



Manly  
Hydraulics  
Laboratory

# General Capabilities

# Manly Hydraulics Laboratory

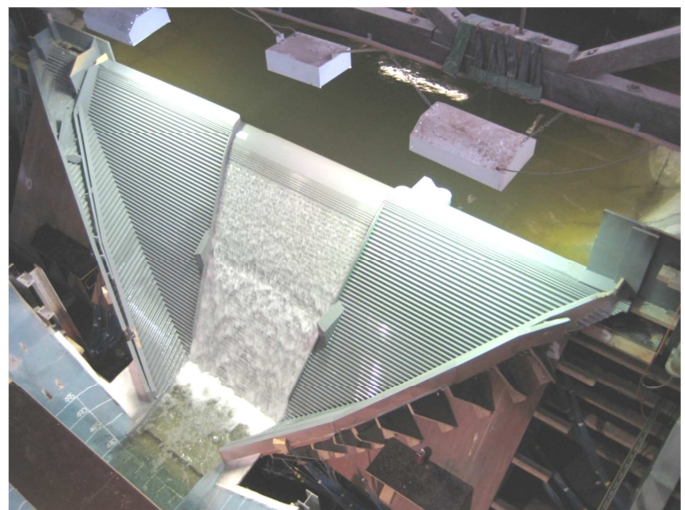
NSW Government's Manly Hydraulics Laboratory (MHL) provides specialist services in coastal, water, sewer, stormwater, irrigation and environmental solutions including physical and numerical modelling and delivery of extensive data collection programs. MHL hosts NATA-accredited facilities for open channel and piped water flow meters with facility capabilities up to 1,500 L/s and up to 60 m head. We have been solving coastal, port and hydraulic engineering problems since 1944 and manage Australia's largest coastal monitoring network. In an uncertain future, MHL offers adaptive solutions with a proper understanding of physical hazards to provide significant cost savings that avoid unnecessary overdesign inherent in many conventional approaches.

## Services Provided

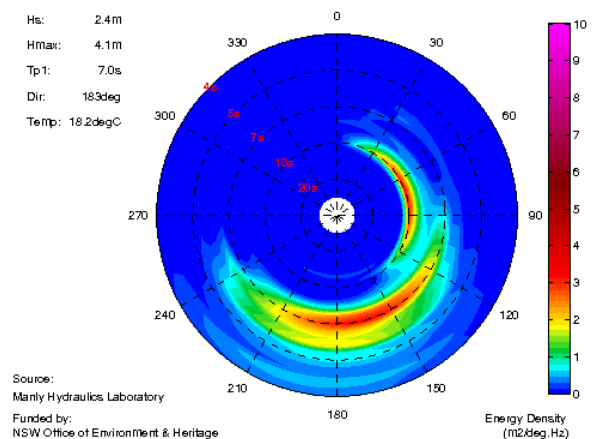
- Environmental data:
  - monitoring, analysis and management of environmental data including ocean waves, tides, sea temperature, river and estuary water levels, currents, rainfall, wind, barometric pressure, water quality, sewer flows and floods
  - development of numerical (digital) models of natural environmental processes, and computer-based, decision support tools for natural resource managers.
- Physical modelling – design and scale model testing of water engineering structures and equipment to replicate highly complex physical processes and optimise design and performance.
- Investigation of oceanographic, coastal, estuarine and riverine processes; hydraulic and dynamic flow studies for water, sewerage and stormwater systems.
- Design of marine structures and protection works for waterways and foreshores.
- Specialist diving and logistics services.



Coffs Harbour Eastern Breakwater Physical Model



Cotter Dam Physical Model



Port Kembla Offshore Directional Wave Spectra



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# Environmental Data

# Environmental Monitoring

Hosting one of the richest coastal databases worldwide, NSW Government's Manly Hydraulics Laboratory (MHL) provides environmental data from over 1,000 monitoring stations to clients, stakeholders and the public, enabling:

- natural resource managers to make timely and informed decisions based on real-time data
- agencies and the community to be abreast of emergency situations such as floods, storms events and water quality incidents.

## Services Provided

MHL has considerable field expertise complementing its analytical and investigation roles, with the ability to work safely and effectively in both the marine and freshwater environments. Our environmental data collection and analysis capabilities include:

- |   |                           |
|---|---------------------------|
| • wind                                  | • flow and discharge      |
| • waves                                 | • sediment sampling       |
| • currents                              | • water sampling          |
| • tides and floods                      | • rainfall                |
| • groundwater                           | • long-term water quality |
| • tsunamis                              | • tidal ingress           |
| • stormwater                            | • climate change impacts  |
| • water profiling                       | • algal species           |
| • summary statistics and trend analysis | • macro-invertebrates     |
|   | • data quality assurance  |

MHL has undertaken data collection projects and managed large data collection programs across NSW, interstate and overseas. Data is collected in coastal environments, estuaries, groundwater, rivers and inland water bodies. MHL specialises in finding solutions to challenging problems, providing strategic advice on monitoring networks, providing real time data via the Internet, and developing decision support tools to assist natural resource managers.

## Benefits

MHL's services combine extensive field capability with scientific, engineering and information technology expertise to provide clients with a comprehensive solution.



Remote water flow measurement



Remote monitoring station access



Water quality sampling



# Automated Messaging and Alarming

NSW Government's Manly Hydraulics Laboratory (MHL) uses automated data acquisition systems to collect data across a wide variety of environmental parameters. This system allows for automated alarms to be issued when certain conditions are encountered. When an alarm is issued MHL's automated messaging and alarming service sends notifications to recipients in various delivery types including email, SMS, web services and social media integration.

MHL clients are using automated messaging and alarming services for:

- decision support tools – high water level threshold alarms are used for road closure notifications, drain and pond retention opening and closures
- flood warning – rainfall and high water level threshold alarms are used to assist with alerting to potential flood conditions
- environmental licensing compliance – early warning systems to assist with managing environmental protection.

## Services Provided

MHL provides design, equipment, installation and configuration in a wide range of specialised environmental monitoring solutions, and provides consultancy services in designing and employing automated data acquisition systems.

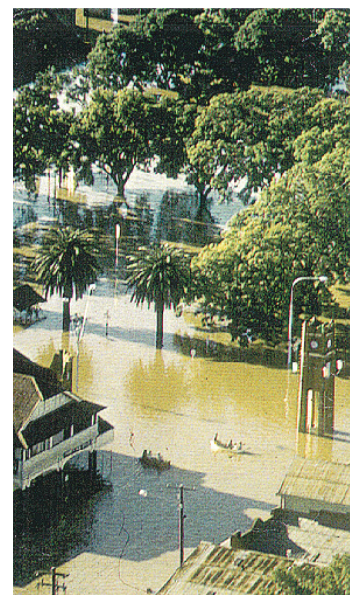
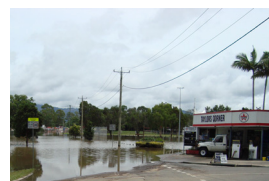
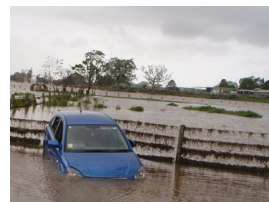
Part of the implementation process is employing systems for monitoring the environment and providing real-time information to decision makers, emergency services and the public.

Our web data portal facilities allow for the storing of environmental data as well as keeping records of all alarm activities. A web portal is available for clients to view messaging activity.

MHL's automated messaging and alarming system is used to notify operators in the field, supervisors in control rooms, emergency services or update data dissemination systems such as web pages or social media sites. Organisations using our services include Roads and Maritime Services, NSW Police, State Emergency Service, BlueScope Steel, Australian Bureau of Meteorology and many local councils.

## Benefits

Warning systems provide information about possible future hazards and the current state of the environment. This information is vital for making decisions when the natural environment threatens loss of life or damage to property.



# NSW Local Government Water Monitoring

NSW Government's Manly Hydraulics Laboratory (MHL) provides water monitoring and data management services to NSW local government.

## Services

Our specialist teams monitor water quantity (flow, level, pressure) and quality (in-situ measurement and automated sampling) in urban water networks (water supply, recycled water, sewerage, stormwater) and water supply catchments.

