

## DR DAVID WAINWRIGHT

### DIRECTOR AND COASTAL/WATER RESOURCES/ENVIRONMENTAL ENGINEER

David has close to 25 years' professional engineering experience, primarily in consulting associated with coastal, estuarine and riverine projects. This includes international experience with projects in Europe, Africa, Asia, South America and the South Pacific. In 2013, David completed a part time PhD in coastal engineering through the University of Queensland. He is a chartered engineer in both the civil and environmental colleges of Engineers Australia, holds an adjunct research fellowship with the University of Queensland and is a conjoint lecturer with the University of Newcastle.

In late 2015, David established Salients Pty. Ltd. to continue providing consulting services within his fields of expertise. During 2016, David also undertook part time research, through the University of Newcastle, as part of an NCCARF funded study into the effectiveness of different risk assessment methods for climate change impacts around the Australian coast.

### AREAS OF EXPERTISE

- Environmental Hydraulics
- Consulting Project Management
- Numerical Modelling
- Scientific Programming
- Climate Change / Sea Level Rise
- Staff Training and Supervision
- Civil, Coastal Engineering Design
- Fluvial/Coastal Geomorphology
- Computer Systems / I.T.
- GIS, including GIS customisation
- Environmental Impact Studies
- Client/Community Liaison
- Risk Assessment
- Policy/guideline development
- Applied Research

### KEY POINTS / HIGHLIGHTS

- 2016-Current, as director of Salients, successfully managed over 50 projects for a range of clients including local and state government mostly as the lead consultant, plus also as a subconsultant to others. Project range from small (\$2-3K) coastal engineering assessments for residential developments up to larger (~\$150,000) analysis, modelling and design projects for foreshore design protection works. Increasing focus on coastal management planning and coastal management programs under new legislation in New South Wales.
- 2016 undertaking NCCARF funded research on climate change and sea level rise risk within the coastal zone.
- Late 2015, established Salients Pty. Ltd. a small, focussed consultancy providing services within David's areas of expertise.
- Since 2014, David has been a member of the judging panel for Engineers Australia Newcastle Division's Engineering Excellence Awards. David also regularly interviews candidates for chartered engineer status in the Civil and Environmental Colleges of Engineers Australia.
- Appointed in 2011 as a senior researcher / post-doctoral research fellow with the Coastal Engineering Research Group at the University of Queensland, developing advanced methods for determining coastal hazards. Presently holds position of Adjunct Research Fellow with the University of Queensland.
- In 2013, completed PhD in coastal engineering (Coastal Lagoon Breach Modelling) through the University of Queensland.
- 12 years' experience in Newcastle, Australia, with BMT WBM's water and environment consultancy group. Ongoing involvement with management of the Newcastle business unit particularly since being appointed an associate of the company in 2005.
- Management of and coordination of numerous consulting projects (fees > \$AUD 1.5M) associated with the drying, salinisation and acidification of the Lower Lakes at the end of the Murray River in South Australia, during the "Millennium Drought".
- Resulting from involvement with the Lower Lakes was invited by the Australian Parliament to provide evidence to a Senate Enquiry into Water Management in the Coorong and Lower Lakes in September 2008. He also provided services / advice to senior management within the Murray Darling Basin Authority, South Australian Government and the Wentworth Group of Concerned Scientists.
- International consulting experience, primarily through the Cambridge, UK office of Mott MacDonald's Water and Environment Division in 1999 - 2000. Past international experience spans projects in the United Kingdom, Mexico, Columbia, Uganda, China, Japan, Indonesia, Solomon Islands and Australia.
- Graduated second in class with a Bachelor of Civil Engineering from the University of Technology, Sydney in 1998 (Weighted Average Mark 83.5%).

## RECENT AND SELECTED CONSULTING EXPERIENCE

Location	Description
<b>Solomon Islands National Liquid Waste Guidelines (2019/20)</b>	Development of national liquid waste guidelines for the Solomon Islands Government, in conjunction with the University of Newcastle. Work involved the supervision of research into internationally relevant standards for water contaminants, considering the state of existing legislation, current government management framework, level of economic development and industries operational within the Solomon Islands. The project involved a week-long study excursion to the Solomon Islands to undertake face to face consultation with numerous key stakeholders, and to visit sites including laboratories and industries operating within and around the capital, Honiara.
<b>Probabilistic Hazard Assessment for Pelican, Blacksmiths and Swansea (2018/19)</b>	In conjunction with the University of Queensland development of a probabilistic inundation framework for Monte Carlo modelling of inundation around coastal entrances to enable probabilistic inputs to a subsequent cost benefit analysis. Application of that framework and consolidated damages calculation for the suburbs of Pelican, Blacksmiths and Swansea in Lake Macquarie.
<b>CMP for Eurobodalla Estuaries (2018-20)</b>	Following the commencement of new legislation in NSW, and in conjunction with the University of Newcastle and Coastal Environment Pty. Ltd. Preparation of a Coastal Management Program covering the Moruya River, Mummuga Lake and Wagonga Inlet.
<b>Belongil Creek Entrance opening strategy (2018/19)</b>	Provision of high-level assistance in the development of an entrance management strategy for Byron Shire Council. Management here is complex, involving a very low trigger level for artificial breaching, a desire to minimise inundation of low-lying pasture lands, and a significant threat of acid sulphate soil drainage and fish kills.
<b>MacMasters Beach Revetment (2016-20)</b>	Following storms in June 2016, Salients was called in to provide an emergency assessment of an eroded foreshore fronting the SLSC building at MacMasters Beach. Provision of initial advice, completion of coastal processes assessment (aerial photograph interpretation & numerical modelling) and conceptual design for a 100m long protective revetment.  This was subsequently followed by the detailed design and documentation of the seawall, involving complex and competing constraints relating to the retention of vegetation, indigenous heritage and maintenance of access along the beach. Included the management of geotechnical, survey and coastal engineering (peer review) sub consultants
<b>Spatial Water Quality and Catchment Analysis (2018)</b>	Acting as subconsultant to University of Newcastle, undertaking advanced spatial-stochastic water quality condition assessment of a large catchment to identify areas of high conservation value as an input to setting broad planning objectives. Combined analysis in ArcGIS and R. (Location confidential)
<b>OEH Floodplain Management Program Review (2017-18)</b>	Providing support to a lead economics consultant, Syneca Consulting, in a review of the NSW State Government Floodplain Management Program. Services provided included the interview of state government and local council staff, review of project outcomes in the context of flood risk objectives, the analysis of program data and report quality assurance.
<b>Port Stephens ats Clippers Anchorage (2016-17)</b>	Provision of expert witness services to the land and environment court relating to a development application for marina expansion at Soldiers Point. Development of Expert's Report, Joint Expert's report and provision of evidence at hearing. Consultation with expert ecologists regarding impacts.
<b>Gosford Coastal Entrances Review (2016)</b>	Review of existing information relating to the policy and procedures associated with managing five intermittent lagoons and three coastal creeks in the Gosford area for Central Coast Council. Community consultation, impact assessment (social and ecological), workshop facilitation, strategy development and revision of existing policy and procedures for entrance management. Included coastal engineers (for quality review) and specialised ecologists (estuarine processes / green and golden bell frog) as sub consultants to Salients Pty. Ltd.
<b>Sandy Point / Conroy Park (Port Stephens, 2015 - 2016)</b>	Managing multidisciplinary team. Survey (ground and UAV ( <i>Drone</i> )), extensive community consultation, coastal and drainage processes modelling and assessment. Advanced conceptual design, drafting and costing. Artistic visualisation and presentation to public meeting. Preparation of detailed design and documentation in 2016.
<b>Correa Bay, Woy Woy (2015)</b>	Managing investigation of dredging options. Project formulation, processes assessment, geotechnical field sampling and testing, management option formulation including acid sulfate soils management, planning and environmental impact assessment
<b>Murray River, SA (2011)</b>	Development of integrated wave and hydrodynamic models to simulate hydrodynamic and sediment transport processes at the Murray Mouth. Models validated against measured scour of the ocean entrance to the Murray as a result of variations in releases from the River. This work followed extensive consultancy at this site during the Millennium Drought.

## RELEVANT EMPLOYMENT HISTORY

**DIRECTOR AND COASTAL, WATER RESOURCES AND ENVIRONMENTAL ENGINEER**      **DECEMBER, 2015 – PRESENT**  
**Salients Pty. Ltd., Wallsend, NSW, Australia**

David established Salients Pty. Ltd. in late 2015 to provide consulting services in a range of environmental engineering, coastal engineering, design, planning and risk assessment studies suited to his range of professional experience.

