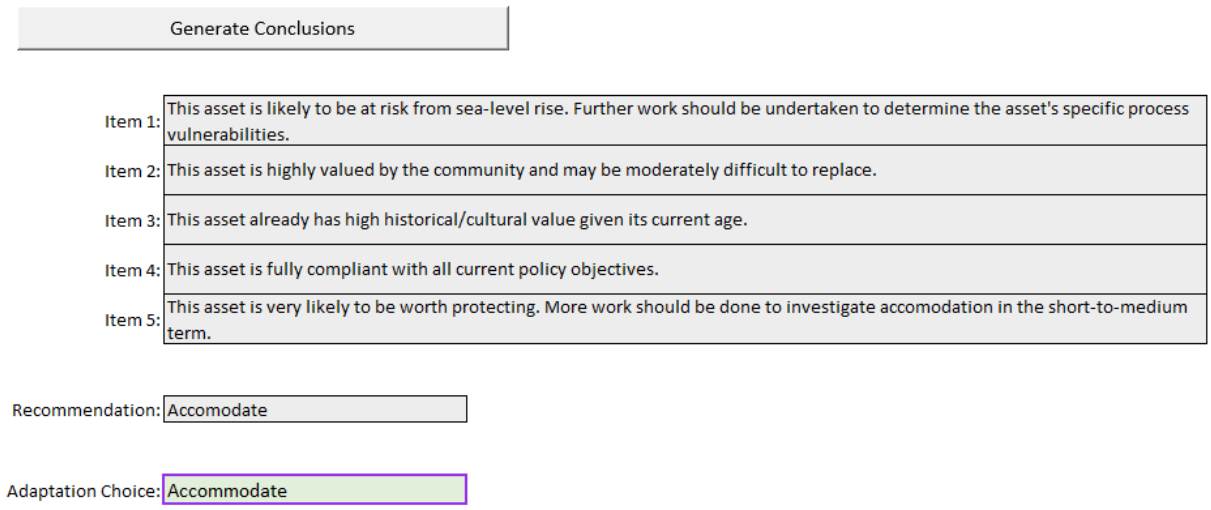

Figure 2.6 Strategic conclusions for the urban rock pool

Future projections for this asset are calculated based on LGA trends in economic and social indicators as well as the selected adaptation option and SLR due to climate change. These are used as input into the existing methods included in the tool to estimate how each MCA criterion may change through time. These projections are calculated for short (10 year), medium (20 year), and long term (50 year) planning horizons. Results of these projections are presented in **Figure 2.7.**

MCA - **Accommodate**

	Short-Term	Medium-Term	Long-Term	Comment
Culture & Heritage	3	4	5	
Replaceability	3	3	4	
Policy Alignment	4.3	4.3	4.3	
Community Value	4.2	4.2	5	
Resilience	5	2	0	

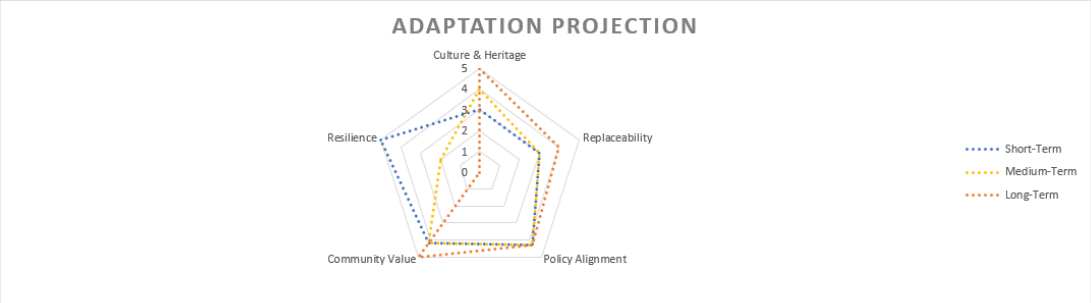

Figure 2.7 – Future MCA projections for the urban rock pool

Based on the age of the asset, its historical significance is expected to increase with time, becoming a highly significant asset within the next 50 years. Due to a moderate projected rise in population and associated increased wealth of the LGA, the replaceability of the asset is expected to rise slightly in the long-term.

