TOWARDS A SUSTAINABLE FRAMEWORK FOR NAVIGATION IN SWANSEA CHANNEL

Framework Report

August 2013
Executive Summary

1. Boating Context

Swansea Channel is the marine gateway to Lake Macquarie. Lake Macquarie is an outstanding recreational waterway used by local and regional boating enthusiasts.

Recreational boating is a popular activity on Lake Macquarie, attracting local residents and people from the broader Hunter, Central Coast and Sydney regions. The lake regularly hosts State and National yachting events. Currently over 18,000 boats use Lake Macquarie and this number is expected to increase to over 25,000 by the year 2020.

More than 90% of registered recreational vessels in Lake Macquarie are of small to medium size and utilise foreshore boating infrastructure such as jetties, ramps and reserves. However, deep water, uncrowded bays and steady winds also make Lake Macquarie a highly regarded destination for larger, deep keeled yachts. Approximately 1500 yachts drawing more than 2.0 metres are based in Lake Macquarie, of which approximately 500 draw more than 2.5 metres. Whilst many of these are entirely lake based, a proportion of local owners and visitors from Sydney and other ports value safe ocean access to and from the Lake, for safe haven, racing and cruising.

2. A Need For Action

Yachting and other recreational boating use of Swansea Channel and the lake by local, the state and inter-state boating enthusiasts contributes to the social, environmental and economic values of the Lake Macquarie area.

Currently, dredging in Swansea Channel is carried out on an as needed basis, when funding and management capacity at state and local government levels permit. Dredging on this basis leads to uncertainty about locations of shoaling and reliability of boating access.

The cost of an initial dredging program needed to achieve the desired channel form is likely to be beyond the capacity of the current level of funding committed by the State government for state-wide dredging programs. Council has made no allocation for dredging in Swansea Channel in its budget planning. Community surveys conducted by LMCC have found that the majority of residents do not believe Council should make investment in channel dredging a priority for its funds.

This has lead to a situation in which the expectations of the yachting community and commercial operators for reliable navigability of the channel are not being met. Lack of certainty about channel navigability affects the reputation of Lake Macquarie as a boating destination.

Maintaining reliable boating access to the Lake is considered desirable for social and economic reasons. Dredging of Swansea Channel to achieve reliable navigability requires ongoing support from both State and local government.
3. Management Background

Lake Macquarie is an example of a coastal lake or lagoon feature known as ICOLL (intermittently closed lakes and lagoons). The entrances of these waterways are naturally shoaling and not suitable for regular navigation in their natural form. Pressure to create a navigable entrance to Lake Macquarie commenced in the mid-nineteenth century, and training walls were constructed at the entrance in the 1890s. These training walls increased the hydraulic capacity of the entrance and altered the hydrodynamic processes. More than a century later, the channel form is continuing to adjust, by progressively deepening and widening from the entrance towards the lake and shoaling with pulses of sand in the upstream reaches. Other structures and activities such as Swansea Bridge, bank protection works, various dredging programs that realigned the main channel and works at the entrance to Swan Bay have all contributed to ongoing dynamic conditions.

Coastal engineering studies a decade ago identified a proposed channel form for the already highly modified waterway which would tend to concentrate tidal flows upstream of Swansea Bridge and reduce shoaling in key sections. If dredged to a deep and wide channel form (minimum width 60m and depth to -3.5m AHD), the study concluded that the channel would provide more reliable navigation conditions and require less frequent maintenance. Dredging programs since 2003 have been limited in scale and have not achieved the proposed channel form. The reasons for this include the risks and costs of a major dredging program, taking into account limited funding and competing priorities; lack of clarity about responsibility and accountability for dredging and the environmental and social benefits; and complex approvals processes which constrain a timely response.

4. Report Focus

This report outlines nine strategic and operational components of a framework to facilitate the implementation of a dredging program for reliable navigation in Swansea Channel. It builds on previous technical studies, reviews the statutory, policy and planning controls and updates the previous assessment of the social and economic costs and benefits of channel management. The report is informed by input from relevant State agencies and Lake Macquarie City Council, from a Project Steering Committee which included community representatives with experience in lake management and yachting, and from consultation with diverse waterway user groups and individuals.

The report outlines, discusses and evaluates options to deliver the key framework elements.
5. **Operational Components for Appropriate, Effective and Efficient Dredging**

(i) **Channel form.** A channel of minimum width 60 metres and with a design bed level of -3.5 metre AHD would cater for 97 per cent of Lake Macquarie waterway users and allow contingencies for natural variations in water level and for sudden pulses of sand. The trigger for preparation for ongoing maintenance dredging would be set at a bed level of -2.8 metres AHD at specified locations in the channel. The intent of the action trigger is to support timely dredging and reduce uncertainty.

It is important to note that the recommended long term framework for dredging of the channel is based upon a large initial campaign with a cost of more than two million dollars followed by on-going periodic maintenance dredging.

(ii) **Beneficial uses of dredged sand.** Key long term uses of sand dredged from Swansea Channel include dune nourishment, foreshore management (for
environmental and recreation values) and sale of sand for construction purposes. Uses such as dune nourishment provide indirect benefits for the Lake Macquarie community, but no direct financial contribution to the cost of dredging. Sale of dredged sand for concrete or for clean fill can partially offset dredging costs. However the sand would be sold into a competitive market and would require processing and stockpiling site, with good road access. The former Aero Pelican site at Belmont South has potential for these activities, although it is proposed to retain an infrastructure (airport) zoning. Its use would require negotiation with the land owner as well as Lake Macquarie City Council. An alternative is a parcel of Crown land located between the Pacific Highway and Blacksmiths Beach, which is cleared and has access to the Highway. However this land is currently subject to an Aboriginal Land Claim.

(iii) **Comprehensive and responsive approval and management processes.** Channel dredging should operate under a comprehensive impact assessment, approval and management plan that covers extraction and sand use for a period of up to 20 years. Relevant licences and permits should be incorporated into the approval and management plan. Approval processes should be reviewed in the light of the current planning reforms. The management plan could set out implementation requirements from the approval, including:

- responsibility, accountability and powers within the management partnership;
- design and operational parameters;
- environmental protection matters and responsibility, including performance targets;
- emergency measures and responsibility;
- ongoing environmental, technical and usage monitoring requirements;
- reporting and accessibility of monitoring information;
- program review triggers and default timeframes; and
- engagement processes for stakeholders and waterway users.

(iv) **Dredge ownership and contractual arrangements.** In the current state policy context, and in terms of efficient implementation of dredging programs, private dredging contractors with appropriate equipment and skills provide more flexibility and value for money than other options. Different dredging equipment is expected to be needed for an initial large scale dredging campaign to that which would be required for ongoing maintenance after the initial channel form has been achieved.

(v) **Ongoing adaptive management.** The channel is a dynamic sedimentary environment. Boat ownership and waterway usage are also changing in response to economic conditions and new technologies. Reliable channel navigability requires regular monitoring and reporting of any changes to channel form, environmental parameters and community use, with agreed triggers for commencing maintenance dredging programs and for full review of the value of dredging outcomes.

(vi) **Community involvement in channel management.** Navigability has a community value as well as an economic value. Effective long term management of the channel should be informed by an inclusive community consultation process, such as a reference group or expert committee. Several local options for consultation exist through arrangements lead by the Roads and Maritime Services (RMS) and LMCC. It is important that channel dredging is managed in the context of broader estuary values and objectives, so consultation through a broader recreational boating or estuary management group should be considered.
6. **Strategic Components – Funding and Responsibility**

(i) **Costs and benefits of a navigable channel.** The history of channel management, magnitude of channel adjustment and shoaling and the channel form needed for reliable safe navigation by the recreational boating community suggest that a single large dredging initiative is needed in the first instance, to reset the morphodynamic context of Swansea Channel.

Indicative costs for the initial dredging campaign for a channel of 60 metres wide and -3.5 metres AHD deep is a minimum of $1.5 million and $4.1 million for a channel 120 metres wide, plus detailed design, approvals and project management costs. The ongoing maintenance costs, which are dictated by the sustainability of the initial channel form provide a better understanding of the least-cost channel option. For instance:

- over the short-term (10 years) the Present Value cost of not committing to a large-scale dredging operation and continuing to dredge opportunistically (current situation) is $4.8 million. Over the long-term (25 years) this increases to $8.1 million.

- For a channel initially dredged to 60 metres wide and -3.5 metres AHD deep the PV10 cost is $4.3 million and the PV25 cost is $6.1 million.

- For a channel initially dredged to 120 metres wide and -3.5 metres AHD deep, the PV10 cost is $8.8 million and the PV25 cost is $11.4 million.

Potentially, these costs may be partially offset through sand sales. Nevertheless, the lowest Present Value cost option remains the 60 metre wide channel. When a suite of social and environmental benefits are included in the analysis, the 60 metre wide channel (at -3.5 metres AHD deep) also has the highest benefit versus cost ratio.

Based on the estimated increase of visitors from outside Lake Macquarie of 150%, analysis shows a potential increase to local revenue in the order of $7 to 8 million a year, increased value to the local economy of $3.3 to 3.7 million a year, increased income of $0.9 to 1.0 million a year and the generation of additional employment, potentially around 19 to 22 jobs. These increases are irrespective of channel width and represent a boost to the local recreation and tourism economy, but a relatively minor change to the overall economic activity of the City.

(ii) **Funding.** There are several potential options for funding the initial and longer term maintenance dredging in Swansea Channel. For sustainable navigation management, a clear, multi-stakeholder, up-front funding strategy and commitment to funding is essential, together with a formal and transparent review process to maintain value for money.

Boat owners in Lake Macquarie contribute approximately $7 million annually to the State government in licences and fees. Owners of vessels drawing more than 2.5 metres comprise approximately 3 per cent of vessels registered in Lake Macquarie and contribute approximately 14 per cent of this revenue to the State. There is some potential to enhance and/or redirect funds from the Better Boating Program to dredging in Lake Macquarie if Council and the local community advised that this was the highest priority and most beneficial investment for the local and regional community.

Suggested options for funding from the State budget include direct State investment (potentially to support regional development) or reallocation of funds from the Rescuing
Our Waterways Phase 2 Program and/or the Better Boating Program. These options require a change from current policy and program arrangements.

Other suggested options include consideration of various partnerships between State agencies and local government under other State government funding programs (e.g. Rescuing our Waterways), noting that Lake Macquarie City Council has stated that its current and medium term financial commitments and planning do not include allocations for dredging in Swansea Channel. Additional charges and levies on boat owners could be used, but would need to be clearly set aside for work in Lake Macquarie. On the basis of current limited understanding of willingness to pay, the economic analysis indicates that investment required for ongoing dredging is unlikely to be offset by community contributions. Nor will sale of sand fully offset dredging costs.

As the framework calls for a distinct up-front dredging campaign followed by on-going maintenance, it would be beneficial to consider the two funding streams separately.

All of these options may require changes to the current funding arrangements under the relevant State grant programs and/or stakeholder willingness to pay for a service privilege, consistent with the regional to state level significance of Lake Macquarie.

(iii) Responsible management entity and partnership arrangements. The NSW Sustainable Dredging Strategy generally identifies local government with responsibility for maintaining regional recreational waterways. However, there is a strong community view and Council policy perspective that major dredging works in Swansea Channel to maintain a high level of service in recreational navigability are not Lake Macquarie City Council’s responsibility.

It is important to recognise that responsibility for program and/or project management and responsibility for funding are not the same thing.

NSW Crown Lands, RMS and Lake Macquarie City Council all have valuable capacities and some statutory and/or policy responsibilities for contributing to the management of the recreational boating values of Swansea Channel. All have potential roles in future management, and a more formal partnership which specifies responsibilities for delivery of management services, monitoring and reporting services and technical advice is a likely sustainable option. There is limited value in a separate management authority for dredging in Swansea Channel.

7. A Partnership Based On Strategic Choices about Program Leadership and Operational Responsibility

Effective management partnerships are based on well aligned values, shared understanding of the challenges, clear and agreed objectives and a willingness to communicate and work proactively together. During this project the views expressed by the stakeholders in the navigability of Swansea Channel made it clear that there is good alignment of values, concerns and objectives at the local to regional level. There is support for the concept of adaptive management of navigability with actions, responsibilities, triggers, monitoring and review schedules to be set out in any future detailed management plan. To be successful, there also needs to be support for a combined management fund to which all partners make agreed financial contributions. Ideally the fund should be able to hold financial resources from one financial year to the next, and make provision for long term commitments.

Three potential models for how a partnership between the stakeholders could deliver sustainable navigability outcomes for Swansea Channel have been considered. Of these, a model in which the NSW government provides overall program guidance and
various state agencies and stakeholders such as RMS, Crown Lands and Lake Macquarie City Council each have specific responsibilities offers better potential as the general way forward. However this partnership is crucially dependant on further negotiation of specific roles and arrangements to deliver long term viability. The responsibilities and level of involvement of the various stakeholders is expected to adjust over time.

Implementation of a long term navigation dredging program based on this concept of a strategic partnership would be consistent with the local, regional and state significance of the natural and recreational values of Lake Macquarie and the role of Swansea Channel as the marine gateway to this asset. Operational management at the local council level would help deliver consistent processes and outcomes for the local and regional community, across a range of estuary programs in Lake Macquarie.

8. **Link between the Swansea Channel Dredging Framework and the Coastal Zone Management Plan**

This report is not a framework for integrated management of the environmental and socio-cultural values of Swansea Channel. The Lake Macquarie City Council Coastal Zone Management Plan (Part 3) and subsequently the fully integrated Coastal Zone Management Plan, will provide the overarching waterway objectives to which sustainable navigation will contribute and with which future navigation management should be aligned.
Report Structure

To assist readers to review contextual information and analysis of options, this document is presented in three parts.

| Part 1 | Sections 1 to 3 | These sections provide background to the Swansea Channel situation including details of this framework development process and the historical and policy context of dredging in the channel. |
| Part 2 | Sections 4 to 10 | Technical and operating elements of a sustainable and streamlined framework including channel design, contracting arrangements, sand disposal and approval processes. |
| Part 3 | Sections 11 to 13 | This part examines the major policy elements of the framework that require consideration by the government. These are the costs and benefits analysis, the options for funding, and the model for management of the channel into the future. |
TABLE OF CONTENTS

1.0 Introduction .......................................................................................................................... 1.1

1.1 Scope of this Project .............................................................................................................. 1.2
  1.1.1 Project Location ............................................................................................................. 1.4
  1.1.2 Project Approach and Methods ..................................................................................... 1.5
  1.1.3 Project Steering Committee ......................................................................................... 1.6
  1.1.4 Report Structure ......................................................................................................... 1.6

2.0 Historical and Policy Context of Dredging in Swansea Channel ........................................ 2.1

2.1 Swansea Channel Navigation and Dredging History ......................................................... 2.1
  2.1.1 Early Navigation Efforts .............................................................................................. 2.1
  2.1.2 Planning for Improved Navigation in Modern Times .................................................... 2.2
  2.1.3 Dredging History ....................................................................................................... 2.3
  2.1.4 Current Situation ....................................................................................................... 2.4

2.2 Relevant Legislation and Responsibilities ................................................................. 2.5
  2.2.1 Crown Lands Act 1989 ............................................................................................. 2.8

2.3 State Government Policy and Programs ........................................................................ 2.8
  2.3.1 NSW State Plan 2021 .............................................................................................. 2.8
  2.3.2 Coastal Infrastructure Program .................................................................................. 2.9
  2.3.3 NSW Sustainable Dredging Strategy 2012/13 to 2014/15 ........................................ 2.9

2.4 Level of Service............................................................................................................. 2.10

2.5 Local Government Policy and Plans ........................................................................ 2.11
  2.5.1 LMCC Community Strategic Plan ............................................................................. 2.11
  2.5.2 Zoning of Lake Macquarie ......................................................................................... 2.12
  2.5.3 Lake Macquarie City Council Dredging Policy Position ........................................... 2.13

3.0 The Case for Navigation Dredging in Swansea Channel............................................. 3.1

3.1 The Significance of Swansea Channel .............................................................................. 3.2
  3.1.1 Regional waterway context ......................................................................................... 3.4
  3.1.2 Local Tourism and Yachting Events .......................................................................... 3.5
  3.1.3 Lake Macquarie as a NSW Tourism Destination .......................................................... 3.5
  3.1.4 Chambers of Commerce ............................................................................................ 3.6

3.2 Swansea Channel Users and Stakeholders ...................................................................... 3.7
  3.2.1 Stakeholder and Community Consultation ................................................................. 3.8
  3.2.2 Community Perceptions of Navigability Issues in Swansea Channel ........................ 3.9

3.3 Boat Ownership and Usage ............................................................................................. 3.11
  3.3.1 Hunter Inland Region ............................................................................................... 3.11
  3.3.2 Boat Ownership in Lake Macquarie .......................................................................... 3.11
  3.3.3 Projected Boat Ownership Growth .......................................................................... 3.12

3.4 Swansea Channel Waterway User Needs ........................................................................ 3.13
  3.4.1 Vessels Requiring Bridge Openings ......................................................................... 3.14

3.5 Impacts of Unmanaged Shoaling on Navigation and Use ............................................. 3.15

3.6 Sustainable Management of Navigability in Swansea Channel – Rationale for Special Funding Consideration ................................................................. 3.17
3.6.1 Maintaining Navigability of Lake Macquarie Entrance Channel - Special Consideration .......................................................... 3.18

4.0 Components of a Management Framework ......................... 4.1
  4.1 What Does Sustainable Navigation Dredging Mean? ........... 4.2
    4.1.1 Alignment of Strategy across Land Use, Community Planning and Infrastructure Sectors ........................................ 4.3
    4.1.2 Strategic and Planning Factors ........................................ 4.3
    4.1.3 Operational Factors – Sustainable Dredging Design and Action .................. 4.4

5.0 Dredging Plan and Design ................................................. 5.1
  5.1 Environmental Processes and Constraints to Navigability .......... 5.2
  5.2 Lake Macquarie entrance – Limiting Factors for Navigability Today 5.3
  5.3 Functional Channel Form .................................................. 5.4
  5.4 Technical Studies and Estuary Modelling ............................ 5.5
    5.4.1 Impact of Sea Level Rise on Swansea Channel .................. 5.6
    5.4.2 Review of Previous Channel Forms and Management Options ....... 5.6
  5.5 Sand Extraction for Channel Design Requirements .................... 5.9
    5.5.1 Dredging Plant .......................................................... 5.12

6.0 Utilising Dredged Sand ..................................................... 6.1
  6.1 Sand Sources, Processes and Beneficial Uses ....................... 6.1
  6.2 Stockpiling and Treatment Sites if Sand is Sold or Used at Replenishment Sites .................................................. 6.4

7.0 Comprehensive and Responsive Approval Processes .......... 7.1
  7.1 Approval Considerations ................................................... 7.1
    7.1.1 Background on Statutory Requirements ......................... 7.2
    7.1.2 Scope of Approval .................................................... 7.3
    7.1.3 Management Plans to Provide Flexibility but Robust Performance Requirements and Compliance .................... 7.5

8.0 Dredging Services and Contractual Arrangements .............. 8.1
  8.1 Guidelines and Criteria for Contractual Arrangements ........ 8.1
    8.2 Research and Analysis – Dredge Ownership Models ............. 8.1
      8.2.1 State Government Ownership of a Dredge ....................... 8.2
      8.2.2 Wyong Council’s Dredge .......................................... 8.2
      8.2.3 Joint Ownership Between Regional Coastal Councils .......... 8.3
      8.2.4 Local Privately-Owned Dredge .................................. 8.3
      8.2.5 Community-Owned Dredge .................................... 8.4
    8.3 Contractual Arrangements for Private Sector Dredges .......... 8.4

9.0 Adaptive Management Process ........................................... 9.1
  9.1 Performance Targets for Channel Management ....................... 9.2
  9.2 Triggers to Activate Maintenance Dredging ......................... 9.2
  9.3 Monitoring, Reporting and Review Strategy ......................... 9.3
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.3.1 Monitoring</td>
<td>9.4</td>
</tr>
<tr>
<td>9.3.2 Reporting</td>
<td>9.5</td>
</tr>
<tr>
<td>9.3.3 Review Triggers and Default Timeframes</td>
<td>9.5</td>
</tr>
<tr>
<td>9.3.4 Ongoing Engagement Processes</td>
<td>9.5</td>
</tr>
<tr>
<td>9.4 Knowledge Improvement and Information Sharing</td>
<td>9.6</td>
</tr>
<tr>
<td>10.0 Community Value and Involvement</td>
<td>10.1</td>
</tr>
<tr>
<td>10.1 Summary of Options</td>
<td>10.1</td>
</tr>
<tr>
<td>10.1.1 Effective Engagement Options</td>
<td>10.2</td>
</tr>
<tr>
<td>10.2 Current Consultative Bodies</td>
<td>10.2</td>
</tr>
<tr>
<td>11.0 Costs and Benefits can be Balanced</td>
<td>11.1</td>
</tr>
<tr>
<td>11.1 Introduction to Economic Appraisal</td>
<td>11.1</td>
</tr>
<tr>
<td>11.2 Updating the Cost-Benefit Analysis</td>
<td>11.1</td>
</tr>
<tr>
<td>11.2.1 Data Collation</td>
<td>11.2</td>
</tr>
<tr>
<td>11.3 Cost-Benefit Assessment (Technical)</td>
<td>11.3</td>
</tr>
<tr>
<td>11.3.1 Costs</td>
<td>11.3</td>
</tr>
<tr>
<td>11.3.2 Potential Benefits</td>
<td>11.4</td>
</tr>
<tr>
<td>11.3.3 Compilation of Costs and Benefits</td>
<td>11.5</td>
</tr>
<tr>
<td>11.4 Socio-Economic Assessment</td>
<td>11.8</td>
</tr>
<tr>
<td>11.4.1 Costs and Benefits to the Community of the Dredging Options</td>
<td>11.8</td>
</tr>
<tr>
<td>11.4.2 Financial Benefits of Dredging Operations – Sale of Sand</td>
<td>11.9</td>
</tr>
<tr>
<td>11.4.3 Regional Economic Impacts</td>
<td>11.10</td>
</tr>
<tr>
<td>11.4.4 Consideration of the Socio-Economic Impacts</td>
<td>11.11</td>
</tr>
<tr>
<td>11.5 Summary</td>
<td>11.12</td>
</tr>
<tr>
<td>12.0 Funding</td>
<td>12.1</td>
</tr>
<tr>
<td>12.1 Historical Funding Arrangements for Dredging</td>
<td>12.2</td>
</tr>
<tr>
<td>12.1.1 Previous Dredging in Swansea Channel</td>
<td>12.2</td>
</tr>
<tr>
<td>12.1.2 Previous Investment in the health and amenity of Swansea Channel</td>
<td>12.3</td>
</tr>
<tr>
<td>12.2 Current Funding Programs</td>
<td>12.5</td>
</tr>
<tr>
<td>12.2.1 NSW Sustainable Dredging Strategy</td>
<td>12.5</td>
</tr>
<tr>
<td>12.2.2 Better Boating Program</td>
<td>12.6</td>
</tr>
<tr>
<td>12.2.3 Coastal Management Program</td>
<td>12.7</td>
</tr>
<tr>
<td>12.2.4 LMCC Funding</td>
<td>12.7</td>
</tr>
<tr>
<td>12.2.5 Revenue and Cost Recovery</td>
<td>12.8</td>
</tr>
<tr>
<td>12.3 Funding Opportunities</td>
<td>12.9</td>
</tr>
<tr>
<td>12.3.1 Funding Examples from other Waterways</td>
<td>12.10</td>
</tr>
<tr>
<td>12.3.2 Potential New Charges and Fees</td>
<td>12.12</td>
</tr>
<tr>
<td>12.4 Summary</td>
<td>12.15</td>
</tr>
<tr>
<td>13.0 Responsible Management Entity</td>
<td>13.1</td>
</tr>
<tr>
<td>13.1 Available Management Entities</td>
<td>13.1</td>
</tr>
<tr>
<td>13.1.1 Regional Crown Reserve Trust</td>
<td>13.2</td>
</tr>
<tr>
<td>13.1.2 NSW Crown Lands</td>
<td>13.2</td>
</tr>
<tr>
<td>13.1.3 LMCC</td>
<td>13.3</td>
</tr>
</tbody>
</table>
13.1.4 RMS ................................................................. 13.4
13.1.5 A New Statutory Authority ........................................... 13.4

13.2 Other Possible Management Entity Concepts ......................... 13.5
  13.2.1 Governance and Funding Models from other NSW Estuaries .......... 13.5
  13.2.2 Governance and Funding Models from other States .................. 13.6

13.3 Summary of Management Entity Options ................................. 13.7

13.4 Evaluation Summary – Management Entity .............................. 13.10
  13.4.1 Acceptable Lead Management Entity .................................. 13.10
  13.4.2 Possible Partnership Arrangements for Ongoing Maintenance of Navigability 13.12

14.0 Summary of Framework Management Options for Swansea Channel ................................................................. 14.1
  14.1 Aligned Values, Concerns and Objectives ................................ 14.1

15.0 References ........................................................................ 15.1

FIGURES

1.1 From Technical Studies to a Management Framework .................... 1.2
1.2 Study Area ........................................................................ 1.4
2.1 LMCC Community Strategic Plan – Implications for Swansea Channel ........................................................................ 2.13
3.1 Advertisement from the Lake Macquarie City Visitors Guide ............ 3.6
3.2 Swansea Channel Stakeholders – Organisations and Individuals ....... 3.7
3.3 Growth in Boat Ownership by Vessel Draught, Lake Macquarie ........ 3.13
3.4 Swansea Bridge Openings and Vessel Passage, 2004 to 2012. ........... 3.15
4.1 Nine Elements of a Sustainable Management Framework ............... 4.1
4.2 Alignment of Environmental, Policy, Strategy and Operational Features of Sustainable Dredging Programs ......................... 4.2
5.1a Black Neds Bay and Salts Bay 1941 ........................................ 5.2
5.1b Black Neds Bay and Salts Bay 2007 ........................................ 5.3
5.2 Calculation of Dredge Volumes ............................................... 5.10
7.1 Summary of the Approval Process ........................................... 7.6
9.1 Adaptive Management to Maintain Navigation ................................. 9.1
TABLES

1.1 Project Steering Committee .................................................................1.7
2.1 Historical Record of Funding for Dredging in Swansea Channel ..........2.3
2.2 Relevant Definitions from the Legislation .............................................2.5
3.1 Significance .......................................................................................3.3
3.2 Regional Comparison ..........................................................................3.4
3.3 Boat Registration by Region .................................................................3.11
3.4 Total vessels in Lake Macquarie by Draught Depth (2007 Data) ..........3.12
3.5 Projected Vessel Numbers in Lake Macquarie LGA ............................3.12
5.1 Context and Sustainable Outcomes .......................................................5.1
5.2 Swansea Channel Tidal Levels (2008) (WP 2010) ................................5.2
5.3 Option 1: Dimensions and Volumes .....................................................5.11
5.4 Examples of Suitable Types of Dredge ................................................5.12
6.1 Evaluating Sand Utilisation Options ....................................................6.2
9.1 Options for Dredging Works Triggers ..................................................9.3
9.2 Monitoring Channel Form, Condition and Use .....................................9.4
10.1 Potential Models for Engagement in Channel Management ..............10.3
11.1 Option 1: Costs Results Summary .....................................................11.3
11.2 Weighted Benefit Scores, Total and Rank ........................................11.5
11.3a PV Costs, Negative Costs (Sand Sales) and Totals for 10 and 25 Year Project Periods ($k) .................................................................11.6
11.3b Total PV Costs (with and without Sand Sales) for 10 and 25 Year Project Periods against Relative Benefits ($k) .............................11.6
11.4 Threshold Values per Vessel per Trip (i.e. Required WTP Estimates) ........................................................................................................11.8
11.5 Estimated Revenue from Sand Sales over the Project Period ............11.8
11.6 Threshold Values per Vessel per Trip (i.e. Required WTP Estimates) including Sand Sales ................................................................. 11.9

11.7 Regional Economic Impacts for Annual Visits from Outside the Lake .................................................................................................. 11.10

12.1 Major Investment in Lake Macquarie and Swansea Channel ............ 12.4

12.2 Estimated Levy Revenue Generated by Levy Type ................................ 12.9

12.3 Recreational Mooring Fees, $ annually, RMS 2012 .......................... 12.9

12.4 Estimated Revenue Generated by Vessel Size converted to Draught Requirement, Lake Macquarie .............................................. 12.10

13.1 Current Dredging Programs, Responsibilities and Funding in NSW .............................................................................................. 13.5

13.2 Acceptable Entity Arrangements ...................................................... 13.9

14.1 Package 1 - Crown Lands leading the program, representing the State as the land owner; up-front investment from the State; ongoing investment shared by state, local and community interests. LMCC an ancillary stakeholder .......................................................... 14.3

14.2 Package 2 - LMCC leading the program, representing the aspirations and commitment of local and regional community. Funding package negotiated within existing programs, to address local and regional objectives and priorities ......................................................... 14.4

14.3 Package 3 - Partnership for strategic choices – program leadership and operational responsibility .................................................. 14.5

APPENDICES

1 Record of Public Consultation

2 Additional planning context

3 Economics Addendum

4 Examples of Estuary Dredging Governance and Funding Arrangements in NSW and Elsewhere in Australia
Acronyms

AHD Australian Height Datum
BLALC Bahtahbah Local Aboriginal Land Council
Council Lake Macquarie City Council
CiOC Caring for our Country
CSP Community Strategic Plan
CZMP Coastal Zone Management Plan
DEM digital elevation model
DPI Department of Primary Industry
CSP Community Strategic Plan
DP&I Department of Planning and Infrastructure
Gov’t Government
EIS Environmental Impact Statement
EP&A Environmental Protection and Assessment Act 1979
EPBC Environmental Protection and Biodiversity Conservation
EPI environmental planning instruments
EPL Environment Protection License
GRCCC Georges River Combined Council’s Committee Inc.
HCRCMA Hunter-Central Rivers Catchment Management Authority
ICOLL Intermittently Closed and Open Lakes and Lagoons
IPART Independent Pricing and Regulatory Tribunal
LEP Local Environment Plan
LMCC Lake Macquarie City Council
LMLEP Lake Macquarie Local Environment Plan
LPMA Lands and Property Management Authority
MOU Memorandum of Understanding
MP Member of Parliament
MSQ Maritime Safety Queensland
<table>
<thead>
<tr>
<th>Acronyms</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSW</td>
<td>New South Wales</td>
</tr>
<tr>
<td>Mirvac</td>
<td>Mirvac Pty Ltd</td>
</tr>
<tr>
<td>OEH</td>
<td>Office of Environment Heritage</td>
</tr>
<tr>
<td>OLMCC</td>
<td>Office of the Lake Macquarie and Catchment Coordinator</td>
</tr>
<tr>
<td>POEO</td>
<td>Protection of the Environment Operations Act</td>
</tr>
<tr>
<td>PV</td>
<td>Present Value</td>
</tr>
<tr>
<td>PWD</td>
<td>Public Works Department</td>
</tr>
<tr>
<td>REF</td>
<td>Review of Environmental Factors</td>
</tr>
<tr>
<td>RMS</td>
<td>Roads and Maritime Services</td>
</tr>
<tr>
<td>RMYC</td>
<td>Yacht Club from Broken Bay</td>
</tr>
<tr>
<td>RSL</td>
<td>Returned Services League</td>
</tr>
<tr>
<td>SEPP</td>
<td>State Environmental Planning Policy</td>
</tr>
<tr>
<td>TBC</td>
<td>to be confirmed</td>
</tr>
<tr>
<td>TRESBP</td>
<td>Tweed River Sand By-passing Project</td>
</tr>
<tr>
<td>Umwelt</td>
<td>Umwelt (Australia) Pty Ltd</td>
</tr>
</tbody>
</table>
PART 1

1.0 Introduction

Technically, Lake Macquarie is an estuarine lagoon or ICOLL (Intermittently Closed and Open Lakes and Lagoons) however it is referred to as a 'lake' in this document to avoid any confusion. The natural process of the entrance of Lake Macquarie to close off from the ocean, rendering Swansea Channel un-navigable, has been altered since European settlement to accommodate the desire for navigation, and is at the heart of the need for ongoing intervention to maintain the channel. As such, access to Lake Macquarie through Swansea Channel has been a contentious issue since those early days when European settlers attempted to make the channel a major transport gateway. Lake Macquarie is now a primarily recreational waterway and maintaining a suitable navigation channel for recreational vessels has been a significant issue for yacht owners as well as businesses dependent on water based tourism for several decades.

Lake Macquarie is widely regarded as one of the best yachting destinations in Australia, for all classes of vessel – from small sailing dinghies to ocean racing yachts. The lake is also the aquatic playground of families from the lower Hunter, Newcastle and Lake Macquarie region, used for fishing, skiing, wake boarding, cruising, swimming and picnics.

Lake Macquarie has a very high level of boat ownership, at approximately 83 registered boats per 1000 people. More than 80 per cent of the registered sail and power vessels from Lake Macquarie access the lake from local boat ramps and foreshore reserves. A further 10 per cent of registered vessels comprise boats moored in the lake for local sailing or cruising who use Swansea Channel as a recreational destination for fishing, swimming and relaxing. However, for the growing group of people owning large yachts and motor cruisers the lake exists in isolation from other ports because of dynamic sedimentary processes in Swansea Channel. There is a strong view in the yachting and cruising community and also held by various stakeholders that the unpredictable depth of Swansea Channel is a major constraint, not just to yacht access to the lake, but to the recreation and tourism sector of the Lake Macquarie economy.

This report builds on previous studies to address the management requirements and decisions that frame dredging activity in Swansea Channel to maintain a sustainable navigable connection between Lake Macquarie and the ocean:

Who is it for? Who else benefits?
What is the objective?
What is technically feasible?
What are the relevant planning controls?
Which organisations are partners in the future of channel management?
How will it be funded?
How will risks and uncertainties be managed?

Satisfactory management of navigability in Swansea Channel will not be achieved until all relevant stakeholders act as partners to agree on a way forward and commit to work together for its implementation. In addition to the significance of the waterway, a combination of specific hydrodynamic, boating usage and stakeholder circumstances mean that funding and governance procedures for sustainable dredging for navigability in Swansea Channel should be treated as a special case. The issues in Swansea Channel do not fit neatly into any current waterway management program.
1.1 Scope of this Project

NSW Crown Lands commissioned this project to analyse options for each of the essential elements of a sustainable framework for managing the navigation dredging needs in Swansea Channel. The findings of the project will be submitted for the consideration of the NSW Government.

The purpose of the project is to facilitate effective long term management of Swansea Channel, by proposing a framework that reviews, analyses and addresses implementation management issues. The focus of this project is not on what to do (although the technical knowledge is reviewed); it is on establishing appropriate framework options and showing how these could be achieved, for the next 20 years.

This project is different from previous studies about Swansea Channel in that it addresses a new suite of questions about managing the channel.

Figure 1.1 shows how this project builds on previous work, but addresses a new suite of management challenges for Swansea Channel.

![Diagram](image.png)

**Figure 1.1 – From Technical Studies to a Management Framework**

The central question of the project is what long-term action could be taken regarding Swansea Channel.
In order to address this question this project:

- Builds on existing technical studies of Swansea Channel.

- Identifies potential dredging options which take into account channel form (i.e. channel width and depth) and channel utilisation in Swansea Channel, given its natural, social and economic context. Which user needs should drive channel form and maintenance parameters (i.e. when should follow up dredging to maintain channel form commence)?

- Defines a management framework that incorporates feasible, flexible and responsive approval processes, monitoring and triggers, communication, funding and organisational responsibilities and accountabilities for management of navigation in Swansea Channel, so that the agreed channel form and use can be achieved.

- Facilitates discussion between community waterway users, industry, agency, Council and political stakeholders about a reasonable interpretation of sustainable navigation management in Swansea Channel.

- Positions the management framework proposal for Swansea Channel to facilitate endorsement by government and community and to streamline implementation.

The framework must therefore provide guidance on the interaction of recreational boating and contemporary estuary entrance processes, community use and aspirations, governance issues and economics/funding issues. To this end the project focuses on the implementation challenges for sustainable management of navigability in Swansea Channel. It considers:

- an overall agreement on the outcomes to be achieved and maintained through management of Swansea Channel;

- the most appropriate channel form to deliver the navigational requirements for the community and appropriate triggers for initiating new maintenance works;

- what to do with the dredged sand, as a resource with potential environmental, amenity and economic benefits;

- acceptance of who (what organisation or entity) may be responsible for managing the form of the channel and adapting and adjusting management to ensure that it is suitable for navigation, recreation and support other community values in the future;

- agreement on the required investment, based on economic analysis;

- a budget estimate for any capital works and ongoing maintenance, together with a proposal for how the costs of managing the channel can be shared;

- agreement about an approval pathway that can provide certainty and flexibility, allowing channel management to proceed in a streamlined way for at least the next 20 years, reviewed every 5 years;

- identification of knowledge gaps that affect the certainty of the framework outcomes and prioritised tasks to fill critical knowledge gaps; and

- a program for communicating information about the condition of the channel and the opportunities for use, so that the benefits of channel maintenance are realised by the community.
1.1.1 Project Location

Swansea Channel is the entrance channel of the Lake Macquarie estuary. The channel is shown in Figure 1.2.

The spatial focus for this project and the proposed new framework is the inner channel, particularly from the ‘cross-over’ upstream of Swansea Bridge, to the ‘drop-over’ into the Lake. This is the area where the hydrodynamic processes in Swansea Channel switch from net scour (deepening and widening) to major deposition, as strong tidal currents that transport pulses or waves of sand lakeward are dispersed.