**RESEARCHER / CONJOINT LECTURER**      **DECEMBER, 2015 – PRESENT**  
**University of Newcastle, School of Earth Sciences, NSW, Australia**

Undertaking research into methods for coastal risk assessment, considering application around Australia. Development of “best practice” recommendations for future risk assessment by local government in Australia. Ongoing (conjoint) roles include the advice on the development of undergraduate courses. the provision of guest lectures and co-supervision of Honours and Masters degree students.

**SENIOR COASTAL AND ENVIRONMENTAL ENGINEER**      **AUGUST, 2013 – JANUARY, 2016**  
**Whitehead & Associates, Cardiff, NSW, Australia**

Following completion of employment with the University of Queensland in 2012, and the award of his PhD in 2013, David was offered a position at Whitehead & Associates, a small niche consulting firm in Cardiff (near Newcastle), NSW. David’s role was to enhance technical capability within the whole business, which previously focussed almost exclusively in the wastewater industry, and to develop a new strand of business in the Environmental (and Coastal) Engineering, Planning and Analysis fields. Work was associated with:

- Business Development;
- Developing risk based policy guidelines for local councils on the south coast of NSW;
- Numerical hydraulic modelling investigations to support coastal process studies and design work;
- Project management of coastal / estuarine design works associated with foreshore protection;
- Assessment of dredging feasibility within estuaries, including the recovery, assessment and development of plans for managing contaminants and acid sulfate soils;
- Environmental site supervision of dredging and acid sulfate soil remediation works;
- Development of software for catchment scale analysis of decentralised wastewater management strategies; and
- Implementation of new techniques for GIS analysis and reporting.

**SENIOR RESEARCHER AND POST-DOCTORAL RESEARCH FELLOW**      **AUGUST, 2011 – PRESENT**  
**University of Queensland, Brisbane, Australia**

While supported by and maintaining a presence with BMT WBM, David took a position with the University of Queensland’s coastal research group, with the following responsibilities:

- Extension of existing stochastic models of coastal erosion hazards;
- Research into methods for the probabilistic treatment of sea-level rise;
- Preparation of original research for publishing in peer reviewed journals;
- Reporting study outcomes to meet funding organisation requirements;
- Presentation of findings at community forums; and
- Presentation of findings at local, national and international conferences.

Following completion of the 18 month fellowship, David has continued as an adjunct research fellow with the University of Queensland.

**ASSOCIATE AND SENIOR ENGINEER**

**APRIL, 2001 – 2013**

**WBM Oceanics Australia / BMT WBM Pty Ltd, Newcastle, Australia**

David was responsible for the administration, coordination, and project management of many studies. As an associate (2005-2013), David assisted with management of the Newcastle water and environment business unit. Project work included:

- Wave modelling;
- Hydrodynamic tidal and flood modelling;
- Environmental Impact Statements associated with coastal zone developments;
- Estuary processes studies;
- Software development;
- Development of GIS databases;
- Fluvial processes and geomorphology;
- Coastal entrance management;
- Coastal processes assessment;
- Sediment transport modelling and assessment; and
- Civil design within the coastal zone.

**RIVER MODELLER / WATER RESOURCES ENGINEER / FLOOD MAPPER**

**MAY, 1999 – MARCH, 2001**

**Mott MacDonald, Cambridge UK**

This period involved work on a number of international projects. During 2001, after returning to Australia, David was also contracted by Mott MacDonald, as a private consultant (through his own business), to undertake a project in Uganda. Generally, work with Mott MacDonald involved projects relating to:

- Flood analysis and management;
- Flood modelling (hydrological and hydraulic) and mapping;
- Water quality modelling;
- Assessment of water quality for water supply sources;
- Development of in-house hydrodynamic modelling software; and
- Development of interfaces between GIS software and hydrodynamic modelling software.

**COASTAL PROJECT ENGINEER**

**OCTOBER, 1997 – APRIL, 1999**

**Patterson Britton and Partners, Sydney, Australia**

Primarily involved in coastal and maritime engineering, conceptual and detailed design studies associated with:

- Recreational and industrial maritime facilities;
- Waterfront development including parklands and marinas;
- Entrance training works;
- Dredging projects;
- Acid sulfate soils management; and
- Coastal Management, seawall assessment and reconstruction

**STUDENT ENGINEER / ENGINEERING ASSISTANT**

**JULY, 1995 – FEBRUARY, 1996**

**DECEMBER, 1996 – JUNE, 1997**

**Department of Land and Water Conservation, NSW**

This involved two periods of "sandwich" work experience during completion of his bachelor's degree. During the second period, David undertook his final year project, a study involving numerical modelling of the Evans River in New South Wales. Responsibilities involved:

- 1-Dimensional Numerical Modelling
- Research Studies
- Community Liaison
- Hydrographic Survey and Data Collection

## EDUCATION HISTORY

### POST GRADUATE

MARCH, 2005 – 2012

#### University of Queensland.

David was awarded a PhD in 2013. The thesis was undertaken with the Coastal Engineering Research Group at the University of Queensland. The research was been undertaken remotely and on a part time basis, requiring a great deal of self-sufficiency and discipline to ensure that suitable progress was made. David developed aspects of BMT WBM's TUFLOW software package in parallel to with the research work

### UNDERGRADUATE

1992 – 1997

#### University of Technology, Sydney

- First Class Honours
- Graduated Second In Class
- Weighted Average Mark of 83.5
- Trevor Buchner Design Award for Steel Design
- Pioneer Concrete Award for Stage 5 subjects

## OTHER SKILLS

Class 1A Australian **Driver's License** • International Advanced Open Water **Diving Certificate** (PADI) • **Touch Typing** at 60 words per minute (self-taught) • **Computer Programming** experience in many languages with a variety of fluency: FORTRAN, Python, R, Ruby/Rails, Matlab/Octave, Visual Basic for Applications, MapBasic, Maple, C++/C#, Java, HTML/CSS, Julia • **Database Development:** Microsoft Access, MySQL, Microsoft SQL Server • **GIS:** QGIS, MapInfo, ArcGIS, MapWindow, GRASS • **Environmental Hydraulics Modelling** Packages: Delft-3d, RMA Suite, TUFLOW, TUFLOW-FV, SWAN, HEC-RAS, ELCOM, XP-RAFTS, Mike-11. **Software:** High familiarity with a broad range of **Office and Productivity Software** on both **Windows and Linux** platforms **First Aid** certificate including CPR