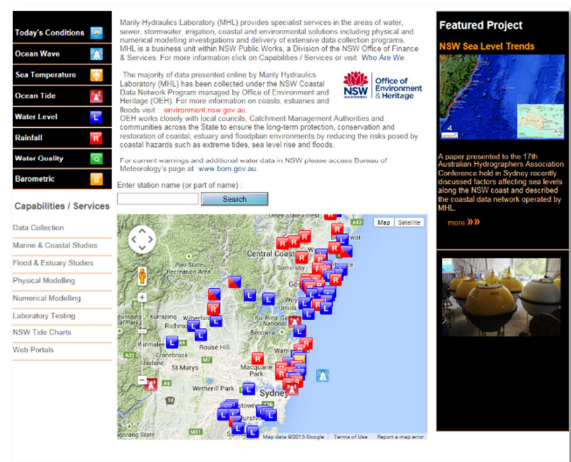


MHL's *Know The Flow* facilities provide NATA-accredited laboratory testing of customer and bulk supply water meters, as well as performance testing of hydraulic structures and stormwater devices.



Data capture can be automated and transferred near real time through telemetry, radio and satellite.

We provide in-house client data quality assurance and manage one of the world's most comprehensive environmental data collection networks, with over 2,500 data feeds and 30,000 station years of records. Information is presented through customised web portals, decision support tools, and automated messaging and alarms.



We complement our monitoring services through: flood warning systems, inflow and infiltration assessments, network modelling, physical hydraulic models, performance audits and operational management tools.

## Benefits

Our inter-government partnerships provide:

- direct engagements without tendering
- government-based data management
- expert advice seeking balanced solutions
- regional presence throughout NSW.

## Contact

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Manager Environmental Data  
Tel: 9949 0234  
adam.joyner@mhl.nsw.gov.au

## Relevant experience

Client	Service												
	Water/ReW system monitoring	Water audits & leakage investigations	Pump & reservoir drawdown tests	Water quality monitoring and sampling	Meter compliance & verification testing	Rainfall monitoring	Sewer flow monitoring	Inflow and infiltration analysis	Stormwater flow monitoring	Stormwater device performance testing	Flood monitoring & warning systems	Groundwater monitoring	Catchment monitoring
Albury City						✓	✓	✓					
Armidale Dumaresq Shire						✓	✓	✓					
Ballina Shire						✓					✓		✓
Barwon Water						✓	✓						
Bluescope - Pt Kembla				✓					✓				
Caltex - Botany Bay						✓			✓			✓	
Eurobodalla Shire					✓								
Gosford/Wyong councils		✓				✓	✓				✓		✓
Hunter Water						✓	✓						
Junee Shire						✓	✓	✓					
Kempsey Shire						✓					✓		✓
Lachlan Shire			✓										
Sydney Metro Councils		✓		✓		✓			✓	✓	✓		✓
Muswellbrook Shire					✓								
Parkes Shire					✓								
Pt Macquarie-Hastings Shire					✓						✓		✓
Roads & Maritime Services						✓					✓		✓
Shoalhaven City						✓	✓	✓			✓		✓
Sydney Airport		✓											✓
Sydney Olympic Park	✓						✓					✓	
Sydney Water	✓	✓			✓	✓	✓						✓
Tweed Shire						✓	✓	✓				✓	✓
Wagga Wagga City		✓											✓
Water NSW (SCA)	✓			✓		✓						✓	✓
Wingecarribee Shire	✓					✓	✓						
Yarra Valley Water						✓	✓						



# Environmental Program Reviews

As part of the NSW Government's State of Environment Reporting, local councils are required to review their water quality and quantity monitoring programs and develop a new program every four years, taking into consideration any changes in scope, objectives or legislation.

## Services Provided

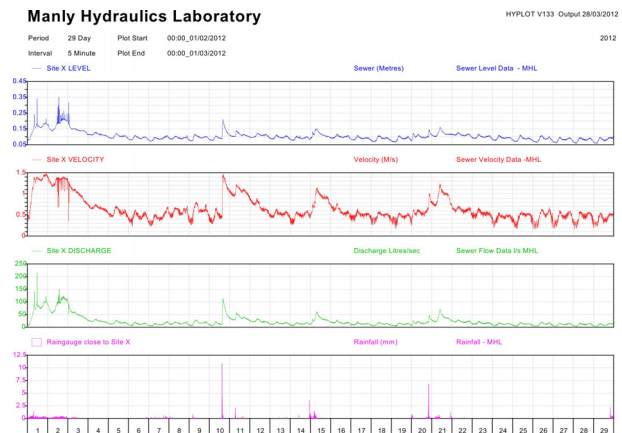
NSW Government's Manly Hydraulics Laboratory (MHL) has considerable field expertise, which complements its analytical and investigation roles, with the ability to provide advice on working safely and effectively in both the marine and freshwater environments. Our experience in environmental data collection and analysis places us in an ideal position to review and update environmental monitoring programs including:

- increasing cost effectiveness
- collating and summarising data
- long-term water quality trends
- application of specific guidelines
- access feasibility of current monitoring sites
- data analysis and reporting advice
- database set up and instruction.

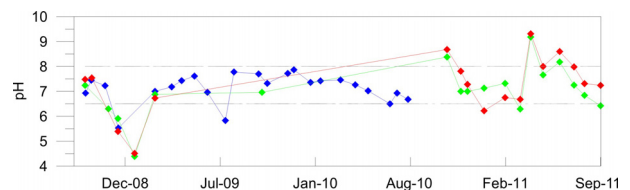
MHL works closely with local councils to ensure compliance with State of the Environment reporting, as well as keeping councils up-to-date with the latest sampling and monitoring techniques. We can provide advice on WH&S improvements, trend analysis, data analysis techniques and reporting to simplify procedures.

## Benefits

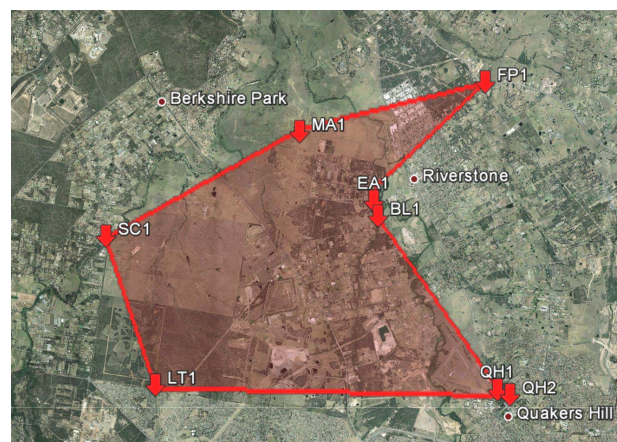
Our services combine extensive field experience with reporting and analysis to provide a comprehensive review for local councils, with the aim to increase cost effectiveness, keep sampling methods and analysis techniques in line with technology advancements, and update WH&S procedures.



By comparing velocity, discharge and level it becomes easy to see the relationship between all three. Adding rainfall into the plot gives the extra dimension and makes clear the effects of short, intense events.



pH values at three sites with comparison to the ANZECC guidelines (grey lines). This type of plot makes it simple to see when on-site values exceed recommended ranges.



An example of how we use simple mapping to create a cost effective sampling timetable.



# Data Dissemination

NSW Government's Manly Hydraulics Laboratory (MHL) operates a network of environmental monitoring stations and automated data acquisition systems collecting valuable environmental data. This data network consists of a state-of-the-art telemetry system, quality control tools and content management systems. MHL communicates with users of diverse needs. To support this we are able to provide a variety of ways for public and private clients to access data as well as near real-time systems to assist in decision making, risk assessments and operational procedures.

## Services Provided

MHL provides a number of solutions for its users to access information, as well as catering to a wide range of presentation needs.