The section of the channel from Pelican Marina, past the southern entrance of Swan Bay and Elizabeth Island to the drop over is the area where yachts regularly report shallow water depths (less than 1.5 metres) that impact directly on recreation and tourism navigation.

The project does not specifically address navigation and channel maintenance issues downstream (seaward) of Swansea Bridge, but does consider how the outer channel area affects the concept for a future, high value and accessible entrance landscape. As noted in Section 2.1.1, the rock bar in the outer channel area has been a constraint to navigation since the earliest days of European settlement.

Figure 1.2 – Study Area (Image kindly provided by LMCC)
1.1.2 Project Approach and Methods

The project is based on integrated analysis of scientific and engineering information, environmental data, waterway use statistics, policy and regulatory frameworks; approval processes, cost-benefit analysis and funding opportunities.

The project strategy is based on:

- Clear and rational objectives for the channel values that are to be achieved.
- Scoping of essential components of a sustainable framework.
- Option evaluation for how each element of the framework could be delivered.

The project is informed by:

- Review of previous scientific and engineering studies of the hydrodynamic processes in Swansea Channel and options for modifying their impact on channel use and waterway health.
- Consultation with waterway users and stakeholders. NSW Crown Lands established a Project Steering Committee with key community and agency representatives prior to the project commencing. A project web site provided information and an email submission facility. Face to face meetings were held with multiple boating organisations, tourism and commercial groups, as well as agency and Lake Macquarie City Council (LMCC) staff and local political representatives.

Details of the consultation program are in Appendix 1 and stakeholder and community input informs all aspects of the project.

- Compilation and review of additional monitoring data and records, such as records of bridge openings and boat passage; trends in boat licences, registrations and moorings in Lake Macquarie and the region.
- Review of the diverse management models that have been applied to estuary issues and particularly to estuary dredging in NSW.
- Review of the NSW legislation relating to navigable waters in estuaries, including definitions and statutory responsibilities.
- Review of funding options using examples from NSW and interstate, across various state agency programs, local government programs and community contributions.
- Review of potential approval models to reduce delays and enhance management efficiency.
- Review and updating of cost benefit analysis and socio economic assessment for various dredging design options.
1.1.3 Project Steering Committee

At the commencement of the project, NSW Crown Lands appointed a Project Steering Committee, comprising representatives from Lake Macquarie City Council (LMCC), relevant state agencies and key community/recreational boating groups. This Committee brings wide ranging experience and expertise in boating and dredging management in Lake Macquarie to the project. Members are noted in Table 1.1.

<table>
<thead>
<tr>
<th>Table 1.1 – Project Steering Committee</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSW Crown Lands – Senior management from the Infrastructure and Land Management Directorate.</td>
</tr>
<tr>
<td>Office of Environment &amp; Heritage – Senior Natural Resources Manager (Coast and Estuaries)</td>
</tr>
<tr>
<td>Roads and Maritime Service – Regional Manager</td>
</tr>
<tr>
<td>Lake Macquarie City Council – Sustainability Unit (responsible for estuary management programs)</td>
</tr>
<tr>
<td>Mr Jeff Jansson – Board member, HCRCMA and former Lake Macquarie and Catchment Coordinator</td>
</tr>
<tr>
<td>Mr Frank Downing – Boat Owners Association, Hunter Division</td>
</tr>
<tr>
<td>Mr Jack Garaty – LMCC Estuary Management Committee, RMS Regional Boating Committee</td>
</tr>
</tbody>
</table>

The two local members of State Parliament, Member for Swansea Mr Garry Edwards MP and Member for Lake Macquarie Mr Greg Piper MP were also invited to Committee meetings for the later review and discussion portions of the project.

The members of the Steering Committee have provided advice and feedback throughout the project and have been involved in the review process. This document has been prepared by Umwelt (Australia) Pty Limited (Umwelt) on behalf of the NSW Department of Trade and Investment, Crown Lands Division.

1.1.4 Report Structure

The document presents the information in the following manner to assist the government in determining the appropriate course of action:

PART 1 – Technical, Policy and Waterway User Context

- The historical background to Swansea Channel both physically with regards to previous dredging work undertaken and in terms of contemporary government policy (Section 2.0).
- An examination of the significance of Swansea Channel and the case as to why it merits special consideration over and above the management and funding arrangements identified in the NSW Sustainable Dredging Strategy (Section 3.0).

PART 2 – Evaluating Elements of the Framework

- Definition of the nine required elements of a sustainable framework for Swansea Channel (Section 4.0).
- An analysis of technical and planning options to set the parameters for sustainable delivery of a navigable channel (Sections 5.0 to 10.0).
Part 3 – Policy and Budget Implications of the Framework

- Three elements of the sustainable framework for Swansea Channel address policy issues, such as funding, responsible management entity and partnerships. The report presents a suite of options and analysis for these policy issues. (Refer to Sections 11.0 to 13.0).

- Part 3 also includes a review and evaluation of the elements of the framework and is presented in the conclusions of Section 14.0.

Much of the detailed work undertaken during the consultancy including public consultation and the socio-economic analysis is contained in appendices to the document.
2.0 Historical and Policy Context of Dredging in Swansea Channel

2.1 Swansea Channel Navigation and Dredging History

Navigational access to Lake Macquarie by commercial and larger recreational vessels has been a recurring problem for more than 100 years.

2.1.1 Early Navigation Efforts

The channel has a history of navigation issues going back to the earliest days of European settlement at Lake Macquarie (including several wrecks of coal-carrying vessels). In 1870, the depth of water over the coal seam at the entrance was described as 'at high tide never exceeding six feet six inches, while at low tide it is barely two feet' (Clouten 1967 p185). Shallow draught coal and timber carrying ketches did cross the bar, but could be trapped in the lake for extended periods in windy or stormy conditions. In the mid nineteenth century, coal mining companies seeking to establish a coal trade out of Lake Macquarie lobbied the government for more than two decades to improve the navigability of the lake entrance.

Before the government constructed the training walls at the entrance, local coal and timber merchants had already initiated changes to the entrance channel by depositing ballast rock along the foreshore at Pelican Flats. Clouten (1967) quotes ‘The Chronicle’ in 1873 that these works narrowed the channel, creating scour and deepening the channel from about three feet to a depth of between twelve and fourteen feet. This allowed schooners to conduct coal and timber trade, although navigation was still hazardous. Formal dredging was conducted in 1876, clearing 'sand and mud from the channel near the Pelican islands'.

Eventually, the government was persuaded to commence construction of training walls at the entrance, and works were underway in the mid 1880s. The impediment of the coal seam was never removed. It is worth noting that by the time the entrance break-walls had been completed and had impacted on navigability by forcing channel scour, the need for a navigable entrance for the coal trade had virtually gone. This was because an ocean loader had been built at Catherine Hill Bay and the northern railway reached western Lake Macquarie and Newcastle at about the same time.

In the mid twentieth century, major dredging was carried out to allow major infrastructure components (e.g. during the construction of Eraring Power Station) to be brought into the lake.

None of these historical navigation functions of Swansea Channel have continued to contemporary times.

Since the break-walls at the entrance to Lake Macquarie were constructed, the channel has been used primarily for recreation, tourism and up to the early 2000’s some commercial fishing. Lake Macquarie is now a recreational fishing haven under the NSW Fisheries legislation and policies, and no commercial fishing vessels is permitted.
2.1.2 Planning for Improved Navigation in Modern Times

Despite a long history of difficult and uncertain navigation, community expectations of reliable ocean access to Lake Macquarie are high. This can be attributed to factors such as:

- the outstanding quality of the waterway for recreation;
- periods of historical accessibility;
- significant recent growth in recreational boating activity;
- increasing size of recreational vessels with increased community wealth and new technologies; and
- perceived future growth potential in water based recreation and tourism.

The 1997 Lake Macquarie Estuary Management Plan (to be updated in 2013) had a specific aim to ‘maintain and improve navigable access to Lake Macquarie to a level consistent with boating usage’. The Plan was integrated into the Estuary and Catchment Management Framework for Lake Macquarie (1998) prepared by an interdepartmental taskforce, lead by the Premiers Department. The Premiers Taskforce recommended both short term interim dredging and the development of feasibility studies, concept designs and implementation mechanisms for a long term stabilisation strategy for Swansea Channel. The implementation of the recommendations was undertaken through the creation of the Office of the Lake Macquarie and Catchment Coordinator and a committee known as the Lake Macquarie Project Management Committee.

More than $35 million has been invested in estuary health and waterway user programs (including dredging campaigns) in Lake Macquarie since 2000, including approximately $6.5 million in Swansea Channel. Lake Macquarie is well served with foreshore recreational boating facilities for the local community and is a high value healthy estuarine waterway. Award winning estuary health programs implemented in the Lake and its catchment have restored both the natural and social values of the Lake Macquarie system and created opportunities for further interdependent recreational access and waterway health initiatives.

Technical studies of the sediment transport processes in Swansea Channel have been completed, reinforcing the dynamic condition of the entrance channel; and design of different channel forms have been prepared and evaluated (see Section 5.0 for further information). This technical information, in part, prepares the way for sustainable management of a navigable waterway, but leaves unanswered a series of questions about implementation processes.

Since the conclusion of the work of the Lake Macquarie Project Management Committee and the Office of the Lake Macquarie & Catchment Co-ordinator, the management of Lake Macquarie and Swansea Channel has reverted to the relevant State and local government agencies.
2.1.3 Dredging History

Table 2.1 summarises available data about dredging locations, volumes and funding to maintain navigability in Swansea Channel (inner channel) over the last 40 years. These records indicate that at least 600,000 m³ of sand has been dredged from the navigation channel over this period.

<table>
<thead>
<tr>
<th>Year</th>
<th>Location</th>
<th>Volume</th>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970/71</td>
<td>Airport to Dropover Disposal on Elizabeth Island</td>
<td>66,000 m³</td>
<td>No data available</td>
</tr>
<tr>
<td>1977</td>
<td>‘Study Area’</td>
<td>22,000 m³</td>
<td>No data available</td>
</tr>
<tr>
<td>1980</td>
<td>‘Study Area’</td>
<td>36,000 m³</td>
<td>No data available</td>
</tr>
<tr>
<td>1981</td>
<td>‘Study Area’</td>
<td>25,000 m³</td>
<td>No data available</td>
</tr>
<tr>
<td>1982</td>
<td>‘Study Area’</td>
<td>13,000 m³</td>
<td>No data available</td>
</tr>
<tr>
<td>1986</td>
<td>Dropover</td>
<td>52,000 m³</td>
<td>50% NSW Govt, 50% LMCC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Grant offer $200,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Actual cost to NSW Govt $170,000</td>
</tr>
<tr>
<td>1990</td>
<td>Dropover</td>
<td>20,000 m³</td>
<td>No data available</td>
</tr>
<tr>
<td>1996</td>
<td></td>
<td></td>
<td>50% NSW Govt, 50% LMCC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Waterways Program Grant</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$40,000 in 1995/6 Financial Year</td>
</tr>
<tr>
<td>1998/99</td>
<td>Airport to Dropover Disposal on Blacksmiths Beach</td>
<td>40,000 m³</td>
<td>50% NSW Govt, 50% LMCC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2 x Waterways Program Grants</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Actual cost to NSW Govt $190,000</td>
</tr>
<tr>
<td>2000/01</td>
<td>Swan Bay South Entrance (Belmont Sands)</td>
<td>10,000 m³</td>
<td>No data available</td>
</tr>
<tr>
<td>2003</td>
<td>Dogleg LM Improvement Project Works</td>
<td>120,000 m³</td>
<td>Lake Macquarie Project Management Committee</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Joint State &amp; Local Funding $750,000</td>
</tr>
<tr>
<td>2006</td>
<td>Swan Bay southern entrance closure LM Improvement Project Works</td>
<td>50,000 m³</td>
<td>Lake Macquarie Project Management Committee</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Joint State &amp; Local Funding $1,400,000</td>
</tr>
<tr>
<td>2010</td>
<td>Airport to Dropover Sand removed from Naru Point</td>
<td>68,000 m³</td>
<td>60% NSW Govt (Crown Lands)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20% NSW Govt (Maritime)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20% Local Govt (LMCC)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$420,000</td>
</tr>
<tr>
<td>2012</td>
<td>Airport to Dropover Disposal in channel and former ‘Belmont Sands’ site</td>
<td>35,000 m³</td>
<td>100% NSW Govt (Crown Lands)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$300,000. Refer Note below</td>
</tr>
</tbody>
</table>

Note: In 2012, a decision was made by government to undertake an interim dredging campaign, based on limited available funds, to provide short term relief for boating access and to provide time to develop a sustainable long term dredging strategy.

Dredging has been conducted as relatively small campaigns, primarily less than 50,000 m³ at a time, with maintenance recurrence intervals of between one and five years. Feedback from the yachting community is that the navigation benefits of these previous dredging campaigns have been short lived and ineffective, creating a reputation for difficult and unreliable navigability in the channel for vessels that draw more than about 1.5 metres.

Dredging a channel suitable to maintain recreational navigation in Swansea Channel was one of the original priorities of the Premier’s Task Force for Lake Macquarie, following long term
community concern about access to the lake by yachts and charter vessels. The Premier’s Taskforce report suggested a minimum depth of 2.5 metres along the full length of the channel. Dredging carried out in 1998/99 was intended to achieve a consistent 2.5 metres water depth. Channel form and usage would then be monitored, to assist in determining the economic benefits of dredging to ensure continued navigability for larger/deeper draught vessels. An economic assessment of dredging options (Gillespie Economics) was part of the 2003 WBM report (see also Section 11.0).

Since the 1970’s (refer Note – page 2.3), all dredging programs in Swansea Channel, excluding the one in 2012, have been funded as partnerships between State and local government, accessing funds from various State grant programs, special levies and other sources. Funding options that are relevant to the future management of dredging in Swansea Channel are discussed in more detail in Section 12.0.

Recent historical dredging campaigns can be split into three categories based on their management:

- Prior to 2000, dredging was undertaken by LMCC usually with funds obtained from the NSW Government Waterways Program.
- For the next decade management of Swansea Channel and Lake Macquarie was headed by the Lake Macquarie Project Management Committee and the Office of the Lake Macquarie and Catchment Coordinator as part of the health of the lake initiatives that resulted from the Premier's Taskforce.
- Since the conclusion on 30 June 2009 of the Office of Lake Macquarie and Catchment Coordinator, coordination of dredging has been by NSW Crown Lands.

Although several of the recommendations made by the Lake Macquarie Project Management Committee have been addressed, the optimum channel form recommended by WBM (2003) has not been achieved by any dredging program to date.

2.1.4 Current Situation

Despite all the previous efforts outlined above shoaling processes continue to shallow the navigable waters and inhibit the passage of ocean going recreational vessels in Swansea Channel.

To date the capacity of state and local government to consistently deliver a channel form suitable for navigation has not met the expectations of the yachting community and commercial operators. Implementation issues and risks have overwhelmed the recommendations of technical studies. Gaps in organisational capacity and funding to deliver effective management of navigability are exacerbated by competition for resources at both state and local levels of government.

Given the dissatisfaction amongst some sectors of the community with the current level of service provided, this strategy outlines the components of a sustainable long-term approach to the issue of dredging the Swansea Channel. The aim of the long term approach is to effectively and efficiently provide appropriate navigability for the users of Swansea Channel as the gateway to Lake Macquarie.
2.2 Relevant Legislation and Responsibilities

This section reviews the complex array of legislation, regulation and policy which applies to waterway related services, creating uncertainty about actual responsibility for waterways like Swansea Channel.

While local government does not have a direct statutory role in the management of navigable waters it does have policy, program and planning responsibilities for estuary health, recreational use of estuarine waterways and sustainable recreation and employment opportunities for local communities. These responsibilities are set out in the Local Government Act, Coastal Protection Act and Environmental Planning and Assessment Act and related regulations and policies.

Table 2.2 summarises statutory definitions relating to navigable waters, ports and responsibility for maintaining navigability. These definitions have been included in NSW maritime legislation over the last century. Additional information about individual Acts, regulations and policies is in Sections 2.2.1 to 2.3.4.

Implementation of legislation, regulations and policy under all of these Acts involves partnerships and delegations between State and local government. The extent of obligation and standard of delivery in relation to services and facilities in individual navigable waterways is not stated in the legislation (see Section 2.4), but is largely set by policy and programs and by regional level discussions between waterway users, local government and state government.

Further information and interpretation of how these responsibilities are intended to be met is included in the policies and program statements of the relevant organisations. For instance, programs specify the priorities and the budget allocated to delivering particular navigability responsibilities.
# Table 2.2 – Relevant Definitions from the Legislation

<table>
<thead>
<tr>
<th>Legislation</th>
<th>Definitions, Allocation of Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure SEPP</td>
<td>Under State Environmental Planning Policy (SEPP) Infrastructure 2007 (see Section 8.1.1 for details), dredging of existing navigation channels for safety reasons or in connection with existing boating facilities by a public authority (including local government) is permissible without consent. Nevertheless, approval of this type of dredging and any associated activities is still required and is usually determined under Part V of the Environmental Planning and Assessment Act 1979, subject to consultation with the relevant State authorities and environmental impact assessment. See Section 8.1.1 for information about the role of the Infrastructure SEPP in approvals for works by state and local government authorities.</td>
</tr>
</tbody>
</table>
| **NSW Navigation Act 1901**  
(most clauses now repealed, but definitions have not been repealed). These definitions show the long history of a broad definition of navigable waters, but limited definition of the standards to which navigability is to be maintained. | **Navigable waters**: means any port, harbour, haven, roadstead, channel, navigable river or creek or arm of the sea within the Jurisdiction (where Jurisdiction refers to navigable waters lying within one nautical league of the coast, and the inland navigable waters of NSW).  
**Authorised works on Navigable waters**: The Governor may authorise the driving of piles, and the construction or erection of any wharf, jetty, wall, or other erection, or work, or the reclaiming in any manner of any land beyond or below the high-water mark of any navigable waters, for any purpose connected with the convenience of the public or the improved navigation of such waters. The Minister may cause such works to be executed by such persons and in such manner as he or she thinks fit out of any moneys at his or her disposal applicable to such or to like public works. |
| **Maritime Services Act 1935**  
(most clauses now repealed or subject to Ports and Maritime Administration Act 1995, but definitions remain). As for the Navigation Act, the definitions show what is considered to be a navigable water, but not the extent to which navigability is to be maintained. | **Port** includes:  
Any harbour or haven, whether natural or artificial, or any estuary, channel, river, creek or roadstead; and  
Any navigable water in which vessels may lie for shelter or for the shipment or unshipment of goods or passengers.  
**Clause 13N(1): Improvement of Navigable Waters**  
The Board may, for the purpose of maintaining and improving the navigation of the rivers and channels within, or leading into, the areas vested in it, dredge, cleanse, and scour the said rivers and channels and alter, deepen, cleanse, scour, cut, enlarge and otherwise alter and improve the bed of the said rivers and channels.  
The Board may reduce or remove any banks or shoals whatsoever within the said rivers and channels; and may abate and remove all impediments, obstructions, and annoyances, and all nuisances and abuses whatsoever in the said rivers and channels, or on the banks and shores thereof. |
<table>
<thead>
<tr>
<th>Legislation</th>
<th>Definitions, Allocation of Functions</th>
</tr>
</thead>
</table>
| **Ports and Maritime Administration Act 1995** | **Navigable waters**: means all waters (whether or not in the State) that are from time to time capable of navigation and are open to or used by the public for navigation, whether on payment of a fee or otherwise, but does not include flood waters that have temporarily flowed over the established bank of a watercourse.  
**Port**: includes any of following waters (or any part of those waters):  
(a) any harbour or haven, whether natural or artificial;  
(b) any estuary, channel, river, creek or roadstead; and  
(c) any navigable water in which a vessel may lie for shelter or for the transfer of cargo or passengers.  
**Section 11**: Port Safety Functions mean the functions also referred to in Clause 25, in relation to ‘Ports’.  
**Section 24**: the Minister responsible for Ports and Navigation Administration Act (identified as the Minister for Roads and Maritime Service (RMS)) has responsibility for:  
- The safe operation of recreational and commercial vessels  
- The safety of navigation in ports and other navigable waters  
**Section 25** (as amended by the Marine Safety Act 1998): the Minister has the following particular marine safety functions:  
(a) To provide or arrange for the provision of marine safety infrastructure and services.  
(b) To provide or arrange for the provision of other infrastructure and services for use by vessels.  
(2) Examples of the infrastructure and services that may be provided under this section are as follows:  
(a) The installation and maintenance of navigation aids  
(b) Vessel traffic control within ports  
(c) Pilotage services within ports  
(d) The dredging and maintenance of navigation channels (including the improvement of river banks and other land for navigation)  
(e) Hydrographic services  
(f) Moorings for vessels  
(g) Wharves, piers, jetties and ramps  
(h) Waste pump out facilities for vessels  
(i) Fire fighting and rescue services relating to vessels and navigable waters  
(j) (all these are subject to any applicable provisions of the marine or other legislation)  
**Section 43**: Establishes the Waterways Fund – to provide the services which are the functions of RMS, subject to the requirements and discretion of the Treasurer. Some money collected by RMS may be required to be paid into NSW Consolidated Fund.  
Money such as licence, registration and mooring charges collected by RMS are paid into the fund. Other sources of money paid into the fund include resources set aside by the Parliament, loans obtained by RMS and regulatory/enforcement fees. **Section 11** provides more information about the Waterways Fund and its application through the Better Boating Program.  
In Swansea Channel, RMS currently provides hydrographic services and navigation aids such as channel markers. Its officers assist the masters of vessels to pass through the shallow and unreliable navigable waters in the channel. RMS also provides funds from the Better Boating program for maritime facilities in Lake Macquarie, to enhance amenity and safety for recreational boating. RMS does not currently contribute to the cost of channel dredging in Swansea Channel but has done so in the past. |
Table 2.2– Relevant Definitions from the Legislation (cont.)

<table>
<thead>
<tr>
<th>Legislation</th>
<th>Definitions, Allocation of Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Marine Safety Act 1998</em></td>
<td>“Navigable waters” means all waters (whether or not in the State) that are from time to time capable of navigation and are open to or used by the public for navigation, whether on payment of a fee or otherwise.</td>
</tr>
<tr>
<td></td>
<td>“Recreational vessel” means a vessel other than a commercial vessel</td>
</tr>
<tr>
<td>Section 84: “Port” includes any particular area of navigable waters that the Minister considers requires a harbour master for the purposes of marine safety. Note that Lake Macquarie does not have a harbour master.</td>
<td></td>
</tr>
<tr>
<td>As noted above Schedule 3 of the Marine Safety Act 1998 amends the Clause 25 of Ports and Maritime Administration Act 1995 to include:</td>
<td></td>
</tr>
<tr>
<td>(c) the dredging and maintenance of navigation channels (including the improvement of river banks and other land for navigation), as well as a range of other services.</td>
<td></td>
</tr>
<tr>
<td>The Act does not specify a definition of the standard of service that is required, or how the service would be allocated across various navigable waterways.</td>
<td></td>
</tr>
</tbody>
</table>

2.2.1 Crown Lands Act 1989

NSW Trade & Investment - Crown Lands Division is responsible, on behalf of the NSW Government, for all Crown land in NSW. Crown land that is the bed of rivers, estuaries and the sea is managed either as unreserved Crown land (i.e. has no specific purposes) or as one of various types of Crown Reserve. The bed of Lake Macquarie and Swansea Channel is part of a Regional Crown Reserve. Further information about Regional Crown Reserves is in Section 12.0.

The Crown Lands Act 1989 does not place any obligations on Crown Lands to undertake dredging nor does it define ‘navigation channels’, standards of service for dredging or waterways to be maintained.

Under the Crown Lands Act 1989, the approval of Crown Lands is required prior to any activity on Crown land, including dredging of the submerged bed of NSW waterways. Crown Lands is required to authorise dredging activities on Crown land by private entities, other state agencies and local government. This is usually done by way of a licence under the Crown Lands Act 1989. Crown Lands also collects royalties on behalf of the Government for extracted materials.

2.3 State Government Policy and Programs

2.3.1 NSW State Plan 2021

The ‘NSW Government State Plan: NSW 2021, A Plan to Make NSW Number One’, has 32 goals. Several of these are broadly relevant to the issues affecting Swansea Channel, including:

**Goal 3**: Drive economic growth in regional NSW.

**Goal 22**: Protect our natural environment.

**Goal 24**: Increase opportunities for people to look after their own environments and neighbourhoods.
Goal 27: Enhance cultural, creative, sporting and recreation opportunities.

Goal 32: Involve the community in decision making on government policy, services and projects.

Target: Increase the devolution of decision making, funding and control to groups and individuals for local environmental and community activities.

The devolution of decisions and management of local scale issues to local communities is a policy centre piece of the NSW State Plan and has been expressed by State government Ministers in multiple contexts and forums in recent months. This policy position implies that the NSW Government will be seeking local scale solutions and local involvement in management of navigation in Swansea Channel; unless it is clear that the issue is much broader than the local scale.

Section 3.0 describes and evaluates the extent, diversity and significance of recreational boating activity and related navigation dredging in Swansea Channel and in Lake Macquarie.

2.3.2 Coastal Infrastructure Program

Crown Lands administers, on behalf of the NSW Government, the Coastal Infrastructure Program and the Sustainable Dredging Strategy. Under the Coastal Infrastructure Program, Crown Lands manages and maintains the maritime infrastructure associated with the 25 regional harbours and 21 trained river entrances along the coast of NSW and undertakes dredging to maintain safe, secure access at the river entrances and to state-owned maritime infrastructure. Funding under the Coastal Infrastructure Program is limited and provided by the state government on a state-wide priority basis. (refer to Section 12.2.1).

Under the Coastal Infrastructure Program, the entrance to Lake Macquarie is identified as a trained entrance (i.e. the presence of breakwalls). However, as there are no other state-owned maritime infrastructure within Swansea Channel or in Lake Macquarie funding under this Program for dredging would be limited to maintaining navigation access at the ‘trained’ river entrance.

2.3.3 NSW Sustainable Dredging Strategy 2012/13 to 2014/15

The NSW Government is committed to delivering a sustainable dredging strategy to improve the accessibility and environmental health of the state’s waterways. The Sustainable Dredging Strategy (2012/13 to 2014/15) includes an implementation package for the Rescuing our Waterways Program which will be delivered in two phases. Key elements of the dredging strategy include minimum 50% contribution by local government and dredging proposals developed and projects managed by local council. The strategy also encourages the ability to leverage funding support from other stakeholders and/or the beneficiaries of dredging to offset costs. (refer to Section 12.2.1).

The first phase advises that funding would be provided to support dredging projects in specific waterways i.e. Wallis Lake, Lake Cathie, Camden Haven River, Port Hacking (Fisherman’s Bay at Maianbar), Myall River, and Manning River including the main entrance at Harrington and at the secondary entrance at Farquhar Inlet.
The strategy is based on the sharing of costs and risks between state and local government for dredging projects and considers that dredging is a discretionary activity designed and undertaken to meet community needs. As such, a framework which encourages community contribution is important. The current State policy is based on shared responsibility for funding, which helps to ensure that proposals are realistic, soundly based and supported in local communities. Contributions by local councils are a demonstration that dredging projects have general community support.

Although there can be broader economic spin-offs, dredging almost invariably provides direct benefits to a limited number of stakeholders (such as recreational and commercial boaters and fishers). As a principle, the state government policy considers that the cost of dredging projects should be met in part by the beneficiaries on a ‘user pays’ basis.

### 2.4 Level of Service

NSW legislation does not set the standard for delivery of statutory functions by the relevant government agencies. For instance, the legislation provides a very wide definition of navigable waters and ports, but does not identify what level of navigability is appropriate for such waterways – particularly when the navigable waters are used for recreation purposes, rather than commercial purposes.

The standard of navigability, services and facilities in regional waterways is generally set through policy and programs and discussions with relevant regional stakeholders (including state agencies, waterway users and local government), taking into account the physical character of the waterway, commercial and recreational uses, significance of the waterway to local, regional and state environmental, social and economic outcomes, and the overall availability of funds from all sources.

In policy and program terms, responsibility for managing and funding dredging programs in recreational navigable waters/ports has been delegated to NSW Crown Lands.

In general, clarity about responsibility and the level of service that is anticipated by the legislation declines for navigable waters that are neither “Designated” Ports nor ports having a harbour master. Swansea Channel is in this category.

This apparent diversity and complexity of interests, responsibility and levels of service helps explain the confusion in the community about how to get action on Swansea Channel.

Because the NSW legislation identifies more than one State government portfolio as having interests and responsibilities in the management of navigation in estuary entrance channels, a cross-jurisdiction solution is needed. The NSW Sustainable Dredging Policy (see Section 2.3.3) proposes a state and local government partnership in maintenance dredging programs.

However, a simple State/local government partnership may not be sufficient to deliver adequate funding for maintenance of navigation in Swansea Channel and indicates the need for a special case management agreement.
2.5 Local Government Policy and Plans

This section considers Council’s stated strategic intent for its management of Lake Macquarie, and particularly its strategic positioning of environment protection and water based recreation.

2.5.1 LMCC Community Strategic Plan

The Community Strategic Plan (CSP) underpins LMCC’s planning for the development of the City and its investment of Council resources in environmental, community development, economic development and infrastructure services for the 10 years to 2018. The Plan positions Council’s role in relation to aquatic recreation very much in the terrestrial sphere – the provision of appropriate facilities for boat launching (i.e. a focus on small vessels) and related quality foreshore reserve areas. Aspects of the CSP which help to define Council’s position include:

- Council proposes a holistic strategy for Lake Macquarie waterway (including updating estuary and open coast aspects of coastal zone management).
- Council will continue to undertake aquatic and terrestrial management works.
- Council’s involvement in Lake management is focused only on environmental protection and enhancement, through catchment and foreshore works and community education and empowerment.
- In relation to sport, recreation and culture, the Community Strategic Plan refers to enhancing foreshore facilities around the lake and to the adequacy and condition of lakeside facilities such as public jetties and boat ramps. This includes the upgrade and development of new lakeside aquatic facilities to service the boating community.
- There is a reference to the preparation of Plans of Management and related Masterplans for Crown land and community land.
- Council proposes to attract major sporting events to the city is a priority strategy, but at this stage, the Community Strategic Plan refers directly only to national surf life saving championships, not sailing or yachting events.
- The Plan recognises the importance of developing Lake Macquarie as a recognised tourist destination.
- The Plan highlights the potential value of regional collaboration–sharing of services, to increase efficiency and cost effectiveness of service provision. Although not specifically mentioned, sharing of dredging services could be an example of this.

Figure 2.1 draws out the implications of the Community Strategic Plan for Council’s involvement in the management of Swansea Channel.
2.5.2 Zoning of Lake Macquarie

2.5.2.1 Lake Macquarie Local Environment Plan (LEP) 2004

In the Lake Macquarie LEP 2004, the bed of Lake Macquarie, including Swansea Channel, is zoned 11 - Lake and Waterways. This zoning has applied to the channel through recent debate about management of navigability.

The objectives of this zone are to:

- recognise the importance of Lake Macquarie and its waterways as an environmental asset, not only to Lake Macquarie City, but to the Hunter and Central Coast Regions;
- ensure that development of the Lake and its waterways occurs in a manner that is consistent with the principles of ecologically sustainable development;
- ensure development does not adversely affect the ecology, scenic values or navigability of the Lake or its waterways;
- ensure that aquatic and terrestrial habitats and their interface are protected and enhanced and are not adversely affected by the recreational use of the Lake or its waterways;
- provide for sustainable and viable economic use of the Lake and its waterways; and
- provide for sustainable water cycle management.
The objectives of this zoning highlight the environmental and biodiversity values of the lake and channel, but also recognise that navigation and recreational use are important values of the lake and channel, to be managed carefully, in alignment with the natural values of the waterway.

### 2.5.2.2 Lake Macquarie LEP 2012


Within the draft LEP 2012, the lake and entrance channel are proposed to be zoned W1 ‘Natural Waterways’. The objectives and permitted uses in this zone as set out in the draft LMLEP 2012 are noted in Appendix 2. These objectives and permitted uses reflect the ecological and recreational functions of the lake and its associated waterways.

**The concept of Swansea Channel as a significant recreational asset, which supports diverse use and enjoyment of the waterway is consistent with the strategic framework provided by the City of Lake Macquarie, provided that channel management is conducted in a manner that also maintains the ecological health of the lake.**

**The two purposes are closely intertwined. One of the drivers of high recreational value of the lake is its water quality and ecological health. LMCC has invested (with the NSW Government) more than $20 million over the last 15 years to achieve this lake condition.**

### 2.5.2.3 Other Relevant Aspects of Zoning under Draft LEP 2012

The zoned waterway is set within areas of foreshore reserve and residential development. In the draft Lake Macquarie LEP 2012, foreshore reserve areas along Swansea Channel are principally zoned:

- **E2 Environmental Conservation.** A small strip upstream of Swansea Bridge is zoned E3 (Environmental Management).
- **RE1 Public recreation.**
- **Naru Point,** which has previously been used as a dredged sand stockpile site, is zoned IN4 Working Waterfront.
- **The former Pelican Airport site,** which has direct frontage to Swansea Channel and to the Pacific Highway, continues to be zoned SP2 (Airport). Council has advised that an airport continues to be a priority use for this land.

The objectives of each of these zones, together with information about permissible development are noted in Appendix 2.

### 2.5.3 Lake Macquarie City Council Dredging Policy Position

Lake Macquarie City Council has been explicit in its position that maintaining a navigable entrance channel to Lake Macquarie is a state government responsibility and not a local council matter.
LMCC’s 10 year community plan as described in Section 2.5.1 does not support an active role for the council in managing dredging within Swansea Channel. LMCC has also indicated that the forward planning budgets and funding for the next 7 years have been approved by IPART and that no provision is made for dredging of Swansea Channel. Council has set a 10 year budget, extending two years beyond the IPART approved budget. This also includes no provision for channel dredging.
3.0 The Case for Navigation Dredging in Swansea Channel

Lake Macquarie is widely recognised as a premium recreational waterway. Much larger than Sydney Harbour, with expansive reaches and steady wind conditions for sailing, smooth waters for wake boarding and skiing, multiple bays to cruise and explore, uncrowded natural shorelines and protected moorings for picnics and holidays, Lake Macquarie is a major recreational asset for residents and visitors. Per capita boat ownership in Lake Macquarie is the highest in NSW (at approximately 83 registered vessels per 1000 population) and growing (see Section 3.3). With increasing affluence and changing demographic profile in the region, preferred recreational vessel size is also increasing.

Swansea Channel is the marine gateway to Lake Macquarie, connecting an otherwise enclosed estuarine system to the sea. Safe passage through Swansea Channel is highly valued by the racing and recreational yachting community because it opens access to ocean sailing, connecting lake sailors with the broader yachting community; but also because it ensures an accessible safe haven to avoid pending storms for yachts and other recreational vessels travelling from Sydney Harbour, Pittwater, Newcastle, Port Stephens and beyond.

Lake Macquarie is primarily used for recreation and has a distinct lack of commercial and industrial waterway uses. This increases the value of Lake Macquarie for recreational boating as Boat owners are not competing for water space with ferries, cruise ships, coal ships or other bulk carriers.

Swansea Channel is a recreational destination in itself, a picnicking, fishing, swimming and paddling playground for families attracted by the clear waters and sandy bed and shores. It offers a unique recreational environment within Lake Macquarie, complementing the deep waters, rocky shores and grassy foreshore reserve areas elsewhere around the Lake.

The reputation of Swansea Channel has a direct influence on the reputation of the lake. In 2012, some yacht clubs in Sydney displayed signs warning their members not to go to Lake Macquarie due to the channel shoaling issues.

The combination of these distinctive waterway values – for blue water sailors and for family recreation, makes Swansea Channel a key element of the recreational and tourism economy of the City. This economy is currently worth upwards of $5 billion annually, with considerable growth potential. Lake Macquarie City Council, RMS (and the State government through various funding programs) and local businesses have invested heavily in providing aquatic services and facilities to support recreational use of the waters of Lake Macquarie, including through marina developments, wharf construction and other general lake projects. Investment in episodic channel dredging over the last three decades has also encouraged the recreational and tourism economy of the lake and the social well being of residents and visitors. As detailed in Section 2.1.3, in excess of $3.5 million has been spent on channel dredging and approximately 600,000 m³ of sand has been excavated from the channel since 1970.

Section 3.1 examines the significance of Swansea Channel as a waterway. Section 3.2 details the local users and stakeholders of Swansea Channel and outlines the consultation process undertaken as part of this report. Section 3.3 provides information about boat ownership and usage in Lake Macquarie and Swansea Channel. Section 3.4 examines the channel navigability requirements to meet the needs and aspirations of local and regional boat owners. Section 3.5 details the impacts of not managing Swansea Channel.

Drawing on this analysis, Section 3.6 presents the rationale for navigation dredging Swansea Channel being managed as a special case being outside existing funding programs.
3.1 The Significance of Swansea Channel

When applied to the social, environmental and economic values of a coastal waterway, the concept of significance takes into account:

- the importance and uniqueness of natural processes and functions. All recreational uses depend on a healthy waterway, for instance, where water quality is suitable to sustain ecological processes, but also primary contact recreation and fishing;
- the biodiversity of the waterway and the resilience of biodiversity values;
- the number and diversity of waterway users (e.g. different boat classes and different types of boating activity);
- specific or unique waterway uses (such as deep keel yachting), not available in other regional waterways;
- the contribution of waterway use to the local or regional economy;
- the contribution of waterway use to the social and cultural values of the landscape (e.g. the social value of recreational boating as part of the Lake Macquarie lifestyle);
- seasonal or spatial constraints to waterway use that affect safety or amenity; and
- accessibility to a growing community of waterway uses.