## PUBLICATIONS / CONFERENCE PRESENTATIONS

- Wainwright D.J. (2019)** Swansea Channel: A Legacy. Presented at the COPEP Annual Full Day Seminary, August 19.
- Wainwright D.J. (2019)** Probabilistic Hazards and Risk Assessment for Inundation Related Coastal Hazards. Invited presentation to the NSW DPIE Coast and Estuary Program Forum, April 10.
- Callaghan D.P., Wainwright D.J., Hanslow, D.J. (2019)** Consideration of uncertainty in sea level rise in Australia's most exposed estuary: a discussion on allowances under different epistemic uncertainties, submitted to *Coastal Engineering*
- Brennan, P., Wainwright, D. (2019)** Journey with the community – presenting challenging technical information. Presented at the NSW Coastal Conference, Terrigal
- Raoult, V., Wainwright, D., Smith, T., Gaston, T (2019)** Foreshore rehabilitation: what's best for the ecology? A case study of Pelican Beach, Lake Macquarie. Presented at the NSW Coastal Conference, Terrigal
- Wainwright, D., Callaghan, D., Howe, A., Hanslow, D., (2018).** Probabilistic Hazard Assessment Methodology to support Local adaptation Planning in Lake Macquarie. Presented at the NSW Coastal Conference, Merimbula.
- Tonmoy, F.N., Wainwright, D.J., Verdon-Kidd, D.C., Rissik, D., (2018)** An investigation of coastal climate change risk assessment practice in Australia. *Environmental Science and Policy* Volume 80 Pages 9-20.
- Wainwright, D., & Verdon-Kidd, D. (2016)** Steps towards developing a risk assessment framework for coastal planning. *NSW Coastal Conference, Coffs Harbour*
- Jongejan, R., Ranasinghe, R., Wainwright, D., Callaghan, D. & Reyns, J. (2016)** Drawing the line on coastline recession risk. *Ocean and Coastal Management* Volume 122 Pages 87-94
- Wainwright, D., D Lord, B Crawley (2015)** 40 years of change. Recent Evolution of the Port Stephens Flood Tide Delta *NSW Coastal Conference, Forster*
- Ranasinghe, R., D. Wainwright, D. Callaghan, T. Duong (2015)** The relative contribution of sea level rise and storm erosion to net coastline recession *Proceedings of Coastal Sediments 2015.*
- Wainwright, D. and Baldock, T.E. (2015)** Measurement and modelling of an artificial coastal lagoon breach, *Coastal Engineering*, Volume 101, Pages 1-16
- Wainwright, D. J., R. Ranasinghe, D. P. Callaghan, C. D. Woodroffe, R. Jongejan, A. J. Dougherty, K. Rogers, and P. J. Cowell (2015).** Moving from deterministic towards probabilistic coastal hazard and risk assessment: Development of a modelling framework and application to Narrabeen Beach, New South Wales, Australia. *Coastal Engineering* 96, 92-99.
- Wainwright, D, D Lord, P Watson, N Lenehan, and I Ghetti. (2014).** 'Widely Accepted by Competent Scientific Opinion'. Sea Level Projections for the Shoalhaven and Eurobodalla Coast *NSW Coastal Conference, Ulladulla.*
- Lord D, D. Wainwright, N. Lenehan, I. Ghetti (2014).** Using Triggers to Implement Coastal Adaptation Measures *NSW Coastal Conference, Ulladulla*
- N. Lenehan, I. Ghetti, D Lord, D. Wainwright, (2014).** South Coast Regional Sea Level Rise Planning and Policy Response: proposed alternative to the rescinded NSW Sea level Rise Policy Statement" *NSW Coastal Conference, Ulladulla*
- Wainwright, D., Ranasinghe, R., Callaghan, D., Woodroffe, C., Cowell, P., Rogers, K., (2014).** An argument for probabilistic coastal hazard assessment: Retrospective examination of practice in New South Wales, Australia. *Ocean & Coastal Management* 95, 147–155.
- Woodroffe, C.D., Callaghan, D., Cowell, P.J., Wainwright, D., Rogers, K., Ranasinghe, R. (2014).** A framework for modelling the risks of climate-change impacts on Australian coasts, in: *Applied Studies in Climate Adaptation Eds. Palutikof J.P., Boulter, S.L., Barnett, J., Rissik, D. John Wiley & Sons Ltd.*
- Wainwright, D & Lord, D (2014)** Historical Evidence and an Uncertain Future: Sea Level Rise on the South Coast of NSW. *Presentation to Engineers Australia COPEP Forum, September.*
- David J Wainwright, David P Callaghan, Peter Cowell, Amy Dougherty and Colin D. Woodroffe (2013)** Probabilistic Coastal Hazard Lines for Risk Based Coastal Assessment. *Coasts and Ports Conference, Sydney, 2013*
- Wainwright, D. J., Callaghan, D. P. & Baldock, T. E. (2013).** Statistical modelling of the barrier height fronting a coastal lagoon and the impact of sea-level rise *Coastal Engineering*, 75, 10-20.
- Callaghan, D. & Wainwright, D. (2013).** The impact of various methods of wave transfers from deep water to nearshore when determining extreme beach erosion *Coastal Engineering*, 74, 50-58
- Lotsari, E., Wainwright, D., Corner, G. D., Alho, P. & Käyhkö, J. (2013).** Surveyed and modelled one-year morphodynamics in the braided lower Tana River *Hydrological Processes*, DOI: 10.1002/hyp.9750
- Wainwright, D, Baldock, T. & Callaghan, D. (2012).** Coastal Lagoon Entrance Management – What Can Models Tell Us? *NSW Coastal Conference, Kiama*
- Wainwright, D., Callaghan, D. et al. (2012).** Coastal Adaptation Framework from Geological to Engineering Time Scales *Coast2Coast National Australian Coastal Conference, Brisbane*
- Wainwright, D, Baldock, T. & Callaghan, D. (2012).** Statistical Modelling of Coastal Lagoon Barrier Height to Inform Coastal Design and Planning *Coast2Coast National Australian Coastal Conference, Brisbane*
- Wainwright, D, Callaghan, D. et al. (2012).** How to Weigh Coastal Hazard against Economic Consequence *Poster presentation at International Conference on Coastal Engineering, Santander, Spain.*
- Wainwright, D. J., L. J. Kidd, et al. (2011).** Morphodynamic Modelling of Entrance Breakout for a Coastal Lake. *Coasts and Ports 2011 Diverse and Developing. Perth, Western Australia.*
- Wainwright, D., Baldock, T. (2010)** A Framework for Probabilistic Berm Height Determination - Application to ICOLL Flood Studies', *50th Floodplain Management Authorities of New South Wales Conference, Gosford, 2010*
- Jenkins, C.G., Hotchkiss, R.H. & Wainwright, D.J. (2009)** Analysis of the Sediment Transport Capabilities of TUFLOW *Poster presentation at the 33rd IAHR Congress, Vancouver 2009*
- Dalrymple, B., Wainwright, D., Cavanagh, D., Wood, M. (2005)** An Integrated GIS Database for the Management of Environmental Data *15th Queensland Water Symposium, Brisbane 2005.*
- Wainwright, D.J., Patterson, D.C.** Significance of Spatially and Temporally Varying Bedforms in Modelling Estuarine Hydrodynamics and Morphology *Coasts and Ports Conference, Adelaide, 2005.*
- Vienot, P., Syme, W.J., Wainwright, D.J. (2005)** Estuary Entrance Scour Modelling and its Implications for Flood Behaviour and Coastal Floodplain Management *NSW Floodplain Management Authorities Conference, Narooma, 2005.*
- Wainwright, D.J., Vienot, P., Syme, W.J. (2004)** Dynamic Modelling of the Impact of Entrance Scour on Flood Behaviour in Coastal Lakes and Estuaries *NSW Coastal Conference, 2004.*
- Wainwright, D.J., Haines, P.E., Wheatley, L. (2003)** Managing Environmental Data using an Integrated GIS Database *NSW Coastal Conference 2003.*
- Wainwright, D.J., Haines, P.E., Harris, B.R. (2003)** The use of GIS in a coastal and environmental engineering consultancy *presented at Coastal GIS Conference, 2003 – University of Wollongong.*

## Numerical Modelling/Computer Programming

**Probabilistic Inundation Hazard Assessment for Pelican, Blacksmiths and Swansea (2018-19):** In conjunction with the University of Queensland development of a probabilistic inundation framework for Monte Carlo modelling of inundation around coastal entrances to enable probabilistic inputs to a subsequent cost benefit analysis. Application of that framework and consolidated damages calculation for the suburbs of Pelican, Blacksmiths and Swansea in Lake Macquarie.

**Tomago Boat Ramp (2017-18):** Modelling (TUFLOW) of tides, floods and wind waves to provide design conditions for the installation of a jetty and floating pontoon at Tomago Boat Ramp.

**Taylor's Beach Wharf (2017):** Modelling (Delft3d) of coastal processes, including wind waves and tides to provide design conditions for the redevelopment of a wharf and installation of a floating pontoon at Taylor's Beach

**Central Coast (2016):** Development of a coastal model (Delft 3d) covering the central coast of New South Wales, including Broken Bay to support studies being undertaken for Central Coast Council.

**Port Stephens (2015)** Development of an integrated wave and tidal hydrodynamic model of Port Stephens, using Delft 3d, to support coastal process analysis as part of foreshore management strategy development around the Port.

**The Coorong, South Australia (2013-14)** Development of an integrated wave and salinity (Advection Dispersion Model) of the Coorong, South Australia, using Delft 3d, as part of a research and development initiative undertaken by Whitehead & Associates for the South Australian Government.

**Murray River, SA (2013-2015)** Development of a predictive discharge spreadsheet model for barrages separating the Lower Lakes from the Coorong at the lower end of the Murray River in South Australia. The spreadsheet models incorporated scripts for calculating discharge rates based on the variations within and between the barrages at Goolwa, Mundoo, Boundary Creek, Ewe Island and Tauwicheere.