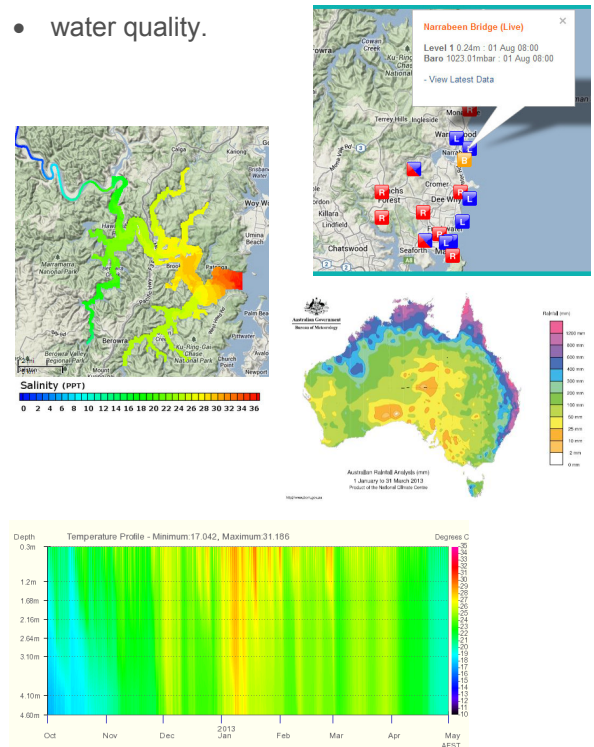
- **Web Portals:** MHL offers access to data via web portals. Users are able to view data via chart graphics, download data and use analytical tools to interact with data. We provide web page hosting for customised web presentations.
- **Business-2-Business Data Exchange:** MHL is able to provide data for automated exchanges in a variety of formats.
- **Web Services:** MHL provides a RESTful solution serving data via JSON for system-to-system data transfers.
- **Automated Messaging and Alarming:** MHL uses a near real-time alarm management system to send notifications to recipients to assist with emergency response, decision support, flood warning and environmental protection requirements.
- **Latest Record Notifications:** MHL provides automated messaging services to notify field operators and supervisors of the latest recordings at given locations.

MHL has extensive experience in collecting, storing and serving data. We have had a web presence serving data to the public and clients since 1993. A substantial aspect of our business is data dissemination. We collect data on behalf of a number of environmental agencies including the Australian Bureau of Meteorology, NSW Office of Environment and Heritage, Water NSW and Sydney Water, as well as industry and local governments across NSW.

## Benefits

MHL provides up-to-the-minute data feeds and full historical records from over 1300 NSW locations, including:

- rainfall and other meteorological parameters
- water levels and tides
- ocean waves and temperature
- stream flows
- water quality.



# Web-based Data and Decision Support Tools

## Background

NSW Government's Manly Hydraulics Laboratory (MHL) operates a network of environmental monitoring stations that collect valuable environmental data for NSW. The data network consists of a state-of-the-art telemetry system, and we are able to provide personalised web links for public and private clients to near real time data to assist in decision making.

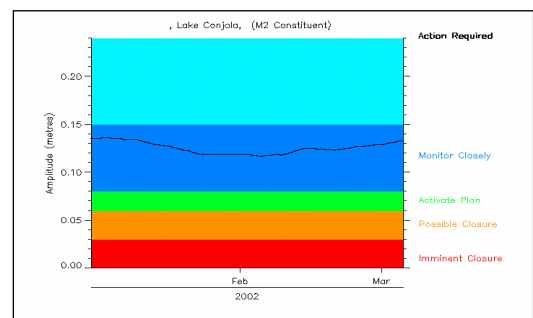
## Services Provided

Using the telemetered data MHL can assist clients by providing decision support tools (DST) based on the following services:

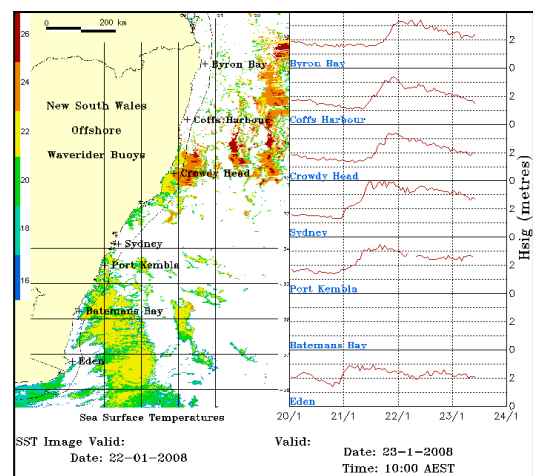
- web pages displaying current river levels and rainfall can be used to provide flood or flow warning to a wide community
- LagoonWatch – utilises existing environmental conditions in a system, and predicts expected future conditions under a range of conditions
- entrance management – provides warning and a staged system for assessing the behaviour of a lake or lagoon entrance, by providing interactive access to the M2 tidal constituent for water levels
- alarms – SMS or email forwarded to clients warning of extreme water level, rainfall or water quality conditions, commonly used for flood warning or road closures.

## Benefits

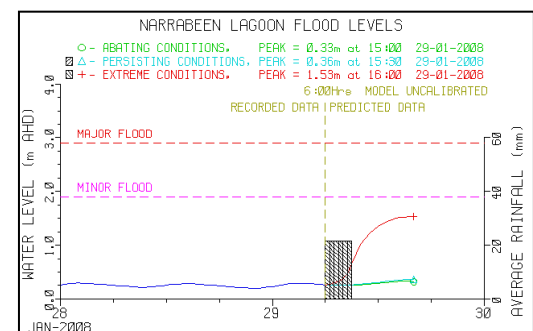
Our public home page provides real-time access to a limited sample of data. On average the data page is accessed over 30,000 times per month and specific data sets are accessed over 8,000 times per month. By adding value to this data we have developed numerous DSTs. Clients include the Office of Environment and Heritage, the State Emergency Service, the Bureau of Meteorology and numerous local councils who depend on the DSTs to help in operational procedures, management decisions, risk assessments, warnings and remedial action which are critical in disaster response situations.



M2 tidal constituent analysis



Wave height and sea surface temperatures



LagoonWatch – predicting conditions for lagoon flooding

# Horizontal Acoustic Doppler Current Profiling

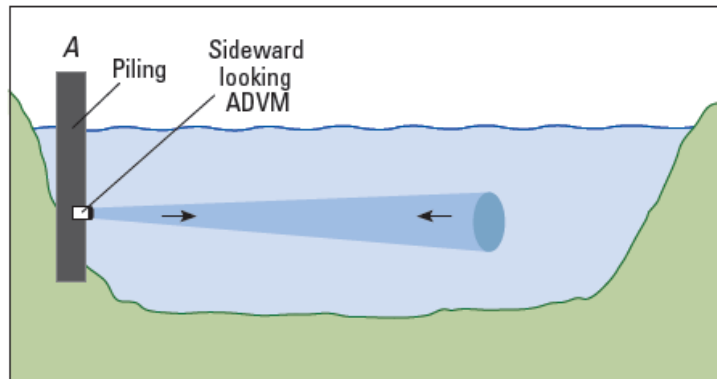
Horizontal Acoustic Doppler Current Profiling (HADCP) is an emerging technology that provides an unprecedented accuracy for continuous monitoring of river discharge in tidal environments. Earlier technologies provided either rough estimates of discharge or very good accuracy but over short periods and using intensive methods (ADCP gaugings). HADCPs provide automated measurement of the discharge, using Doppler velocity measurements across the channel.

A pilot program to trial the technology was commissioned by the NSW Office of Environment and Heritage and implemented by NSW Government's Manly Hydraulics Laboratory. A HADCP was installed at Wisemans Ferry, Hawkesbury River in July 2012 and has been continuously monitoring since then.

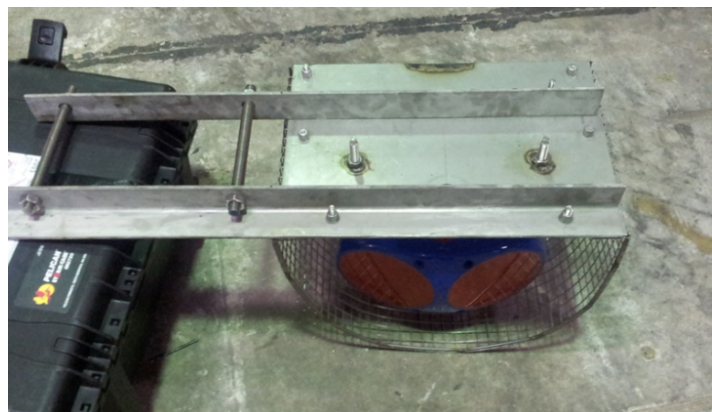
Using a RDI ChannelMaster, up to 128 velocity bins across a 300 m channel width can be measured. Velocity measurements are calibrated against an ADCP gauging to provide discharge values at 15-minute intervals.