The significance of Swansea Channel as a recreational waterway is not necessarily the same as the significance of Lake Macquarie as a whole, although there are clearly interactions between the values of the channel and the main water body.

Although Lake Macquarie is an outstanding boating destination, the portion of recreational use that is dependent on reliable deep water access and the contribution of that part of the boating community to the local and regional economy are currently relatively small. The local yachting and tourism community holds a strong view that improved and reliable navigability in Swansea Channel would increase the amount of deep draught boating activity through the channel and in the Lake, but actual increases are difficult to define.

Table 3.1 summarises the values of Swansea Channel that contribute to aspects of significance. The significance scores in the table are based on the following criteria:

**Local significance**: Used primarily by local community; User groups/vessel sizes closely reflect local community (i.e. not major visits from other areas); recreational opportunities similar to those elsewhere in the local area and region; economic contribution small when compared with other sectors of the local economy; foreshore recreation areas managed locally; usage can be maintained or enhanced without major investment in channel form.

**Regional significance**: Users dominated by a mix of local and regional recreation, with a small representation from further afield; high boating recreation participation; provides specific recreation opportunities not available elsewhere in the region; increased economic contribution through tourism and recreation spending, including a feature of regional marketing material; foreshore/bed managed at regional or state scale – not local. Usage can be maintained or enhanced, but requires specific budget allocations to promote key attributes.
**State significance**: Local users supplemented by substantial numbers from the broader region and elsewhere in the State; provides recreational opportunities that are rare in the region and highly valued at State level; Very high levels of participation in recreational boating, with use adapted to specific conditions; identified in State level tourism and recreation marketing priorities as being a major attraction. Maintaining or enhancing usage requires major, ongoing investment. There is interest from state level stakeholders in management and investment.

<table>
<thead>
<tr>
<th>Value</th>
<th>Significance Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recreational fishing</td>
<td>Channel is of local significance; note Lake Macquarie is a Recreational Fishing Haven – regional significance.</td>
</tr>
<tr>
<td>Commercial fishing</td>
<td>Local significance (only uses outer channel, seaward of Swansea bridge).</td>
</tr>
<tr>
<td>Lake keel yacht racing</td>
<td>Channel of regional significance – access for boats for major competitions; Lake is of regional to State significance.</td>
</tr>
<tr>
<td>Lake dinghy racing</td>
<td>Channel not used, other than to provide access for some support vessels; Lake is of State to National significance.</td>
</tr>
<tr>
<td>Ocean yacht racing</td>
<td>Channel is of local to regional significance (interaction with Newcastle); Lake is used as a mooring and marina site for these vessels.</td>
</tr>
<tr>
<td>Ocean yacht cruising</td>
<td>Channel is of regional to state significance; Lake is of regional to state significance – a safe haven between Pittwater and Newcastle or Port Stephens, plus a cruising destination with diverse in-lake opportunities for people from all parts of the coast. Long term cruising yacht links to northern Sydney and Sydney Harbour.</td>
</tr>
<tr>
<td>Lake motor cruising</td>
<td>Lake is of regional significance, attracting users from the Hunter region, Central Coast and northern Sydney, as well as locals. Channel of local to regional significance (many of these vessels can be transported by trailer).</td>
</tr>
<tr>
<td>Ocean motor cruising</td>
<td>Lake is of local to regional significance as a base for ocean going motor cruisers. Swansea Channel is of local to regional significance.</td>
</tr>
<tr>
<td>Whale watching</td>
<td>Channel is of local significance (very limited investment in this type of tourism, some potential to grow, but good land based vantage points).</td>
</tr>
<tr>
<td>Swimming/diving</td>
<td>Channel is of local to regional significance (sand islands very popular; channel used by scuba divers); Lake is of local significance.</td>
</tr>
<tr>
<td>Kayaking</td>
<td>Channel is of local significance, Lake is of local significance.</td>
</tr>
<tr>
<td>Yacht or fishing charter</td>
<td>Channel is of local significance; Lake is of local significance.</td>
</tr>
</tbody>
</table>

Based on this evaluation, it can be concluded that Lake Macquarie is a recreational boating destination of State significance. The usage and values of Swansea Channel are different to the main lake waterway. When these values are considered separately from the lake, the overall significance of the channel is considered to be lower than the main water body.

It is only for ocean yacht cruising, for which the values of the channel and the lake are interdependent, that the channel itself can be considered to be of greater than regional significance (i.e. of regional to State significance).
3.1.1 Regional waterway context

Table 3.2 provides a qualitative comparison of Lake Macquarie and Swansea Channel with other recreational waterways in the region. This section of the NSW coast is home to most of the State’s population and also the majority of ocean going recreation vessels.

Table 3.2 – Regional Comparison

<table>
<thead>
<tr>
<th>Waterway</th>
<th>Safe haven</th>
<th>Yachting destination (cruising)</th>
<th>Yacht racing (lake based)</th>
<th>Yacht racing port (ocean)</th>
<th>Motor cruising destination (ocean access)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wallis Lake</td>
<td>Yes (strong currents on bar)</td>
<td>No</td>
<td>Minor, local</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Myall Lakes</td>
<td>No (only accessed via the Myall River and Port Stephens)</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes (via Myall River)</td>
</tr>
<tr>
<td>Port Stephens</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes (regular, local)</td>
<td>Yes</td>
</tr>
<tr>
<td>Newcastle Harbour</td>
<td>Yes</td>
<td>Limited</td>
<td>Mostly ocean racing</td>
<td>Yes (regular, local)</td>
<td>No</td>
</tr>
<tr>
<td>Lake Macquarie and Swansea Channel</td>
<td>Yes (rock bar constraint at entrance)</td>
<td>Yes</td>
<td>Yes, locally significant, plus some national championships</td>
<td>Minor, plus some yachts visiting for on lake racing</td>
<td>Yes</td>
</tr>
<tr>
<td>Tuggerah Lakes</td>
<td>No</td>
<td>No</td>
<td>Only for shallow draught</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Brisbane Water</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Minor</td>
<td>Yes</td>
</tr>
<tr>
<td>Pittwater</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes, major</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Sydney Harbour</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes, major</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Port Hacking</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes, major</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Wollongong Harbour</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Lake Illawarra</td>
<td>No</td>
<td>No</td>
<td>Only for shallow draught</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Outside of the Sydney Metropolitan waterways, Lake Macquarie and Port Stephens are the only recreational waterways which provide high quality boating destination values as well as a safe haven for recreational vessels in this densely settled section of the NSW coast. Lake Macquarie is approximately a day’s sail north of Pittwater and Lake Macquarie and Port Stephens are approximately a day’s sail apart. Both Lake Macquarie and Port Stephens are boating destinations for the broader Hunter region. Swansea Channel and Lake Macquarie will retain these recreational boating values only through dredging of the channel to maintain reliable navigability.

This context adds merit to the suggestion that Swansea Channel should be considered as a special case for maintenance dredging on a state-wide basis.
3.1.2 Local Tourism and Yachting Events

The Lake Macquarie Tourism Association, in conjunction with local Chambers of Commerce and the local Yacht Clubs, promotes a range of yachting events (for keeled yachts) and visits by yachting groups to Lake Macquarie. At this local scale, Lake Macquarie is recognised as an ideal day sail distance from Sydney, Broken Bay or Port Stephens. Examples of yachting events or visits include:

- Heaven Can Wait Regatta. This event has been running for seven years. Over 2010 and 2011, the event raised $80,000.00 for cancer support groups, even with only a small group of boats participating (including local, Sydney and Newcastle boats). In 2012, approximately 70 boats participated in the regatta, including boats from outside Lake Macquarie (Swansea Channel was open to 2.5 metres water depth). The regatta raised approximately $30,000.00 for cancer support groups.

- Flotilla of Lights – was proposed for January 2013, now postponed.

- NSW Youth Championships (Yachting Australia), held at Belmont 16 foot Sailing Club every year, for multiple classes of vessels (mostly dinghy classes).

- Cruising Yacht Club of Australia and Royal Motor Yacht Club cruising events, with groups of 30 to 50 large yachts or motor cruisers visiting from Sydney, including the ‘Sea Safari’ event, which has various way stations around Lake Macquarie.

- National championships for various classes of keeled yachts, including Adams 10, Northshore.

- In March 2013, some Lake Macquarie Yacht Club members participated in the Pacific Rim Yacht Challenge in Port Stephens, jointly hosted with Port Stephens Yacht Club (Hood and Etchell classes, amongst others).

Yacht Club members noted that if Swansea Channel was known to be open and accessible for larger vessels, it would be possible to organise a ‘Lake Macquarie Week’ for yachting, along the lines of the Hamilton Island Week in Queensland, which is a major tourism event for cruising yachtsmen.

3.1.3 Lake Macquarie as a NSW Tourism Destination

The local Lake Macquarie Tourism Association promotes a variety of water based businesses, including yacht charter (inside the lake) and fishing charter (inside and outside the lake). The Tourism Association is a strong supporter of lake based events that attract boating visitors (Figure 3.1).
Tourism NSW is the portal for visitors to the state and highlights high profile destinations. Lake Macquarie is not identified as one of the big NSW tourism draw-cards, although it is noted in promotion of short break holidays, with the Central Coast, Hunter Valley and lower north coast. Tourism NSW promotes 'adventure' holiday activities such as bushwalking, horse riding, 4WD, cycling and water based activities such as snorkelling, diving and surfing for the Lake Macquarie area, as well as the network of many local lakeside villages. These are all activities that have a land base (i.e. the beach or a foreshore park).

Local Lake Macquarie boating events are not listed, other than the heritage boat festival at Toronto. Information about lakeside towns does mention the opportunity to enjoy a day's sailing on the lake (or wind surfing or fishing). The listing for Swansea highlights local beaches, but does mention access to deep sea fishing.

The positioning of Lake Macquarie on the Tourism NSW web site contrasts with Port Stephens, which has an established strong presence in marine and coastal tourism, including dolphin watching, whale watching cruises and deep sea fishing charters.

### 3.1.4 Chambers of Commerce

Swansea and Belmont Chambers of Commerce have the most direct association with boating activity in Swansea Channel, but Toronto Chamber of Commerce also has interest, because of the presence of the Royal Motor Yacht Club.
During consultation meetings, the Swansea and Belmont Chambers of Commerce discussed their concepts for ‘branding’ Lake Macquarie to attract visitors and enhance business opportunities. These are strongly linked to boating activity, including the presence of a cluster of World Champion sailors in the lake and the potential for game fishing charters to operate from the lake. The Chambers of Commerce saw the restricted navigability of the inner part of Swansea Channel as a significant constraint to tourism business. They considered this constraint much more significant than the presence of Swansea Bridge, noting the example of yachting around Spit Bridge in Sydney.

3.2 Swansea Channel Users and Stakeholders

Figure 3.2 shows the diverse stakeholders with interests in the management of navigability in Swansea Channel.

- **NSW Government, Agencies and Local Government**
  - Department Trade & Investment - Crown Lands Division
  - NSW Roads and Maritime Services
  - Office of Environment and Heritage coastal specialists and estuary ecology specialists
  - Fishing and Aquaculture (DPI)
  - LMCC Sustainability, Community Development and Asset Management teams

- **Council and Agency Consultation Panels**
  - Roads and Maritime Authority – Maritime Panel
  - LMCC Aquatic Services Committee
  - LMCC Estuary Management Committee

- **Lake Macquarie Political Representatives**
  - Mr Greg Piper, former Mayor of Lake Macquarie and Member for Lake Macquarie
  - Councillor Jodie Harrison, Mayor of Lake Macquarie
  - Mr Garry Edwards, Member for Swansea

- **Marina Operators**
  - Marks Point Marina
  - Marmong Point Marina
  - Wyee Point Marina
  - Pelican Marina

- **Community and Boating Organisations**
  - Marine Rescue Lake Macquarie
  - Lake Macquarie Tourism Association
  - Bahtahbah Local Aboriginal Land Council
  - Belmont Chamber of Commerce
  - Swansea Chamber of Commerce
  - Boat Owners Association of NSW
  - Royal Motor Yacht Club - Toronto
  - Lake Macquarie Yacht Club
  - Newcastle Cruising Yacht Club
  - Wangi Yacht Club
  - Other lake Macquarie sailing clubs
  - Sydney yacht clubs, including Royal Motor Yacht Club in Pittwater, Cruising Yacht Club of Australia
  - Concrete industry
3.2.1 Stakeholder and Community Consultation

Community and stakeholder engagement opportunities were offered in the initial stages of the project to facilitate both the gathering and dissemination of relevant information from and to interested parties. The major stages of the consultation process are briefly outlined below. The information and feedback collected informs several parts of this report but has been collated into a record of public consultation (Appendix 1).

3.2.1.1 Project Website

At the commencement of the project a dedicated website was established at: http://www.swanseachannelframework.com.au/

This website allowed for advertising of the consultation process as well as a mechanism for community input. Several of the initial documents (project FAQs and an initial Summary Document) are also available for download on the site.

3.2.1.2 Stakeholder Interviews

The consultation process involved meetings and briefings with individual stakeholders. Stakeholders were identified through discussion with the Project Steering Committee and on the advice of other stakeholders.

Face to face meetings were held with individuals and organisations, to discuss:

- How channel processes shape the landforms; rates of change.
- How the channel is used; how use is affected by channel change.
- Concepts for the channel landscape in the future.
- How this project is different to previous estuary process and management studies for Swansea Channel.
- Information needed to build a strong case in investment in Lake Macquarie, rather than other coastal waterways with trained entrances. Costs and benefits of channel management decisions – not just for recreational boating, but for the broader Lake Macquarie community and for council and agency stakeholders.
- Opportunities provided by this project.
- Potential elements of a framework for the future.

3.2.1.3 Aboriginal Community Stakeholders

Bahtahbah Local Aboriginal Land Council (BLALC) has its office at Pelican and Swansea channel is within its boundaries. With the NSW Aboriginal Land Council, BLALC has made land claims under the NSW Aboriginal Land Rights Act over Crown land around Swansea Channel. These claims include the bed of Swan Bay, and multiple parcels of land on the shore.

BLALC has a strong view that the banks and bed of Swansea Channel contain archaeological evidence of the lives of traditional Awabakal people who enjoyed, valued and looked after the landscape at the entrance to Lake Macquarie for thousands of years. BLALC has previously been involved in dredging activities in Swansea Channel through their interpretation of the
requirements of the National Parks and Wildlife Act, which protect all Aboriginal objects in NSW. BLALC members have examined some previously dredged material to identify any stone artefacts which may be present. These artefacts are not in situ (i.e. their archaeological value is low), but may have been eroded from the banks/shoreline of the entrance channel and transported with other eroded bed and bank material.

If it is proposed to stockpile dredged sand or dispose of dredged sand by filing low lying land along the shore of Swansea Channel to enhance recreational amenity, BLALC is keen to have a role in landscaping and management, particularly when the land is subject to a Land Rights claim.

3.2.1.4 Community Drop-in Evening

A community drop-in information session was held in the late afternoon and early evening at Swansea RSL, in August 2012. Approximately 40 people attended the session. About half the attendees (e.g. yacht club members and some marina owners) had previously attended a stakeholder meeting.

The people who attended provided input on the night and some also submitted further comments by email. Four specific questions were suggested for response:

- ‘How do navigation issues in Swansea Channel affect the economic value of boating in Lake Macquarie?’
- ‘How do you think this affects the image of Lake Macquarie as a place for safe waterway recreation or business?’
- ‘How should the cost of managing the channel for safe navigation be shared between stakeholders?’
- ‘What other thoughts or comments do you have in regarding to the development of the Swansea Channel Navigation Framework?’

3.2.2 Community Perceptions of Navigability Issues in Swansea Channel

Key issues and suggestions raised by stakeholders are broadly related to the following themes:

- Why this project? At the outset of the project there was significant distrust of the process and many community stakeholders initially believed that all the questions had already been asked and answered.

- Why discuss the roles of Council or agencies other than Crown Lands? Many community stakeholders considered that it was obvious that the work should be done and that it was also obvious that the state government is the responsible organisation. Stakeholders considered that although there was broad acknowledgement that navigability in Swansea Channel for larger vessels is compromised by sediment movement, the government had not made an adequate commitment to real change.

- Similarly, community stakeholders thought that the state government already knows what needs to be done, and they suggested that recent dredging activity had been a waste of time and money, because of the small dredge size and capacity. Community stakeholders also thought that Crown Lands does not move quickly enough when it is apparent that the channel is beginning to shoal to un-navigable depths.
Swansea Channel Framework

The Case for Navigation

Dredging in Swansea Channel

- Why discuss options and potential environmental issues? There is a general lack of awareness of the approval process for significant development – or that a major dredging program would be considered to be significant development. People questioned whether environmental assessment is necessary.

- Strong concerns about the uncertainty of navigability in Swansea Channel. Several owners of larger, deep keeled yachts reported that their vessels had been 'stranded' in the lake because of shallowing of the channel. They also reported that this uncertainty reduced the likelihood of their bringing their yacht into the lake to use local marina facilities.

- A strong view that the boating community of Lake Macquarie pays a significant amount to the State government in boating fees (licences, registrations and moorings) and that more of this money should be returned to fund boating facilities/amenity in Lake Macquarie. It should be noted however, that RMS and LMCC do jointly invest in boating safety and facilities in Lake Macquarie, via Marine Rescue Services, Boating officers, bathymetric survey and construction of shoreline infrastructure (public wharves and launching ramps).

- Stakeholders have expressed the view that maintaining navigation for diverse vessels in Swansea Channel would build on the tourism reputation of the lake and would bring greater return to Council for its investment in boating infrastructure and foreshore facilities.

- Some stakeholders held a strong view that the NSW Government should purchase a dredge to use in Swansea channel, fulfilling a commitment made prior to the last State election.

- Many people commented on the value of the channel as a recreation destination in itself. Families like the clear marine waters and sandy bed. In Lake Macquarie, this environment only occurs in the channel. So managing the channel should take into account accessible sandy day picnic areas as well as the needs of boating people to pass in and out of the lake.

- There was a strong view that limited navigability impedes yachting (and other boating) events in the lake and that the condition of the channel affects the lake’s reputation as a place to visit. Examples of events include championships for various classes of yachts, charity days/weeks (including Heaven Can Wait and Festival of Lights), cruising yacht club visits, summer holiday visits. Events also include motor cruisers; for instance in August 2012, RMYC Broken Bay will visit the lake for its ‘Sea Safari’, with cruisers up to 50’ length.

- Stakeholders suggested multiple different uses for sand extracted from the navigation channel. While many people referred to beach/dune nourishment (open coast or in Salts Bay), there were also suggestions to enhance the sandy shoreline and/or extent of islands for recreation purposes or to enhance habitat for shore birds.

- Some stakeholders linked the channel management issues to other land use planning issues, particularly to the proposed zoning of the lake bed as W1 (natural waterway) in the Lake Macquarie LEP 2012.

- Stakeholders referred to the potential for stand-alone management authorities, such as the Lake Illawarra Authority. They also noted special purpose funding arrangements that apply in some estuaries, such as Port Hacking.
3.3 Boat Ownership and Usage

Statistics relating to boat ownership and vessel size are based on records kept by RMS in relation to boat licences, boat registrations and mooring registrations/fees, with supplementary information from yacht and sailing club membership, or from marina operators about berth occupancy rates.

3.3.1 Hunter Inland Region

Lake Macquarie is part of the RMS Hunter Inland region. This region also includes the central coast and Port Stephens areas, as well as extending inland through all of northern NSW, other than the coast and far west. Many of the boat owners in the Hunter Valley use Lake Macquarie and Port Stephens as their nearest coastal waterways. Compared to other regions of NSW (Table 3.3), the Hunter Inland region has a high number of registered vessels per 1000 people (second to North Coast). However, for all non metropolitan regions, lower regional population densities (across large areas) mean that the total number of registered vessels and the number of registered vessels per square kilometre are lower than for the Sydney metropolitan regions (Sydney Harbour, Botany Bay/Port Hacking and Hawkesbury/Broken Bay).

Table 3.3 – Boat Registration by Region

<table>
<thead>
<tr>
<th>Region</th>
<th>Boats/1000 People</th>
<th>Boats/km²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botany Bay/Port Hacking</td>
<td>29</td>
<td>25</td>
</tr>
<tr>
<td>Hawkesbury/Broken Bay</td>
<td>35</td>
<td>6.92</td>
</tr>
<tr>
<td>Hunter Inland</td>
<td>56</td>
<td>0.12</td>
</tr>
<tr>
<td>North Coast</td>
<td>64</td>
<td>0.66</td>
</tr>
<tr>
<td>South Coast</td>
<td>52</td>
<td>0.44</td>
</tr>
<tr>
<td>Sydney Harbour</td>
<td>19</td>
<td>51.39</td>
</tr>
</tbody>
</table>

From 2001 to 2006, the Hunter Inland region had the highest absolute rate of growth of boat ownership in NSW. When normalised for population size, the region had the third highest rate of growth of boat ownership, after north coast and Murray Inland. All three regions had rates of growth of boat ownership some 2 per cent higher than any Sydney metropolitan region.

3.3.2 Boat Ownership in Lake Macquarie

Table 3.4 summarises boat ownership statistics for Lake Macquarie, by draught depth, using data from RMS and the 2007 Paterson Britton Berth Demand Study. These statistics are organised by draught depth because of the importance of the depth of water drawn to use of Swansea channel. Three classes of estimated draught are provided:

- Shallow – up to 2.0 metres draught.
- Moderate – 2.0 to 2.5 metres draught.
- Deep – more than 2.5 metres draught.

These statistics highlight the popularity of smaller, shallower draught vessels on Lake Macquarie.
Table 3.4 – Total Vessels in Lake Macquarie by Draught Depth (2007 Data)

<table>
<thead>
<tr>
<th>Size</th>
<th>&lt;2 m</th>
<th>2.0-2.5 m</th>
<th>&gt;2.5 m</th>
<th>Total Vessels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moored</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>1,583</td>
<td>489</td>
<td>250</td>
<td>2,322</td>
</tr>
<tr>
<td>Percent</td>
<td>68%</td>
<td>21%</td>
<td>11%</td>
<td>100%</td>
</tr>
<tr>
<td>Berthed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>-</td>
<td>300</td>
<td>200</td>
<td>500</td>
</tr>
<tr>
<td>Percent</td>
<td>0%</td>
<td>60%</td>
<td>40%</td>
<td>100%</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>13,251</td>
<td>0</td>
<td>0</td>
<td>15,595</td>
</tr>
<tr>
<td>Percent</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Total Boats</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>14,834</td>
<td>789</td>
<td>450</td>
<td>16,073</td>
</tr>
<tr>
<td>Percent</td>
<td>92%</td>
<td>5%</td>
<td>3%</td>
<td>100%</td>
</tr>
</tbody>
</table>

3.3.3 Projected Boat Ownership Growth

Table 3.5 presents projected growth in boat ownership for Lake Macquarie from 2006 through to 2026, estimated from NSW Boat Ownership and Storage Report 2009. The projected growth in boat ownership is also shown in Figure 3.3.

The boat ownership projects indicate that over the next 14 years, the number of vessels in Lake Macquarie drawing more than 2.0 metres of water is expected to increase from around 1250 (now) to 2300, close to double. This does not include any current or future visiting deeper draught vessels. Notwithstanding this significant increase, the majority of vessels projected to be registered in Lake Macquarie would still be vessels drawing less than 2.0 metres of water, which have limited need for a continuously maintained (dredged) channel to provide ocean access.

The demand for a regularly maintained deep water entrance to Lake Macquarie, through Swansea Channel is therefore underpinned by a combination of less than 8 per cent of Lake Macquarie registered vessels, plus visiting yachts from other ports. Economic benefits accruing from more reliable dredged depth of Swansea Channel are linked particularly to expenditure in the local area by visiting yachts and cruisers.

Table 3.5 – Projected Vessel Numbers in Lake Macquarie LGA

<table>
<thead>
<tr>
<th>Year</th>
<th>2006</th>
<th>2009</th>
<th>2012</th>
<th>2015</th>
<th>2020</th>
<th>2026</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;2 m Draught</td>
<td>14,834</td>
<td>15,795</td>
<td>17,421</td>
<td>19,214</td>
<td>22,621</td>
<td>27,517</td>
</tr>
<tr>
<td>2.0 to 2.5 m Draught</td>
<td>789</td>
<td>840</td>
<td>927</td>
<td>1022</td>
<td>1203</td>
<td>1464</td>
</tr>
<tr>
<td>&gt;2.5 m Draught</td>
<td>450</td>
<td>479</td>
<td>528</td>
<td>583</td>
<td>686</td>
<td>835</td>
</tr>
<tr>
<td>Total Vessels</td>
<td>16,073</td>
<td>17,114</td>
<td>18,876</td>
<td>20,818</td>
<td>24,511</td>
<td>29,816</td>
</tr>
</tbody>
</table>
3.4 Swansea Channel Waterway User Needs

When vessel draught is linked to navigation requirements (set out below), it is apparent that deep water maintenance dredging in Swansea Channel is an essential waterway need for only a very small proportion of the total boat owners of Lake Macquarie.

Draught Depth up to 2 Metres

- Dinghy sailors, runabouts, trailer sailors, catamarans, small motor cruisers.
- Approximately 92 per cent of users.
- Minimal dredging in Swansea Channel is required for safe waterway use by this group of recreational boaters, with few bridge openings required.
- Small to medium keel yachts also generally draw less than 2 metres of water. Moored on private moorings in the lake, many are only sailed in the lake. If used for ocean racing or cruising, they require a less frequently maintained channel than larger yachts.
Draught Depth 2.0 to 2.5 Metres

- Large motor cruisers, single hull yachts.
- Approximately 5 per cent of users.
- Require navigation information, such as channel markers and bed level surveys (met by RMS).
- Moderate dredging is required to achieve a consistent functional depth in Swansea Channel of greater than 2.0 metres. Not all vessels registered in Lake Macquarie in this draught class regularly leave the lake for cruising or ocean racing activities, as a proportion have always stayed within the lake and would do so even if the channel was reliably more navigable. Exact, actual numbers of potential ocean racing and cruising vessels for Lake Macquarie are not clear. Figure 3.4 shows the number of vessels passing under Swansea Bridge at bridge openings.

Draught Depth More than 2.5 Metres

- Very large motor cruisers, ocean going yachts.
- Approximately 3 per cent of users (currently approximately 450 vessels registered in Lake Macquarie).
- Safety needs, in terms of channel markers, up to date hydrographic surveys and waterway officers are met by RMS.
- Regular deep channel dredging is required for these vessels to move in and out of the lake. These vessels cannot reliably pass through Swansea Channel without regular deep dredging, to a functional depth of approximately 3.0 metres.
- These vessels also need considerable care and skill when crossing the coal seam at the outer entrance. RMS advises that vessels drawing more than 2.0 metres should cross the coal seam only at high tide. The coal seam outcrops at -3.0 metres AHD (which is approximately 3.5 metres below mean high tide).

3.4.1 Vessels Requiring Bridge Openings

Figure 3.4 shows the number of vessels passing trough Swansea Bridge at bridge openings. It highlights several important characteristics of boating use in Swansea Channel, including the following:

- Peak rates of passage through Swansea Bridge occur in January, with a smaller peak apparent in April (Easter). The highest rate is approximately 750 single trips in one month (equivalent to 375 trips in and out of the lake), about 12 per day, in January. The Easter peak accounts for 400 to 500 single vessel trips in a month.
- Total number of vessels passing under Swansea Bridge is influenced by a number of factors, including the condition of the channel (how soon after dredging), the seasonal weather, alternative activities not requiring passage through the channel, the reputation of Swansea Channel outside of the local area and year on year variations in boat ownership or usage linked to economic conditions.
- It is clear that usage of Swansea channel by boats passing between Lake Macquarie and the ocean declined after 2010, relative to previous years. All of the issues noted above may have contributed to this, but the yachting community report strong anti Swansea Channel messages in nearby ports (such as Pittwater) where visiting vessels originate.
These messages were driven by multiple incidents of larger, deep keeled vessels running aground in the shoaled channel.

![Figure 3.4 – Swansea Bridge Openings and Vessel Passage, 2004 to 2012.](image)

### 3.5 Impacts of Unmanaged Shoaling on Navigation and Use

Based on input from waterway users, the **direct impacts** of shallow water depth (less than 2 metres) on navigation in Swansea Channel include the following:

**Impacts on Individuals – Cost, Safety and Convenience**

- Scraping anti fouling from the hull of yachts and motor cruisers.
- Breaking the tip or wings off the keel.
- Sudden stopping of vessels during transit, as the keel hits bottom, throwing crew and passengers around on the boat, and causing minor injuries.
- Motors on both keel and motor cruiser vessels becoming clogged with sand.
- Limited navigable area to share between larger and smaller vessels, especially if several changes of direction are needed to manoeuvre through the channel.
- Vessels being laid over and dragged across the shoals.
- A need for high levels of seamanship capability to negotiate the channel under most conditions.
- Safe transit times (for water depth) linked only to high water slack tide and low atmospheric pressure conditions, which may occur only in the middle of the night, or only once in a week or month. These conditions are impractical for general community use.
Impacts on Service Provision

- RMS officers spend a higher than appropriate amount of their time shepherding recreational vessels through the channel, or dragging them off the shoals or dragging them through the shallow areas.

Indirect Impacts on the Community

- Uncertainty affects tourism and community event planning, when events involve safe passage of vessels into and out of the lake. Examples of events include cruising yacht club visits, Heaven Can Wait Regatta, proposed Flotilla of Lights Regatta; national sailing championships; game fishing events.

- Loss of opportunity for tourism businesses, where the activity involves passage from lake to ocean. Examples include yacht charter and day cruising, which operate on the lake but could also offer offshore options; deep sea fishing charter businesses; seasonal whale watching (such as occurs in Port Stephens).

- Reputation of Lake Macquarie as a yachting destination. Anecdotally, there is a strong view that unreliable navigation in Swansea Channel prevents yacht owners from regarding the lake as a destination for weekend visits, although it is a good day sail from Sydney. People cannot be certain they can get into the lake safely, and then, once in, cannot be certain when they will be able to leave. This is because of the delicate balance between tide, current, water depth and atmospheric/weather conditions.

- Reduced use of other tourism facilities and activities, because yachts and large motor cruisers from other ports do not enter the lake. For instance, marinas in Lake Macquarie have facilities suitable for a larger number of visiting vessels than can currently enter the lake safely. Poor navigability also indirectly affects spending in restaurants and clubs.

- High levels of dissatisfaction in the sector of the recreational boating community that values ocean access, particularly for short trips, but also for longer cruising activities.

- Perception in the community that agency staff and political representatives are either not doing their job properly or are ineffective, or not being transparent. There is also a perception in the community that Lake Macquarie does not receive the state government investment that it deserves as a rapidly growing area.

- Perception of lowered safety for ocean cruising, because of uncertainty about safe access into Lake Macquarie in difficult conditions (however, note that in storm conditions with large swells or strong winds, crossing the coal seam at the mouth of the channel is also very dangerous, so this issue does not relate only to the shoaled section of the channel).

Some of these factors were considered in the previous socio-economic assessment (Gillespie and Hassall 2003). Review and update of the capital and socio-economic aspects of the dredging are in Appendix 3.
3.6 Sustainable Management of Navigability in Swansea Channel – Rationale for Special Funding Consideration

The rationale for maintaining reliable deep water recreational access to Lake Macquarie is based on:

- Clear local goals for estuary management, including estuary health and the interdependence of healthy waterways with social use and economic value. Channel and Lake management objectives are stated in the LMCC Coastal Zone Management Plan, Parts B (Swansea Channel) and C (Lake Macquarie estuary).

- Lake Macquarie is a coastal recreational waterway of regional to State significance, considering waterway quality (water quality, clear open water, steady breeze, lack of congestion), size and depth.

- High and growing boat ownership levels locally and in the region (including accessibility for boat owners from the broader Hunter region, central coast and northern Sydney). Swansea Channel provides ocean access for an increasing number of people participating in deep keel yachting, from the local area, from the Hunter Region and potentially from northern Sydney.

- Strong interest in reliable deep water access from some yachting users and businesses in Lake Macquarie, as well as from visiting yacht owners. A high quality and accessible waterway is a key element of the Lake Macquarie Tourism Strategy. Appendix 1 discusses input from particular waterway users, mostly skippers of large, deep keel yachts, who believe they would be key beneficiaries of reliable deep water navigability.

- Potential to accommodate increased recreational usage for all types of vessels – facilities including ramps, jetties, mooring space and marina berths. In comparison, Sydney waterways are crowded, with limited mooring space; Newcastle Harbour is a major working port, not suitable as a significant recreational destination (but valued as an overnight refuge).

- While the majority of boating in Lake Macquarie does not depend on ocean access, growth in commercial boating (for tourism related business) does require reliable ocean access. For Lake Macquarie to be positioned as a safe destination for cruising yacht and motor cruiser owners, a reputation for reliable deep water entry is essential.

Challenges to a sustainable framework for navigability in Swansea Channel include:

- Navigability issues in Swansea Channel do not fit neatly the situations or scale encompassed in the NSW Sustainable Dredging Strategy or other State government programs. The navigation constraint is not the entrance bar of the trained entrance or the outer channel (downstream of Swansea bridge). Other than the entrance training walls, there is no state-owned maritime infrastructure in Lake Macquarie and there are no public ferry services and no harbour master.

- There is a high and continuing cost for channel maintenance dredging in a dynamic and transforming system. Navigability in Swansea Channel for deep keeled vessels can only be maintained with regular, timely investment in dredging at key shoaling points.

- The indicative costs for dredging of a scale to support reliable navigability in Swansea Channel for larger, deep keel recreational vessels are beyond capacity of existing government funding programs on a state-wide funding basis.
LMCC has stated that a 50 per cent funding contribution from council to dredging the channel, as required by the relevant State funding programs, is outside council’s approved budget capacity, and is inconsistent with the state significance of the waterway for boating. Based on Council’s community surveys, channel maintenance is not regarded by most residents as the highest priority for Council investment in lake boating (see Section 2.5 for details).

Complex governance arrangements, with funding opportunities not directly linked to agencies with statutory or policy responsibility for navigable recreational waterways (detailed in Sections 2.1, 2.2 and 2.3).

Multiple demands for limited resources for maintaining recreational waterways, both locally and state-wide.

3.6.1 Maintaining Navigability of Lake Macquarie Entrance Channel - Special Consideration

Recreational yachting is a long standing component of the recreational culture of Lake Macquarie, and coastal NSW. The lake has remained a haven for recreational users, compared with other coastal waterways in the region. There is a strong interest in the local and regional community to maintain ocean access to Lake Macquarie through Swansea Channel for deeper keeled yachts, as a safe haven for cruising individuals and groups, as a destination for cruising and racing vessels and to maintain opportunities for lake based tourism. Usage of both smaller and larger recreational vessels is continuing to grow in Lake Macquarie and the wider region.

The Lake Macquarie waterway is not just a local asset, but a significant recreational and natural asset at the regional, state and national scale. Whilst some of these values would continue to exist without attention to the navigability issue, Swansea Channel is the recreational gateway by which many users know Lake Macquarie. A responsive and adaptive channel maintenance program is essential to maintain navigability for larger vessels. The combination of high significance and high maintenance dredging costs suggest that consideration for maintaining navigability in Swansea Channel should be given to a Strategy that is managed and funded by a range of stakeholders. Such an approach could streamline funding, project management, approvals, monitoring, triggers for action and wide ranging stakeholder engagement. Components of this approach are introduced in Section 4.0 and options to deliver each component are evaluated in Parts 2 and 3 of this report.
PART 2

4.0 Components of a Management Framework

This section scopes the components of a sustainable management framework for Swansea Channel. Options for the delivery of each component are evaluated in the subsequent sections.

The framework comprises the nine elements highlighted in Figure 4.1.

![Figure 4.1 – Nine Elements of a Sustainable Management Framework](image-url)
4.1 What Does Sustainable Navigation Dredging Mean?

In broad terms, sustainable management means that environmental, social, economic and governance issues have been identified and resolved to provide a solution that protects environmental values, meets community needs and is affordable and within capacity to implement now and in the future.

In the context of an estuary navigation channel, these concepts imply:

- Accommodation of estuary processes.
- Protection of estuary health.
- Appropriate services and facilities for safe and enjoyable community use.
- Ongoing community involvement in management, including availability of information about channel condition and response to management strategies.
- Efficient, cost-effective and affordable management strategies.
- Governance structures which facilitate partnerships for management and cost sharing.
- Alignment of management structures with state and local government policies and plans.
- Adaptive implementation systems.

Figure 4.2 summarises the strategic and operational characteristics of sustainable dredging programs. More detail about these factors is in the following sections.
4.1.1 Alignment of Strategy across Land Use, Community Planning and Infrastructure Sectors

Sustainable dredging is set within a strategic framework with consistent and aligned objectives for natural resource values, land use planning, community development (recreational and economic opportunities) and infrastructure investment. This includes the land use zoning for the channel and lake, strategic recreation and economic development planning so that:

- Dredging produces outcomes that protect or enhance shared values of waterway users, businesses, regulators and the environment.
- Dredging is designed and implemented to achieve clear objectives and measurable performance targets.

