

Monitoring and Modelling Water Quality Treatment and Hydraulic Efficacy of Rain Gardens in Christchurch.

Duration: 1-2 years

Funding: NZ \$16,000 tax-free stipend (not including tuition) plus additional opportunities for paid tutoring, contestable research equipment funds and conferences.

Direction: Hydrological and Ecological Engineering Group (HydroEco), Department of Civil and Natural Resources Engineering, University of Canterbury.

Closing Date: By 5.00 pm on March 1st 2010.

About the Research Group: The Hydrological and Ecological Engineering Research Group (www.hydroeco.info and <http://www.civil.canterbury.ac.nz/hydroeco/about.shtml>) is a team of 4 tenured faculty, 2 post-doctoral fellows, 4 PhD, 2 Masters and 8 Bachelors (Honours) engineering students at the University of Canterbury who apply hydrological and ecological principles to solving engineering problems. HydroEco members have conducted research worldwide in diverse yet interrelated topics such as hydrology, water resources, erosion control, integrated catchment management, irrigation, flood prediction, restoration of mine sites, wetlands, and ecological wastewater treatment. Stormwater monitoring and modelling form a continuous focus of the research team.

About the Project: Our stormwater research includes physical experiments to quantify contaminant accumulation and runoff for urban surfaces in order to derive build-up and wash-off functions, models that simulate contaminant transport under given scenarios, and treatment efficiency investigations that elucidate best practice measures to help mitigate urban contaminant transport. The study of rain garden efficiency in Christchurch will contribute towards model validation and increase the local knowledge and optimization of rain garden effectiveness. Rain gardens (a type of biofiltration system) can serve as effective and integrated solutions for managing urban runoff at source. These engineered ecosystems can provide water quality treatment and also efficient groundwater recharge, where appropriate. They typically form part of an overall management strategy for reducing the transport, and hence negative impact, of urban contaminants on receiving waterways and have been designed worldwide to remove various species of nutrients (N, P), metals (Zn, Cu, Pb) and suspended solids (TSS).

Study scope: A Masters in Engineering student will be recruited to conduct monitoring and modelling investigations of the rain gardens of focus to the Christchurch City and Environment Canterbury Councils. The candidate will have a high GPA and ideally some practical knowledge in water quality investigations and/or an interest in field work. (S)he will be supervised primarily by Dr Aisling O'Sullivan and co-supervised by Dr Tom Cochrane and Dr Daniel Wicke. The project will commence in early-mid 2010 and be completed within 18-24 months, the stipulated timeframe for Masters Students at UC.

Study focus:

- Collect influent (untreated stormwater) and effluent (treated stormwater) from designated rain gardens in the Addington suburb over four seasons with 2-3 sampling events per season including sufficient designated "storm" events
- Analyse water quality for TSS, metals (Zn, Pb, Cu) and perhaps nutrients (N & P) as well as faecal coliforms employing accredited techniques/laboratories
- Collect the first flush and subsequent composite samples from each event
- Collate rainfall data for these catchments (perhaps from NIWA's HIRDAS)

- Measure or calculate volume of runoff from each sampled event
- Monitor soil moisture changes and infiltration rates in the rain gardens
- Calculate flow attenuation in the rain gardens for specified storm events
- Generate Event Mean Concentration pollutographs for each storm event
- Compute contaminant removal efficiencies (rates)
- Model rain garden treatment efficiency under various scenarios (e.g. if concentrations increased or runoff volumes or rainfall intensities etc).
- Sample and analyse substrate cores for metal concentrations
- Conduct particle size analysis on substrate cores (2 depths)
- Ascertain metal concentrations as a function of particle size and depth

Resources available:

- Active academic supervision and guidance for the duration of the project
- Technical and practical support through our Dept. laboratories
- Appropriate training in accredited water quality sampling and handling
- Office, computer and other logistical support for conducting the research
- Field equipment to monitor and collect water (and sediment) samples
- Computer software to analyse, graph and model the data
- High-precision instrumentation (ICP-MS) for analysing metals
- Additional Departmental contestable research funds (twice annually)
- Additional funded tutoring opportunities
- International Stormwater Best Management Practices Database for comparing with international systems
- Funded opportunities to present at national/international conferences

Research outputs expected:

- Database of water quality data for influent (raw runoff) and effluent (treated stormwater) of designated rain gardens during specified storm events
- Database of rain garden sediment chemistry and particle size fractions
- Relevant and comprehensive literature review
- Data analysis through appropriate statistical and graphing packages
- Initial modelling scenarios to test system performance under various events
- Comparison with national and international biofiltration systems
- Recommendations for optimising rain garden designs in Christchurch
- Written documentation including:
 - an academic research proposal (within 3 months of enrolling)
 - 3-4 mid-term (six-monthly) short research reports to the funders and research committee
 - final technical report to the funding organisation(s)
 - peer-reviewed research paper
 - Master thesis
- On-going oral presentations to HydroEco, Dept. Civil and Natural Resources Engineering, CCC and/or ECan upon request

How to apply:

Send curriculum vitae, copy of undergraduate transcripts, names of two referees and cover letter stating your interest in this project to Dr. Aisling O'Sullivan (aisling.osullivan@canterbury.ac.nz) no later than 5.00 pm on **1st March 2010**. For further queries about this project, please contact aisling.osullivan@canterbury.ac.nz