**Sunshine Coast Airport, Coastal Breaching Assessment (2013):** Utilising the morphological model developed as part of David's PhD research, assessed the viability of a cross-beach flood relief scheme associated with expansion of the Sunshine Coast Airport in Maroochydore.

**Botany Bay Shoreline Evolution Modelling (2013):** Application of BMT WBM's in-house software EVOMOD to examine future shoreline evolution along Lady Robinsons Beach in Botany Bay.

**Lower Myall River Numerical Modelling Study (2012):** Project Management of the development, validation and application of a numerical, hydrodynamic and wave model for the Lower Myall River, and Port Stephens

**Murray River Entrance Modelling (2011):** Responsible for the development of integrated wave and hydrodynamic models to simulate hydrodynamic and sediment transport processes at the entrance to the Murray Mouth. Tasks included modification of SWAN software to communicate with TUFLOW-FV and the introduction of cohesionless sediment transport algorithms.

**Murray River Virtual Weir (2009/2010):** Direction of a project involving both 2 dimensional (depth averaged) and 3 dimensional (stratified) flow modelling of the Lower Lakes and Lower Murray River respectively. Coordination of project effort, provision of modelling advice to staff, quality assurance of outputs and presentation of results to senior staff at the Murray Darling Basin Authority and South Australian government.

**TUFLOW Morphological Module Development (2008-2012):** In conjunction with PhD research, developed morphological modelling software for the TUFLOW finite difference model. The software was also integrated into the TUFLOW-FV modelling package, a task which was made easier due to the original modular design of the morphological module.

**Seawater Intrusion Modelling for Barrages EIA (Lower Lakes) (2010):** Direction of modelling effort associated with the provision of advice relating to an Environmental Impact Statement dealing with the introduction of seawater into the Lower Lakes, South Australia. Modelling of tidal hydrodynamics, coastal sediment transport and entrance dynamics, structural capacities and lake recovery processes. Supervision and management of significant subcontractor inputs relating to biogeochemical modelling associated with acid sulfate soils.

**Urban Developer Software Development (2010):** Provision of high level advice relating to numerical algorithms and code structure associated with the Urban Developer software product. Provision of advice regarding software specifications and assistance with bugs associated with upgrading the MUSIC catchment modelling software for incorporation into Urban Developer.

**Goolwa Water level Management Area EIA Modelling (2010):** Direction of two stage modelling project involving "bucket" type spread sheet modelling of the Lower Lakes which, at the time had been divided by several barriers into separate water bodies. Following initial screening with those models, selected simulations were undertaken with the two-dimensional finite volume model TUFLOW-FV. During project conception, I organised and chaired a brainstorming/scoping session between the federal Department of Environment, Water, Heritage and the Arts, and the South Australian Department for Environment and Heritage to determine requirements of the subsequent Environmental Impact Statement. Project undertaken under significant time constraints.

**Coorong Southern Lagoon Pumping Assessment (2009):** Development of both Finite Element and Finite Volume models of the Coorong to investigate the effect of pumping water from the Southern Lagoon of the Coorong on salinity levels within the waterway.

**Finite Volume Model Development (2007-2008):** Development of a strategy for the development of a new in-house modelling code based on finite volume numerical methods. Assistance with code development, testing and quality checking of code

**Queensferry, River Dee Sedimentation Modelling (2007):** Assisting a local UK consultant in the development of a morphological model using TUFLOW to examine the impact of highway duplication, determination of erosion and sedimentation patterns at Queensferry.

**Wellington Weir Modelling (2007-2008):** Modelling study to determine the expected impact of weir construction at Wellington, where the Murray River flows into Lake Alexandrina. Extensive data review, model establishment, validation and application. The initial commission for this project was rapidly expanded as the crisis within the Lower Lakes of the Murray River developed. Management of a team undertaking numerous analyses involving hydrology, extensive modelling, GIS analysis and reporting and hydraulic capacity analyses. During September 2008, was called upon by the Australian Government's Senate Committee to provide evidence at their enquiry into the Lower Lakes.

**Port Macquarie Marina Redevelopment Modelling (2007):** Provision of specialist estuarine hydraulic, wave and sediment transport advice relating to the redevelopment of a Marina at Port Macquarie. Development, calibration and application of a numerical model of the Hastings Estuary to undertake environmental impact assessments.

**Bomaderry Creek Flood Study (2007):** Data collation and review. Reporting

**Tabourie Lake Flood Study (2007-2008):** Data collation and review. Reporting. Community consultation and survey management.

**F3 Upgrade to Heatherbrae (2007):** Modelling of the flood impact of the proposed freeway extension. Study utilised TUFLOW and involved site reconnaissance, data collection and integration into the model, validation and testing of various scenarios. Prediction of flood impacts.

**Sandgate Flood Assessment: Additional Modelling (2006):** Following from a previous flood study, revision of an existing TUFLOW flood model and testing of various management options to alleviate flooding at Sandgate near Newcastle, Australia.

**Port Philip Bay UKC Data Review (2006):** Processing and analysis of a substantial wave data set from numerous recorders deployed at a variety of locations at the entrance to Port Philip Bay. The substantial processing required development of purpose built routines in Matlab for extraction, conversion and presentation.

**Batemans Bay Marina Redevelopment (2006):** RMA modelling of the impact on hydrodynamics resulting from the proposed redevelopment of Batemans Bay Marina

**Kinross Development Flood Impact Assessment (2006):** TUFLOW modelling to assess the impact of a proposed development near Raymond Terrace, NSW.

**Moreton Bay Dredge Disposal Modelling (2005):** RMA/SWAN modelling of hydrodynamics and cohesive silt resuspension and transport resulting from a variety of proposed dredge disposal scenarios in Moreton Bay.

**Spitfire Channel Navigation Improvement Modelling (2005):** RMA modelling of hydrodynamics, waves and cohesionless sediment transport for the investigation of impacts of proposed navigation channel realignment dredging in Moreton Bay

**Swansea Channel Cable Crossing (2005):** RMA modelling of hydrodynamics and development of specialised sediment transport software for the estimation of maximum expected scour depth to enable recommendation of a required burial depth for a 33kV feeder line beneath Swansea Channel

**Tamar River Sedimentation Modelling (2005):** Integrated hydrodynamic, wind wave and cohesive sediment modelling (RMA10S/SWAN) for the Tamar River in Tasmania. Development of software to enable this integration.

**Mooloolaba River Entrance Modelling (2005):** Integrated wave/hydrodynamic and cohesionless sediment transport modelling to investigate sand transport patterns at the entrance to the Mooloolaba River.

**Fukude Port Sand Bypass Modelling (2004):** Integrated wave/hydrodynamic and sediment transport modelling for Fukude Port, Japan. Calibration to existing longshore transport rate data and examination of feasibility for location of sand bypassing system.

**Swansea Bridge Scour Modelling (2004):** Interpretation and extension of flow velocity and bed shear stress results from a Computational Fluid Dynamics (CFD) model (FLUENT) around the base of bridge piers following emergency works to repair Swansea Bridge. Estimation of sediment transport rates and the impact of the repair work.

**Burrill Lake Flood Study (2004/2005):** Development of hydrological (RAFTS-XP) and hydraulic (TUFLOW) models to define planning levels and flood behaviour within the Burrill Lake catchment.

**Moreton Bay Wave/Hydrodynamic & Sediment Modelling (2004):** Integration of existing 2-D hydrodynamic (RMA) and wave (SWAN) models to assess the feasibility of management options within Moreton Bay.

**Forster Keys Flushing Assessment (2004):** Development and application of a two-dimensional tidal hydrodynamic and water quality model for simulating the flushing characteristics of an existing canal estate in Forster, NSW. Assessment of the implications of improving hydraulic connectivity between different sections of the canal system.

**Wolli River Tidal Modelling (2004):** Management of the development and calibration of a two dimensional RMA model of tidal hydrodynamics as part of the Estuary Management Process for the Wolli River.

**Cape Jaffa Marina Modelling (2003):** Provided modelling services to a lead consultant preparing an environmental impact statement for the development of a coastal marina at Cape Jaffa, South Australia. Modelling included three dimensional hydrodynamics and tidal flushing, modelling the impacts of groundwater flows and wind induced movement of buoyant particles

**Mats Point – Black Ned’s Bay Foreshore Erosion Study (2003):** Adaptation of existing RMA and SWAN models for the entrance to Lake Macquarie to investigate a foreshore erosion problem between Black Ned’s Bay and Mats Point in Swansea Channel. Development of an algorithm for the calculation of sediment transport rates within the study area based on offshore wave, wind and tidal conditions. Application of algorithms to investigate patterns of foreshore erosion over the previous decade. Development and assessment of potential management options for the foreshore erosion problem. Recommendation of a preferred management strategy.

