

## TABLE OF CONTENTS

### Part A A Systematic and Adaptive Management Program for the Coastline

<b>1.0</b>	<b>Introduction – Scope and Purpose of the Wyong Coastline Management Plan .....</b>	<b>1</b>
<b>1.1</b>	<b>The coastline is a highly valued and dynamic landscape .....</b>	<b>2</b>
1.1.1	Climate change and the coast.....	2
<b>1.2</b>	<b>Council’s role in coastal zone management .....</b>	<b>13</b>
<b>1.3</b>	<b>Council’s policies and strategic approach.....</b>	<b>15</b>
1.3.1	Council’s policies for coastal zone management .....	15
1.3.2	Strategic actions.....	16
<b>1.4</b>	<b>How will implementing the plan be different to what happens now? .....</b>	<b>18</b>
<b>1.5</b>	<b>An adaptive approach .....</b>	<b>18</b>
<b>2.0</b>	<b>Project spatial focus .....</b>	<b>22</b>
<b>2.1</b>	<b>Where does this Plan apply? .....</b>	<b>22</b>
<b>2.2</b>	<b>Distinctive coastal landscapes.....</b>	<b>22</b>
<b>2.3</b>	<b>Coastal Policy definition of the coastal zone.....</b>	<b>26</b>
2.3.1	Integration of coastline and coastal zone .....	26
<b>3.0</b>	<b>Preparing the Coastal Zone Management Plan.....</b>	<b>29</b>
<b>3.1</b>	<b>Background.....</b>	<b>29</b>
<b>3.2</b>	<b>Key steps in preparing the WSCZMP .....</b>	<b>33</b>
3.2.1	Certification of the WSCZMP .....	34
<b>3.3</b>	<b>Community and stakeholder engagement .....</b>	<b>36</b>
3.3.1	Council and agency stakeholder participation and perspectives .....	38
3.3.2	Community engagement.....	39
3.3.3	Consultation about the coastline management plan - issues .....	41
3.3.4	Community comments - options.....	43
3.3.5	Other community meetings and briefings .....	47
<b>4.0</b>	<b>Overview of key issues for the Wyong coastline.....</b>	<b>49</b>
<b>4.1</b>	<b>The impact of coastal processes on valued coastal landscapes .....</b>	<b>49</b>
<b>4.2</b>	<b>Increasing population and demand for access to coastal ‘services’ .....</b>	<b>54</b>

### Part B Wyong Coastline Management Plan and its Implementation

<b>5.0</b>	<b>The future of the Wyong coastline .....</b>	<b>56</b>
<b>5.1</b>	<b>Council’s vision for the Wyong coastline.....</b>	<b>56</b>
<b>5.2</b>	<b>Principles to give effect to the vision for the Wyong Coastline .....</b>	<b>57</b>
<b>5.3</b>	<b>Eleven Objectives for the Wyong Coastline Management Plan .....</b>	<b>58</b>

<b>6.0</b>	<b>Eight Action Plans for strategic coastline management .....</b>	<b>62</b>
<b>6.1</b>	<b>Background on management approaches for the coastline.....</b>	<b>63</b>
6.1.1	Risk.....	63
6.1.2	Moving between strategies .....	64
<b>6.2</b>	<b>Scope of responses - overview .....</b>	<b>66</b>
<b>6.3</b>	<b>Implementation information for Action Plans .....</b>	<b>71</b>
<b>6.4</b>	<b>Costs of coastline management.....</b>	<b>71</b>
6.4.1	Costs of structural protection .....	71
6.4.2	Other costs for accommodating coastal erosion and recession .....	72
6.4.3	Funding partnerships.....	73
6.4.4	Funding options.....	73
6.4.5	Local government rates and levies and community contributions.....	73
6.4.6	NSW Government programs.....	75
6.4.7	Australian Government Programs.....	78
<b>7.0</b>	<b>Coastal Knowledge Action Plan .....</b>	<b>80</b>
<b>7.1</b>	<b>Contribution to relevant coastline objectives and targets.....</b>	<b>81</b>
7.1.1	Why are these objectives and targets not being met now? .....	83
<b>7.2</b>	<b>Who will be involved in making a difference? .....</b>	<b>83</b>
<b>7.3</b>	<b>What is proposed for the next ten years? .....</b>	<b>84</b>
7.3.1	Implementation planning.....	84
<b>8.0</b>	<b>Coastal Emergency Response Management Plan.....</b>	<b>92</b>
<b>8.1</b>	<b>What is a coastal emergency? .....</b>	<b>97</b>
<b>8.2</b>	<b>How is the Coastal Emergency Management Response Plan different to existing management? .....</b>	<b>105</b>
<b>8.3</b>	<b>Council's priorities for the next ten years .....</b>	<b>106</b>
8.3.1	Immediate actions .....	106
8.3.2	Emergency Management sub plans for Hargraves Beach, North Entrance Beach and Cabbage Tree Harbour .....	107
8.3.3	Geotextile bag structures for coastal reinforcement or protection .....	109
8.3.4	Preparing for the impacts of tsunami.....	111
<b>8.4</b>	<b>Who will be involved in making a difference? .....</b>	<b>111</b>
8.4.1	Preliminary indication of Council responsibilities in coastal emergencies.....	113
<b>8.5</b>	<b>Contribution to objectives and targets .....</b>	<b>114</b>
<b>8.6</b>	<b>Implementation information .....</b>	<b>115</b>
<b>9.0</b>	<b>Action Plan for coastal erosion, recession and inundation risk areas.....</b>	<b>120</b>
<b>9.1</b>	<b>Scope of this Action Plan .....</b>	<b>120</b>
9.1.1	Exposure of homes and community assets to coastal erosion and recession ...	120
9.1.2	How will this Action Plan be different to what happens now? .....	122
9.1.3	Council's strategic approach.....	137
9.1.4	Appropriate development in coastal risk areas .....	137
9.1.5	WSC planning provisions to reduce the risks associated with coastal recession driven by sea level rise or other coastal processes.....	139