## Benefits

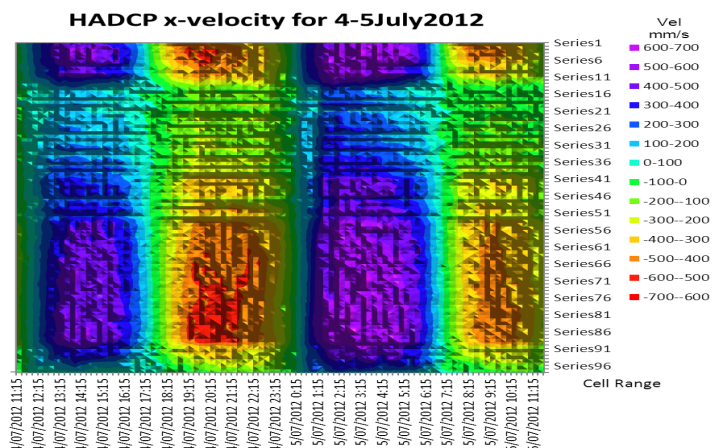
This technology will be an invaluable tool for environmental monitoring and management of our rivers and estuaries. In particular its use in calibrating numerical models of our waterways will provide for better accuracy. It has applications in flood risk management, water quality, salinity intrusion and climate change monitoring.



Schematic of the HADCP installation. The HADCP is mounted on one bank and measures horizontally across the channel. Both cross and along channel velocities can be measured. Courtesy of DERM.



The HADCP in its mounting bracket prior to installation



Velocities measured across the Hawkesbury over two tide cycles, purple regions indicate ebb tide and red regions indicate flood flows



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# Flow Measurement



# Know the Flow

## Hydraulic Test Facility

The *Know the Flow* test facility is designed to perform pattern approval testing of large water meter installations as described in the National Measurement Institute's documents NMI M 10-2 and NMI M 11-2. The facility was established through a National Water Initiative grant from the federal government.

Both open channel and closed conduit meters can be tested at flowrates up to 100 ML/day. The test rig sources water from Manly Dam. Water is recirculated through variable speed pumps (to 60 m head) to enable testing of complete flow measurement installations over a range of conditions.

Common test arrangements include open channel supply irrigation meters and closed conduit flow meters. Laboratory testing can include measurement of:

- the accuracy of flow measurement installations
- sensitivity to various adverse flow conditions that can occur in the field
- head loss measurements over a range of flows.



Open channel meter test area



Closed conduit test area



Water recirculation tanks



Electromagnetic flow meters

# Confined Spaces

NSW Government's Manly Hydraulics Laboratory (MHL) provides confined space entry capabilities to support many of its projects, enabling personnel entry to work in vats, tanks, pits, pipes ducts, flues, chimneys, silos, containers, pressure vessels, underground sewers, wet and dry wells, shafts, tunnels and partially enclosed structures.

## Services Provided

MHL has considerable field expertise which complements its data collection and analytical roles, and the ability to safely and effectively work in confined spaces is fundamental to our operation. We maintain highly skilled operators with accreditation in confined space entry and who have demonstrated understanding of the national codes of practice. We also maintain tagged safety equipment to enable the confined space work (including harnesses, tripods and gas detectors). Typical project work includes monitoring of sewerage systems, stormwater discharge, wet well levels, pressure valves, pits, gross pollutant traps and trade waste outlets. Relevant capabilities include:

- WHS policies and procedures
- Identify analyse and evaluate risk
- Issue work permits
- Work in accordance with permit
- Enter confined space
- Work in a confined space
- Gas test atmospheres
- Operate breathing apparatus
- Undertake first response to fire incidence
- Provide emergency care
- Undertake confined space rescue

MHL has performed confined space entries across Australasia, including Australia, Singapore and Papua New Guinea. We develop project-specific safety plans for all projects. Our clients include:

- |                       |                     |
|-----------------------|---------------------|
| • Sydney Water        | • BlueScope         |
| • Caltex Refineries   | • Shoalhaven Water  |
| • Albury City Council | • Barwon Water Vic  |
| • Junee Shire Council | • AECOM             |
| • GHD                 | • Hunter Water Corp |

Manly Hydraulics Laboratory is committed to a strong safety culture, with the policy being **no injuries to anyone at any time.**



Sewer gauge installation



Safety equipment



Safe deep sewer access



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# Coastal & Marine Studies



# Coast and Beach Studies

## Background

NSW Government's Manly Hydraulics Laboratory (MHL) has extensive experience investigating beach processes and management of the coastal zone. The pressure on the coastal zone from intense competition between alternative uses, increasing population, water pollution, coastal erosion and the destruction of coastal habitats requires an understanding of coastal processes and the application of a broad range of management techniques to solve site-specific issues.

## Services Provided

Investigations are undertaken using physical modelling, numerical modelling, field investigations or often a combination of all three. MHL has the capabilities to conduct leading edge studies in each of these disciplines, including:

- beach plans of management
- coastal protection works
- stormwater inventories
- environmental planning
- wave setup investigations
- sea level rise
- water quality and pollution
- seawalls and breakwaters
- ocean rock pools
- beach pollution monitoring
- river and lagoon entrance dynamics
- dune stabilisation

## Benefits

These studies address issues including beach fluctuations, shoreline recession, coastal entrance behaviour, sand drift, coastal inundation, ocean overwash, slope instability, stormwater erosion and climate change.

Australia's largest database of wave and tidal data is maintained at the Manly Vale facility. MHL is capable of installing and maintaining state-of-the-art instrumentation in the coastal zone and offers the full range of remote sensing and diving team operations.



Turimetta Beach



Severe beach erosion at Cronulla



Storm waves overtopping Coffs Harbour breakwater



Narrabeen Lagoon entrance



# Marina and Port Investigations

NSW Government's Manly Hydraulics Laboratory (MHL) undertakes investigations for the design, operation and maintenance of marinas and boat harbours. These investigations are carried out by highly trained staff using sophisticated physical and numerical models, often interfaced with detailed environmental data monitoring programs.

## Services Provided

MHL has prepared over 70 technical reports on marina and port projects throughout Australia during our more than 70 years of operations. The studies can be broadly grouped into environmental monitoring (winds, waves, currents and water levels), concept and structural design (breakwater alignments, navigation, berthing layouts, launching facilities and land-based services), environmental parameters (water quality, sedimentation, stormwater and other pollutant loadings), performance assessment (diver inspections, wave attenuation, navigability and foreshore stability), and complimentary foreshore beautification works.

## Benefits

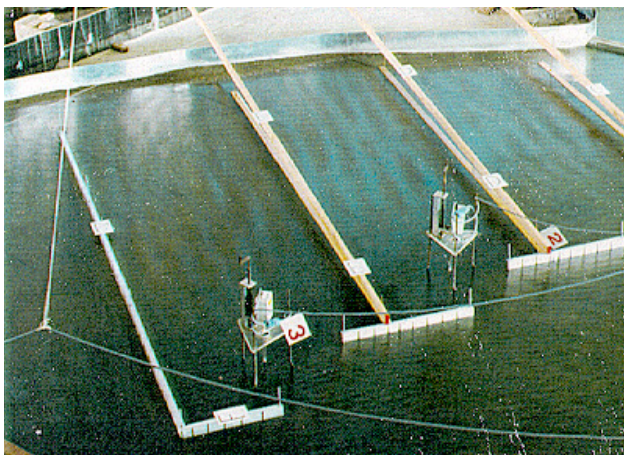
MHL delivers innovative marine design solutions which meet the client's needs.



