USING LIDAR TO ESTIMATE THE CAPACITY FOR STORM WATER RECYCLING AND SOLAR ENERGY COLLECTION

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Abstract
In this paper the accuracy of airborne laser scanning is assessed in conjunction with commercial software, so that the data from large scale lidar surveys of three New South Wales towns and the University of New South Wales can be processed. The buildings in each of these surveyed areas are extracted using the lidar point data to provide an accurate measurement of the total area of roofing within each region. The accurate area measurements are used with simple modelling equations to calculate the amount of rainfall run-off that could be collected and solar energy that could be produced, during an average year. The final results show the potential savings that could be produced each year if these towns and the university campus became more water and energy conscious.

Introduction
Australia is the driest inhabited country on Earth, and yet has one of the highest per capita water consumption rates in the world (Melbourne Water, 2009). Our high water consumption combined with recent droughts has lead to fifteen years of water scarcity (van Dijk, 2009), which is defined as "being where there are insufficient water resources to satisfy long-term average requirements. It refers to long-term water imbalances, combining low water availability with a level of water demand exceeding the supply capacity of the natural system." (European Environment Agency, 2007).

The Business Council of Australia in a report on Australia's water scarcity stated "Australia's water problems are a direct result of a poorly planned and managed water system that has conspired to turn a sufficient supply of water at the source to scarcity for end-users" (Business Council of Australia, 2006). The report shows that more needs to be done in water infrastructure to guarantee that all users will have an adequate supply for their needs. Australia needs to look further into its use of water, in particular the re-use of water; how it can be collected, recycled and re-used within the water cycle.

On top of Australia's concerns with being able to supply enough water for agricultural and urban demands, global attention has shifted to the topic of climate change, greenhouse gas emission and renewable energies. The Australian Government has set a target to produce at least 20% of Australian energy through renewable means by the year 2020. Solar energy is planned to play a large role in reaching this target. Already the Australian Government has handed out large rebates to promote private houses to install solar panels on their roofs.

For these two reasons, this study investigated a large scale surveying technique known as Airborne Laser Scanning (ALS) in the interest of using the technique to measure the potential for rain water collection and solar energy production. The study examined the theory behind laser scanning and data point classification, with the aim of testing the accuracy of the scanner in comparison to other surveying techniques. Once the laser scanner was determined as being an adequate tool for the task, ALS surveys were used to calculate the total area of roofing within the surveyed region. This measured roof area was then used to calculate both the amount of rain-water that could be potentially collected and re-used, and the amount of solar energy that could be collected and placed back into the energy grid.

Concluding Remarks
When combined with ineffective water management, it is no surprise that for the past fifteen years Australia has been suffering from water scarcity; having inefficient water reserves to satisfy long-term average requirements. And with the increased awareness of climate change and Government targets for renewable energy use, now, more than ever, land use and the potential for sustainability are of great importance. Thus, having the ability to perform large scale surveys that measure land use, surveyors have a role to not only be focused on new sustainable developments but also to inform the community of the potential resources that are already available.

Airborne laser scanning is one of the newer techniques available to surveyors and spatial analysts and the ability to combine accurate measurements with a high rate of data capture make it ideal for performing large scale surveys. Used in conjunction with commercially available software, lidar has proven in this study to be an effective tool in the role of accurately identifying objects on the ground and being able to measure their position. As such it was used further to measure the total area of roofing of three townships and the University of New South Wales main campus.

Using these measured areas, the potential for renewable energy production via solar modules and the collection of roof run-off was calculated, and shown to be of a significant value. As more effort is placed into new sustainable developments there will be less ability to bring the focus back onto the infrastructure already in place that should be utilised. And as the study has proven, the potential benefits of re-using these roofing areas for renewable energy and water collection is immense and needs to be carefully considered.

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