**TUFLOW Sediment Transport Modifications (2003):** Modification of WBM’s in house hydraulic and flood modelling software to enable the modelling of sediment erosion/accretion and transport processes. Modifications were required to enable the simulation of coastal entrance breakout during flood events.

**Murray River Entrance Modelling (2001 – 2005):** Responsible for the development of integrated wave and hydrodynamic models to simulate hydrodynamic and sediment transport processes at the entrance to the Murray River. Tasks included modification of RMA & SWAN codes (FORTRAN) to enable on-going integration and updating of wave conditions in the hydraulic model, modification and improvement of the Van Rijn formulation for sediment transport within RMA, calibration and verification of both hydrodynamics and sediment transport, Assessment of various dredging options.

**Swansea Channel/Swan Bay Study (2002):** Responsible for the management of a study of hydrodynamics, sediment transport and navigation within Swansea Channel, including the development of management strategies to ameliorate existing problems within the channel. The study utilised detailed numerical modelling and GIS extensively.

**Hexham Swamp EIS flood modelling (2001):** Responsible for modelling the impact of opening existing flood gates on Ironbark Creek to determine the extents of inundation and changes in water levels. Combined tidal and flood modelling.

**Port Phillip Bay Under Keel Clearance Study (2001/2002):** Responsible for wave modelling associated with the development of algorithms for predicting safe passage of ships through the heads of Port Phillip Bay

**Lake Macquarie Entrance Study (2001/2002):** Integrated wave and hydrodynamic modelling for various management options at the entrance to Lake Macquarie

**Lake Victoria Environmental Management Plan (3-D Modelling) (2000):** Responsible for the development, calibration and verification of two three-dimensional hydraulic models on the Ugandan shoreline of Lake Victoria. The project involved four weeks of on-site work in Kampala and involved a large amount of programming (using Avenue and Visual Basic) and integration of the model into the ArcView GIS package.

**Salfords Stream Flood Study (2000):** Hydrologic modelling, hydraulic modelling and mapping of floodplains for a mixed rural/urban catchment on the outskirts of Greater London. The project involved intensive and integrated application of GIS from start to finish and programming using Visual Basic and Avenue.

**Modelling of Waste Stabilisation Ponds (1999/2000):** Part of an ongoing research project with the University of Surrey, modelling of waste stabilisation ponds at Ginebra (Columbia) and Mexicaltzingo (Mexico). Three dimensional models were developed and calibrated to existing field data. The work involved a large model development component to enable modelling of systems with a very low Reynolds number and the development of post processing utilities to display drogue and pollutant concentration results using FORTRAN and Visual Basic for Applications (VBA).

**Development of Rating Curves for the River Ouse (1999):** Development of spread sheet models to extend existing rating curves for sites on the River Ouse. The models contained a number of macros written using VBA which facilitated the derivation of rating functions through logarithmic regression. Training of client staff (UK Environment Agency) was an integral part of this project.

**Conversion of HYDRO-3D from Fortran77 to FORTRAN 95 (1999/2000):** This project involved upgrading of existing HYDRO-3D Fortran77 code to a more structured, modular format using the FORTRAN 95 standard. Reformatting, debugging, testing and application of the developed model were undertaken as part of this process;

**Evans River tidal hydraulic model development (1997):** This project, undertaken as part of the requirements for David’s university degree involved numerical modelling research, data collation and collection, model establishment (MIKE-11), model calibration, validation and application; and reporting

**Modelling of Camden Haven Estuary (1995):** Assistance in digitising maps and general development of this model to examine the impact of building a sewage treatment plant.



## **GIS and Spatial Database Development**

**Spatial Water Quality and Catchment Analysis (2018):** Acting as subconsultant to University of Newcastle, undertaking advanced spatial-stochastic water quality condition assessment of a large catchment to identify areas of high conservation value as an input to setting broad planning objectives. Combined analysis in ArcGIS and R. (Location confidential)

**Decentralised Wastewater Analysis Model-DWAM (2013-2015):** Development of a distributed, catchment wide analysis model for the simulation of off-site exports from on-site wastewater management systems. Linked to QGIS and written in Python, the model includes routines that work on raster based data sets, using parallel processing, to derive broad scale assimilation capacities and exports to sensitive receiving environments.

**CRL GIS Database (2006/2007):** Development of a comprehensive environmental monitoring database system (ENQASYS) for a sand mining operation on North Stradbroke Island. System linked XML based data sets through an MS SQL metadatabase. Front end capability was provided by MS Access and MapInfo GIS.

**Richmond River Water Quality Database (2005):** Development of a database system for the digital collation and interrogation of existing historical water quality data on the Richmond River.

**South-East Water Quality Database (2004/2005):** Development of a database and associated GIS application for managing water quality data in the Bega Valley and Eurobodalla Local Government Areas.

**Georges River SES Plan (2004):** Coding of a GIS tool in MapBasic for use by the SES in evacuation planning during flood events.

**Sydney Water PSP Assessment Model (2004):** Project management and development of a GIS model (Map Basic) for determining the suitability of environmental conditions at various towns for the implementation of onsite sewerage systems. Algorithms included the determination of disposal capacities considering both nutrient and hydraulic balances. A subsequent program was written in FORTRAN to enable the gravity tracking of discharges from various allotments using the digital elevation model as a basis.

**Dynamic Linking of Wave and Hydrodynamic Models (2001/2002):** Development of a system to facilitate the dynamic linking of hydrodynamic (RMA) and wave (SWAN) models using MapBasic.

**Hawkesbury/Lower Nepean Onsite Sewage Retention Analysis System (HLN - OSRAS) (2003/2004):** Development of routines within ArcGIS 8.3 (using Map Objects and Visual Basic for Applications) to enable the automatic division of soil facets within soil landscapes for the Department of Land and Water Conservation. Application of these routines to develop spatial datasets of "On-site Natural Hazard Class" based on soil properties and location within the catchment

**Newcastle Flooding Database (2003/2004):** Upgrade of an existing historical flood database for Newcastle City Council including the collection and addition of new data, integration of that data into the database and modification of routines for querying the database using a GIS interface coded in MapBasic (MapInfo).

**Gosford Water Quality Database (2002/2003):** Development of a database system for the digital collation and interrogation of existing historical water quality data (collected over 25 years, mainly available in hard copies of reports). Utilisation of optical character recognition (OCR) software for the transfer of digital data. Development of applications in Access (VBA), MapInfo (MapBasic) and Excel (VBA) for the maintenance, interrogation and reporting of results from both historical and future water quality collection programs.

**Coal and Allied Spatial Database (CNA-Map) (2002):** Development of a spatial data management system for the tracking of land title and environmental monitoring information associated with the coal mining operations of Coal and Allied in the Hunter Valley. Development of an application in Microsoft Access (integrated with MapInfo) for the secure storage, perusal and querying of a wide range of data sets. Provision of training courses in the application of MapInfo and CNA-Map interfaces.

## **Environmental Studies / Research Activities / Community Liaison**

**Pelican Foreshores CBA (2019-20):** Following conceptual design, leading a team undertaking cost benefit, social and engineering analyses of proposed options. Work included probabilistic hazard lines for channel morphology, the supervision of planning/social and economics subconsultants and reporting.

**Pelican Blacksmiths Swansea CBA (2019-20):** Part of a team, led by Umwelt, delivering cost benefit analysis of adaptation options for three suburbs surrounding Swansea Channel. Providing initial engineering feasibility and cost estimate assessments of close to 50 adaptation options. Client and community liaison, plus provision of expert inputs to management of probabilistic hazards as part of the CBA (working with the Centre for International Economics). Peer review and QC role in reporting.

**ICOLL Reverse Breaching Advice (2020):** Following severe bushfires in coastal NSW, provision of advice to DPIE relating to mitigating against water quality problems by breaching coastal entrance barriers to inundate ICOLLs with low water levels.