Although the form of the entrance channel has limited impact on water circulation and water quality in the lake, the channel has the same land use zoning as the rest of the Lake Macquarie waterway (proposed W1 in draft LMCC LEP 2012; refer to Appendix 2 for details). The implementation of ongoing navigation dredging should be demonstrably aligned with protection of ecosystem and scenic values as well as provision for sustainable fishing and for recreational use of Lake Macquarie and its waterways.

4.1.2 Strategic and Planning Factors

The following factors are essential in ensuring sustainable waterway management using dredging:

- Dredging processes and outcomes are robust over a long period, i.e. they are aligned with estuary hydrodynamic processes (Section 5.0).
- The dredged sand has beneficial uses. Section 6.0 provides analysis of sand disposal and reuse options for material extracted from the bed of Swansea Channel. The cost of dredging and spoil management can be shared between benefiting stakeholders (Section 6.0).
- The concept and implementation process complies with all environmental policy and regulatory requirements (Section 7.0).
- The work and resulting waterway uses have minimal or positive impacts on the environment. These impacts include those on estuary sedimentary processes, estuary water quality, estuary habitat, but also secondary or operational impacts such as noise, traffic and odour. These matters would be addressed in the approval process and ongoing monitoring (Sections 7.0 and 9.0).
- Individual dredging campaigns are set within a broader strategic framework that provides context and streamlines approval, funding, implementation and monitoring processes (Sections 7.0 and 9.0).
- There is a clear process for stakeholders to obtain information and to contribute to decision making (Section 10.0).
The proposed works are politically and socially acceptable now and in the long term (see also Section 10.0). There are strong direct and indirect links between dredging and social, cultural, environmental and economic benefits. Dredging for a specific purpose, with performance targets that can be measured and monitored. Section 9.0 discusses targets and management plan processes, and Section 11.0 discusses costs and benefits.

Capital and maintenance works are cost effective and affordable (Section 11.0 discusses costs and benefits and Section 12.0 discusses funding options).

4.1.3 Operational Factors – Sustainable Dredging Design and Action

In sustainable dredging operations, a clearly defined channel form, dredging methodology and satisfactory means for disposing (or reusing) dredged material is required. The Victorian EPA Guidelines (EPA Victoria 2001) suggest several measures to consider in a dredge plan, to minimise the scale of dredging and spoil emplacement. Only some of these measures are relevant to Swansea Channel, as much of the focus of the Victorian Guidelines is on dredging sediment that is derived from catchment erosion, not from marine sources. Relevant measures include:

- Justify the depth and width of the channel – choose a channel form that is adequate, rather than over-dredging (see Section 5.0 for details of channel form options).
- Realign channels where this will improve flows and reduce the need for future dredging. Options that could improve the efficiency of sediment transport and reduce shoaling in key navigation points are discussed in Section 5.0.
- Avoid temporary spoil sites (double handling), except where necessary for efficient processing and transport of dredged sand for higher value uses.
- Coordinate dredging proposals with beach nourishment programs. Beach nourishment is one potential use of sand extracted from Swansea channel (see Section 6.0).
- Dredges should be suitable for the scale of work and the type of material and avoid unnecessary environmental impacts (e.g. fine sediment impacts on water quality).
- Time the dredging program to avoid critical ecological process periods such as migratory shorebird breeding and fish spawning. In Swansea channel, migratory shorebirds such as Little Tern are known to utilise the sand islands within the channel for feeding and roosting during summer.
- Time the works to avoid periods of high recreational use, with associated safety risks. Dredging should be timed to prepare the channel for peak recreational periods – winter or early spring is the best period for works.
- Monitor works and outcomes to increase knowledge of the interactions between dredging and environmental, social and economic values.
5.0 Dredging Plan and Design

This section considers the technical components of navigational dredging. These relate to the channel form needed to maintain reliable navigability for most yachting users, and the relationship between channel hydrodynamic processes and dredging design. Table 5.1 outlines the context of the technical assessment and potential outcomes.

Table 5.1 – Context and Sustainable Outcomes

<table>
<thead>
<tr>
<th>Context and Sustainable Outcomes – Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel form for community value</td>
</tr>
<tr>
<td>• The highest level user needs are day and weekend ocean sailors (racing and cruising) in keeled vessels. These users are relatively inflexible in the times they can move through the channel (e.g. can’t wait for slack high water to traverse both the Pelican section and the coal seam navigation hazards); Timing constraints require seamanship skills if safe passage is to be achieved.</td>
</tr>
<tr>
<td>• Dredging in the channel should provide for enough access into and out of the lake to build the lake’s reputation as a great place for a family boating holiday, for both yachting and cruising.</td>
</tr>
<tr>
<td>• Dredging the channel should consider, protect, and potentially enhance the clear water and sandy beaches that appeal to locals and visitors.</td>
</tr>
<tr>
<td>Appropriate channel form</td>
</tr>
<tr>
<td>• The Project Steering Committee is of the opinion that the channel form at high tide should be suitable for vessels drawing up to 2.5 m (i.e. dredge to -3.5 m AHD to allow adequate clearance in varying meteorological conditions, and to extend the return period between dredging campaigns). Dredging to depths greater than -3.5 metres AHD is not considered necessary and may invoke requirements for additional modelling and approvals.</td>
</tr>
<tr>
<td>• Consideration be given to the design of a channel form that alters the existing sediment dynamics by removing sufficient sand from the system to reduce the frequency of maintenance dredging.</td>
</tr>
<tr>
<td>• Maintain channel form to allow passage of vessels drawing 2.5m (with a trigger to commence the planning and dredging process when the bed level reaches -2.8 m AHD at key locations within the channel) to provide certainty about navigability for tourism and recreational users.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Context and Sustainable Outcomes – Dredge Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Initial dredge design and capacity capable of removing large volumes of sand from the system rapidly, to achieve design outcomes.</td>
</tr>
<tr>
<td>• Pump capacity suitable for transferring sand to processing or storage sites 2-3 kilometres from the extraction site.</td>
</tr>
<tr>
<td>• Flexibility in post design maintenance dredging linked to regular monitoring of channel form.</td>
</tr>
<tr>
<td>• Appropriate location to dewater and stockpile dredged sand for timely transport to off-site placement areas – minimal inconvenience to residential amenity</td>
</tr>
</tbody>
</table>

In discussion in this section about water depths and tidal variations, the following parameters apply (Table 5.2).
5.2 Swansea Channel Tidal Levels (2008) (WP 2010)

<table>
<thead>
<tr>
<th>Tide condition</th>
<th>m AHD (Swansea Bridge)</th>
<th>m AHD (Southern entrance to Swan Bay)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MHWS</td>
<td>0.486</td>
<td>0.20</td>
</tr>
<tr>
<td>MHW</td>
<td>0.386</td>
<td></td>
</tr>
<tr>
<td>MHWN</td>
<td>0.286</td>
<td>0.10</td>
</tr>
<tr>
<td>MSL</td>
<td>0.031</td>
<td>0.08</td>
</tr>
<tr>
<td>MLWN</td>
<td>-0.224</td>
<td>-0.08</td>
</tr>
<tr>
<td>MLW</td>
<td>-0.267</td>
<td></td>
</tr>
<tr>
<td>MLWS</td>
<td>-0.315</td>
<td>-0.08</td>
</tr>
</tbody>
</table>

5.1 Environmental Processes and Constraints to Navigability

Two distinguishing features of Swansea Channel are that the active sedimentary processes in the channel are not directly linked to marine sand currently entering from the ocean and the channel is a highly modified system, creating a landscape that is now quite different to the natural (pre European) form.

The mobile sand that progresses through the channel in pulses is derived from bed scouring and shoreline erosion within the channel (PWD 1976; WBM 2003; WorleyParsons 2010). Historically, the primary source of sand is erosion of the shoreline of Salts Bay, which has retreated some 400 metres in 70 years (WBM 2003). Figures 5.1a and 5.1b shows aerial photos from 1941 and 2007. The dots indicate fixed points common to both photos.

Figure 5.1a: Black Neds Bay and Salts Bay 1941
Source: LMCC 2007 ('Groyne Strain')
Ongoing scour of the bed of the outer channel is driven by ongoing adjustment of the system to the increased hydraulic efficiency created by break walls and training walls, which were first installed in the late 19th century. In addition, channel scouring is occurring upstream of Swansea Bridge as the channel form continues to adjust to the hydraulic effects of the entrance training walls and the bridge itself.

The dynamic and transforming nature of Swansea Channel hydrodynamic processes allows flexibility in the management of sediments and the use of the channel into the future. However, it also means that there is no one-off solution to the management of sedimentary processes in Swansea Channel.

5.2 Lake Macquarie entrance – Limiting Factors for Navigability Today

The navigability of Swansea Channel today is affected by several factors, of which the shoaling of the channel upstream of Swansea Bridge is the most conspicuous and contentious. Other important limiting or influencing factors include:

- The depth of the coal seam at the ocean entrance is a key limiting factor for vessels entering Lake Macquarie. In calm conditions, safe draught is a maximum of 3 metres at high tide. The safety of crossing the entrance shoals and the coal seam outcrop in the bed of the channel is also influenced by the swell direction (greatest exposure is to north easterly swell), wave height and period. Roads and Maritime Services (RMS) advises extreme caution crossing the Swansea Heads rock bar in all but the flattest seas, for most boat lengths. Swansea Bridge opens to allow yachts and other tall vessels to enter the lake. Bridge openings must be booked.
• Tide delays from entrance to bridge and bridge to drop over. The tidal lag from the entrance to Swansea Bridge is about 30 minutes. Slack high water at the lake end of the channel is approximately three hours after the advertised high tide for Swansea Heads. People navigating through the channel are not always aware of the extent of tidal delay.

• Upstream of Swansea Bridge, the tidal variation is much less than at the ocean entrance. WorleyParsons 2010 report a tidal range of approximately 1.7 metres at the entrance, decreasing to 1.3 metres at Swansea Bridge and decreasing further to less than 0.2 metre beyond Coon Island Point at the western extent of the channel. However, water levels along the channel are also influenced by atmospheric pressure systems, by wind forcing and by fresh water runoff which influences lake level.

Cardno Lawson and Treloar (2010) note that lake water levels (i.e. at the lakeward end of Swansea Channel may increase by 0.05 metre due to the ‘reverse barometer effect’ and wind set-up during storms can increase this further. These changes may occur over a period of a week or so as weather systems progress.

On a longer time scale, Cardno Lawson and Treloar 2010 report that regional systems such as El Nino can add 0.1 metre to sea level and trapped coastal wave activity can add 0.2 metre to sea level. In the lake itself, the maximum recorded water level occurred during the 1949 flood, when the lake level reached 1.0 metre above its normal high tide. Conversely, persistent high pressure systems, offshore winds and prolonged drought reduce the sea level experienced in Lake Macquarie and in Swansea Channel.

These diverse influences on water level require some buffering of dredge depths, to maintain navigability through unusual sea level patterns. Further analysis of sea level patterns would be needed to quantify how frequently various water levels occur along the channel.

5.3 Functional Channel Form

The functional form of Swansea Channel for navigability for deep keeled yachts is linked to both sedimentary processes and to the depth of the coal seam at the entrance. The coal seam outcrops at approximately -3.0 metres AHD. Tide and wave conditions mean that actual water depth over the coal seam can be as little as 1.4 metres (see Marine Rescue web site, advice on navigating in Swansea Channel). The coal seam sets the maximum functional depth for vessels passing in and out of the entrance to Swansea Channel and limits the design depth for dredging of the inner channel.

Beyond the minimum channel width and cross sectional area, the optimum channel form balances the effect on hydrodynamic process, navigability, return period for dredging and cost.

Functional channel width is influenced by:

• The stability of the batter of the channel side slopes.

• Room for large yachts to pass, plus have other smaller vessels moving safely around them.

• Width necessary to achieve a cross sectional area that is consistent with tidal flow concentration (rather than dispersion across the shoals); encouraging sediment transport rather than deposition at current choke points.
To achieve reliable functional water depth of 2.5 metres at most tide conditions, a dredged depth of -3.5 metres AHD in the channel upstream of Swansea Bridge is suggested. This depth is greater than the depth of the coal seam at the entrance (i.e. -3.0 metres AHD). It has been selected to include two contingency values to allow for additional factors influencing water level and to increase the return interval for dredging campaigns. A design dredging depth of -3.5 metres AHD allows for the maximum tidal range in the channel and also a contingency of 0.5m for variations due to weather systems such as pressure effects on water levels. An additional 0.5 metre contingency is included to allow for some shoaling to occur without affecting the passage of most vessels, which draw up to 2.5 metres.

Similarly, to achieve a functional water depth of 2.0 metres, the dredging profile would be designed at -3.0 metres AHD. However, this depth would not deliver consistently reliable navigability for most vessels.

The next section reviews the technical studies that assess appropriate channel form for navigability and longevity. Cost benefit considerations are discussed in Section 11.0.

### 5.4 Technical Studies and Estuary Modelling

Over the last 20 years, a suite of technical reports has been prepared to investigate and document historic and contemporary estuary processes. The previous studies consider:

- hydrodynamic processes;
- hydrodynamic and sediment transport modelling of the channel (WBM 2003; WBM 2004 and WorleyParsons 2010);
- the geomorphology of the channel (shoals, banks and sand islands);
- shore protection and shore and channel stabilisation methods; and
- modelling of options to mitigate sedimentation and water quality issues.

The studies and models gave valuable insight into the contemporary processes operating in the inner channel (upstream of Swansea Bridge) and enabled testing of the effects of various management options. The baseline scenario was to ‘do nothing’ and allow the channel to equilibrate into a stable erosion/accretion pattern with minimal maintenance dredging.

The previous hydrodynamic studies have concluded that:

- The overriding estuary process issue affecting the navigability of the channel is the erosion and redistribution of channel sediments. These sediments are deposited in the inner reaches of the channel to form large shoals. A number of previous studies have been undertaken to determine the causes of this problem and the hydrodynamic processes that have contributed to it.

- The shoals extended from the entrance to the dropover and are likely to have exerted considerable control over tidal propagation into the lake (WBM 2003).

- Efforts to control the natural shoaling processes in Swansea Channel to maintain a navigable channel commenced more than 130 years ago and have continued ever since.

- In the mid to late 19th Century, training walls were constructed to control the migration of sand at the channel entrance and to facilitate deepening of the channel to allow commercial vessels to enter the lake. This separated the entrance from sand sources from the north (Blacksmiths Beach) and disrupted the natural equilibrium of sediment
erodion and accretion within the channel. The channel is still adjusting to these engineering works.

- Construction of the training walls allowed waves to penetrate further into the channel which caused severe erosion at Salts Bay, leading to approximately 400 metres of shoreline recession (WBM 2003).

- The eroded material from Salts Bay is the principal source of the material that is moving as ‘sand pulses’ through the inner channel. The result is rapidly accreting shoals that drive the ongoing navigation issues (PWD 1976; WBM 1997 and 2003). Other sources of mobile sand include sections of the outer channel that have scoured, deepened and widened in response to hydraulic processes:
  
  - tidal processes are driving the sediment transport rather than catchment sourced flooding;
  
  - the dominant flow path during average tidal conditions (flood and ebb) is past Marks Point; however flow through the Airforce and Coon Island channels is also significant;
  
  - at the time of the WBM modelling it was indicated that approximately 10 per cent of tidal flow into the lake passes through Swan Bay;
  
  - simulated rates of sediment transport are significantly higher on the flood tide than the ebb; which contributes to the advancing flood tidal delta (‘drop-over’); and

- large transport rates exist near Naru Point and the western side of the spoil island are contributing to the erosion of these areas.

- The modern entrance channel retains much of its historic alignment, including the east-west reach in the outer entrance, a 90° change of direction upstream of Black Neds Bay and a north-south aligned reach upstream of Swansea Bridge. Other characteristics of the channel are quite different. The channel has been straightened and lengthened, open bays have been closed and islands have been created.

### 5.4.1 Impact of Sea Level Rise on Swansea Channel

Global sea level, measured using tide gauges and satellite altimetry, has risen 0.21 metre over the last 150 years (Church and White 2006, Church and White 2011). Along the NSW coast, measured sea level rise from 1990 to 2011 was 2.6 mm/year (National Tidal Centre at Bureau of Meteorology 2011). Sea level rise is already one of the drivers of hydrodynamic change in Swansea Channel, along-side the effects of training walls.

WorleyParsons (2010) and Cardno Lawson Treloar (2010) have commented on possible effects of sea level rise on the morphology of Swansea Channel and on shoreline stability/foreshore recession. In general, sea level rise is expected to exacerbate the continuing adjustment of the hydraulic capacity of the channel. Sea level rise is also predicted to increase the tidal range of Lake Macquarie, but reduce lake level set up above ocean levels.

The quantum impact of sea level rise, compared with the effects of training walls, is relatively small in the short term, but would become significant with the amount of sea level rise projected to occur by 2050 and 2100.

### 5.4.2 Review of Previous Channel Forms and Management Options

WBM (2003) evaluated various channel management options to reduce the impacts of sedimentation on navigation in Swansea Channel. The options presented were partly informed by a high level review of options carried out previously by WBM in 1996. Options considered in the feasibility assessment, but not considered further included:
• Reinstatement of a principal channel alignment following the old Air Force Channel. The dominant flow path during average tidal conditions (flood and ebb) is the current main channel past Marks Point; however flow through the Airforce and Coon Island channels is also significant. Reinstating the Airforce Channel would not necessarily assist navigability, but would involve significant changes to the recent estuary processes and sediment pathways. Detailed additional hydrodynamic and environmental studies would be essential.

• Construction of rock structures to prevent flow over the western shoals/western part of the drop over. WBM (2003) discounted this option because of its high cost, more complex study and approval requirements, higher environmental risks and largely irreversible impacts on channel form and function. The construction of a breakwater or training wall would alter the current amenity of the channel and shoal area. Alternative training walls, such as those constructed below the low tide level and employing softer engineering methods, have also been considered to direct the deeper tidal flows, whilst allowing some dispersive flows to the west. Such structures would likely result in a similar pattern of erosion and accretion to that estimated by WBM (2003) for a solid training wall, whilst preserving most of the existing amenity of the western shoaling areas and protecting water quality. It is expected that training wall structures would reduce the required width of the dredging between the Pelican Marina and Spoil Island.

• Removal of the sand islands. This option would require removal of very large volumes of sand, and major changes to the habitat and recreational values of the channel, with no identified benefits for the environment or navigation.

Overall, these three options were assessed by WBM 2003 as being cost prohibitive (very high capital costs or maintenance costs), and/or having high environmental risks. For instance, preventing tidal flows across the western shoal area was shown to increase the flushing time in the lake and therefore to have potential negative consequences for water quality, particularly in the southern parts of Lake Macquarie.

After the feasibility assessment, WBM (2003) recommended a three part channel management plan for community consideration. The recommended approach included:

1) Urgent dredging of the channel adjacent to the southern entrance to Swan Bay, to bypass the ‘dog-leg’. This work, which involved removing 120,000 m³ of sand, was completed in 2003 (prior to finalising the WBM report).

2) Various permutations for broad scale dredging of the main navigation channel in its current alignment. The aim of the dredging was to increase cross sectional area, to optimise flow rates, and therefore minimise sediment accumulation in the channel. WBM (2003) modelled channel widths of 60 m and 120 metres. They also considered a range of design depths, from 3 metres to 4.5 metres. The preferred dredged channel dimensions, to provide a cost effective balance between capital costs and maintenance costs were 100 to 120 metres channel width and 4 metres channel depth. WBM (2003) noted that a channel design with a width of 60 metres or more would be required for navigation.

3) Partial closure of the southern entrance of Swan Bay, to reduce the diversion of tidal flows into the bay, but retain flushing capacity. This was to be supported by some dredging in the main channel. Detailed design evaluations for partial closure of the southern entrance of Swan Bay were completed in 2004 and works to partially close the southern entrance to Swan Bay, to a width of 30 metres, have been completed. The works included the placement of dredge material in a reclamation type scheme supplemented with rock armouring to hold the sand in place and stabilise the southern entrance.

Since 2003 dredging has not achieved the optimal channel dimensions described in the second point above.
Further modelling has been undertaken since WBM undertook the channel specific hydrodynamic and sediment transport modelling in 2003 and 2004. WorleyParsons established a numerical model with the intention of accurately reproducing the tidal hydraulics and sediment transport processes within the lake and channel. Although the modelling was primarily focused on addressing lake flooding issues, the channel was modelled to gain an understanding of the existing processes and morphological change and the implications sea level rise may have on these processes (WorleyParsons 2010). The modelling study found that:

- The net export of sediment currently occurring will continue, with a net loss of sediment determined through survey comparisons. The scoured sediments are being deposited at either end of the channel (drop-over and entrance bar).
- The overall scour mode of the channel is a morphological response to training.
- Wave action within the entrance area is unlikely to be supplying sediment to the channel.
- Channel scour may accelerate with increases in water levels due to sea level rise.

To achieve a low maintenance navigation channel, the rate of erosion and accretion within the navigation channel should be minimised. This requires a combination of reduced downstream channel scour (the source of most of the sediment) and the concentration of most of the flood tidal flows into the navigation channel to maintain sufficient flow velocity to keep sediment entrained. In order to concentrate most of the tidal flows into the main navigation channel, the typical cross sectional area of the main navigation channel must be significantly larger than the alternative flow paths (i.e. Swan Bay and the western shoals).

The scouring mode of the channel and diffusion of flows towards the lake mean that:

- Dredging of the main channel is necessary to keep it defined as the primary channel with concentrated flows.
- Dredging may be complemented with additional works to assist in concentrating the flow and increasing the hydraulic resistance of alternative flow paths.

**Outcomes of Review**

Building on the previous work by WBM and WorleyParsons, three options were suggested for further consideration in the Swansea Channel Summary Paper (August 2012, available on the project web site).

Management Option 1 revisits the dredging strategy previously recommended by WBM (2003). Management Options 2 and 3 are based on reduction of diffusing flows across the western shoals.

Management Options 2 and 3 were established in the context that Swansea Channel is already highly modified, still adjusting to previous structural controls (entrance training walls and construction of Swansea Bridge) and that the current hydraulic efficiency is driving navigation issues rather than controlling them. Previously, WBM (2003) considered the construction of a rock training wall, but assessed it as a very high cost option, with significant potential environmental risks. Alternative indirect training methods, such as those constructed below the low tide level and employing softer engineering methods could potentially be used to assist with flow concentration, while having less impact on lake flushing or other environmental values.
These ‘softer’ options include some infilling of channels and additional works along the western edge of the main navigation channel that would assist in concentrating the tidal flows into the main navigation channel. These partial closure/half tide training options could potentially reduce the volume of dredging required in the main channel, as well as providing an area within the channel landscape for the dredged material to be placed for recreational benefit. To be sustainable, the design of any training structures would need to maintain flushing times, tidal range and water quality in the lake.

The half tide and other ‘soft’ training options have not previously been modelled and prior to detailed design, further detailed modelling would be required so that their actual impacts and benefits could be properly understood. Detailed environmental studies would also be required.

For these reasons, Management Options 2 and 3 are not included in the proposed Framework for maintaining navigability in Swansea Channel at this time. The Framework focuses on the optimum channel form, governance and management.

### 5.5 Sand Extraction for Channel Design Requirements

Sand moves through Swansea Channel in pulses. This means that depths in the channel can rapidly change. Design of the optimum channel form and selection of dredging plant needs to take this into account.

Swansea Channel has been adjusting to increased hydraulic efficiency for more than 120 years. The locus of channel scouring is slowly moving upstream. Whilst scour downstream of Swansea bridge now seems to be abating, scouring (i.e. channel deepening and widening) continues between Swansea Bridge and the southern entrance to Swan Bay. The area between the southern entrance to Swan Bay and the drop over has been the locus of deposition for several decades.

To increase the efficiency of sediment transport through the upstream section of the channel, channel form should be designed to alter the existing sediment dynamics and hence reduce the frequency of maintenance dredging. Experience to date suggests that small to medium scale maintenance dredging of the upstream sections of Swansea Channel, is not sufficient to shift the dynamics towards hydraulic efficiency; rather it allows depositional processes to continue unabated and the channel to infill soon after dredging. Although a large volume of sediment has been dredged from the Channel, WorleyParsons (2010) conclude that contemporary channel adjustment processes continue to be driven by the training walls and/or other sedimentary processes, not by sediment loss from the system.

Volumes of sand that now need to be removed from the inner channel areas to achieve different channel forms are shown in Table 5.3. Channel dimensions shown in the table are based on WBM (2003), and have been revised and updated on the basis of the following:

- The relationship between functional water depth (and vessel draught) and design dredge volume is shown in Table 5.3. The design channel depth of -3.5 metres AHD allows for most vessels (i.e. drawing up to 2.5 metres of water) plus a contingency to allow for maximum tidal range and variations due to weather systems such as pressure effects on water levels. It also provides a small contingency to extend likely return maintenance dredging intervals, by allowing for some sedimentation to occur before key sections of the channel may require to be dredged.

- Consultation with yacht owners in Lake Macquarie indicates that a functional water depth of approximately 2.5 metres (design channel bed at -3.5 metres AHD) would provide reliable navigability for approximately 97 per cent of yachts currently registered by Lake
Macquarie owners and used in the lake. Registration projections by RMS (2010) suggest that a functional water depth (or design vessel) of up to 2.5 metres would continue to dominate waterway use in the future.

The dredge volumes were determined by creating a digital elevation model (DEM) of the channel from most recent hydrographic survey data from RMS (May 2012). The bed level was lowered for the length of channel in question which gave the volumes to be removed for the various option permutations.

WBM 2003 noted that a channel width of 60 metres is considered the minimum to maintain a navigable channel; 120 metres was considered to be more efficient. A width of 100 metres was informally suggested by key stakeholders as a likely preferable width. However there was (and still is) no modelling to support this estimate; therefore it has not been assessed quantitatively. For this reason, although potentially a good design solution, this width was not been included in the original economic assessment, and could not be included in the current basic update (Appendix 3).

However, for the purposes of cost estimation, a linear interpolation of sand volumes and calculated dredging costs has been used for the intermediate channel width, as it provides the most realistic estimate of a workable solution for the government.

A designed channel form with a depth of -4.5 metres AHD was not considered for either of the width options as it is assumed that the coal seam at the channel entrance is the overarching limiting factor. It was also considered unnecessarily deep by WBM (2003), resulting in excessive over-dredging, which could have other undesirable affects on the channel and banks, and on tidal prism and tide levels in Lake Macquarie.

![Figure 5.2 – Calculation of Dredge Volumes](image_url)
Table 5.3: Proposed Channel Form - Dimensions and Volumes

<table>
<thead>
<tr>
<th>Option 1 dimensions</th>
<th>Calculated in situ dredge volume</th>
<th>Calculated volume of sand required to be dredged to achieve design (130%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 1a (60 m wide, bed at -3.0 m AHD)</td>
<td>22,100 m³</td>
<td>28,730 m³</td>
</tr>
<tr>
<td>Option 1b (60 m wide, bed at -3.5 m AHD)</td>
<td>48,100 m³</td>
<td>62,530 m³</td>
</tr>
<tr>
<td>Option 1c (60 m wide, bed at -4.0 m AHD)</td>
<td>90,727 m³</td>
<td>117,945 m³</td>
</tr>
<tr>
<td>Option 1d (120 m wide, bed at -3.0 m AHD)</td>
<td>138,000 m³</td>
<td>179,400 m³</td>
</tr>
<tr>
<td>Option 1e (120 m wide, bed at -3.5 m AHD)</td>
<td>221,100 m³</td>
<td>287,430 m³</td>
</tr>
<tr>
<td>Option 1f (120 m wide, bed at -4.0 m AHD)</td>
<td>324,337 m³</td>
<td>421,638 m³</td>
</tr>
</tbody>
</table>

Note: the Proposed Channel Forms identified in Table 5.3 are based on Management Option 1 (WBM, 2003)

One of the aims of dredging is to achieve rapid removal of substantial volumes of sand, at a rate exceeding the highest deposition rates during depositional pulses. Experience in the channel suggests that additional extraction between 20 per cent and 50 per cent is required to achieve the desired form. Given the large scale nature of the work and likely capabilities of most estuary dredges a factor of 130 per cent is used in estimates. In the first instance, based on mid 2012 hydro survey, this would require removal of:

- between approximately 28,000 and 120,000 m³ of sand for a 60 metre wide channel;
- between approximately 180,000 and 420,000 cubic metres of sand for a 120 metre wide channel, over a 12 to 18 month period; and
- a channel width of 100 metres was not modelled by WBM (2003); indicatively dredging a stable form to this width would require removal of between 91,000 m³ and 324,000 m³ of sand, for a depth at -4.0 metres AHD, or between 48,000 m³ and 221,000 m³ for a depth of -3.0 metres AHD. If adopted, this channel width should be modelled as part of the detailed design work for dredging.

Actual volumes should be regularly updated with the most recent channel hydrosurvey data before any dredging activity takes place.

To achieve timely removal of sediment, for the largest channel form option, this is equivalent to an average of approximately 1000 m³ per day. This is twice the average extraction rate that was achieved in the recent dredging campaigns.

Monitoring of sedimentary processes and channel morphology should be considered during dredging and over several years after dredging to confirm whether the system has changed the anticipated sedimentary trajectory. **Section 10.0** outlines monitoring processes, triggers for maintenance dredging and review processes for the overall dredging plan, if outcomes are not as projected.
5.5.1 Dredging Plant

Theoretically, once the major extraction program has been completed and the channel shifts into transport rather than deposition mode, ongoing maintenance could be conducted regularly with a smaller dredge or occasionally with a large dredge. Preferably, a dredge used in this follow up work should also be able to remove sand at a rate equivalent to the maximum deposition rate, but the amount of sand to be removed in any maintenance dredging campaign is expected to be between 20,000 and 70,000 cubic metres, depending on option outcomes.

Maintenance dredging would preferably be conducted in winter to minimise interference with recreational boating activity during dredging and to prepare a fully navigable channel for the spring and summer recreational and racing seasons.

A small dredge with limited capacity and/or only side casting sand disposal options, is not suitable as a stand-alone dredging option.

Several different types of dredging plant have previously been used, and have potential for, future maintenance dredging. In addition, other types of dredging plant have been proposed by interested stakeholders. For example, a small cutter suction dredge which would respond rapidly to small adjustments in the channel profile could be deployed to shift sand from shallow to deeper sections of the channel, to maintain an average profile.

Broadly, options include cutter suction dredges or barge mounted excavators (Table 5.4).

Table 5.4 – Examples of Suitable Types of Dredge

<table>
<thead>
<tr>
<th>Dredge Type</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barge mounted excavator and separate hopper barges. The 2009 work in Swansea Channel was carried out using a 20 tonne barge mounted excavator and two 75 tonne hopper barges.</td>
<td>This method achieved dredge rates averaging 450-500 cubic metres/day over 7 months.</td>
</tr>
<tr>
<td>Cutter suction dredge with pump line (one pump or booster pumps) to shoreline treatment and storage sites and/or beneficial use locations.</td>
<td>For the major dredging campaign, a dredge capable of excavating and pumping around 1000 m³ of sand a day is required. Dredges of this type are available from specialist dredging contractors and are regularly in use for maintaining navigation in commercial harbours. For future maintenance dredging, required dredge capacity is much less, provided that the dredge can remove the accumulated sand in less than three months (i.e. over a winter or early spring period)</td>
</tr>
</tbody>
</table>

Note that for both options additional booster pumps or other sand transport mechanisms may be needed if sand processing and stockpile sites are not on the immediate shoreline of the channel.

The economic costs in Appendix 3 consider the various types of plant that have been used and costed for previous works in the Channel.
6.0 Utilising Dredged Sand

The sandy sediments that are restricting navigability in Swansea Channel have a number of beneficial uses which can partly offset the cost of dredging. This section reviews potential uses of sand and the associated management requirements.

**Context and Outcomes**
- Dredged materials have potential social, environmental and economic benefits.
- Aim for beneficial uses that are cost neutral for government
- When dredging for navigation purposes takes place in estuarine waterways, the best net social, environmental and economic outcomes are likely to include both direct and indirect benefits.

6.1 Sand Sources, Processes and Beneficial Uses

The sand that is moving through Swansea Channel is derived from erosion of the former shoreline of Salts Bay and from widening and deepening of the main channel both east (seaward) and west (lakeward) of Swansea Bridge. The former shoreline, wetland and beach ridge deposits at Salts Bay were part of a pre-European landscape that had significant ecological and cultural values (such as mangrove, saltmarsh, dune forest, wader habitat and diverse resources for local Aboriginal people). Other parts of the channel that have historically been affected by scouring would always have been quite mobile.

In the modern land use context, the form of Swansea Channel contributes to its social and economic value and also to the environmental health of Lake Macquarie. The sand itself is a resource which could be used for a range of commercial and environmental applications. It should be noted that although not many of the options provide a direct financial return for dredging, many do provide social or environmental benefits.

Options for utilising or disposing of sand extracted from the channel are noted in Table 6.1. These options have been suggested by various stakeholders during consultation for this project. The table also shows the anticipated benefits and problems associated with each option.

All of these sand use sites have some potential, although some would use only a small or intermittent volume of sand and others have potential environmental impacts which would need careful management.

Uses such as stockpiling sand for beach and dune nourishment are generally positive, but the cost offsets are indirect and long term. Sale of sand for construction purposes provides a short term cost offset for dredging, but does not allow any future flexibility in beneficial uses.
## Table 6.1 – Evaluating Sand Utilisation Options

<table>
<thead>
<tr>
<th>Option</th>
<th>Benefits</th>
<th>Constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replenish shorelines in high usage reserves around the lake to maintain a safe and high amenity foreshore.</td>
<td>Provides a safe foreshore environment, covers rock, increases recreational amenity.</td>
<td>May smother near shore sea grass.</td>
</tr>
<tr>
<td>Replenish dune volume on the open coast – especially at vulnerable locations at Blacksmiths and Nine Mile – the sand would enhance the buffer for coastal erosion and recession. More difficult, but still a possibility is replenishment at other open coast locations such as Caves Beach surf club.</td>
<td>Medium to long term projections are for significant sand deficit as frontal dunes are reworked by coastal processes with sea level rise. Could help prevent washover through Cold Tea Creek and at Belmont Golf Course, or provide buffer in front of a sea well at the HWC wastewater treatment plant. Could protect recreational amenity at Blacksmiths. Limited alternative sources of sand for beach replenishment.</td>
<td>Cost of pumping or trucking sand from the channel to the beach (minimum distance is 1.6km). Confirm land tenure for storing sand on landward side of frontal dunes. Would benefit from use of a fixed pipe system and intermediate storage site, such as Crown land east of the Pacific Highway.</td>
</tr>
<tr>
<td>Replenish the shoreline at Salts Bay (outer channel) – provided the shoreline continues to be stabilised by groynes.</td>
<td>Restores an outer channel form approximating the pre European form.</td>
<td>Cost of pumping or trucking sand from the dredge site to Salts Bay. Booster pumps would be required if pumping, plus potential navigation issues.</td>
</tr>
<tr>
<td>Create a more recreation focused landscape around the navigation channel – potentially building up the sand islands, increasing shallow beach area, possibly including the western shoals and some nourishment at mouth of Swan Bay.</td>
<td>Increases the tourism and recreation value of the channel by increasing the area of sandy beach/shallow water available for picnics and family recreation. Existing sandy shoreline and shallow shoals are heavily utilised in summer. Easily marketed recreation landscape, bringing economic return for the Swansea-Belmont community.</td>
<td>If a half tide wall is required to stabilise emplaced sand, costs will be very high. Potential impacts on fishing areas and on sandy bed habitat across the western shoals (but these could be offset by other shallow fishery habitat areas). Previous modelling suggests that closing off or reducing flows across the western shoals may increase water residence time in the south of the lake, with potential impacts on local water quality. Requires detailed plan of management – linked also to additional habitat for important species, so that no conflicts arise.</td>
</tr>
<tr>
<td>Option</td>
<td>Benefits</td>
<td>Constraints</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Establish and replenish sand volume on the proposed tombolo at Matts</td>
<td>Protects parts of shoreline from erosion</td>
<td>Would need to include in estuary management plan and/or Channel Master Plan, plus prepare an approval.</td>
</tr>
<tr>
<td>Point.</td>
<td>Habitat for migratory shorebirds could be regionally significant, but would need careful management because of multiple potential disturbance factors.</td>
<td></td>
</tr>
<tr>
<td>Create new habitat for important species or improve existing habitat.</td>
<td>Management may provide employment for Aboriginal community members as rangers.</td>
<td>Detailed plan of management and community awareness raising required, to minimise disturbance risk. Could include seasonal fencing or recreation use exclusion.</td>
</tr>
<tr>
<td>Examples would include roosting, feeding and breeding sites for</td>
<td></td>
<td>Additional wader habitat may be at the cost of shallow aquatic habitat. Plan would need to maintain or enhance both.</td>
</tr>
<tr>
<td>Little Tern or other migratory shorebirds.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use sand to raise ground levels in reserves along the channel</td>
<td>Could be used to diversity foreshore reserve terrain (plus landscaping), and to raise foreshore reserve areas above flood levels.</td>
<td>Would need to be detailed site planning in Plan of Management and Masterplan.</td>
</tr>
<tr>
<td>foreshore, with landscaping to increase recreational amenity.</td>
<td>Link to plan for channel foreshore walking and cycling pathway, high profile children’s playground, cultural information displays etc., in reserves along the channel such as Pelican Foreshore reserve and Coon Island area.</td>
<td>Not appropriate where there is existing high value habitat in the foreshore reserve. May require cultural heritage studies.</td>
</tr>
<tr>
<td>Sell sand as clean fill for construction sites.</td>
<td>Market value is around $4/tonne of sand depending on demand, so sale of sand for fill would recoup some of the cost of dredging.</td>
<td>Storage site required. Road access to the storage site, so that sand can be moved to local markets without increasing heavy truck movements on suburban streets. Road access through the Mirvac owned (former) Pelican airport site would achieve these objectives.</td>
</tr>
<tr>
<td>Sell sand for concrete manufacture.</td>
<td>Market value of sand suitable for concrete manufacture is around $17/tonne, so sale of sand would recoup part of the channel maintenance cost. However, sand from Swansea channel would need to be washed and dried to meet quality requirements.</td>
<td>Would benefit from use of a fixed pipe system and intermediate storage site, such as Crown land east of the Pacific Highway.</td>
</tr>
<tr>
<td>Place sand in deep parts of the lake bed.</td>
<td>Low cost option, particularly for deep water close to the drop over.</td>
<td>Extraction rate will be variable from year to year, so contracts to supply sand must be designed to take this into account.</td>
</tr>
<tr>
<td>This is a step beyond what happens now as sand is transported over</td>
<td>Long term storage site, from which sand could later be extracted if needed.</td>
<td>As above.</td>
</tr>
<tr>
<td>the drop over.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6.1 – Evaluating Sand Utilisation Options (cont)
6.2 Stockpiling and Treatment Sites if Sand is Sold or Used at Replenishment Sites

Sale of dredged sand for either clean fill or for concrete manufacture (and potentially for dune nourishment) requires a site where dredged material can be dried, washed and graded, depending on the specific end use. Sand may also be stockpiled at this site, for months or longer, depending on market conditions.