9.1.6	Coastal protection structures for existing development.....	145
9.1.7	Planning strategies for specific locations.....	145
9.1.8	Funding for coastal protection works.....	154
<b>9.2</b>	<b>Contributions to achieving coastal zone objectives and targets .....</b>	<b>155</b>
<b>9.3</b>	<b>Coastal Erosion and Recession Action Plan .....</b>	<b>158</b>
9.3.1	Who will be involved in making a difference? .....	158
9.3.2	Erosion and recession actions also in other Action Plans .....	158
<b>9.4</b>	<b>Coastal Inundation Action Plan.....</b>	<b>175</b>
9.4.1	Council's priorities .....	175
9.4.2	Who will implement the Coastal Inundation Action Plan? .....	175
<b>10.0</b>	<b>Lake and Sea Interactions Action Plan .....</b>	<b>186</b>
<b>10.1</b>	<b>Scope.....</b>	<b>186</b>
10.1.1	Sediment dynamics – beach and estuary.....	186
10.1.2	The Entrance and North Entrance Beach.....	188
10.1.3	Measured changes to shoals and channels at The Entrance.....	188
<b>10.2</b>	<b>Dredging operations .....</b>	<b>189</b>
<b>10.3</b>	<b>Sediment budget issues at The Entrance.....</b>	<b>191</b>
<b>10.4</b>	<b>Council's priorities .....</b>	<b>192</b>
<b>10.5</b>	<b>Who is responsible for making a difference? .....</b>	<b>193</b>
<b>10.6</b>	<b>How these actions contribute to coastal management objectives and targets .....</b>	<b>193</b>
<b>10.7</b>	<b>Implementation of management responses .....</b>	<b>194</b>
<b>11.0</b>	<b>Geotechnical Hazards Action Plan .....</b>	<b>198</b>
<b>11.1</b>	<b>Scope.....</b>	<b>198</b>
11.1.1	Locations included in geotechnical hazard assessment.....	199
11.1.2	How is this Action Plan different to what happens now? .....	219
11.1.3	Who will be responsible for making a difference? .....	219
<b>11.2</b>	<b>Managing Cabbage Tree Harbour .....</b>	<b>220</b>
11.2.1	Install effective toe protection and drainage .....	220
<b>11.3</b>	<b>How geotechnical management actions contribute to objectives and targets .....</b>	<b>221</b>
<b>11.4</b>	<b>Implementation .....</b>	<b>223</b>
11.4.1	Information to assist land owners.....	228
<b>12.0</b>	<b>Building Coastal Biodiversity Resilience Action Plan .....</b>	<b>229</b>
<b>12.1</b>	<b>Scope of Biodiversity Resilience Action Plan.....</b>	<b>229</b>
<b>12.2</b>	<b>Why is this plan important?.....</b>	<b>230</b>
<b>12.3</b>	<b>Who will be involved in making a difference.....</b>	<b>230</b>
<b>12.4</b>	<b>How the biodiversity actions contribute to objectives and targets .....</b>	<b>231</b>
<b>12.5</b>	<b>Council's priorities .....</b>	<b>232</b>
<b>12.6</b>	<b>Implementation of biodiversity actions .....</b>	<b>232</b>
<b>13.0</b>	<b>Recreation and Tourism Action Plan .....</b>	<b>238</b>

