WATER EFFECTIVE TECHNOLOGIES AND TOOLS (WETT) RESEARCH CENTER

The aim of the WETT Research Centre is to develop means for the sustainable provision of clean safe water, particularly for cities, and in so doing contribute to adaptation to climate change. Such goals require a multi-disciplinary approach, fostering collaboration across a wide range of expertise including engineering, environmental chemistry, ecotoxicology, biology, modelling and renewable energy.

The Centre has three major research themes which encompass the water cycle:

- Water resources and management and water quality monitoring (design of systems and methods to improve management of the quantity, quality and distribution of water whether it be potable, ground, waste or storm water; environmental impacts are also covered)
- Water and wastewater treatment (drinking water, industrial and municipal wastewater, and water recycling)
- Biosolids and bioenergy (safe and sustainable application of organic sludges arising from wastewater treatment processes)

1. Water resources and management and water quality monitoring

This research theme embraces the design of systems to manage the quantity, quality and distribution of water, whether potable, waste or stormwater. Water quality management includes the development of systems to protect and monitor the quality in water bodies, such as catchment management, novel methods for the detection of pesticides, and detection and reduction of cyanobacterial (blue green algal) blooms. Studies are conducted on the fate of heavy metals in the environment, and the relationship and impacts of recycled water and stormwater on wetlands and shallow marine ecosystems.

Major project areas

- Groundwater contamination and remediation in urban areas and assessment of future impacts on key vulnerable groundwater resources at risk from climate change and population growth.
- Rainfall runoff modelling and stormwater management, drought reporting and forecasting, water conservation.
- Urban irrigation, hydrodynamic modelling of natural flow systems.
- Chemical and ecotoxicological methods of water monitoring.

2. Water and wastewater treatment

Research in this area covers the treatment of drinking water and industrial and municipal wastewater, and water recycling. There is particular emphasis on the characterisation and removal of organic matter by various means such as advanced oxidation processes (such as UV/peroxide, Fenton and photoFenton, electrochemical and ozonation), membrane treatment, adsorption, enzymic and biological processes, and combinations of these.

Advanced oxidation processes and membrane-mediated processes for the treatment of wastewater are currently two major foci of research.

Desalination using reverse osmosis and distillation powered by standard energy sources as well as renewable energy such as geothermal and solar sources is also an area of research activity.

Water quality and safety (microbiological and toxicological) are key parameters for evaluating the efficacy of these treatment processes.

Major project areas

- Characterisation of organic components of water and wastewater and their removal by advanced processes such as membrane technology, advanced oxidation processes and biological treatment and their combinations as hybrid systems.
- Desalination of ground and seawater using renewable energy (solar thermal and geothermal systems) and membrane technology; reduction of generated wastes.

3. Biosolids and bioenergy

The organic sludges arising from wastewater treatment processes are being investigated with regard to their safe and sustainable use for agriculture. Studies are being conducted on the assessment and tracking of microbiological pathogen indicators in wastewater treatment processes and the resultant biosolids, and the factors which lead to their die-off. The efficacy of the utilisation of biosolids as soil amendments for crops in terms of nutrients and soil organic matter is under investigation. Studies are being conducted on the hydrodynamics of biofouling, rheology and handling of sludges, particularly with regard to the mixing and thus efficient energy generation in anaerobic digesters.

Major project areas

- Evaluating microbial and chemical safety in sludge treatment in wastewater treatment systems and the beneficial utilisation of the resultant biosolids.
- Effect of ecosystem services on the removal of pathogens in applied reclaimed water and biosolids.
- Biogas production from municipal wastewater and industrial wastes: optimisation through pre-treatment and also rheological design to enhance digester mixing and sludge heating.