It should be noted that this relates only to the economic replaceability of the asset and not its community, cultural or historic replaceability which are captured in other criterion, a common misconception in our case studies. Policy is too complex a criterion to try and project with any certainty, so it remains the same under all planning horizons.

The community value of the asset is expected to increase in the long term with proportionally fewer of these types of assets available for the growing population despite a reduction in serviceability.

Resilience under the accommodate case for this asset type is calculated from a reduced serviceability requirement – in this case doubling the allowable unserviceable days from 30 to 60. This results in an increased resilience (serviceability) in the short term, however due to the extreme sensitivity of wave overtopping to still water level in a depth-limited scenario in the medium and long-term projections, the pool becomes unusable much of the time. Council could use this information to form trigger levels for this asset based on a minimum acceptable level of serviceability and/or a given amount of sea level rise at which time they could either physically protect or retreat from the asset.

Cost projections for this asset's CBA are based only on maintenance, adaptation costs, and end-of-life capital works since damage to rock pools occurs progressively, is highly variable and hence difficult to estimate. As such these values could be considered a lower bound for future costs under the accommodate scenario. All values are presented in modern dollar equivalents. Results of the CBA projection are presented below in **Figure 2.8**.

CBA - **Accommodate**

	Short-Term	Medium-Term	Long-Term
Estimated Average Cost per Annum:	$ 45,000	$ 56,853	$ 86,262

Required WTP

Annual Visitation	Short-Term	Medium-Term	Long-Term
100	$ 9.00	$ 11.37	$ 17.25
500	$ 1.80	$ 2.27	$ 3.45
1000	$ 0.90	$ 1.14	$ 1.73
2000	$ 0.45	$ 0.57	$ 0.86
5000	$ 0.18	$ 0.23	$ 0.35
10000	$ 0.09	$ 0.11	$ 0.17
20000	$ 0.05	$ 0.06	$ 0.09
50000	$ 0.02	$ 0.02	$ 0.03
100000	$ 0.01	$ 0.01	$ 0.02
500000	$ 0.00	$ 0.00	$ 0.00
1000000	$ 0.00	$ 0.00	$ 0.00

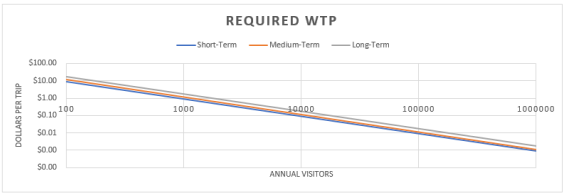

Figure 2.8 – CBA projections for the urban rock pool

3. Case Study 2 – URBAN COASTAL PARK

3.1 Description

This coastal park is a highly utilised asset within a Sydney metro LGA. It was constructed around the middle of the 20th century, with exact dates unavailable for this case study. Its current equivalent construction cost is estimated at around $5,000,000 with a design life of 25 years. Asset data for this case study is presented in **Figure 3.1.**

Asset Data

Info	Characteristic	Value	Unit	Comment
	Year of construction	1945		Unclear - used aerial imagery to estimate clearing/construction times
ⓘ	Cost of initial construction		$	Unknown
ⓘ	Design life	25	yrs	Must be assumed from varying assets within park perimeter - no single figure exists
ⓘ	Today's construction cost	$ 5,000,000		
ⓘ	Annual maintenance cost	$ 150,000	$	Estimated man hours for cleaning, mowing and maintenance
ⓘ	Date of last capital works (partial/full reconstruction)	1/01/2002		
ⓘ	Cost of last capital works	350000	$	Replacement of fencing
ⓘ	Current condition	1		The park is maintained at a high level as one of the LGA's Premier parks

Figure 3.1 – Asset data for the coastal park

The park is moderately sized at ~21,000 sq. m, 140m of which is frontage to the open ocean. The slope leading up to the 5m oceanward height is around 1:30m. The park is not currently protected by any coastal defence structures, however Council is seeking additional funding to build a sloping seawall along the length of the park. This plan of action came out of the park sustaining considerable damage during the June, 2016 East-Coast Low event. **Figure 3.2** presents the physical data for this asset.