<b>13.1 Scope</b> .....	<b>238</b>
13.1.1 Who will be involved in working towards sustainable coastal recreation and tourism? .....	238
<b>13.2 Objectives and targets</b> .....	<b>239</b>
<b>13.3 Implementation of recreation and tourism actions</b> .....	<b>241</b>
13.3.1 Spatial distribution of actions .....	245
<b>14.0 Cultural Landscapes Action Plan</b> .....	<b>246</b>
<b>14.1 Scope</b> .....	<b>246</b>
<b>14.2 Who is involved in making a difference?</b> .....	<b>246</b>
<b>14.3 Objectives and targets</b> .....	<b>246</b>
<b>14.4 Implementation</b> .....	<b>247</b>
 <b>Part C Current Management and Coastal Compendium: Trends in the Condition of Valued Coastline Assets</b>	
<b>15.0 Existing Management Framework</b> .....	<b>251</b>
<b>15.1 Land tenure</b> .....	<b>251</b>
<b>15.2 Community stakeholders, management activities and issues</b> .....	<b>259</b>
15.2.1 Community stakeholder groups .....	259
15.2.2 Previous community comments on coastal zone values, objectives and issues – related planning contexts .....	262
<b>15.3 Wyong Shire Council roles and responsibilities</b> .....	<b>262</b>
15.3.1 Existing Council planning instruments, policies, plans and guidelines for the coastline .....	266
15.3.2 Land use zoning .....	268
<b>15.4 Sustainability is a key part of Wyong Council’s Strategic Vision</b> .....	<b>276</b>
15.4.1 Sustainability research on the Central Coast .....	276
15.4.2 WSC Strategic Vision .....	277
15.4.3 Council structure for delivering sustainable coastline management .....	278
15.4.4 Natural hazards and coastal emergencies .....	279
15.4.5 Wyong Shire Climate Change Policy .....	281
<b>15.5 Roles, responsibilities and requirements of the NSW Government</b> .....	<b>282</b>
15.5.1 Land and Property Management Authority responsibilities and issues, Wyong Shire	285
15.5.2 NSW Sea Level Rise Policy Statement (DECCW 2009) .....	286
15.5.3 Coastal erosion hot spots and Authorised Locations (Department of Climate Change 2009b) .....	286
15.5.4 Overview of related OEH policies, legislation and guidelines released during 2010	287
15.5.5 NSW Coastal Planning Guideline: Adapting to sea level rise (Department of Planning 2010) .....	291
<b>15.6 Australian government requirements and initiatives</b> .....	<b>294</b>
15.6.1 Coast and Climate Change Council .....	297
15.6.2 Australian Government investment in adaptation to climate change .....	298
<b>15.7 Is the existing management framework promoting resilience of coastal values in the context of climate change?</b> .....	<b>298</b>
15.7.1 Knowledge gaps .....	299
15.7.2 Gaps in policy and legislation .....	299

15.7.3	Institutional cooperation.....	300
15.7.4	Community engagement.....	300
<b>16.0</b>	<b>Coastal Landforms and Processes .....</b>	<b>301</b>
<b>16.1</b>	<b>The diversity of the coastline .....</b>	<b>301</b>
<b>16.2</b>	<b>The climate of the Central Coast – now and in the future.....</b>	<b>304</b>
16.2.1	Wave climate.....	304
16.2.2	Patterns of storm frequency and intensity .....	307
16.2.3	Sea level and sea level rise .....	307
16.2.4	Regional scale climate change predictions.....	311
<b>16.3</b>	<b>Tsunami.....</b>	<b>312</b>
<b>16.4</b>	<b>Sandy coast landforms and features .....</b>	<b>313</b>
16.4.1	Sandy Beaches .....	313
16.4.2	Dunes.....	317
16.4.3	Creek and Lake Entrances .....	319
<b>16.5</b>	<b>Sandy coast processes and hazards .....</b>	<b>320</b>
<b>16.6</b>	<b>Results of sandy coast erosion hazard studies.....</b>	<b>321</b>
16.6.1	Immediate coastal erosion hazard .....	321
16.6.2	Beach recession over the last three decades .....	321
16.6.3	Predicted long term beach recession, with sea level rise.....	322
<b>16.7</b>	<b>Results of inundation hazard studies .....</b>	<b>324</b>
16.7.1	Long term estuary entrance processes .....	325
<b>16.8</b>	<b>Geotechnical processes on cliffs and bluffs.....</b>	<b>325</b>
16.8.1	Cliffs, Bluffs and Rock Platforms along the coastline .....	326
16.8.2	Processes on cliffs and bluffs.....	330
16.8.3	Results of geotechnical hazard studies .....	332
16.8.4	Risks: existing development affected by geotechnical hazards, now and in the future.....	334
16.8.5	Climate change and cliffs and bluffs.....	335
16.8.6	Indicative summary of changes to hazards with climate change and sea level rise .....	335
<b>17.0</b>	<b>Baseline condition and status: biodiversity, settlement and land use.....</b>	<b>341</b>
<b>17.1</b>	<b>Biodiversity values .....</b>	<b>341</b>
17.1.1	Vegetation communities .....	341
17.1.2	Coastal Fauna.....	348
17.1.3	Biodiversity assessment of rocky shores.....	349
17.1.4	Ecosystem services.....	350
17.1.5	Threats to biodiversity values.....	351
17.1.6	Trends in biodiversity resilience – what will climate change do? .....	351
<b>17.2</b>	<b>Land use and assets .....</b>	<b>352</b>
17.2.1	Evolution of settlement and coastal communities .....	352
17.2.2	Coastal property values and ownership profile .....	354
17.2.3	Population trends.....	358
17.2.4	Commercial uses of Wyong coastline beaches .....	360
17.2.5	Recreation and tourism.....	360