**Pearl Beach Lagoon CZMP Implementation (2019-20):** Progression of three management actions for the Pearl Beach Lagoon CZMP Investigation including the detailed design of stormwater treatment measures and investigations into the removal of sediments deposited by stormwater and the potential removal of a weir from the entrance channel to the lagoon. Leading a team of coastal engineering, ecological and stormwater design consultants. Investigation, community consultation, bathymetric survey (RTK-GPS) and sediment sampling and analysis.

**Swansea Heads Breakwater Coastal Engineering Advice (2019):** Provision of advice to contractor undertaking repair works on Swansea Breakwater.

**Seminar on Probabilistic Inundation (2019):** Invited presentation given to DPIE staff on methods for probabilistic inundation hazards.

**The Entrance SLSC Building Coastal Assessment (2019):** Preliminary advice on requirements for redevelopment of the SLSC building and The Entrance Beach considering long term projections of sea level rise and the response of coastal processes and impacts on the site.

**The Entrance SLSC Boat Shed (2019):** Coastal Engineering Assessment of a proposed Temporary storage shed at The Entrance Beach. An existing shed had been condemned and demolished and a rapid assessment was required to enable installation of a temporary shed prior to commencement of the patrol season for the SLSC.

**Coastal Lagoon Entrance Policy Presentation (2019):** Presentation on ICOLL entrance management given to the Central Coast Council Coastal Lagoons and Estuaries Committee.

**Solomon Islands National Liquid Waste Guidelines (2019/20):** Development of national liquid waste guidelines for the Solomon Islands Government, in conjunction with the University of Newcastle. Work involved the supervision of research into internationally relevant standards for water contaminants, considering the state of existing legislation, current government management framework, level of economic development and industries operational within the Solomon Islands. The project involved a week-long study excursion to the Solomon Islands to undertake face to face consultation with numerous key stakeholders, and to visit sites including laboratories and industries operating within and around the capital, Honiara.

**CMP for Eurobodalla Estuaries (2018-20):** Following the commencement of new legislation in NSW, and in conjunction with the University of Newcastle and Coastal Environment Pty. Ltd. Preparation of a Coastal Management Program covering the Moruya River, Mummuga Lake and Wagonga Inlet.

**205 Mitchell St Stockton (2018):** Preparation of a Coastal Engineers Report in accordance with the requirements of Newcastle City Council to assess a proposed subdivision of beachfront property in Stockton.

**Sanctuary Point Police Station SEPP71 Report (2018):** Preparation of a Coastal Protection Report, in accordance with SEPP 71, for a proposed police station in Sanctuary Point.

**Belongil Creek Entrance opening strategy (2018/19):** Provision of high-level assistance in the development of an entrance management strategy for Byron Shire Council. Management here is complex, involving a very low trigger level for artificial breaching, a desire to minimise inundation of low-lying pasture lands, and a significant threat of acid sulphate soil drainage and fish kills.

**Office of Environment and Heritage Floodplain Management Program Review (2017-18):** Providing support to a lead economics consultant, Syneca Consulting, in a review of the NSW State Government Floodplain Management Program. Services provided included the interview of state government and local council staff, review of project outcomes in the context of flood risk objectives, the analysis of program data and the review of project outputs.

**16 Cabarita Avenue, Avalon (2017):** Preparation of an Estuarine Risk Management Report in accordance with the requirements of Northern Beaches (ex. Pittwater) Council

**3 Murray Avenue, Newcastle East (2017):** Coastal Hazards Report for proposed redevelopment of a residential property into an area affected by wave overtopping spray. Completed in accordance with the requirements of Newcastle City Council

**83 Richard Road, Scotland Island (2017):** Preparation of an Estuarine Risk Management Report in accordance with the requirements of Northern Beaches (ex. Pittwater) Council

**Peer Review of Risk Assessment, 1 Queensbridge (2017):** Review of analysis and justification for establishment of design floor levels in the context of tide, storm surge and sea level rise for 1 Queensbridge, a proposed Skyscraper at Southbank Melbourne.

**Coomba Park Stormwater Management Plan (2017):** Examination of flood levels and the impact of revised climate change projections on inundation levels at Coomba Park along the foreshores of Wallis Lake. In support of Alluvium, which was preparing a Stormwater Management Plan for Mid Coast Council.

**12-13 The Chase, Lovett Bay (2017):** Preparation of an Estuarine Risk Management Report in accordance with the requirements of Northern Beaches (ex. Pittwater) Council

**Avoca Foreshore Improvements (2016-17):** Preparation of a Coastal Engineers report, a sub-report of the Review of Environmental Factors, being prepared by NGH Environmental for the Avoca Foreshore Improvement Works, southern Avoca Beach.

**Gosford Coastal Entrances Review (2016-17):** Review of existing information relating to the policy and procedures associated with managing five intermittent lagoons and three coastal creeks in the Gosford area for Central Coast Council. Community consultation, impact assessment (social and ecological), workshop facilitation, strategy development and revision of existing policy and procedures for entrance management. Included coastal engineers (for quality review) and specialised ecologists (estuarine processes / green and golden bell frog) as sub consultants to Salients Pty. Ltd.

**Eagleton Property Development Flood Risk Report (2016):** Preparation of a report on flood risk and management for the Eagleton Horse Resort (classified, high hazard floodway) property where a stock refuge mound and additional development were proposed. Assessment of flood mechanisms from flood report and assessment of flood risk.

**Cochrone Lagoon Public Access Assessment (2016):** Examination of the historical morphological behaviour of Cochrone Lagoon and preparation of preliminary management options for a public access adjacent to the entrance which was being progressively undermined.

**Seaham Property Development Flood Risk Report (2015):** Preparation of a report on flood risk and management for a single lot (classified, high hazard floodway) property where development was proposed. Assessment of flood mechanisms from flood report and assessment of flood risk.

**South Coast, NSW (2014):** Preparation of a Policy and Planning Response framework for Eurobodalla Shire Council and Shoalhaven City Council to address future sea-level rise. Work completed using ISO 31000 risk management standard.

**Lord Howe Island (2014):** Development of an overarching strategy for the management of on-site wastewater on Lord Howe Island. Application of software for automating the calculation of irrigation capacities in GIS, preparation of maps and development of future management strategies.

**Bungan Beach, NSW (2014):** Assessment of Coastal Erosion potential for a residential lot on Bungan Beach, NSW to determine the appropriateness of proposed development.

**Marks Point / Belmont, NSW (2013):** Examination and detailed mapping of the effects of projected sea-level rise on foreshore recession and inundation along the foreshores of Lake Macquarie between Swan Bay and Belmont Bay.

**Swansea Channel Risk Management Study (2013):** Preparation of a plan based on risk assessment for the management of assets in and around Swansea Channel.

**NCCARF Research into Advanced Methods for Coastal Erosion Assessment (2011-2012):** Part of a multidisciplinary academic team developing a framework for beach erosion design, considering future mean sea level conditions.

**Jimmy's Beach Sand Sourcing Study (2012):** Provided support & direction for longshore transport and impact modelling resulting from various sand sourcing strategies for Jimmy's Beach, Port Stephens.

**Shoal Bay/Halifax Park (2012):** Analysis of existing data and development of a management strategy to address sand accumulation across the dive site at Halifax Park, Port Stephens

**South Sumatra Coal Corridor Pre-Feasibility Study (Fluvial Geomorphology) (2010):** Provided advice on fluvial geomorphology relating to the proposed transport of coal along the Musi River, South Sumatra. Participation in a multi-disciplinary, international effort between a number of BMT subsidiaries.

**Kooragang Dykes Erosion Management Project (2010):** Investigation of coastal processes and development of management options to protect an eroding "Dyke Wall" from destruction. The structure is an important high tide roosting habitat for Migratory Wading birds, protected under Federal EPBC legislation.

**Shoalhaven Estuary Entrance Sensitivity Project (2010):** Investigation into the feasibility impact that potential changes to coastal processes will have on the tidal entrances to three lagoons in the Shoalhaven Area, NSW.

**Burrill Lake Tourist Development Flood Assessment (2008):** Examination of the likely flood impact, and suitability of a proposed development adjacent to the foreshores of Burrill Inlet. Examination of consequences related to safety, evacuation pathways, and likely speeds of floodwater rise and risk to inhabitants of a temporary holiday accommodation development.

**Forster Keys Revetment Wall Analysis (2007/2008):** Examination of existing survey, original construction plans, and detailed site visit measurements to determine the likely causes of revetment wall failure at Forster Keys, on behalf of Great Lakes Council.