Physical Characteristics

Info	Characteristic	Value	Unit	Comment
ⓘ	Area	21721	m^2	
ⓘ	Frontage length	140	m	
ⓘ	Representative height	5	m AHD	
ⓘ	Distance to shoreline	0	m	Assumed to include the beach front
ⓘ	Ocean ward slope	0.03	m/m	
ⓘ	Sheltered/Exposed	Exposed		Exposed to swell and ocean conditions

Figure 3.2 Physical data of the coastal park

3.2 Cultural and heritage value

This particular park is State heritage listed which would indicate a strong heritage value and indeed upon interviewing many members of Council, the cultural/heritage value of the asset was decided to be 5/5.

The local Aboriginal Land Council did not have identify this site of cultural heritage significant, however the European heritage listing of the asset was enough justified the high score.

Figure 3.3 presents the cultural/heritage value of this asset.

	You	Aboriginal Land Council	Person 2	Person 3	Person 4	Person 5	Person 6	Person 7	Person 8	Person 9	Person 10
Scores: (/5)	5	0	5	5	3	5	4	5	5	5	5
Weighting	5	1	1	1	1	1	1	1	1	1	1

Recommended Value:	4.5	/5
Culture & Heritage Score:	**5**	**/5**
Confidence Flag:		
Comments (explain rationale):	State heritage listed	

Figure 3.3 – Cultural/Heritage value of the coastal park

3.3 Replaceability

A $5M price tag represents a recommended replaceability score ranging from 3-5 depending on the metric. This user however decided that, due to the asset's value within the community, it could *not* be replaced and gave it a score of 1/5. This was a common enough mistake during the case study process where an asset which was moderately replaceable from a financial perspective would receive a much lower score because the community would not be open to its relocation.

There are two main outcomes of this observation:

1. this criterion needs to be emphasised as the *financial* replaceability of the asset to overcome this misconception,
2. longer term planning is not currently a primary focus of recreational asset managers in NSW.

Community members may not be open to relocation of an asset *now* when it is perfectly serviceable and well maintained. However, if, in the future it becomes more damaged by coastal inundation and the costs to maintain and renew it grow, the local community could begin to consider alternate options other than utilising a park which is unserviceable or damaged much of the time. This forward-thinking approach is a desired outcome of the tool's meta-process and more work can be done to communicate it through the replaceability criterion. **Figure 3.4** presents this data.

Non-depreciated replacement cost	$	5,000,000
Depreciated replacement cost	$	5,000,000
Comments		

Don't know the WDV? Coming soon!

Are there other pre-existing assets nearby which could take up demand if this asset was decommissioned/damaged?
No — Comments: This asset is highly valued by the community.

Are there any other nearby sites which could be repurposed to fulfil a similar role?
Y/N: No — Comments: Events currently scheduled for the site could be moved elsewhere
If yes, are they greenfield or brownfield site(s)?: Greenfield — Comments:
Approximate cost of site acquisition (in today's $) — Comments:

	Median income	GRP	Land value	Revenue	Recreational budget	
Scores	1.9	0.00050670	5.0		0.45	
Recommended values	4	3	5	0	3	/5

Replaceability Score: 1 /5
Confidence Flag:
Comments (explain rationale): There is no other asset which can fulfil the role of this park - unrealistic to assume people would want to go elsewhere

Figure 3.4 Replaceability of the coastal park

3.4 Policy alignment

Council recorded four policies which the park complies with. It was unsure which policies were in existence and it is clear that more guidance should be given in this section before the final rollout of the tool. Policy data is presented in **Figure 3.5.**