Eden breakwater



Coffs boat harbour



Royal Prince Alfred marina



Crowdy Head boat harbour



# Physical Modelling of Port Facility Design

## Background

Since 1944 NSW Government's Manly Hydraulics Laboratory (MHL) has been constructing and testing physical models of harbour infrastructure for Australian and international projects. The laboratory is located at the base of Manly Dam where waters are directed over scale models before returning to Manly Creek. A flume (30 m x 1 m x 1.8 m) constructed in 2008 and a 3D directional wave generator acquired in 2011 for the wave basin (30 m x 18 m x 1 m) have increased our capability in facility design.

## Services Provided

The physical modelling facilities comprise random and monochromatic wave flumes and basins. These range from small to large and may include water level sensors, wave and flow measuring devices. The wave basin and wave flumes are housed in buildings that remove wind effects during testing, and have capability to generate current in conjunction with waves.

Over the last 70 plus years MHL has undertaken a diverse range of physical model projects relating to harbour studies and offshore structures. Our coastal engineering team has extensive experience, including:

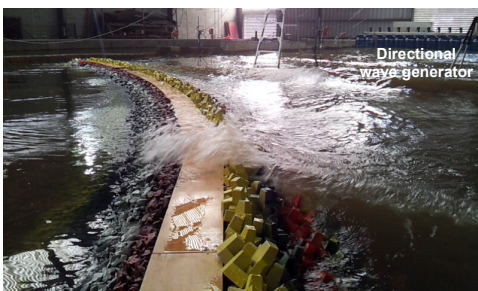
- wave penetration, overtopping and structural stability of breakwaters
- ship movement and fender force estimation
- mobile bed modelling
- force measurement on port structures
- dredge channel design.

## Key Features

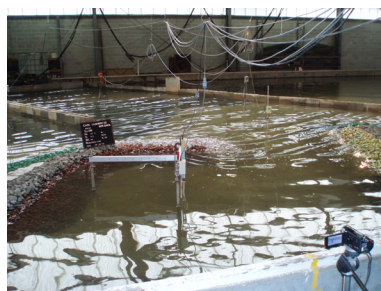
MHL has the resources to provide comprehensive physical modelling services and facility design expertise for port facility design in NSW and beyond.

## Benefits

The laboratory is a unique resource for the coastal engineering industry that allows physical models of port projects to be constructed, tested, modified and re-tested at scale prior to adoption and construction.



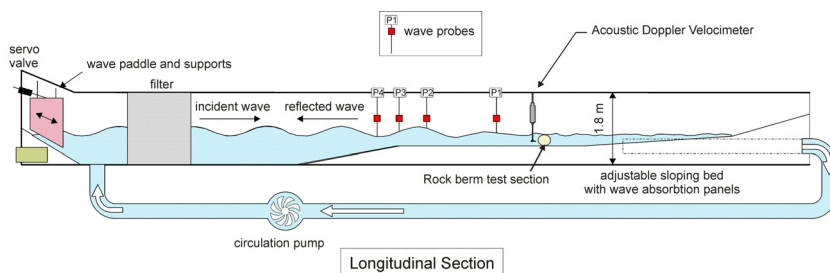
3D model repair testing simulating influence of diffracted wave



3D model testing existing harbour wave penetration



2D berm testing with currents and waves. The berm protects a pipeline



Schematic of new flume with wave and current generating facilities



Berm damaged by waves and currents

# Boating and Diving

NSW Government's Manly Hydraulics Laboratory (MHL) maintains boating and diving capabilities to support many of its projects, enabling trained personnel to undertake a variety of work in the marine environment.

## Services Provided

MHL has considerable field expertise which complements its analytical and investigation roles, and the ability to safely and effectively work in the marine environment is fundamental to our operation.

MHL maintains a commercial boating and diving capability, using a variety of specialised boats, field equipment, state-of-the-art instrumentation and highly skilled operators.

Project work includes scientific diving, investigation and monitoring, as well as structural assessment and contract surveillance. Our field data collection capabilities include:

- winds
- waves
- currents
- water levels
- water quality
- discharge
- sediment sampling
- mapping
- diving observations.

MHL has undertaken data collection for projects throughout Australia and overseas. Data is collected in coastal environments, estuaries, rivers and inland water bodies. We have also undertaken archaeological surveys of historic shipwrecks along the NSW coast for the NSW Heritage Office.

## Benefits

MHL's services combine extensive field capability with scientific and engineering expertise to provide clients with a comprehensive solution.



Tidal gauging data collection



Dam wall valve diving inspection



Vibro-core sediment sampling



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# Flood & Hydraulics Studies



# Physical Modelling of Hydraulic Structures

## Background

NSW Government's Manly Hydraulics Laboratory (MHL) provides a range of data monitoring, numerical and physical modelling and technical services in the field of water and environment. One of our main strengths is our capacity to undertake a full range of physical modelling and develop techniques outside the box to meet project objectives.

Example structures we have modelled include:

- dams and weirs
- spillways
- control gates
- fishways
- bridges
- wetlands
- conduits

## Key Features

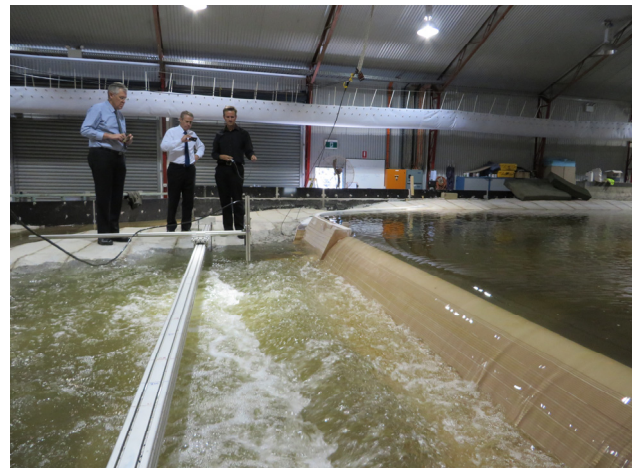
Our facilities are world class and can model flows up to 1300 l/s. We have three buildings, four headwater tanks and a flume set up for physical modelling, providing an extremely versatile facility.

## Services Provided

MHL's well established experience in constructing and testing physical models of water infrastructure makes us a unique contributor to the higher level design standard for the client.

## Benefits

Our extensive knowledge and experience in physical modelling is second to none, and combined with our world class facilities means we are able to deliver on projects in an assured and efficient manner. Our ability to undertake physical modelling requiring large water flows is unmatched in Australia and makes MHL the only one of its kind in the water industry allowing physical models of water projects to be constructed, tested, modified and re-tested at scale prior to adoption and construction.



Paradise Dam Physical Model



Kangaroo Creek Dam Spillway Physical Model



Melton Dam Steps Physical Model

# Physical and CFD Modelling

## Background

NSW Government's MHL provides a range of data monitoring, numerical and physical modelling and technical services in the field of water and environment. One of our main strengths is the ability to combine information from physical and numerical models with experience and data from prototype installations.

## Services Provided

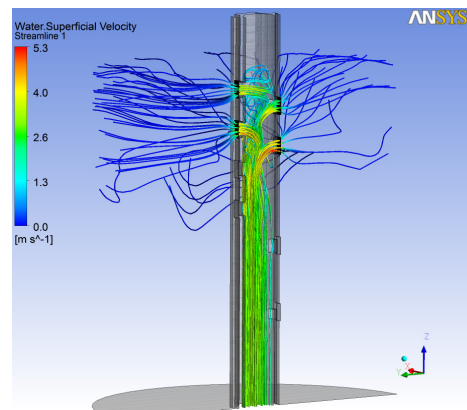
MHL's well established experience in constructing and testing physical models of water infrastructure as well as with the application of computational fluid dynamics (CFD) in the water industry makes us a unique contributor to the higher level design standard for the client.

## Key Features

We can undertake both physical and CFD model studies, which provides an important role in validating the results obtained from these computer models with the physical model results.