**Cardiff RSL Flood Advice (2007/2008):** Provision of advice on likely flooding mechanisms for the purpose of assessing an insurance claim by Cardiff RSL.

**Newcastle Council Post Flood Data Collection (2007):** Following the devastating June 2007 floods in the Hunter Valley. Management of a team of data collection personnel, development and streamlining of field data collection processes, Database establishment and reporting.

**Surrey River Estuary Advice (2007):** Site inspection and review of available background information to provide direction to the Glenelg Hopkins Catchment Management Authority on future strategy for the opening of the Surrey Estuary.

**Coastal Development Advice (2007):** Provision of advice to landowners at Boomerang and MacMasters Beaches, regarding the suitability of proposed redevelopment activities in the vicinity of coastal dune systems.

**Vales Point Desalination Review (2007):** A review of environmental impact assessment documentation with regards to coastal and estuarine processes associated with a proposed desalination plant at Mannering Park, involving the increase of ocean discharge volumes at Norah Head.

**Kurnell Desalination Plant: Outfall Dispersion Investigation (2007):** Examination of various ocean outfall configurations being considered by a consortium bidding for design and construction of the proposed Desalination Plant at Kurnell.

**Wollongong Harbour Coastal Management Study Brief (2006):** Preparation of brief to undertake preparation of a Coastal Management Study and Plan, and to provide coastal engineering design advice on behalf of Wollongong Council.

**Wyong Temporary Desalination Plants, Review of EIA (2006):** A review of environmental impact assessment documentation with regards to coastal processes associated with beach wells and outlet infrastructure resulting from installation of temporary desalination plants. Development of appropriate consent conditions on behalf of Wyong Council.

**Woronora Estuary Management Study and Plan (2006):** Following from the estuary processes study, supervision of the development, and final production of the estuary management study and plan under the requirements of the NSW Governments Estuary Management Program.

**Woronora Estuary Processes Study (2005):** Management of the estuary processes study for the Woronora Estuary. Components of the study included hydraulic, water quality and catchment modelling, water quality data and sedimentation analyses, ecological analyses and reporting.

**Corrimal Beach 50 yr. Coastal Hazard Line Definition (2004):** Determination of a 50 yr. Coastal Hazard Line to enable appropriate siting of a life guard tower at Corrimal Beach.

**Lake Macquarie Organic Sediment Removal Project (2003/2004):** A project aimed at identifying locations and best practice means for the removal of organic sediments from various enclosed bays in Lake Macquarie. Tasks included preliminary identification of sites based on the contributing catchment, extent of community concerns and nature of seagrass beds; research of world's best practice methods for 'environmental dredging' short listing of sites for targeted removal, development and analysis of management options for each short-listed site and reporting.

**Woronora Estuary Data Compilation Study (2003/2004):** Management of the entire data compilation study, including research activities, reporting, database development and delivering presentations to the Woronora Estuary Management Committee.

**Coledale Beach Coastal Processes and Hazards Study (2002):** Project Management of a study to define hazard lines for Coledale Beach. The project required management of geotechnical and ecological components.

**Harrington Waters Estate EIS (2001-2004):** Responsible for production of the EIS and detailed involvement in the assessment of flood and tidal hydrodynamics and the impact of dredging upon sediment transport processes and bank erosion. Development of preliminary Acid Sulfate Soils management strategy.

**Pittwater Estuary Processes Study (2001):** Responsible for the assessment of sedimentation processes within the estuary

**Gunnamatta/Gynea Bay Processes Studies (2001):** Responsible for the assessment of erosion and sedimentation, sediment quality, water quality and hydrodynamics

**Shanghai Water Supply Master Plan Study (2000):** The study involved the assessment of locations for extractions from the Huan Pu (River) to provide an additional water supply for Shanghai. Processing, analysis and reporting of results from historical salinity data collected from this tidal river.

**23 Eastbourne Rd, Darling Point (1998):** Provision of maritime engineering advice on conceptual designs for a private small craft facility at Darling Point. Production of a Statement of Environmental Effects for the preferred proposal.

**Batemans Bay Fuel and Sewage Facility (1998):** An investigation into the options for replacement of the existing fuel facility at Batemans Bay Marina. Development of a conceptual design for the preferred project proposal

**Malabar Beach Slope Stabilisation (1998):** Coastal engineering investigation and conceptual design of slope stabilisation works for the back beach area at Malabar, Sydney. Investigation involved survey and historical analysis of the behaviour of the back beach area.

**Howard Park Rehabilitation (1997-1999):** Investigation and preparation of conceptual design for the rehabilitation of Howard Park, an area adjacent to the Georges River in Sydney which had been severely degraded by sand mining. Design components included foreshore treatments, earthworks, a wetland and acid sulfate soil remediation methods. Preparation of a pollution control plan for construction. Detailed design of the works and production of technical specification. Management of geotechnical sub-consultants.

**Torrens Lake Rehabilitation (1997-1999):** Post construction assessment of dredging works undertaken as part of the Torrens Lake Rehabilitation Project in Adelaide.

**Lake Ainsworth Flushing of Closed Estuaries Study (1995):** Fieldwork and data reduction.

**Hunter River Tidal Gauging (1995):** Fieldwork.

**Hydrographic Surveys (Smiths Lake and Berowra Creek) (1995):** Work as crew member on DLWC's hydrosurvey boat. Operation of ultrasonic scanning equipment and establishment of GPS control.

**Lake George Wind Wave Generation Study (1995):** Fieldwork aimed at further developing deep water wind generated wave theory.

**StreamWatch Water Quality Monitoring Program (1995):** Assisting in the promotion of this program and education of high school students about the program.

## ***Design and Project Implementation***

**Marks Point & Belmont South Foreshore Concept Design Review (2019/20):** Assisting Lake Macquarie Council with the development and presentation of a range of foreshore concepts to address actions outlined in the Local Adaptation Plan for Marks Point and Belmont South. Included assessment of overall plan and strategy, and the review of proposed concepts to assess adequacy and feasibility considering waves, tides and other constraints.

**Gosford Park Tidal Terrace (2019):** During detailed design phase of this project, which involved the construction of a tidally inundated 'nature-based play' area along the foreshore reserve of Gosford. Provision of tidal hydrodynamics, sediment suspension and transport mechanics and coastal engineering design services. Also involved University of Newcastle as a subconsultant for ecological response advice, sediment sampling and testing. Advising on mitigation strategies against the entrance of harmful bacteria and the accumulation of sediments into the tidal terrace during operation.

**Pelican Foreshore Interim Management Options (2018):** While the more comprehensive analysis was being undertaken (see next project) temporary works to address safety concerns with immediate foreshore erosion fronting a public park were required. Site inspection and measurement, consultation with council staff and the development of design sketches to provide a temporary (18-24 month) solution and monitoring strategy.

**Pelican Foreshore Management Option Assessment and Design (2018-20):** Lake Macquarie City Council required the assessment and design of a strategy to address chronic erosion problems along the foreshore of Swansea Channel at Pelican. Services included stakeholder consultation, workshop facilitation, development of design concepts and conceptual cost estimation. Detailed design and documentation including the management of several subconsultants (ground survey, ecological, geotechnical, quantity surveying).

**MacMasters Beach Revetment Detailed Design (2018/19):** Community Liaison, Detailed design, Rock quality assessment, cost estimate and tender specification development for a revetment at the southern end of MacMasters Beach.

**Terrigal Lagoon Entrance Clearance Design (2017):** Generation of digital elevation model and development of a volumetrically balanced design for the clearance of sand from the entrance of Terrigal Lagoon and the nourishment of adjacent areas with the spoil won from the clearance operation. Drafting of detailed design drawings using AutoCAD Civil 3d.

**Avoca Lagoon Entrance Clearance Design (2017):** Supervision of survey, generation of digital elevation model and development of a volumetrically balanced design for the clearance of sand from the entrance of Avoca Lagoon and the nourishment of adjacent areas with the spoil won from the clearance operation. Drafting of detailed design drawings using AutoCAD Civil 3d.

**Pelican Boat Ramp Relocation Options (2017):** Investigation of background information, review of constraints and design of concepts for the replacement of boat a boat ramp along the foreshores of Swansea Channel. Conceptual cost estimates were prepared by Salients and certified by a Quantity Surveyor subcontracted to Salients Pty Ltd. Certified estimates were found to be within 10% of the estimates prepared by Salients.