	Policy	Complies? (Y/N)	Weight	Comments
1	Adopts strategic plans for adapting to future risks	Yes	3	
2	Engagement Policy	Yes	3	
3	Sea-Level Rise Policy	Yes	1	Not fully fleshed out
4	SEPP - Coastal Protection	Yes	3	
5		No	1	
6		No	1	
7		No	1	
8		No	1	
9		No	1	
10		No	1	

Recommended Score: 5.0 /5

Policy Score: 5 /5
Confidence Flag:
Comments (explain rationale): Need to look through asset management policy

Figure 3.5 – Policy alignment of the coastal park

3.5 Community value

This asset did have a preliminary survey done to determine the community's willingness to pay for any upgrades of the asset as well as the rough utilisation figures. Based on current usage, the WTP of $5 per person is more than adequate to cover current ongoing costs of this asset. The community value therefore rated a score of 5/5 and a green confidence flag.

			Comments:
Estimated utilisation per week:		5000	Based on observation
Utilisation known?		No	
Required WTP:	$	1.35	
Percentage tourist visitation			
Average tourists per week:		0	
WTP from study: ($/person)		5	Based on a cup of coffee per person
Recommended Value:		5.0	/5
Community Value:		**5**	**/5**
Confidence Flag:			
Comments (explain rationale):	Large number of people use this park for picnicking and play. It is also a heavily used event space		

Figure 3.6 Community value of the coastal park

3.6 Resilience

This asset lies within a designated coastal hazard zone and has therefore been exempt from risk assessment by this tool. The value entered by Council was 3/5, however it was unclear how this value was obtained as no comments were provided. This is not a huge issue as recreational assets within a coastal hazard zone have their own well-defined risk assessment as part of the coastal management program and can thus be managed effectively through other mechanisms.

3.7 MCA, CBA results and projections

Results of the MCA are presented in **Figure 3.7.**

MCA Results

	Score	Flag	Weighting	Comment
Cultural/Heritage Value	5		3	
Replaceability	1		4	
Policy Alignment	5		2	
Community Value	5		4	
Resilience	3		1	
Total	**3.7**			

Figure 3.7 – MCA of the coastal park

The adaptation conclusions generated for this asset lead to, unsurprisingly, a recommendation to protect based on the high community and heritage value and the inability for Council to replace this asset. However, using the recommended replaceability score of 3/5 this recommendation turns to accommodate as the ability to supplement usage of this asset maintenance with other nearby sites when it requires repair becomes more viable. Looking at the protect scenario in the CBA (**Figure 3.8**), it would cost Council more than the $5 per person value they found from their survey to pay for protection to the asset on all time scales (assuming constant usage and a $70,000 p/m cost of protection as quoted by Council).

CBA - Protect

	Short-Term	Medium-Term	Long-Term
Estimated Average Cost per Annum:	$ 1,580,000	$ 1,109,131	$ 825,429

Do Nothing

	Required WTP		
Annual Visitation	Short-Term	Medium-Term	Long-Term
100	$ 632.00	$ 443.65	$ 330.17
500	$ 126.40	$ 88.73	$ 66.03
1000	$ 63.20	$ 44.37	$ 33.02
2000	$ 31.60	$ 22.18	$ 16.51
5000	$ 12.64	$ 8.87	$ 6.60
10000	$ 6.32	$ 4.44	$ 3.30
20000	$ 3.16	$ 2.22	$ 1.65
50000	$ 1.26	$ 0.89	$ 0.66
100000	$ 0.63	$ 0.44	$ 0.33
500000	$ 0.13	$ 0.09	$ 0.07
1000000	$ 0.06	$ 0.04	$ 0.03

Figure 3.8 – CBA for the protect scenario of the coastal park

If however, Council chose to accommodate in the short and medium terms it would be likely to cost less on an annual basis, at which time they could re-investigate whether protection would be a cost effective measure (**Figure 3.9**).