Similarly, sand which will be used for beach or lake shore replenishment may need to be stockpiled subject to other planning processes.

Sites which are used for processing and/or stockpiling of sand should preferably have the following characteristics:

- Close to the extraction area, to minimise pumping costs or double handling. For instance, sites east of the Pacific Highway would be accessed by pumping sand in pipes through culverts under the Pacific Highway, with booster pumps required.

- Have minimal constraints (noise, traffic) from neighbouring land uses, mainly residential.

- The site(s) should be available for at least ten years (equivalent to the contract period for the dredge) and longer term options are preferable. Maintaining navigability for deep draught vessels in Swansea Channel is expected to be an ongoing long term activity.

- Sites should not have high value ecological habitat or cultural values. In general, this means sites that are already cleared or have been subject to considerable previous disturbance. The former Aeropelican site (now Mirvac land) and Crown land east of the Pacific Highway (former dump site) would meet this requirement. The entire undisturbed parts of the coastal landscape (frontal dunes and back barrier areas to Swansea Channel) have high cultural heritage values, mapped as part of the Lake Macquarie LEP.

- Sites should be large enough for stockpiles of more than 100,000 cubic metres of sand and for equipment to move around the stockpiles. Sites should also have the capacity for installation of necessary environmental controls.

- For sand sales, stockpile sites should preferably have direct, safe vehicle access onto the Pacific Highway. In addition, a straightforward route for pumping sand from the dredge area to the treatment/stockpile site would be beneficial. Agreements may be required with land owners to gain access for pipeline installation, intermediate pumps and/or intermediate transfer or staging sites.
7.0 Comprehensive and Responsive Approval Processes

One of the constraints to efficient management of navigability to date has been a cumbersome approval process, with separate one-off approvals for each dredging event. This section considers options for streamlining the approval process, providing certainty, but also allowing for flexibility.

**Sustainable Outcome**

A strategic assessment so that the management framework can be given long term statutory effect – i.e. it is facilitated by a wide ranging approval/consent and/or it is empowered by a statutory management plan. A statutory management plan would be reviewed at regular intervals.

7.1 Approval Considerations

Key considerations of this component of the framework include:

- The NSW Planning system is currently under review with a green paper released in July 2012 which identifies replacement of State Environmental Planning Policies (SEPPs) with a more streamlined strategic planning process.

- Under the existing SEPP Infrastructure, maintenance dredging on behalf of a public authority may be carried out for specific purposes without consent on zoned or un-zoned land. **Section 7.1.1** provides further detail about how maintenance dredging for recreational waterways can be accommodated under the SEPP Infrastructure.

  The SEPP applies to LMCC, RMS, Crown Lands or persons on their behalf completing works such as dredging, subject to the preparation of an environmental review under Part 5 of the Environmental Planning and Assessment Act, 1979 (EP&A Act). The requirement for a Part 5 review is satisfied through completion of a Review of Environmental Factors (REF) in accordance with Clause 228 of the Environmental Planning and Assessment Regulation.

- Should it be determined through the REF process that an activity will significantly affect the environment, the determining authority is not able to carry out the activity unless it has first obtained and examined an EIS in relation to the proposed activity (Sec 112)

- The scope of the REF or EIS should include all potential dredging and disposal options that may be implemented over a specified period. In this way, separate subsequent approvals may be avoided.

- The Part 5 approval process allows for an ongoing adaptive approach to resource management. The REF or EIS would act as a strategic approval document which defines the nature of the proposed activity (a major dredging campaign and subsequent smaller maintenance activities) and establishes the environmental baseline to be maintained as a result of the general activity being carried out.
The approval would require the preparation of a detailed management plan which sets up how the activity will be monitored to ensure the objects of the EP&A Act are maintained. The plan would identify specific environmental constraints that should be checked before subsequent dredging programs, to ensure that no important environmental values have changed. The presence of sea grass or migratory shorebird habitat would be examples. Further information about monitoring is in Section 9.0. The management plan would also be approved by the Determining Authority.

In the case that Crown Lands entered into a licence arrangement over the lake bed with a private dredging and sand supply contractor, for the purposes of sand extraction, a Part 4 approval under the EP&A Act would be required (or alternative consent process when the review of the EP&A Act has been completed).

The structure of the approval process under Part V of the EP&A Act for proposed dredging in the Swansea channel is summarised in Figure 7.1.

7.1.1 Background on Statutory Requirements

Planning and development in NSW is managed principally under the following mechanisms:

- the NSW Environmental Planning and Assessment Act (EP&A) 1979;
- the NSW Environmental Planning and Assessment Regulation 2000;
- NSW Environmental Planning Instruments (EPIs), i.e. Local Environment Plans (LEPs) and State Environmental Planning Policies (SEPPs); and
- The Commonwealth Environmental Protection and Biodiversity Conservation (EPBC) Act, if there is a relevant trigger.

7.1.1.1 SEPP Infrastructure

Division 13 of the SEPP relates to port, wharf or boating facilities. This Division allows a public authority to undertake dredging works on any land (whether zoned or unzoned), without development consent. In particular, Clause 68 (4) states:

Development for the purpose of wharf or boating facilities may be carried out by or on behalf of a public authority without consent on any land. However, such development may be carried out on land reserved under the National Parks and Wildlife Act 1974 only if the development is authorised by or under that Act.

Furthermore, Clause 68(5) state:

In this clause, a reference to development for the purposes of port facilities, navigation facilities, wharf or boating facilities or associated public transport facilities for a public ferry wharf includes a reference to the operation of such a facility and to development for any of the following purposes if the development is in connection with such facilities:

(a) construction works (including dredging) and land reclamation, if it is required for the construction of facilities

(b) routine maintenance works including dredging, or bed profile levelling of existing navigation channels, if it is for safety reasons or in connection with existing facilities
‘Facilities’ is defined to include (amongst other things) in Clause 67:

- facilities for the embarkation or disembarkation of passengers onto or from any vessels, including public ferry wharves,
- refuelling, launching, berthing, mooring, storage or maintenance facilities for any vessel.
- sea walls and training walls

The dredging for recreational and some commercial navigation in Swansea Channel is routine maintenance works for existing navigation channels, for safety reasons and to provide ongoing access (for any vessel) to refuelling, berthing, mooring, storage or maintenance facilities (both private and commercial) within Lake Macquarie. Lake Macquarie and Swansea Channel both meet definitions of navigable waterways/navigation channels.

Clause 69 (3) allows dredging (other than dredging referred to in Clause 68) with consent, by any person on any land.

**Maintenance dredging for the purpose of maintaining access to boating facilities is permitted without consent by a public authority on any land, or on unzoned land, where it is for safety reasons or in connection with existing facilities (including moorings, refuelling etc).**

### 7.1.1.2 Planning Reforms

In July 2012, the Department of Planning and Infrastructure released “A New Planning System for NSW - Green Paper” and set about extensive community consultation on the major proposed reforms.

A White Paper, was released for public comment on 16 April 2013. The White Paper sets out the details on how the new planning system will be implemented and includes accompanying draft legislation and responds to issues raised from initial community feedback.

It is not clear as yet exactly how the potential changes will affect the statutory requirements and approvals for maintenance dredging. The planning review documents focus on strategic planning reforms (Part 3 of the EP&A Act) and streamlining development assessment under Part 4 of the EP&A Act.

The information provided below is based on the pre-reform statutory requirements and should be reviewed as the structure and detail of the new planning system take shape.

### 7.1.2 Scope of Approval

The aim of the approval process is to provide for flexibility in management of sedimentary dynamics and navigability in Swansea Channel. The approval process must therefore consider the full scope of potential activities involved in maintaining an agreed level of navigability.
Defining the ‘Activity’ to be Assessed

The activity to be assessed in the approval process will include the following components:

- The purpose of the dredging activity, its scope and location and the dredging methodology.

- Dredge type and dredge establishment, including ongoing mooring if the dredge is kept in Lake Macquarie. Note that to achieve both efficient dredging to deliver the optimum channel form and ongoing maintenance of channel form, two different dredges may be required.

- The full range of maintenance dredging options, in terms of volume and location of sand extraction. This should include a major upfront sand extraction campaign, to achieve an agreed channel design, and ongoing smaller channel maintenance dredging.

- Sand treatment and storage options and sites.

- Sand transport mechanisms – for instance, pumping through pipes to sites adjacent to the channel or to sites east of the Pacific Highway (involving piping sand through culverts under the highway), and transport of sand away from the extraction area by truck. Sand that is sold for clean fill or concrete applications will be transported by truck.

- Sand placement options, for sand that is used for environmental or amenity purposes within the lake system or on the open coast. Flexibility of management means that multiple sand placement options will be considered. Different sand placement options will be most appropriate at different times.

- Channel condition monitoring processes and reporting and evaluation of monitoring results. This will be linked to triggers for initiating new dredging works as discussed in Section 9.0.

The activity to be assessed in the approval process does not include other consequent activities such as increased recreational use of sand shoals in the channel, increased marina berth space or increased take up of moorings within the lake Macquarie Mooring Management Plan or other locations. Where any of these activities require development consent, it will be separate to the approval governing navigation dredging in Swansea Channel.

Other Matters to be Addressed in the Approval

The approval must meet all requirements of Part 5 of the EP&A Act and comply with local government conditions and planning requirements, including zoning, special environmental protection or heritage clauses and other matters.

If the proposed activity - dredging and sand placement, is expected to impact on the habitat of species that are protected by Commonwealth legislation (EPBC Act), then additional referral and assessment to address the Commonwealth requirements would be required. This could possibly arise in relation to habitat for migratory shorebirds, but is unlikely.

Licences and Permits

Due to the potential scale of the dredging activity an Environment Protection Licence may be required.
A Fisheries Permit is required if sea grass or mangrove will be impacted by the dredging activity.

If the management of dredged material is likely to impact on Aboriginal sites or Places, a Heritage Impact Permit under the National Parks and Wildlife Act would be required. This process involves extensive and formal consultation with Aboriginal stakeholders.

A Crown Lands licence may be required by the proponent (if not Crown Lands).

### 7.1.3 Management Plans to Provide Flexibility but Robust Performance Requirements and Compliance

An approval under Part 5 of the EP&A Act provides the performance controls for dredging and beneficial uses of the sand that require use/placement on land or waters.

The project also requires a detailed Environmental Management Plan which sets out the detail of how compliance with performance standards will be achieved and how monitoring and reporting of progress will be done. The Environmental Management Plan would also set out triggers for dredging activity, decision making processes for selecting one or more sand use/disposal options and communication processes in relation to these changes. It would identify communication requirements for each step of the dredging program.

Although other aspects of governance at Gippsland Lakes in Victoria are different to Lake Macquarie, the Gippsland Ports Initiative project does provide a model for how the operational (and adaptive) management plan can be integrated with the dredging approval and community engagement activities. See Section 12.3.1 for more details about the components of navigability management in the Gippsland Lakes.
The activity of dredging can be carried by or on the behalf of a Public Authority without the need for EP&A Act 1979 Part 4 approval pursuant to the Infrastructure SEPP. EP&A Part 5 Approval process is therefore applicable.

Public Authorities subject to Part 5 are required to prepare a REF document to ensure all matters likely to affect the environment have been appropriately considered.

Preparation of an REF to be approved by determining authority (Public Authority) whom will have a strong/ embedded relationship with the ‘management entity’ created for managing the environment.

If REF determines activity will significantly affect environment then an EIS may be required.

REF likely to include:
- Activity Description including description of stages of the project
- Profile of the Existing Environment
- Legislative requirements
- Environmental Impact Assessment
  - Hydrodynamics and Sediment processes
  - Landforms
  - Water quality
  - Ecology
  - Noise
  - Visual
  - Safety and Navigation
  - Heritage
- Mitigation and Management Mechanisms

REF will strategically describe the concept of the proposed dredging work, including provision of concepts for channel training works and sand disposal locations. Document to focus on establishing the process for managing the activities impacts and will focus on the maximum project.

Monitoring strategy developed to ensure adherence to environmental standards

Biophysical bottom lines established upon which the activity of the project will be managed.

Management plan created as a requirement of the REF to be reviewed (time period TBC) by management entity to ensure monitoring strategy is being adhered to. Management Plan to be targeted at contractor to ensure activities are consistent with the concepts presented in the REF and ensure adherence to the biophysical bottom line. (Environmental Specification for contractor)

Figure 7.1 – Summary of the Approval Process
8.0 Dredging Services and Contractual Arrangements

This section examines a range of options for accessing a dredge(s) suitable for delivering the proposed design outcomes for Swansea Channel. Dredge services and contractual arrangements are a separate governance issue to both the selection of an appropriate management entity and to the question of how the dredging would be funded.

A related issue is the size and dredging/pumping capacity of any dredge used to improve navigation, so that the work can be completed efficiently.

8.1 Guidelines and Criteria for Contractual Arrangements

The objective of the NSW Government Procurement Policy provides guidance in considering the merits of obtaining dredging services:

To ensure that government procurement activities achieve best value for money in supporting the delivery of government services.

Mandatory business case and gateway reviews are required for complex, high risk and innovative procurements, including any procurement with a value of $10 million or more. A long term contract for maintaining a navigable waterway in Swansea Channel may involve several million dollars, but is unlikely to exceed $10 million.

The following criteria should guide the contract arrangements if sustainable management of navigation dredging is to be achieved:

- Contractual arrangements must provide for timely and responsive dredging activity.
- Contractual arrangements must be cost effective, and include consideration of dredge relocation and other costs.
- Contractual arrangements must provide for well trained and experienced dredge operators, for safe and efficient operation.
- Arrangements must also comply with state and local government policies about asset purchase and management.
- Contractual arrangements must provide for flexibility in sand use or disposal.
- The size and dredging/pumping capacity of any dredge used to improve navigation, must be consistent with the local hydrodynamic conditions so that the work can be completed efficiently.
- Contractual arrangements must be able to accommodate an upfront major campaign (large dredge, powerful pump) and ongoing maintenance.

8.2 Research and Analysis – Dredge Ownership Models

This section provides additional background about the potential benefits and constraints associated with dredging options which have been promoted by a number of stakeholders.
8.2.1 State Government Ownership of a Dredge

Prior to the 2011 NSW government election, the then NSW government called tenders for the purchase of a dredge. Subsequent to the elections it was determined not to proceed and for government to continue with the existing method of procuring dredging services from the private sector.

A State-operated dredge fleet was disbanded in the 1970's for a number of reasons, including the demise of coastal shipping from the State’s minor ports. In the 1970's and 1980’s the rapidly growing recreational boating community surpassed the commercial fishing industry as the most significant user of the State’s waterways. It is considered that State government ownership of a dredge does not represent good value for public money as the private sector is much better positioned to provide on-demand dredging services to suit the navigation requirements of the recreational boating community.

Notwithstanding the government’s position, there have been requests from some stakeholders to explore dredge ownership as an option for Swansea Channel.

8.2.2 Wyong Council’s Dredge

Wyong Shire Council purchased a dredge, barge and pumping equipment for use in The Entrance of Tuggerah Lakes in the early 1990s. The dredge is used for approximately three months every two years to dredge sand from the entrance to Tuggerah Lakes. Sand is placed either in the entrance channel foreshore or on The North Entrance Beach. Council also owns and operates a wrack harvester in Tuggerah Lakes. Council employs three staff to operate this equipment, all with appropriate Marine Master licences.

WSC has been approached previously by other coastal councils in the region to provide advice on dredging issues and has also considered submitting a tender for dredging works in estuaries in other council areas such as Lake Macquarie, Great Lakes (Myall River entrance) and Gosford (Ettalong area).

WSC has advised that it would be interested in opportunities to make use of its dredge in other waterways, to offset costs and make more effective use of the asset. There are several factors that have previously constrained opportunities for use of this dredge in other waterways. These include:

- The WSC dredge is approved (‘in survey’) specifically for use in the entrance to Tuggerah Lakes. These waters are shallow and protected, unlike the more open, higher velocity and more wave exposed waters in Lake Macquarie, Ettalong and Great Lakes/Port Stephens. The dredge would need to be modified to meet survey requirements for these waterways. Whilst changes could be made to meet different specifications, it would require additional investment in the dredge and preparation time, which is not always practical.

- The current specifications for the dredge allow it to excavate sand to a maximum depth of two metres below the waterline. The dredge would need to be modified to make it suitable for use for deeper water dredging in Swansea Channel.

- To relocate the dredge from Tuggerah Lakes to Lake Macquarie, it must be dismantled, lifted by crane onto trucks, transported, reassembled and made safe and functional. The estimated cost for moving the dredge and returning it to Tuggerah Lakes after a dredging program is in the order of $200,000 (estimate provided by WSC staff). This cost is considerably higher in comparison to private sector dredges of similar sizes.
• There are additional employee costs in operating the dredge outside of Wyong Shire, depending on the structure of the contract.

8.2.3 Joint Ownership Between Regional Coastal Councils

The benefits of joint ownership include shared capital, operating and maintenance costs and risks. However, there are several practical difficulties/complexities associated with this, including:

• The dredge would need to be in survey to meet the needs of the highest risk waterways. This may increase costs for some Councils.

• Most councils conducting navigation dredging have seasonal time constraints. All Councils are looking for safe and accessible navigation and recreational waters for the summer season, to maximise tourism and recreation benefits. Other seasonal time constraints are associated with habitat protection for migratory shorebirds or protected fish species, or fishery seasons. These shared constraints could create scheduling conflicts, although it should also be possible to manage dredging operations so that not all estuaries require maintenance dredging works each year.

• There is an issue about who would employ the dredge operators. Dredge operators require specialist skills and certificates which need to be maintained. It is not practical or cost effective for each regional Council to have suitably trained staff. There would also be risks associated with regular changes of operational staff from one estuary to another. One option in this instance would be for dredge operators to be employed by Crown Lands or RMS, provided suitable contractual arrangements could be made between the regional councils group and the relevant state agency.

8.2.4 Local Privately-Owned Dredge

There have been suggestions by a small number of local marine related business operators to procure and operate a dredge. While such a suggestion and the availability of a local dredge has merit, currently under NSW procurement guidelines the owners of the dredge would need to compete alongside other dredging contractors through an open tender process.

All dredging carried out in Lake Macquarie to date has utilised privately owned dredges, under contract to the NSW Government and/or the Office of Lake Macquarie and Catchment Coordinator.

Private contractors are also used for maintenance dredging of other estuarine entrances in NSW, with few specific exceptions.

In the local case, previous dredging works have been criticised by waterway users for not being responsive enough and for not achieving the preferred channel design (as set out in WBM 2003), so that the channel has rapidly lost any gains in navigability. As a result, there is a strong community view, expressed by many stakeholder groups that the private contract dredging is not cost effective and/or cannot deliver the required navigability outcomes.

It is important to note the reasons for the limited performance of some contract dredging activities. These include:

• The work has always been conducted as a one off activity, with contracts let only for the specific immediate dredging issue. Contracts are usually initiated only after multiple community complaints or incidents associated with limited or unreliable water depth for
navigation. In this context, waterway users are already dissatisfied before dredging commences.

- Budget limitations have meant that contracts have been let for maintenance dredging of limited quantities of sand. These contracts were not intended to achieve the channel design recommended by WBM (2003).

- Delays in commencement of contract dredging activities have also been related to “one off” approvals rather than an overarching Part 5 approval which provides for several channel dredging campaigns, and/or lack of a dedicated funding arrangement and/or lack of predetermined beneficial use or disposal options for the sand.

### 8.2.5 Community-Owned Dredge

Dredging in parts of the Manning River estuary has been carried out by a dredge owned by the local community. An old dredge was purchased and restored by a local community group. The dredge operates under contract to Greater Taree City Council with funding provided by the community and by State and local government. To date, the dredge has been used for small scale dredging projects only within the Manning River estuary.

The scale of dredging required to maintain navigability in Swansea Channel is much larger than the projects for which the Manning River community owned dredge is designed. However, to make a community owned dredge feasible as part of the navigation dredging solution for Lake Macquarie, the following are likely to be required:

- Investment of an order of magnitude higher than the community owned dredge in the Manning. A dredge for Swansea Channel must be able to operate in deep water and fast currents.

- Appropriately trained and skilled operators.

- Contributions from beneficiaries, including the yachting community, Chambers of Commerce, tourism businesses and Council. Contributions would need to be sufficient to cover capital and maintenance costs. These funds could be raised by agreed direct contributions, or from a levy on waterway users (e.g. see Section 11.0).

- Contributors would need to be part of a formal entity which can enter contracts with council or NSW government.

While these requirements are possible to achieve, they introduce significant organisational and economic risks to long term dredge function. Furthermore, currently under NSW procurement guidelines the owners of the dredge would need to compete alongside other dredging contractors through an open tender process.

### 8.3 Contractual Arrangements for Private Sector Dredges

Factors to consider in developing a contract with a private dredging contractor include the following. Many of these issues have been raised by community stakeholders in previous correspondence (e.g. Boat Owners Association, June 2011) and in meetings during this project.

**Continuity of Contract**

- Contractors could be invited to tender for long term dredging of the channel, including the initial larger volume of sand and ongoing maintenance. To provide certainty and
continuity of process, the contract should extend for at least ten years. This would allow for initial major dredging and at least three maintenance projects: sufficient to evaluate the contract and channel management process.

An alternative is to separate the initial contract, which will likely require a large dredge, from the ongoing maintenance contract, which could be carried out with a smaller dredge. In this case, the maintenance contract should still extend for at least 10 years.

**Approvals and Licences**

- Currently under NSW planning provision i.e. SEPP Infrastructure and Part 5 of the EP&A Act, the Approval for maintenance dredging would be held by a public authority, not by the contractor. In addition, the public authority would be responsible for addressing any requirements for permits under the *Fisheries Management Act* and the *National Parks and Wildlife Act*. Compliance requirements for these permits/consents would be specified in a management plan.

- The contractor would be required to comply with the conditions of a management plan, linked to the Part 5 Approval. The management plan would specify environmental controls and outcomes to be achieved, to protect the environmental values of the channel. As an aquatic activity, water quality and ecological requirements (such as impacts on sea grass beds) will be most important, but other likely standards and limits would relate to noise, access and safety issues, amongst others. The contractor would be required to conduct relevant monitoring to demonstrate compliance and report to the management entity.

- The Management Plan would specify the channel form to be achieved, in terms of dimensions. The plan and the contract would also specify the time over which dredging to achieve the required channel form can take place and would limit the volume of sand to be removed.

- The contractor would be required to hold the relevant Environment Protection Licence(s) and would be responsible for operational compliance under this Licence. Licence requirements would depend on whether the dredge contractor also operates a sand processing and stockpiling site, and the nature of processing. The EPL would be expected to set water quality standards and protection measures.

**Income from Sale of Sand**

There are several feasible beneficial uses for sand extracted from Swansea Channel during navigation dredging. Sale of sand for fill/construction purposes is one use, which can help to recoup the cost of dredging. **Section 11.0** sets out economic analysis of income and costs of dredging, including with sale of sand. It is unlikely that sale of sand will recoup the cost of dredging i.e. cost neutral.

Other environmental enhancement uses for the sand will be valuable from time to time. There is potential that both the demand for sand for fill and the demand for sand for environmental purposes will increase over time, as projected sea level rise and climate change impacts begin to take effect on the open coast and around the estuary shoreline. These demands will be both from the private sector (to raise land levels on low lying foreshore property) and from the public sector (for open coast dune enhancement, creation of recreation areas and enhancement of habitat for species such as migratory shorebirds). These environmental and community benefits are more difficult to quantify than direct sale of sand.
In this context, it may not be appropriate to enter long term contracts with the dredge operator allowing sale of all sand. Several options to balance different types of demand and cost recovery can be considered, including:

- Sale of all sand from the first major dredging program, for construction or clean fill; with subsequent smaller volumes of sand from maintenance dredging used for environmental and recreational enhancement.

- Part or all of the sand from the initial major dredging program could be stored for later environmental protection works, locally and potentially regionally. LMCC expects to need large volumes of sand for dune enhancement in coming decades, to protect ecological communities and infrastructure behind Nine Mile Beach from coastal recession. Sand can be stored at the landward side of the frontal dune system (on Council or Crown land). If Council or other Nine Mile Beach stakeholders receives this benefit from sand, they could be expected to contribute to the cost of sand extraction; otherwise the offset value of using the sand is lost.

- Contractors could be paid an annual maintenance fee (by state and/or local government, or by a community consortium), based on a long term average sedimentation rate in the critical area, linked to channel design criteria and the trigger depth. In this situation, in some years less dredging would be required and in others more dredging than the value of the annual fee would be required. Adjustments to fees would likely be required as monitoring reveals actual sedimentation rates after the proposed major dredging program.

- Payment to contractors could be based on the volume of sand extracted, or for maintaining a specific channel form/design, or a hybrid of these (e.g. channel design, but with total volume of sand limited, or total payment limited).

- If contractors are paid by the government, then the government would receive funds from sale of sand, in addition to capacity to use some sand for environmental and/or community purposes.

- If contractors depend on sale of sand to achieve income from dredging, the government may consider waiving royalties on the sale of sand, to make the cost structure more attractive. In this case, foregoing royalties would be equivalent to a government financial contribution to maintaining navigability in Swansea Channel.

---

**Appropriate and feasible dredging contracts**

*The appropriate and feasible immediate options for the priority upfront dredging campaign all involve a private dredging contractor entering a contract with state (NSW Crown Lands or RMS) or local government (LMCC).*

*In the longer term, for smaller scale and more opportunistic and responsive maintenance dredging, other contractual arrangements are feasible.*
9.0 Adaptive Management Process

Adaptive management is a process of continuous review and improvement, to ensure that management responses are properly tailored to meet the challenges of changing environmental, social and economic circumstances and to allow for uncertainty associated with the management of complex or dynamic systems. The basic adaptive management cycle is illustrated in Figure 9.1.

**Context and objectives**

- Swansea Channel is a very dynamic sedimentary environment; usage, policy and program contexts are also dynamic
- Channel management must focus on ongoing recreational use and environmental performance objectives
- Channel management needs to include monitoring of change, have clear triggers for action and be responsive if unexpected or undesirable outcomes happen inadvertently
- Dredging plans and plant must be appropriate for the variable rate of sediment transport
- Establish at the outset an evaluation and review program for the framework as a whole.

![Figure 9.1 – Adaptive Management to Maintain Navigation](image-url)
9.1 Performance Targets for Channel Management

Successful and sustainable management of the navigability of Swansea Channel will be demonstrated by the extent to which channel form, use and cost benefit align with key management targets. These targets will be set out in the planning approval and aligned with the management plan. Targets may also be included in the Environment Protection Licence held by the dredging contractor.

Potential performance targets for navigation dredging could include:

- **Channel Form**
  - Design bed level is -3.5 metres AHD, to provide a reliable functional water depth allowing for passage of vessels drawing up to 2.5 metres (i.e. most vessels).
  - WBM (2003) noted that a channel width of 60 metres is the minimum required to maintain a navigable channel. The hydrodynamically optimal channel design width would need to be determined by further modelling but is assumed to be between approximately 80 metres to 100 metres (at the surface), with a stable trapezoidal form (as per Figure 5.2).
  - The channel width is maintained at not less than 50 metres at bed level, with a design target of 60 metres or wider (i.e. 80 to 100 metres if confirmed by modelling and defined in the management plan).
  - Dredged bed level of channel is not deeper than -4.0 metres AHD.
  - Channel bed level is not shallower than -2.5 metres AHD from October to April each year.

- **Compliance**
  - The dredging operations comply with all approval and licence conditions for 100 per cent of the time.

- **Engagement and Communication**
  - The management entity provides information about dredging activities and outcomes that is accessible to waterway users.
  - Information provided is the most up to date available.
  - A management liaison committee with stakeholder representatives meets prior to each dredging campaign and after each dredging campaign (as a minimum).

9.2 Triggers to Activate Maintenance Dredging

The options in Table 9.1 assume that the planning, approval and contractual arrangements are already set up under the Framework. It also assumes a preferred bed level of -3.5 metres AHD, however these will be revised if another option is adopted. An alternative to these functional navigation triggers is to require the maintenance dredge to be available for works in the channel at specified intervals – for instance every two or three years. This time based contract will be based on evidence of rates of sediment infill after the major dredging campaign has been completed.
Outcomes

- Ongoing maintenance dredging processes are linked to specific channel depths, which trigger the commencement of planning for on ground works.
- These triggers are included in the approved management plan for the channel
- Triggers are included in contracts for ongoing maintenance dredging

### Table 9.1 – Options for Dredging Works Triggers

<table>
<thead>
<tr>
<th>Planning trigger</th>
<th>Options (examples), with a design channel floor at -3.5 m AHD, after the initial major dredging program</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Bed level at -2.8 m AHD at any point along the channel:</td>
<td>- Notify dredging contractor, so establishment processes can commence (if necessary).</td>
</tr>
<tr>
<td></td>
<td>- Confirm any environmental constraints and any additional design requirements.</td>
</tr>
<tr>
<td></td>
<td>- Confirm where sand will be placed/disposed of for this work.</td>
</tr>
<tr>
<td></td>
<td>- Confirm volume of sand to be extracted.</td>
</tr>
<tr>
<td>2. Bed level at -2.8 m AHD at specified locations (e.g. at the “dog leg”).</td>
<td></td>
</tr>
<tr>
<td>3. Bed level at -2.8 m AHD over a specified length of channel (e.g. 100 m of marked navigation channel).</td>
<td></td>
</tr>
</tbody>
</table>

This bed level is suggested as the trigger to commence new maintenance dredging because of the potential for sudden pulses of sediment to move into the depositional area, quickly taking navigability from marginally acceptable to unacceptable or dangerous. Experience in the channel shows that the shoaling process accelerates once sand build-up develops in specific locations.

If the depth trigger is linked to a specified length of channel, rather than any specific location within the channel, the trigger should slightly extend the period between dredging events. This assumes that keeled vessels passing through the channel can manage to pass through localised spots of shallowing channel, but cannot pass through an extended distance of shallowed channel because of the drag on the keel.

### 9.3 Monitoring, Reporting and Review Strategy

The best solution now will not necessarily be the best solution in the future, so the strategy must be flexible and adaptive. The best solution envisages change and outlines how change will be accommodated. It will be based on sound information about management outcomes and trends, relative to objectives and anticipated processes, costs and benefits.

Channel maintenance dredging should be conducted within a management plan linked to the planning approval. The management plan may set out implementation requirements from the planning approval, including:

- channel form and design criteria;
- environmental protection matters and responsibility, to ensure compliance with all relevant environmental legislation, permits and licences;
- emergency measures and responsibility;
ongoing environmental, technical and usage monitoring requirements;

reporting and accessibility of monitoring information;

program review triggers and default timeframes;

maintenance responses; and

consultation processes (as set by the managing entity and its stakeholder and waterway user involvement processes).

### 9.3.1 Monitoring

Table 9.2 identifies a range of monitoring activities relevant to tracking the success and sustainability of management and these may be considered for inclusion in the management plan.

<table>
<thead>
<tr>
<th>Options</th>
<th>Indicative timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitor channel usage, by type of vessel and areas used; home port of vessels passing through the channel; channel usage relative to rates of boat ownership in the local area and region.</td>
<td>Ongoing, cumulated monthly and annually.</td>
</tr>
<tr>
<td>For vessels using the channel for ocean access, monitor period out of the lake and conversely, for visitors, time spent in the lake (e.g. are they day sailors or cruising visitors for several weeks at a time). For instance, collect data at the time of booking a bridge opening, e.g. name of vessel, type, LOA. Data could be collected by Marine Rescue.</td>
<td>Ongoing, as needed.</td>
</tr>
<tr>
<td>Monitor use of channel foreshore reserves (by whom and how accessed).</td>
<td>Sample surveys in peak use periods.</td>
</tr>
<tr>
<td>Monitor ongoing sedimentation rates and rates of sand extraction. Note potential to use GPS, LiDAR, sonar and other tools for accurate records of sedimentary processes.</td>
<td>Monitor extraction rates during dredging events.</td>
</tr>
<tr>
<td>Monitor channel condition – bank condition and bed morphology, including hydrographic survey. Hydrographic survey is currently conducted quarterly.</td>
<td>Bank condition, annual survey. Hydrosurvey – initially monitor quarterly, but could be reduced to annually depending on performance of the channel in first year after dredging. Note current surveys are conducted at intervals of four to six months.</td>
</tr>
<tr>
<td>Monitor investment in dredging and other aspects of navigation and channel maintenance.</td>
<td>Annual.</td>
</tr>
<tr>
<td>Monitor investment in local marinas and occupation rates of swing moorings and marina berths.</td>
<td>Annual.</td>
</tr>
</tbody>
</table>
Table 9.3 – Monitoring Channel Form, Condition and Use (cont.)

<table>
<thead>
<tr>
<th>Options</th>
<th>Indicative timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collect data on expenditure by visiting sailors in local clubs, restaurants etc.</td>
<td>Annual.</td>
</tr>
<tr>
<td>Monitor value of sand sold for construction purposes and rate of sales.</td>
<td>Ongoing, cumulated to annual.</td>
</tr>
<tr>
<td>Monitor volume of sand used for beach replenishment or other environmental applications.</td>
<td>Ongoing, cumulated to annual.</td>
</tr>
<tr>
<td>Ecological values of the channel. Note particularly potential for presence of protected sea grass species in sand extraction and placement areas; also potential for migratory shorebird habitat on shallow sand spits/shorelines.</td>
<td>Annual (appropriate season).</td>
</tr>
</tbody>
</table>

9.3.2 Reporting

The management entity should report on relevant information about maintenance dredging processes, budgets and outcomes – i.e. the performance of navigation management in the channel. Such a report could be presented to the community through a range of forums and made available electronically on an accessible web site.

9.3.3 Review Triggers and Default Timeframes

Whilst the reporting provides an opportunity to evaluate progress on what is being done (are actions being implemented as intended) and basic performance indicators, a more wide ranging review process is also required to ensure that the overall program remains appropriate, efficient and cost effective.

The overall dredging program and management plan should be reviewed at intervals of approximately five years. The management plan can be modified without changing the approval. However, if the results of monitoring indicate that significant unanticipated changes are occurring corrective actions should be developed or if necessary the program concept could be revisited and a new approval prepared.

9.3.4 Ongoing Engagement Processes

Potential stakeholder involvement models are outlined in Section 10.0. In addition, accurate and up to date information about the condition of the channel should be available electronically to waterway users.

The management entity should provide regular updates (through RMS), for instance on channel depth and any hazards requiring careful attention during passage through the channel. Users should still be referred to RMS and/or Marine Rescue for information on trip planning and best boating practice for using the channel.
9.4 Knowledge Improvement and Information Sharing

Broader advice about measures to improve the safety of boating in the specific conditions that affect Swansea Channel are not part of the brief for this project. However, during consultation about navigability issues, a number of hazards and constraints and potential opportunities to improve safe navigation have been noted. These matters are separate to reliable navigable channel dimensions. The boating safety opportunities all relate to access to detailed guidance about Swansea Channel and could all help to restore confidence in the navigability of the channel and Lake Macquarie as a yachting destination for people from outside the region. Potential measures include:

- New boating guidelines for Lake Macquarie and for Swansea Channel in particular, which highlight the navigation hazards and clear advice from experienced skippers about how best to negotiate the channel. These guidelines could provide and/or reinforce advice about:
  - crossing the coal seam at the entrance to the channel, including water depth at different tides and the effects of following seas and variable wave heights/periods;
  - currents close to Swansea Bridge and likely competition for water space from small craft;
  - the tidal lag along the channel towards the lake;
  - reduction in tidal range along the channel towards the lake;
  - following the lead markers into the channel; and
  - using only the main channel and not diverting across the western shoals or other parts of the entrance. There is insufficient water depth across the western shoals at any time for keeled vessels or for large motor cruisers.

It has been apparent during consultation that some visiting (and local) skippers do not appreciate the critical timing needed for safe passage through Swansea Channel. It is a very different waterway to Pittwater, Sydney Harbour, Newcastle Harbour or Port Stephens. Even if the channel is dredged to desired specifications, Swansea Channel will require care with navigation and an awareness of processes in narrow, elongated estuary entrances.