## Benefits

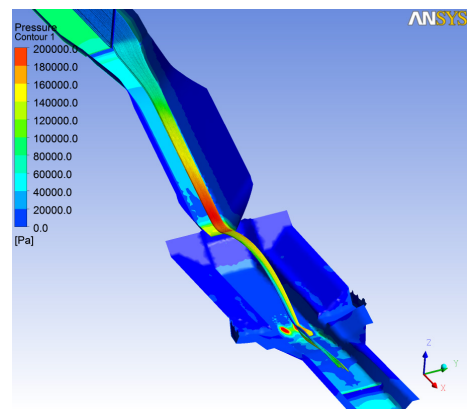
MHL provides not only services to government agencies but also to clients in the private sector. The laboratory has an extensive range of facilities and expertise available for both physical and numerical modelling. Our ability to undertake physical modelling requiring large water flows is unmatched in Australia, and makes MHL the only one of its kind in the water industry allowing physical models of water projects to be constructed, tested, modified and re-tested at scale prior to adoption and construction. The unique advantage of offering the option of using numerical models for initial investigation, verification and/or refinement of the physical model provides an invaluable insight to the general hydraulic behaviour of the model.



Intake tower Iso-view contour and vectors of horizontal cross-section of velocity



Physical model of a spillway chute plunge pool



Iso-view of hydraulic behaviour of spillway

# Computational Fluid Dynamics Modelling

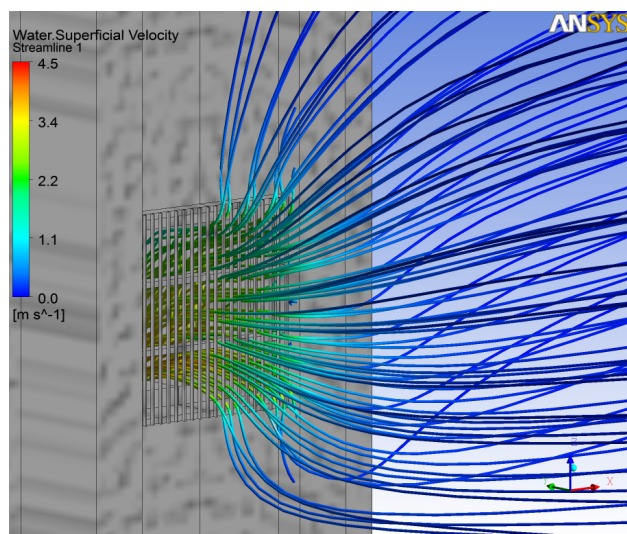
## Background

NSW Government's Manly Hydraulics Laboratory (MHL) offers a comprehensive consultancy and technical services specialising in flow simulation requirements in the fields of water and environment.

## Services Provided

MHL has experience in a wide range of fluid flows and assesses the design development process from a fundamental understanding of the core flow physics. Some of the investigation options when undertaking a CFD approach include:

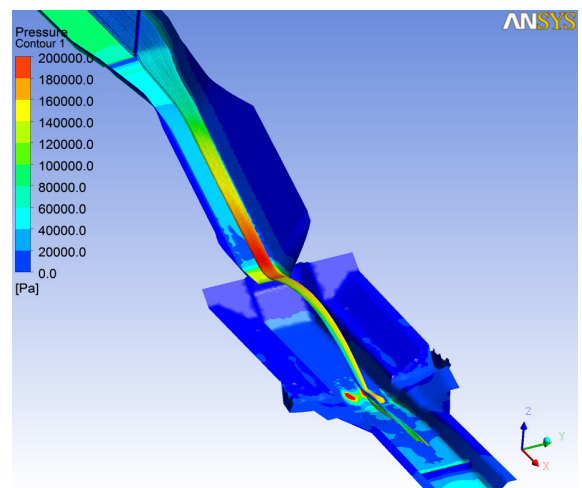
- verification of existing equipment performance
- understanding of general hydraulic behaviour
- effects of geometrical changes and flow conditions on hydraulic system performance
- what-if scenarios to potentially improve design.



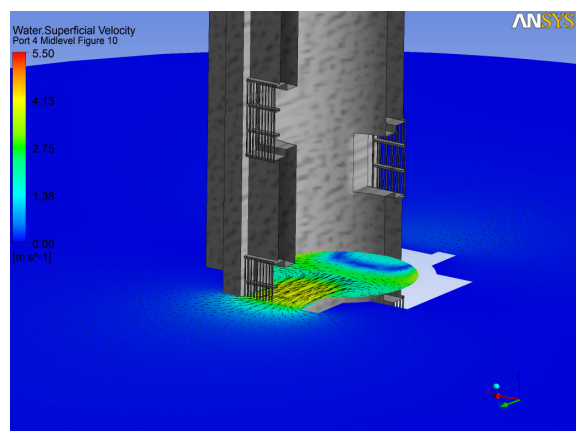
Intake tower front view contour and vectors around port

## Benefits

Our well established experience in constructing and testing physical models of water infrastructure as well as with the application of CFD in the water industry makes MHL a unique contributor to the higher level design standard for the client. We create a tight partnership with the client during the development of modelling options, and recommend a practical CFD approach designed to obtain the best value for the client.



3D view of a spillway simulation



Contours and vectors of velocity through a reservoir intake



# Dam Investigations

## Background

NSW Government's Manly Hydraulics Laboratory (MHL) provides a comprehensive service in dam investigations, including hydraulic, environmental and field investigations, and numerical and physical modelling.

MHL has been involved in the investigation of many Australian dams, either when constructed or during upgrade investigations. These dams include Warragamba, Burrinjuck, Keepit, Copeton, Burrendong, Chaffey, Hume, Dungowan, Split Rock, Pindari, Mangrove Creek, Lake Manchester, Googong, Tallowa, Wellington and Worsley FWL.

## Services Provided

MHL has the capacity to cater for both physical and numerical modelling of dams and associated infrastructure. Areas of investigation include:

- spillways – including discharge characteristics, pressures, forces, air demand
- outlet controls, regulator works, valve cavitation, energy dissipators, scour
- pumping stations
- coffer dams and diversion structures
- fishways and fish ladders
- underwater inspections
- coldwater pollution investigations
- algal pollution investigations
- dam movement studies.

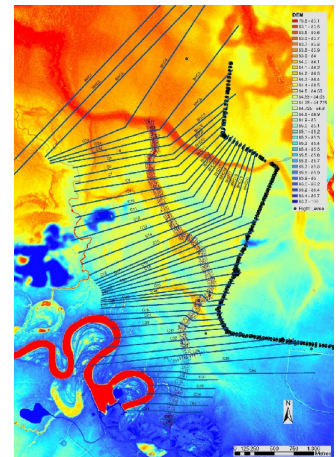
## Key Features

MHL has the resources to provide a comprehensive physical and numerical dam modelling service to the water industry.

## Benefits

The laboratory is a unique resource for the water industry that allows shortlisting of options using numerical models and verification/refinement using physical models at scale prior to adoption and construction. MHL has an extensive range of facilities and expertise available for both physical and numerical modelling.

Koondrook-Perricoota  
numerical modelling  
digital elevation map



Lake Manchester spillway Hydroplus fusegate testing



Burrendong Dam spillway physical model

# Outfalls and Diffusers

## Background

NSW Government's Manly Hydraulics Laboratory (MHL) offers comprehensive consultancy and technical services specialising in flow simulation requirements in the fields of water and environment. We are a multi-disciplinary organisation that will combine a number of approaches in a single study.

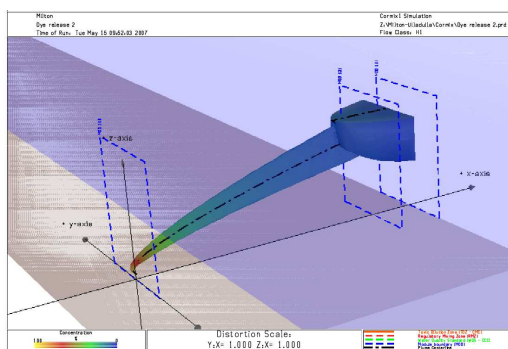
## Key Features

MHL offers a wide variety of approaches and a wealth of experience that can tailor a study approach to client needs.

## Services Provided

MHL has a wealth of experience in dealing with the transport and fate of pollutants in the environment and relating this to the design and operation of water release structures. Options available include:

- semi-empirical Lagrangian modelling: using software such as CORMIX rapid simulation of diffuser structures can be undertaken. This allows analysis of concept designs and sensitivity in a short timeframe or as a preliminary stage to a more complex study.
- Computational Fluid Dynamics (CFD): using software such as Ansys CFX detailed analysis of diffuser designs can be undertaken in complex hydraulic situations while retaining flexibility in the design.