CBA - Accommodate

	Short-Term	Medium-Term	Long-Term
Estimated Average Cost per Annum:	$ 950,000	$ 869,131	$ 1,079,429

Do Nothing

	Required WTP		
Annual Visitation	Short-Term	Medium-Term	Long-Term
100	$ 380.00	$ 347.65	$ 431.77
500	$ 76.00	$ 69.53	$ 86.35
1000	$ 38.00	$ 34.77	$ 43.18
2000	$ 19.00	$ 17.38	$ 21.59
5000	$ 7.60	$ 6.95	$ 8.64
10000	$ 3.80	$ 3.48	$ 4.32
20000	$ 1.90	$ 1.74	$ 2.16
50000	$ 0.76	$ 0.70	$ 0.86
100000	$ 0.38	$ 0.35	$ 0.43
500000	$ 0.08	$ 0.07	$ 0.09
1000000	$ 0.04	$ 0.03	$ 0.04

Figure 3.9 - CBA for the accommodate scenario of the coastal park

There are several assumptions such as community impact of a reduction in serviceability of the asset or building a protection structure, as well as detailed annual damage estimation based on a range of SLR scenarios. However, the tool demonstrates that this asset *is*

sensitive to changes in the replaceability criterion and that more work should be done with their community and with future cost projections before deciding to protect immediately.

Asset Data

Info	Characteristic	Value	Unit	Comment
	Year of construction	2017		
ⓘ	Cost of initial construction	$ 113,000	$	INCLUDES THE DEMOLITION OF THE EXISTING AND SOLAR LIGHTING EMPLACEMENT ($9.5K) REQUIRED TO COMPELTE THE WORKS AND PROVIDED AMENITY AT THE SITE
ⓘ	Design life	25	yrs	THIS WAS INCLUDED AS A KEY ITEM IN THE SPECIFICATION OF THE NEW FACILITY
ⓘ	Today's construction cost	$ 113,000		
ⓘ	Annual maintenance cost	$ 750	$	THIS IS AN ESTIMATE BASED ON THE ASSUMED ANNUAL MAINTENANCE COST ACROSS THE LIFE OF THE STRUCTRUE. OBVIOUSLY THIS IS NON-LINEAR WITH CONSIDERABLY GREATER EXPENSE INCURRED AT THE END OF LIFE. THIS IS AN AREA WHERE WE HAVE VIRTUALLY NO ASSET SPECIFIC STATS. THIS IS AN AREA WE ARE ATTEMPTING TO RECTIFY TO ENABLE "WHOLE OF LIFE" OR "LIFE CYCLE PLANNING"
ⓘ	Date of last capital works (partial/full reconstruction)	1/11/2017		THIS IS THE PC DATE OF THE MOST RECENT WORKS AT THE SITE
ⓘ	Cost of last capital works	113000	$	
ⓘ	Current condition	1.5		EXCELENT / GOOD CONDITION - USING THE INTEGRATED PLANNING AND REPORTING MANUAL SCALE
ⓘ	Number of commercial properties using asset	0		THIS IS A RECREATIONAL BOATING FACILITY
ⓘ	Approximate annual revenue from these businesses	$ -	$ p/a	THIS IS A RECREATIONAL BOATING FACILITY

Physical Characteristics

Info	Characteristic	Value	Unit	Comment
ⓘ	Length	7	m	THIS IS THE LENGTH OF THE PONTOON ONLY - GANGWAY, ABUTMENT ETC NOT INCLUDED
	Number of moorings	2		FORMAL MOORINGS - I HAVE SEEN AT LEAST 4 VESSELS ON THIS AT ONE TIME
ⓘ	Representative height	1.2	m	THIS IS A FLOATING PONTOON - THE HEIGHT OF THE ABUTMENT BLOCK HAS BEEN PROVIDED
ⓘ	Oceanbed level	-2	m	
ⓘ	Sheltered/Exposed	Sheltered		
ⓘ	Coastline angle	270	° TN	THIS IS A RIVERINE ENVIRONMENT

