The Water Research Laboratory (WRL) is an industry leader in the engineering and science of marine and riverine outfalls. Over the past 20 years WRL has been involved in numerous studies covering all aspects of outfalls including hydraulics, dilution, commissioning and field studies. WRL offers complete services to assess outfalls from concept to commissioning. WRL has extensive expertise in outfall hydraulics, including numerical assessment and physical model testing. The receiving waters immediately surrounding the outfall, known as the near-field zone, is assessed numerically using the Visjet, Jetlag and Cormix modelling suites. 3-Dimension far-field hydrodynamics are assessed using the RMA suite of models, coupled with the 3DRWALK random walk model to assess far-field dilution behaviour.

In addition to physical and numerical modelling, WRL has significant experience in field based assessments. WRL has the expertise and equipment to assess a site potential for process understanding and development, as well as existing sites for outfall performance and commissioning. WRL has designed and implemented several large field sampling programs for outfalls at a range of locations.

**STP Outfall Services**

- Detailed design
- Near-field dilution modelling
- Far-field hydraulic modelling
- Far-field dilution modelling
- Site investigation and process understanding
- Outfall layout
- Optimised hydraulic design
- Scale physical model testing
- Expert advice and peer review
- Field assessment of outfall performance
- Commissioning investigations
- Bacteria die-off
- Concentration exceedance probability
- Event based assessment
- Development of monitoring programs
- Ongoing monitoring modelling
Selected Recent Projects (More available upon request)

**Sydney Deepwater Routine Modelling:** A data collection ocean reference station provides current, temperature, salinity and pressure data. This data is input into numerous models to predict plume behaviour for the North Head, Bondi and Malabar deepwater outfalls. WRL undertakes numerical modelling of the outfall plumes in 3D and supplies the results to Sydney Water via a secure internet site. This includes near-field and far-field modelling, pollutant source identification, stratified hydrodynamics, harbour and estuarine impacts and beach water quality assessment. Dilution rates are calculated in conjunction with floatable and settleable particle tracking.

**Illawarra Outfall Commissioning Studies:** Throughout 2006-2007, WRL undertook a range of field studies to determine near-field dilution for Sydney Water Corp at the Illawarra Outfall. These studies were undertaken over various climatic periods to simulate the range of conditions that would be experienced on site. Various near-field tests were successfully undertaken using Rhodamine WT as a tracer and included the use of a dive team for visual inspection. The data gained from the multiple field trials were detailed within a WRL technical report. This project compliments the previous near-field and physical modelling investigations undertaken for the site. Similar work was also undertaken at the Shellharbour outfall.

**Burwood STP Upgrade:** Initial field work in 1996 into the performance of the Burwood Beach ocean outfall was supplemented with a range of field dilution studies in 2007 to assist in numerical modelling of the ocean outfall. The field work included Rhodamine WT dilution testing, the use of a dive team for video and sample collection, ADCP transects and drogues releases. Collection of field data in 1998 and 2007, culminated in the modelling of current and ultimate discharging condition under stratified summer conditions and non-stratified winter conditions. The near and far-field modelling was complimented by the inclusion of particle inactivation by sunlight into the 3DRWALK random walk model to accurately assess effluent impacts on local beaches. This work is ongoing in 2009.

**Yamba/Iluka Ebb Tide Release:** WRL was commissioned by Clarence Valley Council to undertake a detailed concept design of an ebb tide release at Yamba and Iluka. This involved the potential installation of two outfalls in the Lower Clarence estuary. Numerous field investigations surveyed the river bathymetry under normal conditions and post flood event. A range of data collection including ADCP transects, dye release studies and sediment transport investigations were undertaken to compliment the computer modelling. Near and far-field modelling was undertaken to optimise the release window and ensure minimal impact to shareholder interests. This study is ongoing in 2009.

**Christchurch:** Oceanographic data collected for a year long period was used to undertake hydrodynamic and water quality modelling to assess the 2 km and 3 km ocean outfall options. A hydrodynamic model was calibrated and verified with the collected data and used to undertake three 12 month simulations with three constituents of faecal coliforms, a conservative pollutant and a somatic coliphage virus. Assessment of the model statistics was undertaken to assess the percentile exceedance of constituent concentration at the beaches nearest to the proposed outfall locations. Similar work was undertaken for the Waimakarirri Outfall.