- RMS conducts bathymetric surveys of the inner channel every four to six months. The value of these surveys would be enhanced if the charts were available on line, directly linked to real time tide information for key points along the channel, to give the most accurate possible information about how to negotiate shallow areas.

- Use yachting or boating association newsletters and magazines to highlight safe passage options in Swansea Channel as well as the navigation difficulties.
10.0 Community Value and Involvement

The wide range and numerous stakeholders actively interested in the management of navigation dredging in Swansea Channel reflects the importance of Lake Macquarie to the local community, as a recreational and tourism location and resource, which contributes to the enjoyment, well being and prosperity of the local community.

These stakeholders include waterway users, local businesses and business organisations. The Lake Macquarie Tourism Association, and Belmont and Swansea Chambers of Commerce have strong interests in the business opportunities facilitated by the management of Swansea Channel. Various local boating and yachting organisations represent different sectors of the boating and yachting community. Because a more reliably navigable entrance channel for Lake Macquarie would be expected to increase incoming boating traffic from other ports and recreational waterways, members of yacht clubs from Sydney and Newcastle have also been consulted during this project.

Important feedback from stakeholder consultation during this project is that waterway users value highly the opportunity to provide information and feedback about the management of recreational waterways. Future management of navigation dredging in Swansea Channel should build on engagement conducted during this project, providing ongoing opportunities for access to information about the navigability of the channel for waterway users, and opportunities to be involved in monitoring, review and adaptive changes to management activities within the framework.

The future stakeholder engagement group would be linked to the relevant management entity.

This section considers the options for achieving ongoing stakeholder involvement.

**Context and outcomes:**

Ongoing stakeholder involvement in the management of the navigability of the channel is critical, particularly in the context of adaptive management of a changing environment, with considerable uncertainty.

The managing entity should have a formal community representation group or utilise one of the existing groups centred on the Lake Macquarie waterway for this purpose. Such a forum would provide opportunities for waterway users to advise the management entity about channel management issues and satisfaction with outcomes, as well as encouraging an ongoing sense of community ownership of the natural and social assets of the channel.

10.1 Summary of Options

Several different State and local government organisations have policy, planning or regulatory responsibilities for management of estuarine waterways and there are several existing consultative forums operating in the Lake Macquarie area. These groups provide opportunities for some community stakeholders to be involved in discussion of issues and solutions affecting waterway use, including navigability. None of these existing consultative forums is exclusively about Swansea Channel.
This section considers the extent to which existing management bodies provide consultation opportunities that meet desired engagement outcomes for Swansea Channel. It also considers whether other possible consultative bodies could provide improved engagement outcomes. Key existing consultative committees are discussed in Table 10.1 and include:

- Lake Macquarie City Council Aquatic Services Committee.
- Lake Macquarie City Council Coastal and Estuary Management Committee.
- RMS Regional Maritime Panel.

### 10.1.1 Effective Engagement Options

Of the existing community consultative bodies (see Section 10.2 for details), the Lake Macquarie Aquatic Services Committee or Lake Macquarie Coastal and Estuary Management Committee are effective engagement bodies for Swansea Channel issues. These committees review and discuss proposals for management of a range of lake health and lake use issues, and therefore could consider management of Swansea Channel in the context of other important components of sustainability.

These Committees are Committees of Council, so their focus is on consultation about matters that are Council’s responsibility. Their relevance is linked to the extent of LMCC’s involvement as the management entity for this framework. If a different managing entity is nominated then a separate specific consultative forum may be considered, such as an extended and reconstituted Project Steering Committee (such as contributed to this report) attached to Crown Lands. Management processes and decisions from any separate consultation group should be reported to the LMCC Aquatic Services Committee and Coast and Estuary Management Committee as well as the existing RMS regional committee.

In the long term, the Regional Crown Reserve management structure potentially provides a good consultation option.

### 10.2 Current Consultative Bodies

Four existing consultative groups provide forums for discussing waterway management issues in Lake Macquarie, including issues associated with the navigability of Swansea Channel.

Table 10.1 summarises the membership of existing consultative groups that are relevant to Swansea Channel and also considers the decision making processes and powers for those groups. The Table also includes some other potential consultative models which could be relevant to efficient and transparent channel management.
<table>
<thead>
<tr>
<th>Consultative forum</th>
<th>Membership</th>
<th>Decision making processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake Macquarie Estuary and Coastal Management Committee</td>
<td>Committee is chaired by a LMCC Councillor</td>
<td>Committee is chaired by a Councillor and meets regularly. Committee receives presentations from Council and consultants (working on relevant projects for Council) for discussion and advice or feedback. Committee may recommend that a report is submitted to Councillors for their consideration. Committee has no budget or statutory powers.</td>
</tr>
<tr>
<td></td>
<td>LMCC, various sections</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RMS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NSW Crown Lands,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DPI Fisheries</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Local community representatives</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Boating community representatives</td>
<td></td>
</tr>
<tr>
<td>LMCC Aquatic Services Committee</td>
<td>The Committee has a large membership and is chaired by a LMCC Councillor (or nominee). Applications are made at the commencement of a new Council term, but members can also be appointed at other times. Members include Marine Rescue Services, RMS, Multiple yacht and sailing clubs; general 'community advisors', Progress Associations, game fishing clubs, charter operators.</td>
<td>As above. Committee provides review and advice, but has no decision making powers.</td>
</tr>
<tr>
<td>RMS Maritime Panel</td>
<td>Committee is chaired by RMS Regional Manager. Members include</td>
<td>Advisory group only. Significant overlap of membership with LMCC Aquatic Services Committee.</td>
</tr>
<tr>
<td></td>
<td>LMCC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RMS officers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Marine Rescue Service</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yacht clubs (as above)</td>
<td></td>
</tr>
<tr>
<td>Crown Lands Project Steering Committee</td>
<td>Committee is chaired by Director Crown Lands (Coastal Infrastructure).</td>
<td>The Project Steering Committee is a consultative committee established specifically for the current project. Secretariat support is provided by NSW Crown Lands officers. Community representation was based on experience in lake management and yachting. The Committee has no statutory power, and no budget. It also has no decision making power, but provides feedback on issues and draft documents. Other yachting community representatives have expressed interest in membership. Two local Members of Parliament (Member for Swansea and Member for Lake Macquarie) have also attended most meetings.</td>
</tr>
<tr>
<td></td>
<td>Representatives from:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Crown Lands</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RMS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OEH</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LMCC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Local community experts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Boat Owners Association</td>
<td></td>
</tr>
<tr>
<td>Consultative forum</td>
<td>Membership</td>
<td>Decision making processes</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Regional Crown Reserve Trust</td>
<td>Trustees have not been appointed for the Regional Crown Reserve.</td>
<td>If appointed, this group would have statutory responsibilities across a very large reserve area, of which Swansea channel is a small part. The Regional Crown Reserve includes parcels of land in the catchment of Lake Macquarie, the bed of the lake, parts of the coastal dunes and the sea bed. The diversity of the Regional Crown Reserve in its current form and the lack of any existing management group detract from its suitability as a consultative forum.</td>
</tr>
<tr>
<td>(Crown Lands)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hunter Central Rivers CMA, Board</td>
<td>Land holders, Aboriginal community representatives, Local Councils, Community conservation organisations (including coast and marine focused groups)</td>
<td>The CMA has a Board which includes people with experience in land management, conservation, business and community. The CMA also has a number of community forums or liaison committees for specific issues. Management of waterways specifically for recreational values is not part of the brief of the CMA. In addition, the government has announced that CMAs will be amalgamated with agricultural extension services and other parts of Department of Primary Industries, to form Local Land Services.</td>
</tr>
<tr>
<td>or operational committees</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PART 3

11.0 Costs and Benefits can be Balanced

11.1 Introduction to Economic Appraisal

In Australia the majority of coastal and estuarine management schemes and navigation dredging campaigns are funded by state governments in partnership with local councils. Decisions to invest public funds should take into consideration factors including economic viability and good value for money.

The underlying process of economic appraisal is cost-benefit analysis to support and aid in decision making. It determines how much economic benefit an investment (or cost) would attract. For management projects to be economically viable, the benefits should be more than the costs, or at least break even.

In addition to the economic or financial costs and benefits, some projects have social, environmental or cultural costs and benefits which are more difficult to quantify, but which can drive decisions to invest despite the lack of direct economic viability. Projects that are for the public good are in this category.

11.2 Updating the Cost-Benefit Analysis

Previously, technical economic and socio-economic appraisals for dredging in Swansea Channel were undertaken in 2003 by WBM (2003) and Gillespie Economics and Hassall & Associates Pty Ltd (2003), respectively. This work has now been updated with contemporary information and is included as an Addendum (Appendix 3). The scope of this new work was to update relevant input and values where possible and to apply similar methodologies (as used in the previous appraisals)

The updates have been conducted in two ways:

- by incorporating any new relevant information into the assessment, such as:
  - updated dredging cost estimates;
  - updated benefits;
  - updated boat owner numbers and potential revenue;
  - updates on the amount of money spent on boating and boating related infrastructure; and
  - updates related to the socio-economic aspects of the project.
- Where new information is not available, previous values may be updated to today's prices to account for inflation.

The economic analysis in this assessment focused on the main channel dredging options previously considered by WBM (2003):

- Large scale channel dredging (and various depth/width permutations).
Different depth and width options have been investigated to determine the financial implications of dredging the channel to accommodate deeper draught vessels. The economics addendum (Appendix 3) looks at which depth and width permutation is the most appropriate based on the updated dredge volumes, costs and benefits.

The analysis briefly considers two other options related to partial training walls and dredging works outside the main channel. These additional options were suggested by some members of the yachting community (see Section 3.0 and Section 6.0). As discussed in Section 5.2, these options have not been considered in this report as there implementation would require significant additional modelling and studies to clarify process and environmental risks.

The socio-economic assessment determines the financial benefits of the different channel forms identified in Table 5.3. The analysis of different channel forms addresses whether the deeper dredge depths are justified based on the potential number of channel users (local and non-local), and the general economic benefits the dredging may contribute to the wider community. The potential revenue from sale of the dredged sand is also investigated.

### 11.2.1 Data Collation

The economics addendum (Appendix 3) presents the new information available to update previous assessments, and the assumptions that have made to enable the current updated economics appraisal to progress.

The following information was available to aid in updating the framework economics:

- RMS boating information from 2002 to 2012. The data consists of:
  - annual vessel registration numbers for the Hunter Inland region by hull type and size from 2002 to 2012. Lake Macquarie is part of the Hunter Inland Region;
  - annual mooring numbers - categorised by vessel type and length from 2002 to 2012; and
  - Swansea Bridge openings and vessel movements from 2002 to 2012.
- NSW Boat Ownership and Storage: Growth Forecasts To 2026 (RMS 2010). This report was released in 2010 and documents past trends in boat ownership in NSW. The report also projects growth in boat numbers to 2026.
- Social and Economic Impact Assessment - Proposed Redevelopment of the Yacht Club Site, Belmont (Insite 2009). This report presents local boating trends and berth demands, as well as some wider implications of redevelopment of the Yacht Club.
- Economic Development Opportunities in the Swansea Area (Buchan Consulting 2009). This report covers the southern Lake Macquarie area from Swansea to Catherine Hill Bay. It identifies the long term impacts of population change and notes some economic development opportunities.

Some of this information was used directly, i.e. boat registration numbers, vessel movements and mooring trends. Some was used to common sense check and confirm assumptions in boating tourism growth, e.g. the projected ownership numbers as no direct boating trend numbers were available.
11.3 Cost-Benefit Assessment (Technical)

The costs-benefit assessment provides indicative costs for the capital and maintenance dredging works based on available information. Where new information was not available, previous values have been inflated to current (2012) prices using a local consumer price index (CPI). The benefits are assessed similarly to the previous WBM assessment (2003).

A discount rate of 7 per cent has been used. This is consistent with the previous assessment and NSW Treasury Guidelines (NSW Treasury 1999).

11.3.1 Costs

Cost rates per cubic metre of dredged sand have been determined based on information received from Crown Lands (2012). This information was taken from recent tender submissions for dredging works in Swansea Channel. These are ‘all in’ costs that assume removal of the material from the channel. An average dredge rate was adopted for the costs calculation for the initial dredging campaign. These costs were compared to costs derived from estimates in Moses & Ling (2010) (Compare 1) and the previously estimated dredge costs from WBM (2003) (Compare 2), and are considered reasonable. This also suggests that the CPI rates used are reasonable.

A 15 per cent increase on capital costs is included to account for design, site investigation and supervision, to be consistent with WBM (2003). No adjustment has been made for optimum bias. In addition there is likely to be additional costs for further modelling and necessary approvals. An estimated $0.5 million is considered conservative to allow for all “project management” costs associated with an initial large-scale dredging campaign.

The annual maintenance costs are based on the costs presented in WBM 2003 uplifted to 2012 prices using changes in the CPI. Note, in the PV calculations the design fees are assumed to apply in Year 1, giving a year for preparation and approvals. The capital and maintenance costs do not apply until Year 2.

The Present Value (PV) costs of each option are then calculated for the short term (10 years) and long term (25 years) using a discount factor of 7 per cent. The full methodology and assumptions for calculating the Option 1 costs are presented in Appendix 3.

Baseline:

The economic benefits calculations for any option initially requires an assessment of a baseline case or a ‘do nothing’ case in which maintenance and intervention is all but stopped. The baseline case is consistent with WBM (2003) – the management of the channel to maintain current use. This involves maintenance dredging on an irregular and as-needed basis or emergency dredging once a critical depth is reached.

Option 1:

Option 1 involves large scale dredging of the channel to design dimensions. In this option sand is removed from the channel system.

Option 2:

Option 2 includes dredging as per Option 1 but with in situ disposal of the sand on the western shoals, i.e. the sand is not removed from the waterway.
### 11.3.1.1 Costs Summary for Dredging Design Options

The summary of the costs results for the various channel depth permutations (with assumptions as above) is presented in **Table 11.1**.

**Table 11.1 – Option 1: Costs Results Summary**

<table>
<thead>
<tr>
<th>Option 1 Summary</th>
<th>Initial Cost</th>
<th>Ongoing Annual Maintenance</th>
<th>Total PV Cost</th>
<th>Total PV Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Capital, maintenance, fees, contingency (10 years)</td>
<td>Capital, maintenance, fees, contingency (25 years)</td>
</tr>
<tr>
<td>Baseline</td>
<td></td>
<td>$646,000</td>
<td>$4,855,000</td>
<td>$8,055,000</td>
</tr>
<tr>
<td>Option 1 (60m wide, -3.0m AHD)</td>
<td>$710,000</td>
<td>$368,000</td>
<td>$3,303,000</td>
<td>$5,129,000</td>
</tr>
<tr>
<td>Option 1 (60m wide, -3.5m AHD)</td>
<td>$1,545,000</td>
<td>$360,000</td>
<td>$4,311,000</td>
<td>$6,095,000</td>
</tr>
<tr>
<td>Option 1 (60m wide, -4.0m AHD)</td>
<td>$1,705,000</td>
<td>$327,000</td>
<td>$4,299,000</td>
<td>$5,918,000</td>
</tr>
<tr>
<td>Option 1 (120m wide, -3.0m AHD)</td>
<td>$2,594,000</td>
<td>$763,000</td>
<td>$8,272,000</td>
<td>$12,055,000</td>
</tr>
<tr>
<td>Option 1 (120m wide, -3.5m AHD)</td>
<td>$4,156,000</td>
<td>$533,000</td>
<td>$8,755,000</td>
<td>$11,395,000</td>
</tr>
<tr>
<td>Option 1 (120m wide, -4.0m AHD)</td>
<td>$6,096,000</td>
<td>$184,000</td>
<td>$8,952,000</td>
<td>$9,864,000</td>
</tr>
</tbody>
</table>

**Note all costs are rounded to nearest $1000**

### 11.3.2 Potential Benefits

The previous WBM (2003) assessment used a weighted value to evaluate relative benefits. A score between -10 and +10 was assigned to a stream of value criteria which was then multiplied by a weighting factor. The options were then ranked (**Table 11.2**). This method was repeated; however the criteria scores have been revised based on up to date knowledge and the changes to the options. The full methodology and assumptions for calculating the relative benefits are presented in **Appendix 3**. A summary of the benefits and ranking is presented in **Table 11.2**.

The criteria in **Table 11.2** relate to the following:

a) Need for Maintenance Dredging;

b) Accretion near the entrance to Swan Bay;

c) Navigation;

d) Scour at Nauru Pt;

e) Scour adjacent to Spoil Is.;

f) Scour Elizabeth Is.;
g) Scour Coon Is.;

h) Scour Pelican Is.;

i) (1) Seagrass Health - short term (2) seagrass health – long term;

j) Waves in Swan Bay;

k) Lake Hydraulics and Tidal Exchange; and

l) Flushing of Swan Bay.

Table 11.2 – Weighted Benefit Scores, Total and Rank

<table>
<thead>
<tr>
<th>Option</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
<th>f</th>
<th>g</th>
<th>h</th>
<th>i1</th>
<th>i2</th>
<th>j</th>
<th>k</th>
<th>l</th>
<th>Tot</th>
<th>Rnk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 1a (60 m wide, -3.0 m AHD)</td>
<td>0.83</td>
<td>0.97</td>
<td>5.56</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.42</td>
<td>0.56</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.42</td>
<td>0.56</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Option 1b (60 m wide, -3.5 m AHD)</td>
<td>1.67</td>
<td>0.97</td>
<td>6.94</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.83</td>
<td>1.11</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Option 1c (60 m wide, -4.0m AHD)</td>
<td>2.50</td>
<td>0.97</td>
<td>8.33</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>1.25</td>
<td>1.67</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Option 1d (120 m wide, -3.0 m AHD)</td>
<td>0.83</td>
<td>0.00</td>
<td>6.94</td>
<td>3.89</td>
<td>2.92</td>
<td>-0.28</td>
<td>1.25</td>
<td>1.67</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Option 1e (120 m wide, -3.5 m AHD)</td>
<td>3.33</td>
<td>0.00</td>
<td>9.72</td>
<td>4.44</td>
<td>3.33</td>
<td>-0.56</td>
<td>1.67</td>
<td>2.22</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Option 1f (120 m wide, -4.0 m AHD)</td>
<td>6.67</td>
<td>6.61</td>
<td>11.11</td>
<td>5.00</td>
<td>3.75</td>
<td>0.00</td>
<td>2.08</td>
<td>2.78</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

A scenario where the additional benefits from the sale of sand (applied as negative costs) are applied before applying the ranking method. In the 2003 report, sales were not considered to be viable from the 60 metre width. To be consistent with this previous assumption, for Option 1, benefits from sales are only included for the 120 metre channel width options. The report at Appendix 3 details this for Management Options 2 and 3 as well.

With these assumptions, the results show that Option 1f is still the leading option in terms of benefits.

11.3.3 Compilation of Costs and Benefits

The previous sections have detailed the methods and results of each discrete aspect of the economics appraisal. This section integrates all of these results.

The total PV costs are presented with and without the addition of the potential revenue generated through sale of the sand. This is to account for uncertainty as to whether sale of the sand is viable. Table 11.3a shows the difference in costs with and without the negative costs for sand sales incorporated. Table 11.3b integrates the costs and benefits, based on the benefits assessment in Section 11.3.2.

The ratios of “a” and “b” in Table 11.3b allow comparative evaluation of the options. It is important to note that the ratios are not true cost-benefit ratios, but rather a ranking tool that
shows which option provides the most benefit compared to cost. The resultant ratios range from greater than 5 to less than 2 and indicate that the wider and deeper channels represent some increased benefit per unit cost.

The report at Appendix 3 shows that Option 2 (infilling the western shoals) is marginally more beneficial than Option 1f, due to the low sand handing costs and no need for stockpiling. However the option of infilling parts of the channel (western shoals) has significant environmental risks, not previously modelled or assessed and is not included for consideration in the main body of this report.

Including the sale of sand, Option 1 is the most beneficial.
### Table 11.3a – PV Costs, Negative Costs (Sand Sales) and Totals for 10 and 25 Year Project Periods ($k)

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Option 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>60m x -4m AHD</td>
<td>120m x -4m AHD</td>
</tr>
<tr>
<td>10 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PV Costs</td>
<td>4,855</td>
<td>4,299</td>
</tr>
<tr>
<td>Negative PV costs (sand sales)</td>
<td>1,883</td>
<td>1,426</td>
</tr>
<tr>
<td>Total PV Costs including sand sales</td>
<td>2,972</td>
<td>7,526</td>
</tr>
<tr>
<td>PV Costs</td>
<td>8,055</td>
<td>5,918</td>
</tr>
<tr>
<td>Negative PV Costs (sand sales)</td>
<td>3,124</td>
<td>1,699</td>
</tr>
<tr>
<td>Total PV Costs including sand sales</td>
<td>4,932</td>
<td>8,165</td>
</tr>
<tr>
<td>25 years</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 11.3b – Total PV Costs (with and without Sand Sales) for 10 and 25 Year Project Periods against Relative Benefits ($k)

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Option 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>60m x -4m AHD</td>
<td>120m x -4m AHD</td>
</tr>
<tr>
<td>10 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) PV Costs</td>
<td>4,855</td>
<td>4,299</td>
</tr>
<tr>
<td>b) Total PV Costs Including sand sales</td>
<td>2,972</td>
<td>7,526</td>
</tr>
<tr>
<td>Benefits adjustment</td>
<td>16.39</td>
<td>41.53</td>
</tr>
<tr>
<td>Ratio for a</td>
<td>3.81</td>
<td>4.64</td>
</tr>
<tr>
<td>Ratio for b</td>
<td>5.52</td>
<td>3.79</td>
</tr>
<tr>
<td>25 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) PV Costs</td>
<td>8,055</td>
<td>5,918</td>
</tr>
<tr>
<td>b) Total PV Costs Including sand sales</td>
<td>4,932</td>
<td>8,165</td>
</tr>
<tr>
<td>Benefits adjustment</td>
<td>16.39</td>
<td>41.53</td>
</tr>
<tr>
<td>Ratio for a</td>
<td>2.77</td>
<td>4.21</td>
</tr>
<tr>
<td>Ratio for b</td>
<td>5.09</td>
<td>2.98</td>
</tr>
</tbody>
</table>
11.4 Socio-Economic Assessment

Part of the scope of this project is to update the socio-economic assessment to better reflect today’s community requirements and economic climate. This assessment is different to the cost-benefit model enumerating costs versus perceived/potential benefits (as previous); rather, it considers the wider implications of the costs against the (somewhat indirect) benefits to the local and regional community. Thus, the assessment methodologies make different assumptions and take different factors into consideration.

The socio-economic impacts of the preferred channel dredging option were investigated by Gillespie Economics and Hassall Associates Pty Ltd (2003) to determine the following:

- the costs and benefits to the community of the dredging options;
- the financial feasibility of dredging operations, which examined the revenues and costs associated with dredging, processing and sale of sand; and
- the regional economic impacts, which examined the additional stimulus to the Lake Macquarie economy from the expenditure of visiting vessels and dredging operations.

The results from WBM (2003) informed the socio-economic assessment, therefore only the preferred option (Option 1) was assessed by Gillespie and Hassall (2003). Where possible, the data, analysis and findings of this report have been updated for the framework.

Some matters, not readily costed, were not included in the original analysis and also have not been included in this update. Examples include the indirect costs to the environment and the community if dredging did not proceed, such as potential changes to perceptions about the health and amenity of the lake.

11.4.1 Costs and Benefits to the Community of the Dredging Options

The most significant direct benefit the dredging facilitates is improved navigation through the channel. Therefore recent use of the channel was considered, and the potential number of users that will benefit from the increased channel width and depths.

Gillespie and Hassall (2003) examined vessel movements through the channel based on bridge openings, types of vessels and size, and therefore the required draught. This gave a number of assumed return trips per annum which would (normally) be multiplied by an assumed willingness to pay (WTP) value. Since no appropriate values for WTP were available, the previous values in Gillespie and Hassall (2003) are indicative.

Since 2003, a study in the United States estimated the change in value of recreational boating with a dredging program along the Atlantic Intracoastal Waterway in North Carolina. The annual benefits of the dredging program were valued at US$20.5 million, with recreational boat users willing to pay US$97 annually, potentially as a surcharge on their boat registration fee (Whitehead 2007). As an indication, this was converted to $AU and was multiplied by the assumed number of vessels, equalling a total contribution of $212,850 per year. This sum is far below the contribution required to fund the dredging.

Gillespie and Hassall (2003) opted for a second method that enumerated the critical threshold value which represented the required WTP value for the navigational benefits to outweigh the costs. The potential increase in user numbers was assessed by applying a 75 and 150 per cent increase to the current number of return trips. The return trips are per vessel, rather than per person. The previous assessment assumed 4 persons per vessel.
The full methodology and assumptions for calculating the community benefits and WTP estimates are presented in Appendix 3; a summary of the results is in Table 11.4.

Table 11.4 – Threshold Values per Vessel per Trip (i.e. Required WTP Estimates)

(Note that these figures apply equally to all channel widths)

<table>
<thead>
<tr>
<th>Option 1</th>
<th>Return trips per year</th>
<th>Return trips per year + 75%</th>
<th>Return trips per year + 150%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2m (3m AHD)</td>
<td>Trips: 1369</td>
<td>Threshold value per trip (7%): $706</td>
<td>Trips: 2396</td>
</tr>
<tr>
<td>2.5m (3.5m AHD)</td>
<td>Trips: 1460</td>
<td>Threshold value per trip (7%): $626</td>
<td>Trips: 2554</td>
</tr>
<tr>
<td>3m (and 3+) (4m AHD)</td>
<td>Trips: 1500</td>
<td>Threshold value per trip (7%): $527</td>
<td>Trips: 2625</td>
</tr>
</tbody>
</table>

11.4.2 Financial Benefits of Dredging Operations – Sale of Sand

Sand is a valuable commodity used regularly within the construction industry. Previous studies have determined that sand dredged from the channel is suitable to be sold as fill material for the construction industry.

To aid in financing the ongoing dredging, the revenue generated from sale of the dredged sand needs to be considered as an additional benefit.

Local knowledge of sand industries was used to update this part of the assessment, as well as information from local sand suppliers as to the value of the dredged sand per tonne.

The estimated yearly revenue from sand sales from the capital and maintenance dredging is presented in Table 11.5. The results are then incorporated directly into the benefit cost analysis as a negative cost (see Section 11.2.3).

Table 11.5 – Estimated Revenue from Sand Sales over the Project Period

<table>
<thead>
<tr>
<th>Option</th>
<th>Year one</th>
<th>Year 2</th>
<th>Yearly Maintenance Yr 2 - 25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>$461,000</td>
<td>$227,000</td>
<td></td>
</tr>
<tr>
<td>Option 1 (120m wide, -3.0m AHD)</td>
<td>$738,000</td>
<td>$159,000</td>
<td></td>
</tr>
<tr>
<td>Option 1 (120m wide, -3.5m AHD)</td>
<td>$835,000</td>
<td>$248,000</td>
<td>$55,000</td>
</tr>
<tr>
<td>Option 1 (120m wide, -4.0m AHD)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Option 2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Option 3</td>
<td>$835,000</td>
<td>$238,000</td>
<td>$55,000</td>
</tr>
</tbody>
</table>

The critical threshold values in Table 11.5 can then be recalculated to incorporate the revenue from sand (Table 11.6).
Table 11.6 – Threshold Values per Vessel per Trip (i.e. Required WTP Estimates) including Sand Sales

<table>
<thead>
<tr>
<th>Option 1</th>
<th>Draught (dredge depth)</th>
<th>Return trips per year</th>
<th>Return trips per year + 75%</th>
<th>Return trips per year + 150%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Trips</td>
<td>Threshold value per trip (7%)</td>
<td>Trips</td>
</tr>
<tr>
<td>2m (-3m AHD)</td>
<td>1369</td>
<td>$455</td>
<td>2396</td>
<td>$260</td>
</tr>
<tr>
<td>2.5m (-3.5m AHD)</td>
<td>1460</td>
<td>$432</td>
<td>2554</td>
<td>$247</td>
</tr>
<tr>
<td>3m (and 3+) (-4m AHD)</td>
<td>1500</td>
<td>$409</td>
<td>2625</td>
<td>$234</td>
</tr>
</tbody>
</table>

11.4.3 Regional Economic Impacts

Gillespie and Hassall (2003) used an input-output model to examine the potential regional impacts of the dredging activity and the visitation by vessels moored outside Lake Macquarie based on the value of additional visitors (see following sections). The premise behind this assessment is that a direct impact (e.g. investment in the ongoing dredging) will have flow-on impacts; for example increased local demand for other services and greater employment. More details of the assumptions and methodology of this assessment are in Appendix 3.

11.4.3.1 Value of additional Visitor Vessels into Lake Macquarie

This economics update to enumerate additional value due to increased visitors to the Lake follows a similar methodology to Gillespie and Hassall (2003). A revised number of assumed visitors from outside of the Lake was used to update this portion of the economics. Assumed visitor numbers were distributed based on vessel draught, and thus, dredge depth required. It was assumed visitors would come for a seven day visit and spend approximately $5000 per vessel, $178 per day per person (assuming 4 people per vessel per trip).

Gillespie and Hassall (2003) allocated this expenditure across different sectors (e.g. restaurants) and applied the input-output analysis to determine multipliers that could be used to estimate the flow-on impacts for a given direct impact. The ratio multipliers determined in Gillespie and Hassall (2003) are also still assumed to be applicable. The updated values have followed the same methodology. The same tax and margin adjustment values were also used to determine the direct impacts for the income and value-added. The results are presented in Table 11.7.
Table 11.7 – Regional Economic Impacts for Annual Visits from Outside the Lake

<table>
<thead>
<tr>
<th>Draught (dredge depth)</th>
<th>Output ($)</th>
<th>Value added ($)</th>
<th>Income ($)</th>
<th>Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Direct Benefit</td>
<td>Production Induced</td>
<td>Consumption Induced</td>
<td>Flow-on Benefit</td>
</tr>
<tr>
<td>2 m (3 m AHD)</td>
<td>4,329,000</td>
<td>2,208,000</td>
<td>909,000</td>
<td>3,117,000</td>
</tr>
<tr>
<td>2.5 m (3.5 m AHD)</td>
<td>4,614,000</td>
<td>2,353,000</td>
<td>969,000</td>
<td>3,322,000</td>
</tr>
<tr>
<td>3 m (and 3+) (4m AHD)</td>
<td>4,741,000</td>
<td>2,418,000</td>
<td>996,000</td>
<td>3,413,000</td>
</tr>
<tr>
<td>2 m (3 m AHD)</td>
<td>1,928,000</td>
<td>1,022,000</td>
<td>443,000</td>
<td>1,465,000</td>
</tr>
<tr>
<td>2.5 m (3.5 m AHD)</td>
<td>2,055,000</td>
<td>1,089,000</td>
<td>473,000</td>
<td>1,562,000</td>
</tr>
<tr>
<td>3 m (and 3+) (4m AHD)</td>
<td>2,112,000</td>
<td>1,119,000</td>
<td>486,000</td>
<td>1,605,000</td>
</tr>
<tr>
<td>2 m (3 m AHD)</td>
<td>543,000</td>
<td>250,000</td>
<td>125,000</td>
<td>375,000</td>
</tr>
<tr>
<td>2.5 m (3.5 m AHD)</td>
<td>579,000</td>
<td>266,000</td>
<td>133,000</td>
<td>400,000</td>
</tr>
<tr>
<td>3 m (and 3+) (4m AHD)</td>
<td>595,000</td>
<td>274,000</td>
<td>137,000</td>
<td>411,000</td>
</tr>
</tbody>
</table>

11.4.4 Consideration of the Socio-Economic Impacts

The socio-economic update has furthereed our understanding of the social aspects of the dredging campaigns in the past, and potentially in future. The total revenue generated from the regular users of the channel (the willing to pay (WTP) calculations) show that the dredging costs to regular users to keep the channel open are far beyond the means of the channel users.  With the assumptions made in 2003 and continued in the update, estimates range between $100 and $550 dollars per return trip for full cost recovery in a user pays arrangement. This cost lessens when incorporating the revenue from sand sales. However, even assuming full sale of dredged sand, the remaining cost burden cannot be realistically met directly by waterway users.

Additional socio-economic impacts are seen when the potential tourism revenue generated is factored in. The results show that there would potentially be revenue increases in the order of $7 to 8 million a year, increased value of $3.3 to 3.7 million a year, increased income of $0.9 to 1.0 million a year and the generation of additional employment, potentially around 19
to 22 jobs. This would be a significant boost to the local recreation and tourism economy, but a relatively minor change to the overall economic activity of the City.

However, it is necessary to consider the potential costs that this boost to the tourism sector may incur. The money to initiate the benefits must come from investment by State or local government, to maintain statutory, policy or economic development service obligations to the community. Increased public funding could potentially be supported by higher revenue collection (e.g. increased taxes, levies or rates) or reduced investment in other services (e.g. reduction in infrastructure projects or community grants) (see Section 12.0). Both of these options require clear evidence of support for investment in dredging by the broad community.

It is important to consider the net effects of the investment in dredging for reliable navigation by larger vessels. The net benefits may be positive if the investment stimulates use of surplus capacity, i.e. under-used resources (e.g. waterways personnel, and conceivably navigable waters and/or potential mooring spaces, if there was very high unmet demand in the region), underutilised infrastructure (e.g. public wharves or moorings) and unemployed people. This was not investigated as part of the previous assessment, and is beyond the scope of the current framework investigations.

Intuitively, there are no significantly underutilised resources in Lake Macquarie which would become more efficiently used after further investment in navigation dredging. However, these broader cost benefit issues could be considered in more detail in subsequent analysis or in the approval process, to determine appropriate balances in funding contributions from direct and indirect beneficiaries.

11.5 Summary

This section offers a very brief overview of the results of the detailed analysis.

a) Cost Comparison

<table>
<thead>
<tr>
<th></th>
<th>Capital Cost</th>
<th>On-Going Yearly Maintenance Cost</th>
<th>NPV (10 years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Nil</td>
<td>$646,000</td>
<td>$4,855,000</td>
</tr>
<tr>
<td>60m / -3.5m Channel</td>
<td>$1,545,000</td>
<td>$360,000</td>
<td>$4,311,000</td>
</tr>
<tr>
<td>120m / -3.5m Channel</td>
<td>$4,156,000</td>
<td>$533,000</td>
<td>$8,755,000</td>
</tr>
</tbody>
</table>

b) Benefit Scores Comparison

The methodology for arriving at relative benefits involved scoring options for channel intervention at +/- value which was then multiplied by a weighting factor. This leaves the baseline or “do nothing” option as the zero point.

<table>
<thead>
<tr>
<th></th>
<th>Weighted Relative Benefit Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>0</td>
</tr>
<tr>
<td>60m / -3.5m Channel</td>
<td>+13.2</td>
</tr>
<tr>
<td>120m / -3.5m Channel</td>
<td>+25.3</td>
</tr>
</tbody>
</table>

c) Regional Benefits Comparison

The regional benefit numbers are based upon an increase in visitors to the lake of 150%. The “benefit” is assessed as being an increase over the baseline case and the same for any width of channel.
<table>
<thead>
<tr>
<th></th>
<th>Value Added to the Local Economy Per Year</th>
<th>Employment Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>NIL</td>
<td>NIL</td>
</tr>
<tr>
<td>60m / -3.5m Channel</td>
<td>$3,617,000</td>
<td>22 additional jobs</td>
</tr>
<tr>
<td>120m / -3.5m Channel</td>
<td>$3,617,000</td>
<td>22 additional jobs</td>
</tr>
</tbody>
</table>
12.0 Funding

The cost of effectively dredging Swansea Channel is a long standing constraint to the level of action desired by stakeholders, and this remains a challenge today.

As reported in the Newcastle Herald 11 May, 1972:

‘In almost every generation since the first major works in the early 1880’s, there has been constant agitation for improvements, whether major or minor. The constant demand has been for breakwater restoration, dredging and still more dredging. …and the uniform reply has been lack of money to meet the cost of such works, sometimes with a variation that while proposals would improve the channel the cost could hardly be justified.’

This section examines potential arrangements that may provide funding for the initial large scale and the longer term maintenance dredging at the scale required to ensure reliable navigability for most vessels in Swansea Channel.

The channel does not fit neatly into the current State and local government funding partnership arrangements and programs for navigation dredging of recreational waterways (see Section 2.4.2 and below). In addition:

- the channel is very hydrodynamically active;
- a minority (but still substantial group) of waterway users (primarily owners of yachts drawing more than 2.5 metres) require a reliable deep water channel into Lake Macquarie; and
- the budget for maintaining the service level expected by the yachting community is outside the budget available in existing programs.

The navigation dredging issues at Swansea Channel require an innovative and site specific solution.

Context and Objectives

- Funding arrangements for maintaining reliable navigation in the channel must be affordable now, but is also be sustainable into the future
- Funding be clearly linked to increasing community well-being, social involvement or economic benefits – cumulative benefits that at least balance costs to government and community
- Past ad-hoc funding arrangements have not delivered a favourable outcome, a well considered commitment to on-going funding is preferred
- The case for channel management competes favourably with proposals for other estuary entrances
- Funding that is drawn from multiple different sources that stand to benefit from improved channel amenity and function; opportunities to gain income from investment in managing the channel are explored

It is important to note that the recommended long term framework for dredging of the channel is based upon a large initial campaign with a cost of more than two million dollars followed by on-going periodic maintenance dredging.
The funding for the large initial campaign is considered to be beyond the scope and financial capacity of existing State government programs to deliver and is viewed as a potential once off commitment from the State government (see Section 13.0 for further discussion). This section focuses on the options for funding the on-going maintenance dredging that would take place after the initial campaign.