**MacMasters Beach Stairs (2016):** Project Formulation, Design (Conceptual and Detailed) and documentation plus inspection and advice during the construction of a set of beach stairs adjacent to the ocean baths at MacMasters Beach. Included structural and geotechnical engineers as sub consultants to Salients Pty. Ltd.

**Macmasters SLSC Revetment (2016):** Following storms in June 2016, Salients was called in to provide an emergency assessment of an eroded foreshore fronting the SLSC building at MacMasters Beach. Provision of initial advice, completion of coastal processes assessment (aerial photograph interpretation & numerical modelling) and conceptual design for a 100m long protective revetment.

**Ettalong Creek Revetment Repair Advice (2016):** Following a severe coastal storm in June, 2016, provision of advice to repair and stabilise a failing revetment subject to toe scour and stormwater damage. Included geotechnical engineers as sub-consultants to Salients Pty. Ltd.

**Terrigal Lagoon Entrance Clearance Assessment (2016):** Examination of historical sand accumulation behaviour in the entrance to Terrigal Lagoon and design of options for managing the sand, including relocation to nourish Terrigal Beach

**MacMasters Beach Stairs (2016):** Preliminary analysis of options for managing a set of beach stairs that had fallen into disrepair.

**Sandy Point / Conroy Park at Corlette (2015-2016):** Managing multidisciplinary team. Survey (ground and UAV (*Drone*)), extensive community consultation, coastal and drainage processes modelling and assessment. Advanced conceptual design, drafting and costing. Artistic visualisation and presentation to public meeting. Detailed design and documentation completed in 2016.

**Kangaroo Point (Port Stephens, 2015):** Coastal processes and numerical modelling. Conceptual design and drafting. Cost estimates and community consultation.

**Correa Bay, Woy Woy (2015):** Managing investigation of dredging options. Project formulation, processes assessment, geotechnical field sampling and testing, management option formulation including acid sulfate soils management, planning and environmental impact assessment

**Belmont, NSW (2014):** Site supervision and management of dredging and excavation work at Yacht Club, testing and certification of acid sulfate soils and their treatment.

**Belmont, NSW (2013):** Preparation of management plans relating to works at Lake Macquarie Yacht Club. Plans dealt with the periodic dredging of a 'ventilation' channel, the management of acid sulfate soils and the handling of water from dewatering activities prior to discharging into Lake Macquarie.

**Sandringham Bay Foreshore Protection Works (2012):** Detailed Design of 130 m of foreshore protection works using sand bags in Sandringham Bay for Rockdale Council.

**Swansea Channel Dredging Advice (2012):** Undertook small study providing advice to the Department of Primary Industries (Crown Lands) on appropriate locations for deposition of dredged spoil from Swansea Channel.

**Pindimar Foreshore Study (2010):** Assessment of coastal processes affecting the erosion of areas in the vicinity of Upper and Lower Pindimar, on Port Stephens, New South Wales. Development of guidance for the preparation of Planning Controls for foreshore protection.

**Curragong Boat Launching Ramp Conceptual Design (2006):** Development of preferred concept for a boat launching ramp in a difficult coastal location. Work involved supervision of design sub consultants, liaison with the local community and stakeholders and preparation of a Review of Environmental Factors.

**Neverfail Bay Foreshore Management Conceptual Design (2006):** Provision of coastal engineering advice relating to waves, tidal levels and foreshore overtopping

**Greenwell Point Foreshore Management Plan (2004/2005):** Supervision and coordination of detailed design for foreshore protection works at Greenwell Point. Feasibility studies for the relocation of a public boat ramp, including site investigations and community consultation.

**John Williams Reserve Groyne Detailed Design (2004):** Detailed design of groyne structure for John Williams Reserve, St Georges Basin. Design incorporated wind wave, sediment transport and aesthetic considerations.

**Narrawallee Inlet Foreshore Erosion Management (2003):** Involved a 400m length of the shoreline of Narrawallee Inlet. Review of existing information, investigation of processes, site inspection, development of conceptual management options, conceptual designs (revetments, toe walls and revegetation areas) and cost estimates.

**Pelican Foreshores Erosion Management Project (2003):** Involved a 700 m length of the shoreline of Swansea Channel at Pelican. Review of existing information, investigation of processes, site inspection, development of conceptual management options, conceptual designs and cost estimates. Recommendation of a preferred management option. Organisation of planning documentation, production of detailed designs and technical specification.

**Tabourie Lake Foreshore Erosion Management (2003):** Involved a 220 m length of the shoreline of Tabourie Lake. Review of existing information, investigation of processes, site inspection, development of conceptual management options, conceptual designs (revetment, revegetation, constructed beaches and toe walls) and cost estimates.

**Lions Park (Burrill Inlet) Foreshore Erosion Management (2003):** Involved a 200m length of the foreshore of Burrill Inlet at Lions Park. Review of existing information, investigation of processes, site inspection, development of conceptual management options, conceptual designs (toe wall with revegetation, timber stub jetties with current baffles) and cost estimates.

**Point Rd Tuncurry, Conceptual Design Advice (2002):** Involved as a sub consultant in providing advice on hydraulic, wave and sediment transport processes in conjunction with the development of a conceptual design for the rehabilitation of boat launching / recreational fishing facilities within Wallis Lake at Tuncurry.

**Lake Illawarra Entrance Improvements Project (1998/1999):** Supervision of geotechnical investigations, detailed design and preparation of contract documentation for the works including a training wall, breakwater, sand dune (including a vegetation planting plan) and a shallow water recreation area.

**Northside Storage Tunnel Project (1998):** Completion of dilapidation survey and compilation of dilapidation record for structures which could have been affected by dredging undertaken for the Northside Storage Tunnel Project. Site inspections and reporting.

**Hooka Point Reserve Revised Project Proposal (1998):** Preparation of a project proposal for the removal and handling of material from the bed of Lake Illawarra adjacent to Hooka Point and placement of that material in onshore dewatering/encapsulation pits. The proposal included provisions for the treatment of Acid Sulfate Soils. Design of encapsulation cells for acid sulfate soils.

**Manly Beach Stairs (1998):** Investigation of the existing condition of the seawall toe protection provided along a section of Manly Beach prior to the construction of stairs. Coordination of design and technical specification production for the construction of the stairs.

**Dee Why Sea Wall Reconstruction (1999):** Production of Technical Specification, assistance with design and cost estimation for the reconstruction of a seawall at Dee Why Beach in Sydney, following a severe coastal storm.

**Tea Gardens Fishermen's Facilities (1998):** Preparation of detailed working drawings and technical specification for the construction of Fisherman's Facilities (including a jetty, floating pontoon and rock revetment) at Tea Gardens on the North Coast of NSW.

### ***Legal, Expert Witness and Peer Review***

**Coffs Harbour City Council ats Regional Architects (2020):** Provision of expert witness services associated with a subdivision development application at Toormina, NSW. Services related to coastal floodplain inundation and geomorphology in the context of the scientific description of an Endangered Ecological Community.

**Bellingen Scoping Study Peer Review (2019):** Peer review of Bellingen Coastal Management Program Scoping Study as part of a consulting team led by Alluvium.

**Sea Level Rise Planning Assessment (2019):** Confidential review of the adequacy of an Australian Local Council's technical justification for adopting a particular sea level rise projection for planning purposes.

**Tomago Flooding and Inundation Assessment Report (2017):** Review of the circumstances surrounding regular flooding of a residential property at Tomago, subject to a dispute between adjacent landowners.

**Peer Review of Risk Assessment, 1 Queensbridge (2017):** Review of analysis and justification for establishment of design floor levels in the context of tide, storm surge and sea level rise for 1 Queensbridge, a proposed Skyscraper at Southbank Melbourne.

**Moonta Bay Seawall Review and Assessment (2017):** Review of a proposed seawall at Moonta Bay, South Australia, which was subject to a dispute between residents regarding the efficacy and impacts of the seawall.

**Port Stephens Council ats Clippers Anchorage (2016-2017):** Provision of expert witness services to Port Stephens Council relating to a development application for marina expansion at Soldiers Point. Detailed review of hydraulics and morphodynamics, Delft3d numerical modelling, development of Expert's Report, Joint Expert's report and provision of evidence at hearing. Consultation with expert ecologists regarding impacts.

**Cardiff RSL Flood Advice (2007/2008):** Provision of advice on likely flooding mechanisms for assessing an insurance claim by Cardiff RSL.