Figure 3.10 – Asset data for the estuarine jetty

4. Case Study 3 – RURAL ESTUARINE JETTY

4.1 Description

This estuarine jetty was recently reconstructed as a floating structure after the previous fixed jetty was no longer serviceable. It cost over $100,000 to build and is expected to cost approximately $750 p/a over its design lifetime of 25 years. It lies in a sheltered estuary of a large NSW river with a bed level of -2m AHD. This asset was particularly interesting from the perspective of the tool as a floating structure was not explicitly accommodated in the spreadsheet.

4.2 Cultural and heritage value

Council was not able to contact their LLC for the purposes of this case study, however it was estimated that the site did not hold much historic or cultural significance based on those interviewed (**Figure 4.1**).

	You	Aboriginal Land Council	Person 2	Person 3	Person 4	Person 5	Person 6	Person 7	Person 8	Person 9	Person 10
Scores: (/5)	2		3	3	1	0					
Weighting	1	5	1	1	1	1	1	1	1	1	1

Recommended Value: 1.8 /5

Culture & Heritage Score: 1.8 /5

Confidence Flag:

Comments (explain rationale): ALC HAS NOT BEEN CONTACTED WITH RESPECT TO THIS ASSESSMENT.

Figure 4.1 – Historic/cultural significance of the estuarine jetty

4.3 Replaceability

Council stated that they were able to acquire other greenfield sites from the Crown at nominal license cost, however the location of the jetty adjacent to a boat ramp and required for its use precluded its relocation. Further, the >$100,000 cost of construction was very large compared to the $200,000 annual asset budget of the LGA.

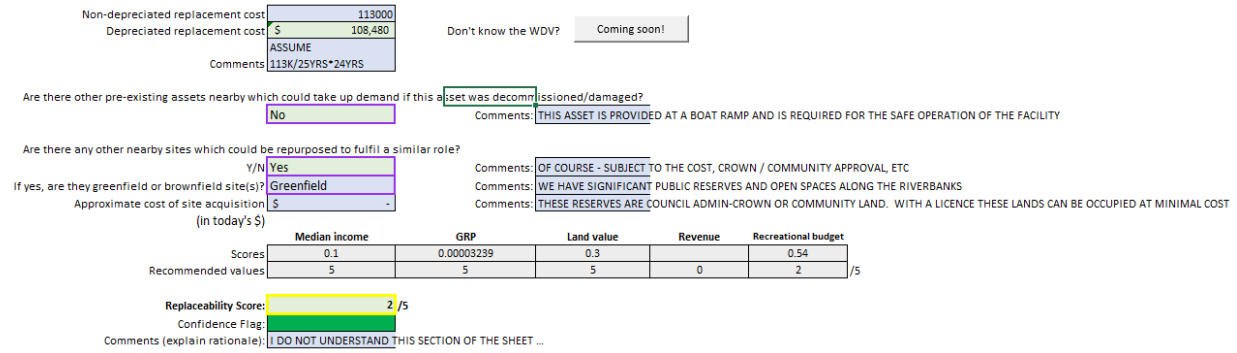

Figure 4.2 – Estuarine jetty replaceability

4.4 Policy alignment and community value

Council did not understand how to add the relevant policies into the tool and so left that section blank, instead allocating a score of 4/5 based on their understanding of the relevant guidelines. According to Council, only around 50 trips are made to the jetty per week which, when entered into the tool, gives a score of 1/5.