12.1 Historical Funding Arrangements for Dredging

In NSW, dredging of the entrances to trained coastal rivers was historically a State function undertaken to provide access by commercial shipping. A State-operated dredge fleet was disbanded in the 1970s for a number of reasons, including the demise of coastal shipping from regional harbours.

During the 1960s and 1970s the commercial fishing industry had expanded and over this period the Government constructed a major portfolio of regional harbour facilities for commercial fishing along the coast. Under the then Minor Ports and River Entrances Programs (now the Coastal Infrastructure Program) dredging to maintain navigation access to the state-owned maritime infrastructure and at the entrances to trained river where breakwaters had been constructed to assist in providing stable navigation conditions was 100 per cent funded by Government.

In the 1970s and 1980s the rapidly growing recreational boating community surpassed the commercial fishing industry as the most significant user of the State’s waterways and there were increasing demands for dredging from this group.

In 1985 the Government introduced the Waterways Program which provided a 75 per cent State subsidy to local government for projects that provided access to waterways (including dredging) for recreational boating benefits, reduce foreshore degradation and provide facilities to maintain water quality. The subsidy level for the Waterways Program was reduced to 50 per cent in 1988. This program has now been discontinued (refer section 12.2.1.1).

This 50:50 split between State and local government is the present basis of funding for navigation dredging to aid recreational and commercial boating in NSW.

12.1.1 Previous Dredging in Swansea Channel

Table 2.1 summarises available data about dredging locations, volumes and funding to maintain navigability in Swansea Channel (upstream of Swansea Bridge) over the last 40 years. At least 600,000 m$^3$ of sand has been dredged from the navigation channel over this period.

The navigation outcomes that have been achieved over this period have been funded as partnerships between State and local government. In 2012, a decision was made by government to undertake an interim dredging campaign, based on limited available funds, to provide short term relief for interim dredging campaign, based on limited available funds, to provide short term relief for boating access and to provide time to develop a sustainable long term dredging strategy.
12.1.2 Previous Investment in the health and amenity of Swansea Channel

Over the last 15 years, the NSW Government and Lake Macquarie City Council have invested heavily in major environmental and recreation projects in and around Lake Macquarie and Swansea Channel, to restore a healthy estuary system and to provide infrastructure supporting multiple recreational values. Examples include, but not limited to:

- Lake restoration program managed by the Office of Lake Macquarie and Catchment Coordinator (OLMCC) and more recently by LMCC itself. Whilst much of this work focused on catchment management and foreshore management around the main body of the lake, OLMCC also implemented recommendations of the Premiers Task Force in Swansea Channel for navigation dredging in Swansea Channel. Funding for these projects was provided in a partnership between State and local government.

- Lake foreshores – development of a highly awarded and extremely popular ‘icon park’ at Speers Point, the lake foreshore walk, and foreshore facilities at Croudace Bay, Warners Bay, Belmont Bay, Toronto Foreshore, Pelican Foreshore and other locations. These facilities have been funded with Council funds and grants.

- Public jetties/wharves and boat ramps adjoining major recreational facilities and popular parts of the lake. These facilities are constructed with Council funds and grant funds from the Better Boating Program.

- Construction of training walls at Swan Bay and groynes at Salts Bay.

- Maintenance of the Lake entrance training walls. This is a State government investment.

- Maintenance of Swansea Bridge and opening mechanisms. This is a State government investment.

- Provision of three Roads and Maritime Service vessels which are based in Swansea Channel, plus management of channel markers and other boating support (RMS, State government).

- Part funding for the Marine Rescue Service (from boating licence fees).

Estimates for examples of major investment packages are in Table 12.1. This is not intended to be a comprehensive list of all investment in lake and channel health and facilities.
The investment in waterway health and recreational amenity in Lake Macquarie has been delivered through a series of State and local government partnerships. Crown Lands, RMS, OEH (or their precursor organisations) and LMCC have all contributed to aspects of this investment.

By far the largest investment in recent decades has been in improving the health of Lake Macquarie, following the preparation of the Estuary Management Plan and Premiers Taskforce reports in the late 1990s.

In combination, this investment has created a healthy functioning coastal lake system, and a very high quality recreational waterway, with outstanding waterway and foreshore characteristics. A key remaining constraint to the reputation of Lake Macquarie as a recreational asset of at least State significance is the risk of unreliable navigation for larger, deeper keeled vessels in the channel.

### Table 12.1 – Major Investment in Lake Macquarie and Swansea Channel

<table>
<thead>
<tr>
<th>Type of Investment</th>
<th>Indicative Amount</th>
<th>Agency/Council</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake health – estuary health programs.</td>
<td>More than $35 million since 1999 (note, initial estimate for three years of funding was $28.5 million). Also note, this amount does not include investment in sewerage system upgrades, or other discharge controls which reduce stresses on natural estuary processes.</td>
<td>LMCC (staff and capital works, part funded by a Lake Levy)/OLMCC, State Treasury, OEH (Coast and Estuary Program and Environmental Trust) HCRCMA (part CIOC) Lake Levy contribution from residents (some of whom are direct waterway users).</td>
</tr>
<tr>
<td>Waterway recreation facilities (ramps, signs, public jetties, swimming enclosures).</td>
<td>$2.8 million since 2004.</td>
<td>50/50 funding partnership LMCC and state government through Better Boating Program (RMS). Contributions from waterway users (through Better Boating Program).</td>
</tr>
<tr>
<td>Swansea Channel dredging.</td>
<td>More than $3.5 since 1970.</td>
<td>Various joint funding arrangements: LMCC/OLMCC and state government (e.g. RMS, Crown Lands).</td>
</tr>
<tr>
<td>Waterway safety services – RMS and Marine Rescue (volunteers, sponsored by RMS).</td>
<td>Vessels and staff, based at Pelican in Swansea Channel Estimate more than $5 million since 2000.</td>
<td>RMS Contributions from waterway users through RMS part funding of Marine Rescue.</td>
</tr>
</tbody>
</table>
12.2 Current Funding Programs

There is a number of existing government funding programs available for enhancing waterways in NSW. Responsibility for the administration of these programs is assigned to a number of different government agencies. The most relevant programs include the following:

12.2.1 NSW Sustainable Dredging Strategy

As noted in Section 2.4.2, the NSW Government has released its Sustainable Dredging Strategy (2012/2013 to 2014/2015. The strategy outlines the basis and level of State government support for dredging in NSW coastal waterways. Funding is limited and the strategy views co-contributions as a key to prioritising support and a demonstration there is general community support for dredging projects.

The strategy recognises there can be broader economic spin-offs, but dredging almost invariably provides direct benefits to a limited number of stakeholders (such as particular recreational and commercial boaters and fishers). The strategy therefore also suggests that dredging should include a component of funding on a ‘user pays’ basis. Potential user pays concepts are noted in Section 12.3.

The strategy identifies the funding arrangements for different categories of dredging and an implementation process. These details are outlined below:

12.2.1.1 Rescuing our Waterways Program

A minimum of $1.5 million has been allocated for “First Phase” dredging projects in specific waterways, previously identified in the ‘Rescuing our Waterways’ policy statement, being the waterway entrances at Lake Cathie, Camden Haven River, Hastings River and Manning River as well as projects at Myall River, Fishermans Bay and Wallis Lake. Funding is dependent on a minimum 50 per cent contribution by local government and dredging proposals developed and projects managed by local councils.

For these “First Phase” projects, Crown Lands is working with the relevant local councils directly to discuss projects, local priorities and funding arrangements.

Swansea Channel is not identified in the First Phase dredging projects under this program.

For other dredging of estuaries to provide public benefits with preference for projects where the main purpose is to aid navigation by recreational and commercial vessels a “Second Phase” category with up to $1.5 million over 3 years has been proposed under the Rescuing our Waterways Program.

It is anticipated that an initial call for project proposals will be made as part of the second phase of the program.

While the scope of the initial and ongoing dredging works proposed in Swansea Channel fits within the Second Phase of the program, the expected amount of funding required and the timing of the works may not fit the following criteria:

- Minimum 50 per cent contribution by local stakeholders.
- Annual call for funding applications.
• Project development, management and delivery (including obtaining all approvals) by local council or other suitably qualified entity.

• Projects to be prioritised based on agreed criteria up to maximum available funding.

### 12.2.1.2 Coastal Infrastructure Program

Under the Coastal Infrastructure Program, dredging to maintain navigation access to state-owned regional coastal harbour infrastructure and at ‘trained’ river entrances where breakwaters have been constructed to assist in providing stable navigation conditions is managed by NSW Crown Lands. This program is fully funded by government and is based on stakeholder consultation and a state-wide prioritisation basis and agreed set of criteria.

In this context, it is important to note that the navigation issues are upstream of Swansea Bridge and are:

• Not ‘entrance shoals’. An entrance shoal (sometimes described as ebb shoal or entrance bar) is usually active marine sand which accumulates at the mouth of the river estuary or coastal lake, not upstream along a long entrance channel or elsewhere in the system. The shoaling under consideration in this report is in the upstream part of an elongated entrance channel.

• Not associated with providing access to state-owned regional coastal harbour infrastructure.

In the 2012 NSW Sustainable Dredging Strategy, the Coastal Infrastructure Program has the following specific requirements/investment:

• Dredging to maintain navigation access to government-owned maritime infrastructure and at ‘trained’ river entrances where breakwaters have been constructed to assist in providing stable navigation conditions.

• $2.250 million has been allocated over three years from 2012/2013.

• Project management by Crown Lands.

• Co-contributions to be sourced from others where possible.

### 12.2.2 Better Boating Program

The Better Boating Program is a State government grant program, which provides funds for boating infrastructure in regional areas and in Sydney waterways. A total of $5 million is currently available annually. Of this up to $2.5 million is allocated to the Regional Infrastructure Program and a further $2 million to Sydney Harbour access improvements and boat ramps. An additional $0.5 million may be distributed across any category, subject to demand and other conditions.

An important feature of this grant program is that it uses revenue from boating registrations and licences. Organisations eligible to apply for Better Boating Program grants include local government, community organisations, boating organisations and State agencies. Grants are made on a 50/50 funding basis. Applicants can include a range of in-kind contributions in their component of the project budget. Regional boating infrastructure is generally defined as ramps, pontoons, wharves, jetties, pump out facilities and similar structures. Dredging works are specifically excluded from the program (p6 of the guidelines).
LMCC has established a strong partnership with RMS to access grant funds from the Better Boating Program (and its predecessor programs) for boating infrastructure such as boat storage racks, boat ramps and jetties, providing boating facilities that are used by the local and regional community.

Under the RMS guidelines (2012) for the Better Boating Program additional funds may be allocated in special circumstances, which include:

- funding of facilities identified by RMS as having significant strategic value; and
- additional funding assistance of up to 75 per cent for selected projects in high demand or strategic areas.

Although the guidelines for the Better Boating Program exclude dredging, it is understood that this priority is set at a regional level and as such may be altered in exceptional circumstances. RMS has contributed funds for dredging in Swansea Channel in the past, in a situation of ‘emergency’ dredging.

It could be possible to argue that navigation dredging in Swansea Channel is an exceptional region-specific priority. A policy change of this nature would require clear commitment and agreement from all relevant stakeholders, particularly RMS, LMCC and boating associations. However, RMS has also advised that there are many calls for diversion of Better Boating Program funds to non boating infrastructure applications and investing funds in these alternative estuary works would dilute the core value of the program.

### 12.2.3 Coastal Management Program

The NSW Office of Environment & Heritage offers up to 50% funding as a grant for projects aimed at managing coastal hazards such as coastal erosion, and restoring degraded coastal habitats. This funding source may be an option as a cost offset for specific dredging campaigns where the sand was being used for beach nourishment and coastal zone protection.

However, there are issues with this source of funding:

- The program is set up such that local councils are required to be the principal applicant with overall responsibility for administering the grant.
- As applications are not open and funding is not available all the time, it would be dependent on both an imminent dredging campaign and beach nourishment needs at the time that applications are open; i.e. it would not fit the responsive nature of this framework to respond to channel conditions.
- The grant application process is very competitive and evaluated on a state-wide priority basis.

### 12.2.4 LMCC Funding

LMCC has recently (2011) consulted with its community about the importance of various services that it provides, as part of its preparation of an application to IPART for a rate variation. Council reports that dredging was not identified in the consultation process as an important service to be provided by Council. Survey results from 2011 indicate the most popular lake uses are walking and picnicking on the foreshore. Approximately 60 per cent of the respondents never use the lake for boating. However, 20 per cent of the respondents
said they used the lake for boating (type of boating activity not specified) either weekly or once or twice a month.

Council used this community feedback as part of its case to IPART. Funding for dredging in Swansea Channel is not included in Council’s approved budget for the next seven years or in its financial planning for the next 10 years. Council has advised that while IPART variation of the approved budget with a rate variation is technically possible, Council understands that IPART would not approve a special variation to rate income unless Council could demonstrate broad support from the Lake Macquarie community. In Council’s view, the currently available survey results make this unlikely.

Council has reviewed the level of income generated by State agencies from Lake Macquarie residents/waterway users, from aquatic licences, boat licences, vessel registrations, mooring fees, jetty and slipway leases and recreational fishing licences and has reviewed the level of State investment in boating infrastructure within its LGA. Based on this review, Council is of the opinion that the income received by the State government was not appropriately balanced by State investment, leading to what Council considered to be an inequitable situation. Council’s calculations of State investment in boating infrastructure in the lake do not include personnel, boats and services provided by RMS and Marine Rescue, or other state investment in the health of Lake Macquarie which directly or indirectly benefits waterway users.

12.2.5 Revenue and Cost Recovery

Recreational users of coastal waterways currently contribute to State funds through:

- boating licences;
- boat registrations (varying with the size of the vessel);
- mooring fees (varying with the size of the vessel); and
- jetty leases from Crown lands.

Other significant contributions by waterway users and businesses to boating facilities and amenity include: development application fees for private jetties (user pays) (to local government); and private investment in marinas and related infrastructure, plus lease payments for marina sites.

Table 12.2 gives an indicative estimate of the funds currently raised through charges (licences and other fees) in Lake Macquarie, based on data from RMS and Lake Macquarie City Council.

<table>
<thead>
<tr>
<th>Table 12.2 – Estimated Levy Revenue Generated by Levy Type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Price range</strong></td>
</tr>
<tr>
<td>Boating licences</td>
</tr>
<tr>
<td>Boat registrations</td>
</tr>
<tr>
<td>Domestic waterfront licences for jetties and slipways; Council jetties</td>
</tr>
<tr>
<td>Mooring fees</td>
</tr>
</tbody>
</table>
Mooring fees and jetty fees in Lake Macquarie are much less (per mooring) than the fees charged in metropolitan waterways (Sydney Harbour and others). Indicative fees for moorings in different areas and for vessels of various lengths are shown in Table 12.3 below (from RMS 2012).

### Table 12.3 – Recreational Mooring Fees, $ annually, RMS 2012

<table>
<thead>
<tr>
<th>Vessel length</th>
<th>Sydney Harbour East</th>
<th>Rest of Sydney Harbour and Pittwater</th>
<th>Other NSW Waterways, including Lake Macquarie</th>
</tr>
</thead>
<tbody>
<tr>
<td>to &amp; incl. 7m</td>
<td>464.00</td>
<td>297.00</td>
<td>199.00</td>
</tr>
<tr>
<td>7.01m - 8.00m</td>
<td>620.00</td>
<td>398.00</td>
<td>242.00</td>
</tr>
<tr>
<td>8.01m - 9.00m</td>
<td>776.00</td>
<td>499.00</td>
<td>285.00</td>
</tr>
<tr>
<td>9.01m - 10.00m</td>
<td>932.00</td>
<td>600.00</td>
<td>328.00</td>
</tr>
<tr>
<td>10.01m - 11.00m</td>
<td>1,088.00</td>
<td>701.00</td>
<td>414.00</td>
</tr>
<tr>
<td>11.01m - 12.00m</td>
<td>1,397.00</td>
<td>900.00</td>
<td>493.00</td>
</tr>
<tr>
<td>12.01m - 13.00m</td>
<td>1,706.00</td>
<td>1,099.00</td>
<td>572.00</td>
</tr>
<tr>
<td>13.01m - 14.00m</td>
<td>2,015.00</td>
<td>1,298.00</td>
<td>651.00</td>
</tr>
<tr>
<td>14.01m - 15.00m</td>
<td>2,324.00</td>
<td>1,497.00</td>
<td>730.00</td>
</tr>
<tr>
<td>15.01m - 16.00m</td>
<td>2,633.00</td>
<td>1,696.00</td>
<td>809.00</td>
</tr>
</tbody>
</table>

Table 12.4 shows the total estimated contribution to income from fees and charges in Lake Macquarie, distributed amongst the size classes of vessels and assumed draught. It is noted that the larger vessels, drawing 2.5 metres or more, make up approximately 3 per cent of the total number of vessels within Lake Macquarie, and contribute approximately 14 per cent of the revenue generated from licences, registrations and mooring fees.

### Table 12.4 – Estimated Revenue Generated by Vessel Size converted to Draught Requirement, Lake Macquarie

<table>
<thead>
<tr>
<th>Approx. total</th>
<th>Draught &lt;2 m</th>
<th>Draught 2 m - 2.5 m</th>
<th>Draught greater than 2.5 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of revenue by draught</td>
<td>$4.8 million</td>
<td>$1.4 million</td>
<td>$1 million</td>
</tr>
<tr>
<td>Percentage of total vessels by draught</td>
<td>66%</td>
<td>20%</td>
<td>14%</td>
</tr>
</tbody>
</table>

Note that the figures for % vessels by draught are estimates only

#### 12.3 Funding Opportunities

This section considers potential opportunities for new long term funding models that would support maintenance of the navigability of Swansea Channel in the context of waterway health and recreational amenity drivers. It reviews the existing financial contributions made by waterway users in Lake Macquarie; the current funding programs and possible alternatives. A funding model that will be suitable for the specific situation in Swansea Channel will need to be developed outside the standard navigation dredging programs.
The options involve:

- Higher local contributions through additional levies on waterway users or the broader community, or tourists.

- Increasing Lake Macquarie’s share (specifically Swansea Channel’s share) of funds from the RMS Better Boating Program, recognising the significance of Lake Macquarie (more so than Swansea Channel itself) as a recreational boating destination for all types of vessel. This would require a policy change, with RMS agreeing that Better Boating Program funds could be used for dredging in this specific instance – i.e. that dredging of Swansea Channel is a beneficial strategic investment, over and above other potential investments in boating infrastructure and ensuring the ongoing community value of other infrastructure. The dredging program would need to show compliance with other criteria relevant to the program.

Funds from the Better Boating program are provided on a 50/50 basis with local government (see the discussion of the Better Boating program above, for more details). In this case, a further policy change would be required, recognising the specific circumstances of the significance of Swansea Channel and Lake Macquarie for regional yachting and recreation.

- A defined financial and/or in kind commitment from LMCC, recognising the economic value of recreational boating activity, including small and large vessels and flow on expenditure in the local economy, and also the potential environmental and social benefits that could be associated with use of sand extracted from the channel. In kind contributions could include staff resources for project management.

- A review of the level of funding provided under the Rescuing our Waterways Program, noting the limited funds available for commitments and the 50/50 funding arrangement.

- A combination of the above. For instance, dredging campaigns in Swansea Channel have previously been funded by a partnership between RMS (then NSW Maritime), NSW Crown Lands and LMCC. To achieve the necessary long term funding commitment for Swansea Channel, a multi organisation funding commitment is likely to be necessary.

- A separate State government investment in providing consistent navigability in Swansea Channel, recognising that the channel and Lake Macquarie are waterways of regional to State significance for recreational boating, a value not currently recognised in navigation dredging programs.

All of these options may require changes to NSW policy and/or stakeholder willingness to pay for a service privilege, consistent with the regional to State level significance of Lake Macquarie.

12.3.1 Funding Examples from other Waterways

The issue of cost effective management of navigation in high usage recreational waterways is not unique to NSW. The management of the Gold Coast Waterways in Queensland and Gippsland Lakes, Western Port and Port Phillip in Victoria provide examples of management and funding of dredging to maintain navigability in ports which have dynamic sedimentary processes, elsewhere in Australia.

It should be noted that these ports serve high numbers of recreational users but are also commercial ports with commercial fishing and tourism vessels complementing use by recreational fleets.
Other waterways such as Tuggerah Lakes or Lake Illawarra in NSW have funding for dredging based upon improvement of waterway health. Port Hacking is maintained by Sutherland Shire Council, with 100 per cent of the budget provided by the NSW Estuary Management Program, based on an MOU with a previous NSW Government. None of these examples really relate well to Lake Macquarie and Swansea Channel.

**Gold Coast waterways**

Over five years, the Queensland government has invested $12 million in maintaining navigation channels by dredging in Gold Coast waterways. Maritime Safety Queensland and Gold Coast City Council have committed to invest a further $2.5 million annually on an ongoing basis.

The Gold Coast Waterways Steering Committee, with representatives from state government, Gold Coast City Council and Marine Queensland oversees waterways development, including dredging.

Maritime Safety Queensland also oversees a competitive bid program for boating infrastructure and waterway management/maintenance. Key input to the assessment of bids is a recent study of recreational demand forecasts, which identifies priority needs for boat ramp, boat harbour and jetty requirements.

**Westernport and Port Phillip Bay**

Parks Victoria is the Port manager for local ports in Westernport Bay and Port Phillip Bay estimates some 73 million visits annually, supporting 600 local businesses such as commercial fishermen, tour operators and fishing charters.

In a media announcement in August 2011, the Victorian Minister for Ports announced:

As Minister for Ports, I’m pleased to work in partnership with parks Victoria in management of these local ports and we provide $4.4 million each year to Vic parks to help them maintain these assets and keep these ports active and open. But I’m pleased to announce today that, in addition to that annual funding, we’re providing an additional $2 million lump sum for Parks Victoria for really important works and part of those works are undertaking $450,000 for dredging of Patterson River to remove the silt, to make a deeper channel for boating, make it safer, make it more accessible and to make this active waterway even busier, which is really terrific for this local community.

**Gippsland Ports**

The history of management of the entrance to Gippsland Lakes has several similarities with Lake Macquarie, the shoaling of the trained lake entrance has required on-going dredging for more than 30 years. However, Gippsland Lakes is a significant commercial waterway, with the largest fishing industry in Victoria and other commercial boating. The principal navigation constraint to ocean access is shoaling at the entrance bar.

Gippsland Ports is a State organisation and is responsible for the effective management and development of local ports and waterways in Gippsland. It is the custodian of specified State Government assets. Gippsland Ports has a statutory Board, and a series of specialist committees (including technical matters, auditing etc). The organisation structure includes an overall dredging manager and a program manager for the Lakes Entrance works. State funding for Gippsland Ports includes operating grants, special purpose grants for upgrading boating infrastructure and a separate special grant for managing sand issues at Lakes Entrance. The Victorian Government allocated $31.5 million to the Lake Entrance Sand Management Plan in 2005 (through the Provincial Victoria Economic Statement); a five year program.
This is a different situation to Lake Macquarie.

Gippsland Ports’ dredging strategy is to maintain the various channels at historic levels of navigability, between dredging interventions, by dredging to target depths below chart datum. Other features of the program include:

- The Gippsland Lakes Ocean Access Initiative and Gippsland Lakes Ocean Access Environmental Management Plan include design depths and widths for navigation channels (vertical and horizontal tolerances for channel form are specified). Gippsland Ports holds the necessary Commonwealth and State permits and consents. Requirements included an environmental risk register, management plan and stakeholder engagement plan.

- The Gippsland Lakes Ocean Access Engagement Strategy identifies key stakeholders such as local, State and Commonwealth government organisations; recreational, business and commercial/industry users; indigenous and heritage users; local residents and environmental interest groups. The Gippsland Ports web site is a key communication tool, together with an annual stakeholder briefing.

- Annual reports of dredging activities and compliance with the environmental management plan. This includes ongoing detailed bathymetric survey of the channels and the disposal grounds, ongoing wave climate monitoring, as well as review of environmental performance in all aspects of the program.

Most recently, the Gippsland Lakes Ocean Access Initiative has been funded with $9.1 million over four years. The strategy includes a management plan that defines channel design and environmental risks and a management entity that holds the relevant permits.

Gippsland Ports has recognised issues affecting ongoing management of navigability in the lake entrance, including:

- Ongoing ingress of sand into the inner channels and the accretion of sand on the Bar resulting in compromised navigability.

- Continuing Victorian Government policy commitment to maintaining ocean access to the Gippsland Lakes.

- Available funding to maintain ocean access through dredging and related sand management activities.

- The acquisition of requisite permits from various regulatory agencies to allow dredging and sand disposal to be performed.

- The availability of a contract dredge at particular times.

Gippsland Lakes waterways also have very high ecological/biodiversity values. Separate to the dredging and entrance management program, a Ministerial Advisory Committee manages an environmental management and protection program for the lakes.

12.3.2 Potential New Charges and Fees

Currently in NSW, waterway users make a contribution to the provision of waterway facilities and safety services, through payment of boating licences, registrations and mooring fees, paid to RMS and invested through the Better Boating Program, in partnership with local government. These contributions are, in effect, user levies. Some waterway users also contribute to the cost of boating facilities through their membership of sailing and yacht clubs.
These clubs provide training, berthing and other facilities, usually at reduced rates for members, but also for the general public. It should be noted that some clubs also pay a subsidised rent for their sites, often in high value waterfront locations.

Several local councils along the NSW coast, recognising the need to raise funds to match State government contribution to coastal environment management programs and the Better Boating Program, have introduced small levies (as a flat per cent or a set dollar value added to rates) on ratepayers, approved by the NSW Government.

For instance LMCC has an environmental and sustainability levy, Great Lakes Council, Hornsby Council, Ku-ring-gai Council, Bega Valley Council, Nambucca Council and Coffs Harbour Council all have an environment levy. Some funds from these levies are used to contribute to the cost of waterway maintenance (including dredging) for environmental purposes, depending on the specific purpose for which the levy was approved.

The current LMCC environmental levy does not provide funds for dredging of Swansea Channel, as channel dredging was not considered a high priority by ratepayers (see Section 12.2.2) and LMCC is of the opinion that navigational dredging does not provide an environmental benefit for the lake.

Theoretically, these beneficiary pays processes could apply more than they do now to cost recovery for the provision of boating infrastructure (including navigation channels), particularly where it benefits a specific group of users over and above the general population of waterway users. However, there is no specific case study of such arrangements being in place for waterway facilities for specific users to date. It is noted, however, that existing licensing charges are partly linked to vessel size, so charges are scaled relative to waterway user needs.

In relation to potential infrastructure levies, the intent would be to encourage provision of infrastructure for diverse users and to address higher demand expectations, but also to spread the cost recovery across the broadest base of beneficiaries, and over an extended, but defined period. An unnecessary concentration of costs on consumers should be avoided.

A clear, transparent link between levy revenue collection and infrastructure programming and delivery is essential. This is the case for the current boating licences/registration/mooring fees system, in that revenue is directed to the Better Boating Program. Despite this link, the rationale for investment in different waterways is not currently transparent, leaving open perceptions that the boating community in high usage regional areas (such as Lake Macquarie) is unreasonably supporting boating infrastructure investment in other waterways.

12.3.2.1 Application of a Dredging Levy

It would theoretically be possible to recover some costs associated with dredging in Swansea Channel that benefits a specific user group, by increasing fees with additional revenue being directed to that specific purpose.

Some waterway use charges are currently directly applied, rather than being paid to consolidated state revenue. For instance, funding for the Better Boating Program is largely sourced from boating registrations and licences.

If an additional levy was to be introduced on waterway users to contribute to dredging costs, a way of applying it to ensure a fair distribution of the levy based on actual users and beneficiaries would be necessary. To apply blanket levy on all boat users would disadvantage those small vessel owners that operate regardless of channel dredging. Applying the levy to only those with larger vessels who use the channel would be fairer;
however, full cost recovery in this way is not feasible as the cost per vessel per trip to cover dredging costs would be very high (see the socio-economic assessment, Appendix 3). Possible options for recovering costs from waterway users therefore include:

- a small blanket increase for all vessel registered in Lake Macquarie;
- an additional charge targeted at vessels above a certain size or draught, registered in Lake Macquarie; and
- some mechanism for also recovering costs from boat owners whose vessels are not registered in the lake (for instance, a toll on bridge openings, or a broader increase in charges outside of the local area).

Assessing these options is outside the scope of the current project. Policy changes at State and local level may be required. There has been no consultation with LMCC or with boat owners about specific willingness to pay additional charges to assist with funding of a reliably navigable channel for larger vessels. Before any additional user charges could be levied, further consultation about the details of a collection and application mechanism would be essential.

Also, the cost to establish a charging mechanism may cost more than the revenue generated, and again negate the purpose. Alternative methods for beneficiaries to contribute may include in kind measures, such as berthing for the dredge.

12.3.2.2 Revenue – Sale of Sand and Royalties

As discussed in Section 6.0, some sand dredged from Swansea Channel has previously been sold for clean fill or for concrete manufacture. This has also been done in other estuaries, such as Wallis Lake. Sale of sand is one means of recovering part of the cost of dredging.

The market value of construction sand has increased since the 2003 socio-economic report for dredging in Swansea Channel. Previous prices ranged from $6 per tonne for fill to $12 per tonne for quality ‘bricky’s’ sand. Prices from Don Reed & Associates (2008) indicate that ‘ex-bin’ prices of local sand from Stockton (i.e. dry screened sand loaded on a truck, but not transported) ranged from $6 per tonne in 2001 to $9 per tonne in 2005. Screened and washed sand ranged in price from approximately $10 to $22 per tonne at Salt Ash. In 2008 the ‘ex-bin’ weighted average price was around $12.40. Delivery/trucking costs were calculated to be approximately $0.12 to $0.15 per tonne per kilometre.

For sand from estuary dredging operations, the market value of sand as clean fill is around $2 - $4/tonne depending on local market conditions, and for concrete is around $17/tonne. Moses & Ling (2010) suggest the sale of dredged sand for beneficial uses can also result in other savings such as off-site transport and sand placement costs. Moses & Ling (2010) estimate the revenue from sand sales (for beneficial use, rather than construction) to be $3 per cubic metre (or $5.40 per tonne) and the cost of off-site transport and sand placement costs being $7 per cubic metre (or $12.60 per tonne). There is a local demand for sand for clean fill in the Lake Macquarie area, indicatively at $4 a tonne for dredged sand.

Based on the Beneficial Use Model by Moses & Ling (2010) and an indicative volume of sand available for sale from an initial dredging campaign to achieve a bed level of -3.5 metres AHD and a channel width of 60 metres is around 60,000 cubic metres, potential savings to a dredging project could be in the order of $600,000.
Dredged sand from Swansea Channel competes with sand from other Hunter region sites in the construction sand market. For instance, the dune sand quarries at Stockton Bight produce around 1.5 million tonnes of quality sand annually.

It is noted that the volumes of sand available from dredging of the channel will not be constant. Sand from future maintenance operations will be less than from the initial dredging campaign and may not be sufficient to support a viable ongoing sales operation.

Crown Lands licences issued for the extraction of materials for commercial purposes attract royalty payments on the materials removed. This is a payment to the State for access to Crown resources.

Attractive dredging contract terms are likely to require a balance between return of royalties to the State and income from sale of sand.

If sand is not sold to the construction industry, but used for dune nourishment, increasing the buffering capacity of coastal dunes to storm bite erosion, it also has a value. This value is linked to the value of the assets that are protected, including infrastructure and beach amenity. These values are difficult to quantify and are outside the scope of the current project.

12.4 Summary

To maintain a reliable navigation channel into Lake Macquarie for most recreational and commercial vessels that are based in or visit the Lake, a significant upfront investment (minimum $2 million) as well as ongoing funding (of around $360,000 per annum) is required.

The navigation issues in Swansea Channel do not fit neatly into existing funding arrangements as all current government grant programs have specified targets and limited annual budgets. The regional and State significance of Lake Macquarie and the maintenance of reliable access for the boating community, make dredging in Swansea Channel a special case.

Options or a combination of options (as previously discussed in this report) that may be considered as potential funding arrangements include the following:

- Specific funding under the Sustainable Dredging Strategy, Better Boating Program and/or from other existing government grant programs (i.e. Coastal and Estuary Management Programs, Regional Industries and Investment Fund and/or Regional Development Australia Fund).

- Redistribution of the amount of contribution required by local government under existing grant programs e.g. 20/80 instead the current 50/50 contribution level required from LMCC or the local community for ongoing maintenance dredging.

- Contributions by local government taken as “in kind” e.g. project management and contract supervision rather than as actual funds.

- Dredged sand sales to recover some project costs. Unlikely to be a long term option because of irregularity of supply.

- A small local waterway services levy on all recreational boating users. Likely to require detailed consultation with waterway users.
13.0 Responsible Management Entity

This section reviews options for responsibility for on-going management and maintenance of navigability in Swansea Channel. The sustainable outcome for a management entity in this case would be that:

The entity has statutory power and capacity to plan and approve works, enter contracts, manage funds and to make decisions efficiently and has the resources to develop management plans, monitor improvement works and the channel, and communicate effectively with the community.

13.1 Available Management Entities

An appropriate entity for managing dredging in Swansea Channel should have the following:

- Statutory authority to make decisions.
- Capacity to work effectively in intergovernmental partnerships.
- Capacity and authority to manage funds and contracts (but not necessarily to supply all or the majority of funds).
- Capacity to contribute financially to ongoing maintenance dredging.
- Capability and expertise to administer the framework, including the approvals, monitoring and reporting process not just the engineering components of dredging.
- Expertise in estuary hydrodynamic processes and the response of estuary entrances to dredging, long term changes to water level and other factors; or the capacity to manage external resources which may provide these services.
- Capacity to offer stakeholder engagement in decision making and to provide information to stakeholders and the broader community about the management process and outcomes, based on track record of community engagement.

There are a number of existing entities which have sufficient credentials to manage large scale projects and routine maintenance works. These entities are considered below in Sections 13.1.1 – 13.1.5, while some other potential options are briefly considered in Section 13.2. Table 13.1 summarises models from NSW estuaries and Table 13.2 provides a brief evaluation of four potential entities for managing dredging works in Swansea Channel against the criteria listed above.

There are several factors influencing the suitability of the following entities to manage long term navigation dredging in Swansea Channel, the advantages and disadvantages of each are discussed below.
13.1.1 Regional Crown Reserve Trust

A Crown Reserve Trust has the capacity to tie together a range of waterway management and coastal zone management issues and actions, where clear sources of income are possible.

The Trust framework provides a mechanism for community engagement in planning and decision making through the preparation of a Plan of Management which can define an adaptive strategy, subject to Ministerial approval. Where a Plan of Management exists, it is an adaptive tool, which can include triggers for changed management and is also required to be reviewed and updated from time to time. Plans of Management are signed off by the Minister, so have statutory power. Trusts can enter into contracts for works that are in accordance with the approved Plan of Management.

The entire bed of Lake Macquarie, including Swansea Channel, is part of a Regional Crown Reserve. The Regional Crown Reserve also includes multiple parcels of Crown land along the foreshore of the channel and in the Blacksmiths, Pelican and Belmont areas, as well as the sea bed off Nine Mile Beach. It also includes extensive lands in the catchment of Lake Macquarie, with a total area of 72,200 hectares.

The gazetted purpose of the Lake Macquarie Regional Crown Reserve is to provide for public access, public requirements, tourism purposes and environmental and heritage conservation.

Although the bed of the lake is part of a Regional Crown Reserve, there is currently no Board of Trustees, and no Plan of Management. The ability to tailor the Plan of Management to the suit the dredging framework and the ability of the Trust to 'hold' funds across financial years separate from budget constraints of government departments or councils makes it an attractive future option.

The Crown Reserve is a potential management entity for long term management of navigation dredging in Swansea Channel, but not an immediate option.

13.1.2 NSW Crown Lands

NSW Crown Lands is responsible under the Crown Land Act (1989) for all Crown land within the State which includes the beds of the State’s waterways. Approval of NSW Crown Lands is required where material is proposed to be dredged from or placed on Crown Land.

The State government has tasked NSW Crown Lands with the responsibility for the co-ordination of dredging in NSW outside of the four commercial ports of Newcastle, Sydney, Port Botany and Port Kembla. Under the NSW Sustainable Dredging Strategy (refer Section 12.2.1) Crown Lands funds dredging under the Coastal Infrastructure Program and the Rescuing our Waterways Program

Crown Lands has recently co-ordinated navigation dredging campaigns in Swansea Channel. While Crown Lands has extensive expertise and experience in the management of estuary dredging programs, it has limited resources to undertake a project of substantial scope such as has been developed in this Framework Report in addition to its existing program of works under the Coastal Infrastructure Program.

NSW Crown Lands has informally appointed a Project Steering Committee to provide input to the development of the sustainable management strategy for Swansea Channel (this project). Crown Lands is represented on the LMCC Estuary and Coast Management Committee.
13.1.3 LMCC

LMCC has responsibility to make decisions about aspects of estuary management and to implement management actions either by itself, or in partnership with State agencies and the community, through the Coastal Protection Act, Local Government Act, and Crown Lands Act. LMCC proposes to prepare Parts B (Lake Macquarie estuary) and C (Swansea Channel) of its Coastal Zone Management Plan in 2013, leading into in integrated CZMP for the entire coastal zone in the future. These plans are required to consider ecosystem health priorities and recreational access priorities, in consultation with the land owner. Council’s proposed zoning for Lake Macquarie (W1) encompasses both estuary health and recreational uses, with development consent.