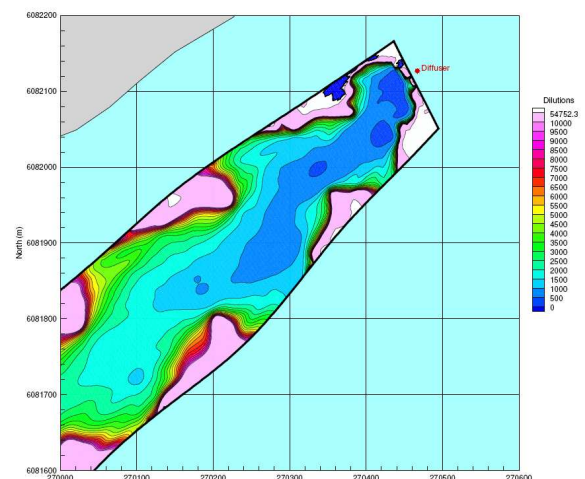


Numerical nearfield plume modelling

- physical modelling: we have extensive experience in the design and construction of physical models and this can be used to conduct detailed physical studies in the laboratory.
- farfield models: simulation of the transport and fate of pollutants over large distances can be conducted using software such as RMA and either a particle tracking or advection/dispersion approach. This is particularly useful when considering community risk assessments and water quality processes.
- direct water quality measurement: we can either commission manual sampling studies or install real time water quality logging equipment to examine environmental processes in operation.

## Benefits

MHL has a variety of approaches to satisfy the needs of individual clients. The wealth of experience can be used to recommend the most appropriate approach for a given situation. Our multi-disciplinary nature will combine a number of approaches in a single study to deliver the best results for each client.



Numerical farfield plume modelling



# Flood Studies

## Background

NSW Government's Manly Hydraulics Laboratory (MHL) staff have extensive experience investigating flood conditions along the NSW coast, including the many rivers, creeks and lagoons that drain into the ocean.

## Services Provided

Studies have included investigation of rainfall runoff flooding in fluvial environments, elevated ocean level and wave action flooding in coastal environments, and the combination of both these types of flooding in the estuarine environment.

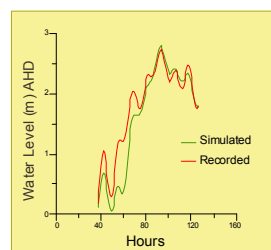
Investigations are undertaken by highly trained staff experienced in physical and numerical modelling.

Physical models of floodplains have been very useful in the past to analyse complex flood behaviours. MHL has at its disposal a range of leading edge numerical models to simulate the hydrologic and hydraulic processes. The models can estimate the flood hydrographs from urban and rural catchments (ILSAX, RORB and WBNM) and simulate the flood behaviour in one-, two- and three-dimensional situations depending on the circumstances (HEC-2, MIKE11, MIKE21, TUFLOW and RMA).

## Benefits

The results from the flood studies can be used to estimate flood levels, flood velocities and flood pathways on the floodplain. These factors are all needed for the management of flood conditions and allow options to be developed to minimise future flood hazards.

MHL maintains a database of historical flood data and is capable of installing instrumentation to monitor flood behaviour. We also have the experience to harness multi-disciplinary teams for floodplain management studies.





# Flood Warning Systems

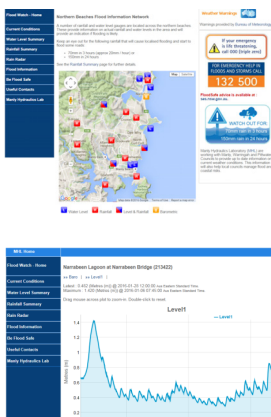
## Overview

NSW Government's Manly Hydraulics Laboratory (MHL) has extensive experience in designing, building, operating, and maintaining flood warning systems which provide vital near real-time information to support the management of flood prone land and infrastructure. Organisations using our services include Roads and Maritime Services, NSW Police, State Emergency Service, Local Government, the Bureau of Meteorology, and the private sector.



## Services Provided

Flood warning systems combine the services of MHL's automated data acquisition systems to collect environmental data; and MHL's automated messaging and alarming service. When high water level or rainfall threshold conditions are encountered, an automated alarm is issued, and notifications are sent to recipients in various formats (email, SMS, web services, and social media integration).



A client web portal allows viewing and retrieval of all environmental data, and records of alarm and messaging activity. Additional services also include:

- automated intensity-frequency-duration rainfall plotting
- predictive early-warning programming logic
- web-enabled flood cameras.

MHL clients are using flood warning systems for:

- road closure traffic signs with flashing lights and VMS – automatic activation
- automated messaging and alarming – critical notifications to supervisors in control rooms, operators in the field, emergency services, and local emergency management officers
- decision support tools – drain, lagoon, and pond retention opening and closing
- flood warning and information portals – data dissemination to web pages, social media
- environmental licencing compliance – early warning systems to assist with management and environmental protection.

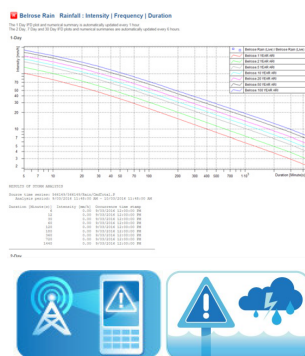
## Benefits

Flood warning systems provide near-real time flood information (environmental conditions and potential hazards on flood-prone land) to support decision makers, emergency services and the public. They are suitable in mainstream and overland flood situations.

Flood warning systems support management of flood-prone land in accordance with the *mitigation* stage in the NSW Floodplain Development Manual's management hierarchy (avoidance, minimisation, and *mitigation*). They are a suitable tool to mitigate both *existing* and *continuing* flood risk (after implementing flood risk management measures, e.g. works, planning controls).

## Local Government Flood Warning System Clients

- Ballina Shire Council
- Bankstown City Council
- Bega Valley Shire Council
- Bellingen Shire Council
- Clarence Valley Council
- Gosford City Council
- Great Lakes Council
- Greater Taree Shire Council
- The Hills Shire Council
- Hornsby Shire Council
- Kempsey Shire Council
- Lake Macquarie City Council
- Liverpool City Council
- Manly Council
- Nambucca Shire Council
- Newcastle City Council
- Parramatta City Council
- Pittwater Council
- Sutherland Shire Council
- Tweed Shire Council
- Uralla Shire Council
- Warringah Council
- Wollongong City Council
- Wyong Shire Council



## Other Related Services

### NSW Floodplain Risk Management Process

MHL provides all major flood related services defined in the NSW Floodplain Risk Management Process.

MHL directly supports NSW Public Works Advisory that has defined roles in NSW State Flood Response operations and NSW Engineering Emergency management. We understand the reliance that Councils and the community place on flood related services.

The MHL advantage:

- Data collection and monitoring (survey, rainfall, water level and flow gauging)
- Flood studies including hydrologic and hydraulic modelling, and high quality floodplain mapping and reporting
- Floodplain risk management studies and plans
- Design and construction management of mitigation options including levees
- Development of web based flood warning systems and real-time predictive tools.



# Flood Investigation and Management

NSW Government's Manly Hydraulics Laboratory has extensive experience investigating and managing flood conditions throughout NSW including rural, urban and coastal environments, as well as site specific development studies.