4.5 Resilience

Since the jetty is located in an estuary, the resilience of the asset is based on the flood levels in the area. Given that the 100 year flood level is 5.7m (compared to a 1.2m jetty which would be inundated under many high tides), the resilience as calculated by the tool would be 0. However, since the structure is now floating, Council was advised to give a resilience score of 5 as the structure should be fully resilient to the effects of SLR. Results from the MCA are presented in **Figure 4.3.**

MCA Results

	Score	Flag	Weighting	Comment
Cultural/Heritage Value	1.8		1	
Replaceability	2		1	
Policy Alignment	4		1	
Community Value	1		1	
Resilience	5		1	
Total	**2.8**			

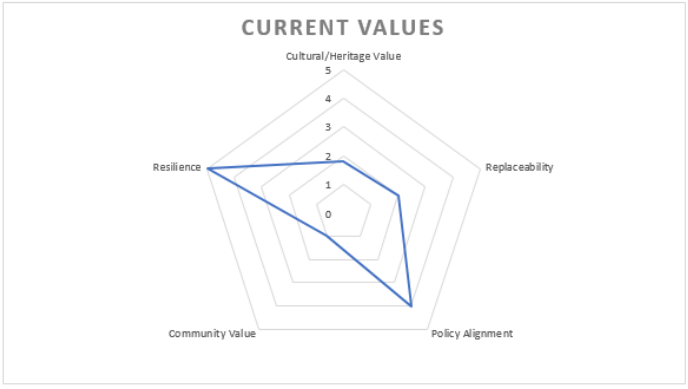

Figure 4.3 – Estuarine jetty MCA

4.6 MCA, CBA results and projections

Council's position was that given the asset's community value, cost and (prior) resilience, it should not have been reconstructed and the tool bears this out. Only the additional resilience provided by recent works brings the score into an acceptable range. With the values placed into the tool as presented, the recommended adaptation is to retreat given these factors. However, in order to accommodate the floating nature of the jetty, MHL advised Council to raise the height of the jetty from 1.2m AHD to its highest potential value (>6m AHD). Recalculating the decision matrix with this value results in a recommendation of 'Do Nothing' as the asset is no longer at risk from SLR. These revised conclusions are presented in **Figure 4.4.**

Item 1:	This asset is unlikely to be directly affected by sea-level rise.
Item 2:	This asset is undervalued by the community and is difficult to replace.
Item 3:	This asset has little historical/cultural significance and is unlikely to gain more in the near future.
Item 4:	This asset complies with most current policy objectives.
Item 5:	This asset is very likely to be worth protecting. More work should be done to investigate accomodation in the short-to-medium term.

Recommendation: Do Nothing

Adaptation Choice: Do nothing

Figure 4.4 – Revised decision framework for the estuarine jetty

The projected CBA shows that once the jetty's condition starts degrading and requires further maintenance, the cost of the asset rise dramatically with long term costs more than doubling over today's values (**Figure 4.5**).

CBA - **Do nothing**

	Short-Term	Medium-Term	Long-Term
Estimated Average Cost per Annum:	$ 750	$ 948	$ 1,635

Required WTP

Annual Visitation	Short-Term	Medium-Term	Long-Term
100	$ 0.30	$ 0.38	$ 0.65
500	$ 0.06	$ 0.08	$ 0.13
1000	$ 0.03	$ 0.04	$ 0.07
2000	$ 0.02	$ 0.02	$ 0.03
5000	$ 0.01	$ 0.01	$ 0.01
10000	$ 0.00	$ 0.00	$ 0.01
20000	$ 0.00	$ 0.00	$ 0.00
50000	$ 0.00	$ 0.00	$ 0.00
100000	$ 0.00	$ 0.00	$ 0.00
500000	$ 0.00	$ 0.00	$ 0.00
1000000	$ 0.00	$ 0.00	$ 0.00

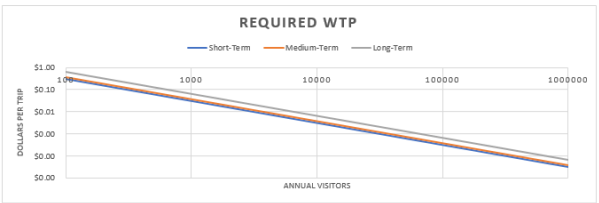

Figure 4.5 – Projected CBA for the estuarine jetty