The existing Estuary Management Plan and Premiers Task Force Reports for Lake Macquarie both address dredging in Swansea Channel, in the context of navigation and recreational amenity.

Along the NSW coast, local councils manage estuary management planning processes through the NSW Estuary Program (OEH), in conjunction with other state government stakeholders, who are now required to formally sign off on actions allocated to them in the CZMP before it is gazetted. A gazetted CZMP does have statutory power and also cannot be approved by the Minister without written agreement from relevant agencies to the works assigned to them. Grants for implementation of estuary management plans by local councils are available on 50/50 basis from the OEH Estuary Management Program, where the works are to enhance estuary ecological health (Councils may also contribute a higher proportion of implementation costs or may source grants from elsewhere). In the Lake Macquarie case, Council’s current funding of estuary health works is well in excess of the funding received from OEH via the NSW Estuary Management Program.

RMS programs and Crown Lands programs in estuaries are funded 50/50 with local government.

Council has advised that it has limited funds available to invest in navigation dredging in Swansea Channel, and its community feedback indicates that residents do not regard navigation dredging in Swansea Channel as a priority for Council expenditure.

Council currently operates two consultative bodies relevant to management of boating issues in Swansea Channel, and both have been consulted during this project:

- The Aquatic Services Committee is for consultation purposes only, but waterway users more strongly represented on the Aquatic Services Committee.
- The Estuary and Coastline Committee has State agency, Councillor and stakeholder representation (appointed by Council) and does make formal recommendations to Council in relation to estuary management. Crown Lands and RMS are both represented.

Conversely, LMCC is represented on the Crown Lands Project Steering Committee for the current project and on the RMS regional maritime consultative group.

Council has extensive civil engineering and contract administration expertise, but its expertise and experience in managing estuary dredging projects is currently limited.
13.1.4 RMS

As discussed in Section 2.0, RMS has statutory responsibility for maintenance of navigable waterways and ports (where there is a harbour master) under the *Ports and Maritime Administration Act 1995*.

Generally, RMS manages recreational boating facilities, services and safety, including wharves, jetties, moorings; boat licences and registrations, navigation markers; Swansea Bridge openings (State road); RMS boating safety officers; preparation of Mooring Management Plans; Better Boating Program (50/50 grant program with local councils); and maintenance dredging of navigable waters (Clause 25 of the *Ports and Navigation Administration Act 1995*).

Under overarching State guidance about eligibility for grant programs, RMS officers manage the grants and projects at the regional level. In the local area RMS has entered into contracts with LMCC to jointly fund projects in Lake Macquarie that meet the criteria for the Better Boating Program (not dredging).

However, within the region, RMS has limited experience and expertise in managing the implementation of a complex dredging framework.

In relation to stakeholder consultation processes, RMS has a local Maritime Panel. The Panel includes Council, agency and community (waterway user) representatives. RMS Chairs the group and provides secretariat services. Further information is in Section 12.0.

At the State level, RMS has a Recreational Vessels Advisory Group which comprises representatives of peak recreational user groups, including Yachting NSW, Australian Power Boat Association, NSW Rowing Association, NSW Water-ski Association and Boat Owners' Association of NSW as well as representatives from Marine Rescue NSW and the NSW Police Force and provides advice on a range of recreational boating issues (RMS web site).

13.1.5 A New Statutory Authority

Several stand alone statutory authorities exist or have existed in NSW with responsibilities for aspects of estuary management. The Office of the Lake Macquarie and Catchment Coordinator was one of these, but its responsibilities were returned to the relevant state and local agencies at the conclusion of the project funding in 2009.

As at 30th June 2009 the term of appointment by the Minister for the Lake Macquarie Project Management Committee and consequently the Office of the Lake Macquarie and Catchment Coordinator and the Lake Macquarie Improvement Project ceased. The responsibility now shifts to Lake Macquarie City Council, Wyong Shire Council and the various, relevant government agencies to continue activities to ensure the restoration of Lake Macquarie and its catchment.

Other examples include the Lake Illawarra Authority (currently under review), Tweed Bypass Authority (an agreement between NSW and Queensland State governments) and Sydney Harbour Foreshore Authority.

None of these existing or former organisations were formed with a narrow function such as dredging for recreational navigation. The regional (non-metropolitan) estuary authorities have all had significant roles in the restoration of estuary processes and estuary health, or major coastal processes and coastal sediment budgets of State significance, with management of recreational access and amenity (for local residents and tourists) a secondary objective. In all cases, the issues to be managed required multimillion dollar
investment over an extended period and a multi agency, multidisciplinary approach which benefitted from a single coordinating organisation.

A separate stand alone statutory authority is unlikely to be an efficient management model for Swansea Channel.

### 13.2 Other Possible Management Entity Concepts

#### 13.2.1 Governance and Funding Models from other NSW Estuaries

Across NSW, several other governance arrangements are in place to manage estuarine waterways, including maintenance of entrance channels. Table 13.1 summarises programs, responsibilities and funding currently operational in NSW. Further details about some of these models are in Appendix 4.

**Table 13.1 – Current Dredging Programs, Responsibilities and Funding in NSW**

<table>
<thead>
<tr>
<th>Waterway</th>
<th>Program</th>
<th>Responsibility</th>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Major river entrances and regional coastal harbours - navigation to provide access and use of existing State-owned maritime infrastructure (and including entrance bars) &quot;Excludes &quot;designated ports&quot;</td>
<td>Coastal Infrastructure Program</td>
<td>Crown Lands</td>
<td>100% by State government</td>
</tr>
<tr>
<td>2. Designated Ports including Ports of Newcastle and Sydney, Port Botany and Port Kembla, regional ports of Yamba (Clarence River) and Eden (Twofold Bay)</td>
<td>Statutory and/or port safety operating licence requirements</td>
<td>NSW Roads and Maritime Services and state-owned Port Corporations</td>
<td>100% by Government</td>
</tr>
<tr>
<td>3. Coastal Waterways (other than 1. or 2.) for enhanced navigation for vessels</td>
<td>Rescuing our Waterways Program</td>
<td>Crown Lands Project Management &amp; Delivery by Local Government</td>
<td>50:50 funding partnership between state and local government</td>
</tr>
<tr>
<td>4. Coastal Waterways (other than 1. or 2.) to improve water quality, reduce flood liability and coastal protection works</td>
<td>Estuary and Coastal Management Programs</td>
<td>Office of Environment &amp; Heritage Project Management &amp; Delivery by Local Government</td>
<td>50:50 funding partnership between State and local government</td>
</tr>
<tr>
<td>5. Port Hacking – main navigation channels for vessels</td>
<td>MOU between State Government and Sutherland Shire Council</td>
<td>Office of Environment &amp; Heritage (funding) Sutherland Council - project management</td>
<td>100% by State government, from Estuary Program</td>
</tr>
<tr>
<td>6. Tweed River – Sand By-passing project for nourishment of Gold Coast beaches and main navigation channel for vessels</td>
<td>MOU between NSW and Queensland State governments</td>
<td>Crown Lands dredging comes under item 1 (above). TRESBP Project Management &amp; Delivery by McConnell-Dowell</td>
<td>50:50 funding partnership between NSW and Queensland State governments</td>
</tr>
</tbody>
</table>
Table 13.1 – Current Dredging Programs, Responsibilities and Funding in NSW (cont.)

<table>
<thead>
<tr>
<th>Waterway</th>
<th>Program</th>
<th>Responsibility</th>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Lake Illawarra – dredging of Lake entrance and other areas within the lake</td>
<td>Lake Illawarra Authority Act</td>
<td>Lake Illawarra Authority (currently under review)</td>
<td>50:50 funding partnership between State and local government</td>
</tr>
<tr>
<td>8. Port Stephens &amp; Great Lakes Marine Park – Shoal Bay</td>
<td>DPI – Marine Parks</td>
<td></td>
<td>67% State and 33% local government</td>
</tr>
<tr>
<td>9. Other waterways (limited number and small scale)</td>
<td>Local government</td>
<td></td>
<td>100% local government</td>
</tr>
<tr>
<td>10. Aquaculture, including oyster lease areas – dredging to maintain tidal flushing</td>
<td>Oyster farmers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Waterways west of the Great Dividing Range – dredging for navigation or environmental flows.</td>
<td>Local government</td>
<td></td>
<td>100% local government</td>
</tr>
</tbody>
</table>

Notes:

- Dredging in Port Hacking is currently 100 per cent funded by the State government. The Port Hacking dredging includes (but is not limited to) works related to the public ferry services from Cronulla to Bundeena and provides sand for beach nourishment works at Cronulla Beach.

- Dredging for the Tweed River Bypass scheme is jointly funded by the NSW and Queensland State governments. Dredging in the Tweed River to maintain access to state government boating infrastructure is discussed in Tweed Shire Council Recreational Boating Study 2008.

- The management structures for Lake Illawarra have been created to manage the entire lake system, not just one aspect of lake management. The scope of the management programs is similar to that formerly administered by the Office of Lake Macquarie and Catchment Coordinator to improve the health and amenity of Lake Macquarie.

- Natural resources issues in the Georges River estuary are managed by the Georges River Combined Councils Committee Inc. (GRCCC), which includes representatives from nine local councils along the estuary, river and its catchment. The Georges River discharges into Botany Bay. The GRCCC program includes the Botany Bay Coastal Catchments Initiative. Its programs do not include estuary dredging for navigation purposes.

13.2.2 Governance and Funding Models from other States

Estuary dredging to improve navigation access for commercial and recreational users is an issue for state and local government in all states. This section briefly outlines governance models used in other states. Further information is in Appendix 4.

Dredging of Recreational Waterways in Queensland

Maritime Safety Queensland is the agency responsible for ‘maintaining access in high use waterways for recreational boating’ (MSQ website). Like NSW, this agency is part of a broader maritime and roads portfolio.
Dredging of Recreational Waterways in Victoria

The recreational and commercial ports of Westernport Bay, Port Phillip Bay and Gippsland Lakes are managed by local Port authorities, under the broader administration of the State Transport Department and Minister for Ports. The Transport Department is responsible for navigation dredging in these ports, which have significant economic value in regional economies.

Gippsland Ports

As mentioned in Section 12.0, the Management Plan and reporting processes for Gippsland Lakes provide useful models for aspects of navigation management in Swansea Channel and Lake Macquarie. In addition, the Gippsland Ports Ocean Access Initiative and related projects are funded directly by the Victorian government (e.g. $9.1 million over four years, managed by Gippsland Ports). However, there are also significant differences between the functions, economic value and management of the two systems. The Gippsland Lakes are the base for a large commercial fishing industry and other commercial uses, so the lakes are a Port, rather than a navigable waterway. The direct economic value of the Lakes in the Victorian economy is much greater than that of Lake Macquarie in the NSW economy. In its current use context, it would not be appropriate to establish a Port Authority for Lake Macquarie.

13.3 Summary of Management Entity Options

Table 13.2 considers the various potential management entities for long term dredging works in Swansea Channel, in relation to the criteria identified in Section 13.1.
<table>
<thead>
<tr>
<th>Organisation /entity</th>
<th>Statutory Authority</th>
<th>Relevant Technical Expertise</th>
<th>Capacity to Manage Adaptive Environmental and Recreational Programs</th>
<th>Capacity to Contribute Financially to Ongoing Maintenance Dredging</th>
<th>Inter-Government Partnerships</th>
<th>Manage Funds and Contracts</th>
<th>Stakeholder Engagement Capacity or Structure</th>
<th>Consistent with State Plan and policies</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regional Crown Reserve Trust</td>
<td>Yes</td>
<td>Possible</td>
<td>Possible</td>
<td>Possible</td>
<td>Possible</td>
<td>Possible</td>
<td>Possible</td>
<td>Yes if in partnership with local government</td>
<td>Potential for managing the entire bed and shoreline reserves of Lake Macquarie in the future, but not practical at this time. Several preparatory actions are required before this could be considered.</td>
</tr>
<tr>
<td>NSW Crown Lands (current situation)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Possible</td>
<td>Yes if in partnership with local government</td>
<td>Solution representing the land owner that is similar to the most recent dredging program. Crown Lands is the owner of the bed of the channel and has expertise and experience in estuary dredging/engineering projects. Stakeholder engagement body would overlap/duplicate to a large extent with other stakeholder groups in the region.</td>
</tr>
<tr>
<td>Lake Macquarie City Council</td>
<td>Yes</td>
<td>Limited</td>
<td>Yes</td>
<td>Limited in short to medium term</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>A solution consistent with management of estuaries elsewhere in NSW, and with LMCC’s strong interest in the sustainable management of its major landscape feature. However, Council does not regard navigation dredging in Swansea Channel as its responsibility/priority.</td>
</tr>
<tr>
<td>Organisation /entity</td>
<td>Statutory Authority</td>
<td>Relevant Technical Expertise</td>
<td>Capacity to Manage Adaptive Environmental and Recreational Programs</td>
<td>Capacity to Contribute Financially to Ongoing Maintenance Dredging</td>
<td>Inter-Government Partnerships</td>
<td>Manage Funds and Contracts</td>
<td>Stakeholder Engagement Capacity or Structure</td>
<td>Consistent with State Plan and policies</td>
<td>Comments</td>
</tr>
<tr>
<td>----------------------</td>
<td>---------------------</td>
<td>-------------------------------</td>
<td>-------------------------------------------------</td>
<td>-------------------------------------------------</td>
<td>----------------------------</td>
<td>-----------------------------</td>
<td>--------------------------------</td>
<td>-------------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Roads and Maritime Authority</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No Potential exists but requires review of current policies.</td>
<td>Yes</td>
<td>Possible</td>
<td>Yes</td>
<td>Yes if in partnership with local government (strong partnerships exist, but not for dredging)</td>
<td>Potential option, but would separate channel maintenance from other aspects of estuary management. RMS has less experience of the broader context of estuary management than either Crown Lands or LMCC</td>
</tr>
<tr>
<td>A new statutory authority</td>
<td>Yes</td>
<td>Possible</td>
<td>Possible</td>
<td>Possible</td>
<td>Possible</td>
<td>Possible</td>
<td>Possible</td>
<td>Subject to reviews of other stand alone, statutory estuary management organisations</td>
<td>Management of estuary health reverted to relevant authorities at the conclusion of the Office of Lake Macquarie project. Establishing a separate authority just for dredging is not an efficient use of resources.</td>
</tr>
</tbody>
</table>
13.4 Evaluation Summary – Management Entity

13.4.1 Acceptable Lead Management Entity

Of the organisations examined, LMCC, NSW Crown Lands and RMS could all provide an acceptable entity for managing navigation dredging in Swansea Channel. If any one of these organisations assumed the lead entity role, they would need to keep the other two fully informed of progress and outcomes. Leading the management process does not require that the organisation provide all, or the majority of funding and it does not relieve other organisations of roles and responsibilities that would streamline management.

A stand alone navigation management authority is not suggested as the long term solution for Swansea Channel.

The analysis in Table 13.1 suggests that although three organisations are feasible management entities, there are advantages and disadvantages associated with any of the potential authorities leading the management process. These are outlined below.

**NSW Crown Lands**

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>• NSW Crown Lands owns the bed of the channel, Lake Macquarie and the nearby sea bed. They are required to give land owners consent for any dredging works.</td>
<td>• Limited funds are available in any of the navigation dredging programs managed by Crown Lands for projects of the expected magnitude and recurrence of dredging in Swansea Channel.</td>
</tr>
<tr>
<td>• The recreational amenity of Lake Macquarie for boating is an asset of State significance.</td>
<td>• Crown Lands has multiple competing priorities for estuary dredging across the State and needs local government/community partners to identify and deliver on sub-regional priorities</td>
</tr>
<tr>
<td>• NSW Crown Lands is the agency responsible for implementing the current NSW Sustainable Dredging Policy, which allocates dedicated State government funds to priority navigation dredging projects for recreational and commercial boating in NSW waterways, and reviews the technical and recreational merit of dredging proposals.</td>
<td>• Crown Lands is a contributor, but not the driver of overall estuary management goals and priorities for the Lake Macquarie community.</td>
</tr>
<tr>
<td>• NSW Crown Lands has in-house technical expertise and experience in managing estuary dredging for navigation purposes, in a range of estuary types and conditions. Note however, that this in-house expertise is subject to staffing capacity.</td>
<td>• Crown Lands has limited demonstrated capacity to report on navigability management – this responsibility has tended to lie with RMS and/or local government</td>
</tr>
<tr>
<td>• Crown Lands has recent experience of managing navigation dredging in Swansea Channel.</td>
<td></td>
</tr>
<tr>
<td>• Crown Lands also has extensive experience in contract management.</td>
<td></td>
</tr>
<tr>
<td>• NSW Crown Lands has a direct reporting relationship with the State government.</td>
<td></td>
</tr>
<tr>
<td>• Crown Lands has demonstrated capacity to work in partnership with other agencies and with local government to deliver benefits for regional communities. Indeed delivering benefits for the State and for regional communities from Crown Land assets is one of the key responsibilities of Crown Lands.</td>
<td></td>
</tr>
<tr>
<td>• Crown Lands has experience in establishing and managing multi-stakeholder partnerships and statutory authorities, where a formal partnership is needed to set the parameters of service delivery and funding. It should be noted however, that although a multi-stakeholder approach is necessary to deliver sustainable outcomes for Swansea Channel, the issues in Swansea Channel should not be managed in isolation from the rest of the Lake Macquarie system.</td>
<td></td>
</tr>
<tr>
<td>• Crown Lands has experience in working with community stakeholders, formally and informally.</td>
<td></td>
</tr>
</tbody>
</table>
Lake Macquarie City Council

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Lake Macquarie (including Swansea Channel) is the environmental and</td>
<td>• Management of Swansea Channel is a regional to state scale issue, affecting the value of a</td>
</tr>
<tr>
<td>social centrepiece of the City of Lake Macquarie and the benefits of</td>
<td>natural and recreational asset that is of state significance (the lake itself). It could be</td>
</tr>
<tr>
<td>reliable navigability are directly to the local yachting community and/or</td>
<td>argued that management responsibility for these assets should be at a regional or higher level of</td>
</tr>
<tr>
<td>local businesses.</td>
<td>government. However, note that Council currently has the lead role in the management of the</td>
</tr>
<tr>
<td>• LMCC Community Strategic Plan envisages a future for the City based on</td>
<td>lake itself through its Estuary Management Committee.</td>
</tr>
<tr>
<td>holistic management of the lake and coast. The Plan recognises the</td>
<td>• LMCC has relied on state agencies such as Crown Lands and RMS for technical expertise in</td>
</tr>
<tr>
<td>importance of developing Lake Macquarie as a recognised tourism</td>
<td>estuary dredging, particularly where it is for navigation outcomes.</td>
</tr>
<tr>
<td>destination and also of attracting major sporting events to the City.</td>
<td>• LMCC has a strongly stated policy position that management and funding of navigation dredging</td>
</tr>
<tr>
<td>The City already hosts (and encourages) State and national sailing and</td>
<td>in Swansea Channel is a State government responsibility.</td>
</tr>
<tr>
<td>yachting events. The proposed zoning of the lake accommodates sustainable</td>
<td>• Based on consultation with the local community, LMCC has determined that investment in</td>
</tr>
<tr>
<td>boating activity.</td>
<td>dredging in Swansea Channel is not a priority for Council. If Council is the management entity,</td>
</tr>
<tr>
<td>• LMCC has a responsibility for managing both natural values and social</td>
<td>it would be leading a project which it does not see as either its responsibility or a priority for</td>
</tr>
<tr>
<td>values of the lake through the NSW coastal zone management program. In</td>
<td>the majority of its community.</td>
</tr>
<tr>
<td>this context, LMCC is uniquely placed to set goals and priorities for</td>
<td>• Council has not allocated funds in its current or future budgets to contribute to shared</td>
</tr>
<tr>
<td>navigation dredging issues in a manner that is integrated with other</td>
<td>funding of dredging with the State Government, either for a major up-front dredging program or</td>
</tr>
<tr>
<td>aspects of lake management – particularly long term estuary health, water</td>
<td>for ongoing maintenance dredging for navigation in Swansea Channel.</td>
</tr>
<tr>
<td>quality and ecological system function.</td>
<td></td>
</tr>
<tr>
<td>• Having LMCC manage a program to maintain navigability of Swansea</td>
<td></td>
</tr>
<tr>
<td>Channel would be consistent with the current NSW government policy of</td>
<td></td>
</tr>
<tr>
<td>local choices, decisions and management, supported by information and</td>
<td></td>
</tr>
<tr>
<td>part funding from the State. (However, note disadvantages linked to</td>
<td></td>
</tr>
<tr>
<td>Council’s policy position).</td>
<td></td>
</tr>
<tr>
<td>• LMCC has a successful track record (in partnership with State agencies)</td>
<td></td>
</tr>
<tr>
<td>of involvement in the management of Swansea Channel for environmental</td>
<td></td>
</tr>
<tr>
<td>and recreational boating outcomes. It has a well established relationship</td>
<td></td>
</tr>
<tr>
<td>with RMS through the Better Boating Program, and with NSW Crown Lands.</td>
<td></td>
</tr>
<tr>
<td>• LMCC has an existing consultative forum that focuses on estuary</td>
<td></td>
</tr>
<tr>
<td>management and a second consultative forum that focuses on aquatic</td>
<td></td>
</tr>
<tr>
<td>services. Minor adjustments to the membership of the Estuary and Coast</td>
<td></td>
</tr>
<tr>
<td>Management Committee (which already has representatives of relevant</td>
<td></td>
</tr>
<tr>
<td>government agencies/authorities and waterway users) would enhance</td>
<td></td>
</tr>
<tr>
<td>representativeness. The consultative committee for the dredging</td>
<td></td>
</tr>
<tr>
<td>program could be a technical subcommittee of the Estuary and Coast</td>
<td></td>
</tr>
<tr>
<td>Committee.</td>
<td></td>
</tr>
<tr>
<td>• Council has an established track record of working in formal agreements</td>
<td></td>
</tr>
<tr>
<td>with State agencies in relation to dredging works and lake health works.</td>
<td></td>
</tr>
</tbody>
</table>
## Roads and Maritime Services

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Has extensive experience working with the local and regional boating community and understands the needs and priorities of recreational boating users</td>
<td>- Limited experience or technical expertise in estuary/coastal engineering</td>
</tr>
<tr>
<td>- Has staff based at Swansea Channel, who provide navigation safety assistance to vessels entering and leaving the lake</td>
<td>- Limited staff resources to manage major dredging programs – experience is more in extension and regulation/enforcement.</td>
</tr>
<tr>
<td>- Collects survey data on channel condition (bathymetry) on a regular basis</td>
<td>- Recreational navigation dredging is not generally seen as part of the RMS portfolio in NSW. For identified commercial ports, dredging programs are managed by the relevant Port Authority.</td>
</tr>
<tr>
<td>- Manages bridge openings at Swansea Bridge, which is the second constraint to unfettered yacht access to Lake Macquarie from the ocean.</td>
<td>- Lake Macquarie is not a Designated Port and does not have a Harbour Master.</td>
</tr>
<tr>
<td>- Has a long standing working relationship with LMCC through the Better Boating Program, to deliver boating infrastructure for recreational users in the lake (not dredging)</td>
<td></td>
</tr>
<tr>
<td>- Has an existing local consultative group on boating issues (not restricted to issues in Lake Macquarie)</td>
<td></td>
</tr>
<tr>
<td>- With some adjustments to policy and within very specific circumstances, RMS has some capacity to divert additional funds from the Better Boating Program to Lake Macquarie projects, where there is clear support from Council and the local community.</td>
<td></td>
</tr>
<tr>
<td>- Experienced in administering grant funds for boating infrastructure (but limited experience in administering grant funds for dredging)</td>
<td></td>
</tr>
</tbody>
</table>

### 13.4.2 Possible Partnership Arrangements for Ongoing Maintenance of Navigability

Rather than trying to assign one entity the task of managing the channel, a more suitable arrangement for the implementation of the framework for maintenance of navigability in Swansea Channel may be a partnership between the state and local government entities. This is similar in theory to the way the channel is managed at the moment but would entail more formally defined roles, responsibilities and powers and new funding arrangement. This partnership is not intended to be equivalent to a new statutory authority.

One possible partnership arrangement could involve:

- Priorities, management responsibilities and funding contributions being formally specified through the development of the Lake Macquarie Coastal Zone Management Plan, using a process where all relevant agencies are required to sign off on responsibilities allocated to them for implementation. The Coastal Zone Management Plan would reference and be aligned with other relevant boating management plans for Swansea Channel and Lake Macquarie, such as mooring management, boating management and breakwall management.

- Crown Lands as the owner of the bed of the lake and the proponent of the dredging could hold all the necessary approvals including a management plan for the delivery of the framework.
LMCC could provide the actual dredging project management (through use of Council staffing resources). LMCC would also be responsible for management of some beneficial uses, such as dune nourishment programs that are also covered by the Coastal Zone Management Plan.

RMS could provide the ongoing monitoring and reporting on the channel conditions including regular channel survey, reporting on channel condition and stakeholder and community engagement through existing committees.

It is important to note that the scale of the dredging for the initial campaign to reach the design channel form would be a large single project and may require additional expertise and resources to deliver.

Section 14.0 provides further information about how a partnership could be delivered and maintained.
14.0 Summary of Framework Management Options for Swansea Channel

The tables in this section (Tables 14.1, 14.2 and 14.3) show some possible options for how the nine components of the framework could combine for effective delivery.

All of these options require a co-operative approach – a partnership by State and local government organisations and the local community.

Effective management partnerships are based on well aligned values, shared understanding of the challenges, clear objectives and a willingness to communicate and work proactively together.

This section briefly reviews the alignment of values, concerns and objectives of the stakeholders in Swansea Channel. It then outlines three possible models for how a partnership between the stakeholders could deliver sustainable navigability outcomes for Swansea Channel.

While each of these three models of a partnership could be feasible, Framework Management Option 3 is likely to provide the best general way forward, subject to further detailed negotiation about the formal partnership structure, responsibilities and financial contributions.

14.1 Aligned Values, Concerns and Objectives

There needs to be state and local government and community stakeholders joint consideration of the following characteristics of management challenges for sustainable navigability in Swansea Channel.

Value

- Yachting in Lake Macquarie is a State significant recreational use, on a waterway of State significance in environmental terms. Boat ownership is growing across all vessel sizes.

- 90 per cent of registered vessels from the Lake Macquarie area are small power or sailing vessels where waterway access and enjoyment depends on foreshore facilities, rather than a deep entrance channel. However, approximately 1500 yachts drawing 2 metres or more are based in Lake Macquarie. Whilst a small number when compared with Sydney Harbour, yacht numbers in Lake Macquarie are regionally significant. Not all yachts currently in Lake Macquarie are interested in ocean access. A reliably navigable Swansea Channel for vessels drawing up to 2.5 metres (i.e. a level of service suitable for a wide range of yachts) would increase yachting interest in Lake Macquarie and facilitate yachting exchange with Sydney Harbour, plus accommodate some overflow from crowded Sydney waterways. Additional yachting activity would bring additional jobs in the recreation and tourism sector, but would have a very small effect on overall employment in Lake Macquarie.

- Lake Macquarie is not a “designated” port and does not have a Harbour Master. Unlike some other estuaries with entrance navigation issues, it does not support a commercial fishery or has state-owned maritime infrastructure or public ferry services.
Concerns

- Without regular dredging the dynamic processes in the Lake Macquarie entrance channel will constrain delivery of community yachting aspirations. Left un-dredged or under-dredged, Swansea Channel will continue to adjust in the short to medium term, with high levels of uncertainty about locations of shoals and accessibility. This places pressure on RMS staff and Marine Rescue. Ineffective management of channel shoaling (both under and over dredging) may also affect lake water levels and flood risks.

- The cost of the initial dredging program needed to achieve the design channel form is likely to be more than the funds currently committed by the State government to dredging programs. Council has made no allocation for dredging in Swansea Channel in its budget planning.

Objectives

- Sustainable management depends on a combination of operational, planning and strategic factors (shown schematically in Figure 4.1 and Figure 4.2). Operational and planning factors should generally follow best practice to provide robust and cost effective community and environmental outcomes. The biggest choices for government and stakeholders are around the two strategic factors – long term funding and responsible management entity.

- Deliver reliable navigability in Swansea Channel that provides for access by the majority of local and regional (e.g. Port Stephens to Sydney) vessels. This would contribute to growing recreational use, yachting reputation and potential economic benefits.

- Determine a formal agreement to a funding model that allows for an initial major dredging program to achieve the design channel form, and ongoing maintenance. Neither component offers good value for money without the other.

- Commit to a partnership for delivery of navigation dredging in Swansea Channel which demonstrates commitment by all stakeholders i.e. Crown Lands, RMS, LMCC, waterway user groups, and to a lesser extent OEH and adjoining local council areas. The partnership will deliver the following elements of the dredging framework:

  - An appropriate, strategic lead entity, not necessarily the same as the funding entity, but able to manage long term arrangements (including holding the funds). The relevant stakeholder engagement group, to maintain strong community input to the ongoing maintenance of navigability, will be linked to the selected lead management entity.

  - Appropriate funding contributions from state and local government and waterway users, now and for a minimum of 10 years

  - Responsibility for managing the combined funding contribution of all stakeholders over an extended period (minimum ten years). Funds and funding commitments will need to be able to rolled over from one financial year to another.

  - An overarching and inclusive approval, given effect by a Management Plan which provides implementation details, monitoring and adaptive review processes.

### Table 14.1 – Framework Management Option 1

Crown Lands leading the program, representing the State as the land owner; up-front investment from the State; ongoing investment shared by state, local and community interests. LMCC an ancillary stakeholder.

#### Operational factors
- Design channel depth is 3.5m AHD, to accommodate vessels drawing up to 2.5m.
- Design channel width is a minimum of 60m, with most effective width predicted to be approximately 100m.
- Dredging carried out by private contractor(s), likely as a contract for initial major program and then a separate contract for ongoing maintenance. Contractors would report to the relevant management entity.
- Suitable dredges include cutter suction and barge mounted excavators, with capacity to move up to 1000m³ a day - rapid resetting of channel form.
- Licences could be held by the management entity or the contractor.
- Monitoring of bed levels and channel usage by RMS.

#### Planning and approvals
- Overarching project approval (to include initial major dredging campaign and ongoing maintenance dredging) under Part V of EP&A Act (or new process when Planning reforms are finalised), including beneficial sand use options.
- Approval supported and given effect by a detailed Plan of Management which sets targets, triggers, includes dredging processes and schedule (e.g. to minimise ecological impacts and maximise recreational value), monitoring protocols, sand management processes, reporting and review.
- Management Plan includes process for selecting beneficial sand use/disposal option for each dredging event.
- Management Plan must be able to be reviewed and updated as new information is obtained.
- Approval held by lead management entity (in this case Crown Lands).

#### Strategic choices
- Invest in assets of state significance, in regional locations - special State government funding, approximately $2 million (outside current dredging programs), based on clear evidence of support for the investment as a priority for the region (initial major dredging program): +
- Value for money - share costs of maintenance between State and local government, (with funds from Better Boating Program or Sustainable Dredging Program or Regional Development funds) with user pays contributions (potentially achieved by increasing registrations or mooring fees for larger vessels). Indicatively, this could be 50%-70% State, 15%-20%-local with small potential contributions from sale of sand and user contributions. Contributions to be formally agreed via MoU; +
- Framework implementation and review lead by Crown Lands as the land owner for the bed of Lake Macquarie; +
- New stakeholder engagement group/reference panel, to provide advice and comment to Crown Lands.
- Communication and reporting to agencies, Council and community, via reports to LMCC Coast and Estuary Committee and/or Aquatic Services Committee.
Table 14.2 – Framework Management Option 2

<table>
<thead>
<tr>
<th>Operational factors</th>
<th>Planning and approvals</th>
<th>Strategic choices</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Design parameters for the channel as for Framework Management Option 1</td>
<td>• As above, single overarching approval with detailed management plan for implementation; management plan must be set up for regular adaptive improvement</td>
<td>• Local leadership of projects that give effect to local to regional priorities. LMCC as the lead management entity, holding the approval, managing funds and providing contract management for dredge operators; +</td>
</tr>
<tr>
<td>• Dredging carried out by private contractor</td>
<td>• Approval held by lead management entity - in this case LMCC, representing the values of the people of Lake Macquarie (acknowledging that not all users are from the local area, but the lake is a local environmental, social and economic asset).</td>
<td>• Channel dredging directly linked to LMCC CZMP and Council’s Community Strategic Plan - provides evidence of community aspirations and commitment. Framework review by LMCC in context of CZMP. +</td>
</tr>
<tr>
<td>• Use cutter suction of barge mounted excavator</td>
<td></td>
<td>• Stakeholder engagement through a technical subcommittee of the Coast and Estuary Management Committee and/or Aquatic Services Committee; +</td>
</tr>
<tr>
<td>• Organisation responsible for operational management undertakes monitoring and reporting; manages implementation according to triggers; responsible for operational incidents;</td>
<td></td>
<td>• Funding for initial major dredging provided to Council by State government (approximately $2 million), e.g. from consolidated revenue or with funds sourced from a one off grant from the RMS (Better Boating Program), negotiated between RMS and LMCC at the local to regional scale.</td>
</tr>
<tr>
<td>• Monitoring of bed levels and channel usage by RMS</td>
<td></td>
<td>• Maintenance dredging funded jointly by State, local government and beneficiaries: e.g. 50% state (permanent commitment from various programs), 50% made up of Council (including kind), sale of sand and boating levies. Contributions to be formally agreed in an MoU or similar.</td>
</tr>
<tr>
<td>• Crown Lands provides technical advice on dredging design and operational matters.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

LMCC leading the program, representing the aspirations and commitment of local and regional community. Funding package negotiated within existing programs, to address local and regional objectives and priorities.
Table 14.3 – Framework Management Option 3
Partnership for strategic choices – program leadership and operational responsibility

<table>
<thead>
<tr>
<th>Operational factors</th>
<th>Planning and approvals</th>
<th>Strategic choices</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Design parameters for the channel as for Framework Management Option 1</td>
<td>• As above, single overarching approval with detailed management plan for implementation; management plan must be set up for regular adaptive improvement</td>
<td>• State government leadership (Crown Lands or RMS), to align with State strategic priorities and other broad regional development investment and the significance of Swansea Channel as the marine gateway to State significant Lake Macquarie. +</td>
</tr>
<tr>
<td>• Dredging carried out by private contractor</td>
<td>• Approval held by lead management entity - Crown Lands or RMS on behalf of the NSW Government. Operation and contract management delegated to LMCC</td>
<td>• Stakeholder engagement managed through a stand alone steering committee, as per the current project, but providing regular reports to LMCC and RMS committees. +</td>
</tr>
<tr>
<td>• Use cutter suction of barge mounted excavator</td>
<td></td>
<td>• Funding - initial major dredging program funded by State government (approximately $2 million), as part of delivering recreational services related to a significant natural asset and growing community in the Hunter region. Ongoing maintenance dredging funded as a partnership between state and local organisations, reflecting anticipated local to regional benefits from a reliably navigable channel into Lake Macquarie. Small potential contributions from sale of sand and/or charges to users. +</td>
</tr>
<tr>
<td>• Organisation responsible for operational management undertakes monitoring and reporting; manages implementation according to triggers; responsible for operational incidents. LMCC with operational/contract management.</td>
<td></td>
<td>• Funds to be managed by the lead management entity to provide for timely ongoing investment - i.e. agreed contributions to be made on an agreed schedule - as per other State and local government partnerships in the coastal zone; formal MoU or similar. +</td>
</tr>
<tr>
<td>• Monitoring of bed levels and channel usage by RMS</td>
<td></td>
<td>• Day to day implementation (e.g. individual dredging events) managed by LMCC, ensure consistent processes and outcomes with other lake management and recreational asset projects that are within Council responsibility (note staff resources would be an in-kind contribution).</td>
</tr>
<tr>
<td>• Crown Lands provides technical advice on dredging design and other operational matters</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
15.0 References


Church JA and White NJ 2011. Sea Level rise from the late 19th to early 20th century. Surveys in Geophysics DOI: 10.1007/s10712-011-9119-1


Department of Primary Industries. Dredging History from 1970 to the present day.

Department of Planning and Infrastructure (July 2012). “A new planning system for NSW Green Paper”, Frequently Asked Questions, Department website http://www.planning.nsw.gov.au/LinkClick.aspx?fileticket=mUCmiR8mDr8%3D&tabid=68&language=en-US


LMCC, Lake Macquarie Community Strategic Plan

LMCC, Lake Macquarie LEP 2004

LMCC, Lake Macquarie Draft LEP 2012


Lake Macquarie Coastal Zone/Estuary Management Plan (to be updated in 2013)
Micromex Research 2011. Lake Macquarie City Council Community Research – Lake and Catchment


Newcastle Herald (11 May 1972)

NSW Boat Ownership and Storage Report, 2009


NSW Government Procurement Guidelines, Office of Financial Management 2004

NSW Government 2012. NSW Sustainable Dredging Strategy


NSW Government State Plan: NSW 2021, A Plan to Make NSW Number One

NSW Minister for Ports, (August 2011)

NSW Minister for Lands, Kelly, Hon. T. (February 2007) Strategy for assessing priorities

NSW Sustainable Dredging Strategy 2012/13 to 2014/15


Paterson Britton (2007). Berth Demand Study for Lake Macquarie


Roads and Maritime Service website (2012)


http://www.livinglakemacquarie.org/download/channelissues.html

