

Executive Summary

A total of ten projects are reported in this 2003 edition of the UTS Freshwater Ecology report. Ideas for the research projects were gathered at the Manly Lagoon Field Day in August 2003 and from the bank of suggestions collected since the programs commencement in 2000. A list of the 2003 community suggestions can be found at the back of this report.

All research projects were commenced and completed in the three-month period August to October 2003. This short time frame placed considerable restriction on the comprehensiveness of the research, particularly in regards to seasonal variations that impact on the physico-chemistry and ecology of the Manly Lagoon Catchment. A short summary of each project is given below:

Waterbirds of the Manly Lagoon Catchment: Involved a 6 week survey of water birds found on the lower lagoon, central lagoon, Burnt Bridge Creek, Mermaid Pools, Manly Dam and Wakehurst Golf Club. Twenty-one waterbird species were found at Manly Dam, whilst Brookvale Creek contained seventeen waterbird species. This result is significant when the size and water quality of these two sites are taken into consideration (Brookvale Creek being a much smaller, and more polluted, waterbody comparatively). The Pacific Black Duck was greatly distributed throughout the Manly Lagoon Catchment in large numbers. High average abundances were noted for the dusky moorhen at Brookvale Creek and Manly Dam. This species also had the highest average abundance amongst the species found at Wakehurst Golf Course. The waterbird reserve in section 4 of Manly Dam was found to be a crucial waterbird habitat within the Manly Lagoon Catchment, and conservation of this area has been strongly recommended.

Seagrass Mapping of Manly Lagoon: In this study the seagrass species present in Manly Lagoon was identified and the distribution of seagrass beds in the lagoon mapped. Only one seagrass species (*Zostera capricorni*) was identified as being currently present in the lagoon. The seagrass beds were found to hug the perimeter of the lagoon, and extended from just downstream of the Pittwater Road Bridge to just upstream of the Queenscliff Bridge. The results indicated that the area of seagrass beds in Manly Lagoon has declined considerably over the last 12 years.

Seagrass Bed-Sediment Characteristics Manly Lagoon: Sediments from seagrass beds were compared to nearby uncovered sandy deposits to determine similarities and differences. Sediment characteristics tested included redox potential, sediment size, nitrogen and phosphorous concentrations and organic content. Results of the study showed that at sites where there was a noticeable abundance of epiphytes on the seagrasses, there was also a higher (although not

statistically significant) concentration of nutrients in the sediments. Grain size analysis showed that the dominant particle size was 0.25-0.5 mm, but grain size throughout the lagoon did not differ significantly. From these results, sites were proposed as being the most suitable locations for attempts to regenerate the seagrass beds in Manly Lagoon.

Macroinvertebrate Survey of Cootamundra Creek: This project catalogues the current macroinvertebrate community in the creek below the sedimentation ponds in Cootamundra Reserve. Out of the 33 Families of macroinvertebrates that were identified as present within Cootamundra Creek, six were identified as potential bioindicators of instream health or particularly sensitive families i.e. Scirtidae, Elmidae, Psephenidae, Corydalidae, Macromiidae and Leptoceridae. The presence of these families suggested that despite many characteristics typical of polluted urban streams, some habitats within the stream remained relatively healthy. Information will provide a baseline reference that can be used to track future changes and serve as a foundation for future more comprehensive studies.

Macroinvertebrates near the Wakehurst Golf Course: The baseline data generated from this project will help identify aquatic organisms suitable for monitoring water quality around the Manly Dam catchment. This study has shown that there was a difference in the distribution, diversity and abundance of macroinvertebrates throughout the three streams sampled. It was found that the water quality of two streams in close vicinity to Wakehurst Golf Course to be of poorer condition to that of an undisturbed stream in the area. The pollution sensitive ephemeropteran species, *Koorrnonga* AV1 satisfies the criterion guidelines for toxicity testing and may be a useful species for monitoring water quality in the catchment. This ephemeroptera species is found to inhabit, in high numbers, the streams with a naturally low pH, giving this species an advantage over other organisms currently used in toxicity testing.

Water Quality Survey of Lower Manly Lagoon. Focusing on the estuarine section, samples were taken from the Lagoon at six locations to measure temperature, pH, dissolved oxygen, turbidity, ammonia, nitrate and orthophosphate. Little difference was found from past data, with many undesirable readings still remaining. Manly lagoon is stratified in some locations, with high salinity and low dissolved oxygen in the bottom water compared to the surface water. The average turbidity and orthophosphate levels in both surface and bottom waters exceed the 95% protection level in all sites, however, the average ammonia and nitrate concentrations were all below the 95% protection level for all sites sampled. The average pH and temperature of both surface and bottom water for each site was within the ANZECC guidelines range.

Water Quality Survey of Central Brookvale Creek. This study covered six sites from Warringah Mall to Nolan Reserve. Variables measured included pH, dissolved oxygen, conductivity, turbidity, nitrate and orthophosphate. The recorded levels were compared with The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000). Variables that did not comply with guidelines were turbidity, dissolved oxygen and orthophosphates. Generally the levels were higher during wet weather and no significant statistical difference could be found between sites.

Water Quality Survey of Upper Brookvale Creek. This study covered seven sites from Allenby Park to just below Warringah Mall. Temperature, pH, dissolved oxygen, and conductivity were measured using portable field meters. Water samples were collected and orthophosphate, nitrate, ammonia, total alkalinity, surfactants and turbidity concentrations were measured using laboratory methods. Both wet and dry weather samples were collected and generally high levels of nutrients were found. This concerning trend is discussed further in the following report by the same authors.

Key Plant Nutrients in Brookvale creek and Manly Lagoon. This report synthesises the data from the three water quality surveys above to give a more integrated interpretation of the problem. Phosphates and nitrogen are key plant nutrients, which frequently limit productivity in a freshwater environment. This report examines the concentrations of key plant nutrients, nitrogen and phosphorus, down the length of Brookvale Creek and Manly Lagoon. Sources, inputs and removal of these nutrients are also discussed. It was found that orthophosphate and nitrate varied significantly between sites and was above ANZECC (2000) guidelines at several locations. Ammonia was found to be below the 95% protection ANZECC (2000) guidelines.

Nutrient Appraisal of Manly Lagoon Catchment Sediments: A selection of waterway sediments from five sites across the catchment including Manly Dam, Burnt Bridge Creek and Brookvale Creek were analysed for their nutrient content. The sediment samples were placed in bottles that were then filled with reverse osmosis purified water. Over the experiment duration of 39 days, dissolved oxygen concentration of the water in the bottles declined to around 25% saturation. Under these reduced oxygen conditions, concentrations of NH_3 exceeded ANZECC (2000) 95% trigger values for all 7 sites. PO_4 levels released from sediment were found to exceed the ANZECC (2000) 99% trigger value at 5 sites, and NO_3 levels were found to exceed ANZECC (2000) 95% trigger values at 4 sites. It would seem that if anaerobic conditions were to occur at many of these sites, sufficient nutrients could be released from sediments to support an algal bloom, regardless of what nutrients are carried into the water bodies through surface run off.