## Services Provided

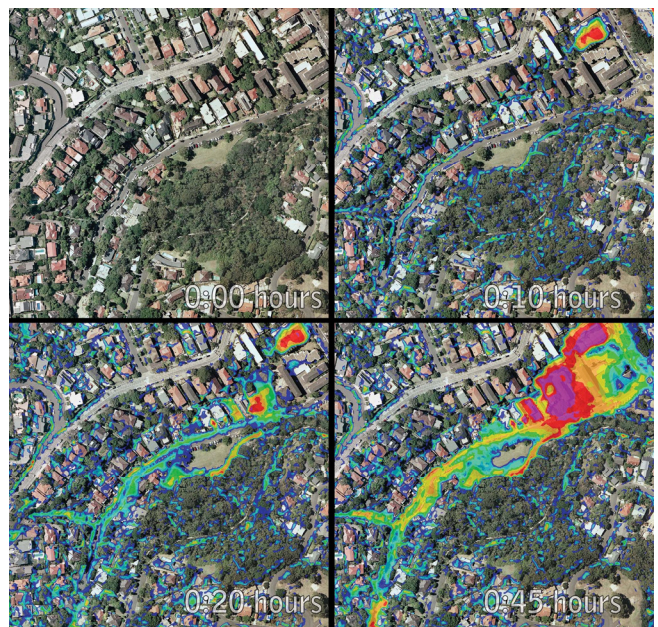
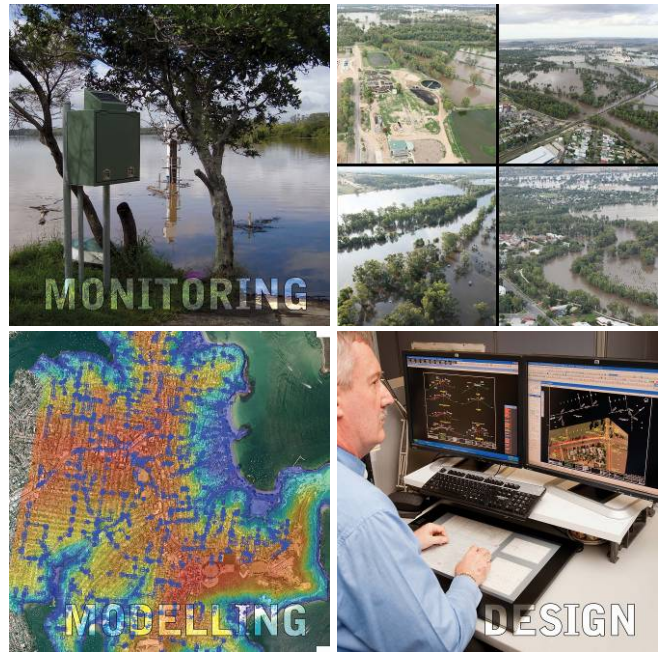
The expertise of MHL offers an unparalleled range of flood-related services including rainfall, water level and flow gauging; hydrologic, 1D/2D hydraulic and stormwater modelling; community consultation; floodplain mapping and reporting; flood studies, floodplain risk management studies and plans to OEH guidelines; coastal inundation studies; development of real-time predictive tools and flood warning systems.

### The MHL advantage:

- Data collection
- Survey
- Detailed modelling services
- High quality mapping and reporting
- Community consultation
- Design of mitigation options
- Construction management
- Real-time predictive and flood warning tools

## Benefits

MHL is in an excellent position to deliver the full suite of flood services from the data collection phase through to flood studies and management plans, design and construction services support, and value add-ons such as web-based flood warning systems.



TUFLOW results showing development of a flood in an urban area



# Wetlands

## Background

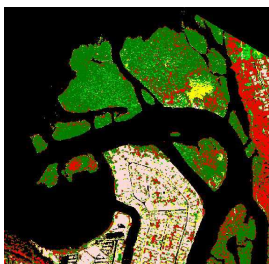
The ecological significance of wetlands is becoming increasingly recognised in modern society. Preservation of existing wetlands, restoration and rehabilitation of degraded wetlands and the professional design and construction of artificial wetlands are all key issues in managing water resources.

## Services Provided

NSW Government's Manly Hydraulics Laboratory (MHL) is able to offer a comprehensive range of wetland services in freshwater and coastal wetlands, including:

- assessment of physical and water quality processes
- monitoring of water levels, water quality and sedimentation, including the capacity for telemetered systems
- vibracoring of tidal mudflats, peatlands and other fragile sediments
- mapping through GIS, remote sensing and other techniques
- numerical modelling of flooding and water quality processes (including real time capabilities)
- residence time and flow path determination through tracer studies and velocity measurements, and
- wetland remediation and construction design services.

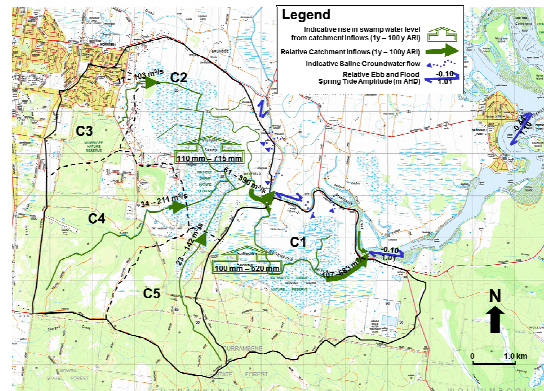
MHL has extensive experience in such studies, performed to the satisfaction of a wide range of clients, providing valuable insights into these environmentally significant ecosystems.



Remote sensing



Golden Bell Frog  
(after Evan Pickett)



Conceptual hydrological model of wetland systems



Floodgates require careful management to restore original habitats



Saltmarsh backed by Melaleuca and Eucalypt Forests



Manly  
Hydraulics  
Laboratory

# Project Sheets

# NSW Coastal Environmental Data

## Background

Since the 1970s, NSW Government's Manly Hydraulics Laboratory (MHL) has collected, stored and hosted data across NSW's eastern flowing streams, estuaries and coastal waters. This work continues under contract with the Office of Environment and Heritage.

## Project Scope

Near real-time data is processed and presented on the internet for easy accessibility by clients and the public. The monitoring network nominally includes:

- > 250 estuary and river water level gauges
- > 220 water flow monitoring devices and
- > 200 rainfall gauges
- 7 Waverider buoys
- 19 ocean tide gauges
- 3 anemometers

Information systems include alarm messaging when thresholds are exceeded.

## Our Role

We have achieved significant efficiency gains over the past 20 years through a strong commercial and client-focused approach to maximise public value. These efficiencies have accommodated 30% growth in the monitoring network and provided substantially improved access and service levels through new technologies.

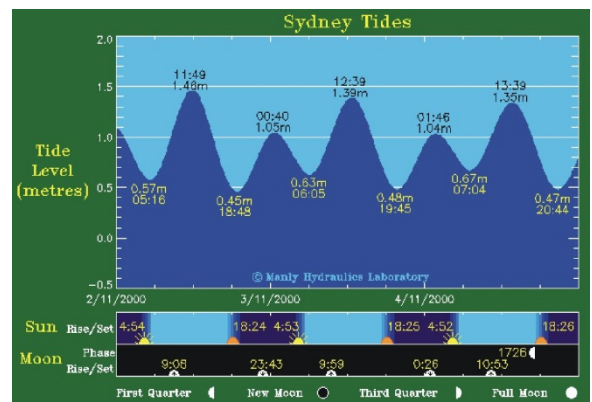
## Outcomes

The data is used for a number of essential purposes:

- coastal, estuarine and floodplain studies, land use and emergency management planning
- optimised and cost effective design and repair of coastal and riverine infrastructure
- water frontage property boundary definitions
- emergency warnings during extreme events
- long-term climate change and sea level rise monitoring
- research and recreational uses by community at large (>1.3 million web visitors in 2015–16)



Some field sensors operated by MHL



Daily predicted tides provided on [www.mhl.nsw.gov.au](http://www.mhl.nsw.gov.au)



Typical tide and wave pole sensor with telemetry housing



# NSW Breakwater Asset Appraisal

## Background

Detailed breakwater survey analyses were undertaken by NSW Government's Manly Hydraulics Laboratory (MHL).

## Project Scope

Every breakwater from Tweed Heads to Eden (33 sites, 61 individual breakwaters) under Department of Industry – Lands control was surveyed as part of an asset appraisal.

## Our Role

Inspections of each breakwater were conducted detailing the condition of the armour, crest and head. MHL continues to assist DPI – Lands with breakwater inspections following storm damage.

## Outcomes

Extensive documentation detailed each breakwater's structural stability and any public safety concerns existing around its use.

Subsequent recommendations were made for maintenance and future upgrading in accordance with each breakwater's physical condition.

A comparison was also made between the breakwaters in terms of their relative levels of usage, damage and maintenance required.



Coffs Harbour eastern breakwater circa 2002



Woolli south breakwater field inspection



Camden Haven breakwaters