17.2.6	Patrolled beaches and Surf Club activities .....	361
17.2.7	Other community infrastructure and built assets .....	364
<b>17.3</b>	<b>Cultural and heritage values .....</b>	<b>366</b>
17.3.1	Indigenous places and values .....	366
17.3.2	Heritage listings .....	367
17.3.3	Cultural landscapes – integrating physical, visual and social values .....	368
<b>18.0</b>	<b>Key Risks for the Wyong Coastline .....</b>	<b>371</b>
<b>18.1</b>	<b>Assessing risk .....</b>	<b>371</b>
18.1.1	Risk assessment protocols for geotechnical hazards .....	372
18.1.2	Standard risk assessment protocols – likelihood and consequence .....	373
<b>18.2</b>	<b>Immediate coastal erosion and inundation risks .....</b>	<b>374</b>
<b>18.3</b>	<b>Coastal erosion risks for the 2050 and 2100 planning periods .....</b>	<b>376</b>
18.3.1	Coastal Hazard Assessment for Surf Clubs .....	379
<b>18.4</b>	<b>Other risks to coastline values .....</b>	<b>381</b>
18.4.1	Inadequate or poorly maintained or managed recreational access .....	381
<b>18.5</b>	<b>Which risks require urgent attention? .....</b>	<b>382</b>
<b>Part D Evaluation of Options to Reduce Risks in the Coastal Zone</b>		
<b>19.0</b>	<b>Response options and evaluation .....</b>	<b>386</b>
<b>19.1</b>	<b>Scope of issues and responses .....</b>	<b>386</b>
19.1.1	Application of options to issues .....	387
19.1.2	Coastal sustainability issues outside the scope of the WSCZMP .....	388
19.1.3	Adaptive management .....	389
19.1.4	Introducing new actions in the future .....	389
<b>19.2</b>	<b>Evaluating sustainable management options for Wyong’s coastline .....</b>	<b>390</b>
19.2.1	What does the ‘sustainability’ score mean? .....	391
<b>19.3</b>	<b>Potential responses for managing immediate coastal erosion and inundation risks .....</b>	<b>392</b>
19.3.1	Summary of actions - Immediate coastal erosion and inundation .....	392
19.3.2	Evaluation of potential actions .....	394
19.3.3	Requirements of an effective emergency response management plan .....	412
19.3.4	Planning considerations for immediate hazard zones .....	412
19.3.5	Sand sources for beach nourishment – immediate time frames and longer term .....	412
19.3.6	Unintended effects of sea walls .....	414
19.3.7	Geotextile bag structures for coastal reinforcement or protection .....	415
<b>19.4</b>	<b>Potential responses for adapting to coastal recession, including erosion associated with sea level rise and climate change – extreme and high risks .....</b>	<b>417</b>
19.4.1	In perpetuity protection of beach access and amenity .....	438
19.4.2	Relocating community infrastructure .....	438
19.4.3	Managing surf club infrastructure .....	438
<b>19.5</b>	<b>Potential responses for managing lake and sea interactions .....</b>	<b>442</b>
<b>19.6</b>	<b>Potential responses for managing immediate and longer term geotechnical hazards .....</b>	<b>448</b>

<b>19.7 Potential responses for enhancing the resilience of coastal biodiversity .....</b>	<b>454</b>
<b>19.8 Potential responses for managing risks associated with community use and enjoyment of the coast .....</b>	<b>460</b>
19.8.1 Potential routes – Coastal Walk and Mountains to the Sea Walk .....	467
<b>19.9 Potential responses for managing heritage and cultural values of the coastline .....</b>	<b>468</b>
<b>20.0 References .....</b>	<b>473</b>