2011-12 TWRI Mills Scholarship Application

Applicant	Chi-Ying Huang	Committee Chair	Dr. John R. Giardino
Student ID		Address	Department of Geology and
Graduate	Water Management and		Geophysics, Rm 257, Halbouty
Program	Hydrological Science		Texas A&M University
Address			College Station, Texas 77843
		E-mail	rickg@tamu.edu
E-mail		Phone	979-845-3224
Phone		Fax	979-845-6162

PROPOSED RESEARCH: Simulation of Land Use Impacts on Water Resources

Surface water flow is affected by impervious surfaces in urban settings, resulting in increased runoff and reduced recharge rates of the ground water system. The purpose of this study is to evaluate the impacts of land use changes on surface and ground water levels in the Walnut Creek Watershed (WCW), Austin, Texas. The WCW has experienced varying stages of urbanization since the 1990s. From 1990 to 2008, the urbanization impacts increased the amount of impervious surfaces by approximately 3.8 times along with 7,018 ha of land (City of Austin, 2011). Land use resulting in impervious surfaces was 47.26% transportation and 15% residential (City of Austin, 2011). Several studies show that urbanization greatly affects ground water discharge and surface water flow (Morgan and Jones, 1995; Cho et al., 2009). Thus, it is important to ask: how much of the surface and ground water levels have changed in the last 20 years in the Walnut Creek Watershed due to urbanization? Previous research emphasizes that surface and ground water flow are interconnected within a basin (Said et al., 2005). Thus, an integrated systems approach covering surface and ground water systems is needed to evaluate the overall impacts of land use on water resources.

This proposed research addresses three objectives: (1) examine land use and annual average recharge values for each land development scenario, (2) simulate and estimate the parameters of hydraulic conductivity, storages, and specific yield, and (3) assess the differences between observed and simulated estimates of hydraulic head and surface water flow during calibration.

To assess the impacts of land use changes on surface and ground water systems in the WCW, the following scenarios will be addressed. The watershed will be divided by location: the headwater, outlet, and the middle section of the WCW, consisting of 10 subwatersheds. MODFLOW[1] will be utilized to simulate surface streamflow and hydraulic head. GIS data sets will consist of topography, land use and land cover, and soil type. Hydrogeological data including aquifer type, precipitation, discharge, and streamflow. All of which will be obtained from the City of Austin and the U.S. Geological Survey (USGS), respectively. The results of simulations will help estimate the impacts of future land use changes and plan the water budget of surface and ground water systems in an urbanized watershed within the state of Texas.

[1] Modular Three-Dimensional Finite-Difference Ground Water Flow Model (MODFLOW) was developed by the U.S. Geological Survey (USGS). It provides for the simulation of ground flow and surface flow conditions.

REFERENCES

Cho, J., Barone, V.A., Mostaghimi, S., 2009. Simulation of Land Use Impacts on Groundwater Levels and Streamflow in a Virginia Watershed, Journal of Agricultural Water Management 96:1-11.

City of Austin. 2011. GIS Data Sets. ftp://ftp.ci.austin.tx.us/GIS-Data/Regional/coa_gis.html. *Accessed June, 2011.*

Morgan, D.S., Jones, J.L., 1995. Numerical Model Analysis of the Effects of Ground-water Withdrawals on Discharges to Streams and Springs in Small Basins Typical of the Puget Sound Lowland, Washington. USGS Open-File Report 95-470.

Said, A., Stevens, D.K., Sehlke, G. 2005. Estimating Water Budget in a Regional Aquifer Using HSPF-MODFLOW Integrated Model. Journal of the American Water Resources Association 41(1):55-66.

ACADEMIC QUALIFICATIONS

Relevant Courses Taken		Education
Water Resources	Applications to Hydrological Science, Issues in Water Resources	• M.S. in Water Management and Hydrological Science, Texas A&M University, College Station, TX. Expected December 2011. GPR: • M.A. in International Economics, Yale University, New Haven, CT. 2006. GPR: • B.S. in Agricultural Economics, National Taiwan University, Taipei, Taiwan. 2005. GPA:
GIS	GIS in Landscape and Urban Planning, Geographic Information System	
Statistical Analysis	Statistics in Research I and II, Operations Research Methods in Agriculture	
Hydrology	Hydrology and Environment	
Geomorphology	Engineering Geomorphology, Fluvial Geomorphology (Expected 2012)	
Ecology	Landscape Ecology (Expected 2012), Fieldtrip to the Llano River in Central Texas	
GRE Q:, V:		

PROPOSED USE OF FUNDS

This scholarship will be used to pay for PhD tuition, student fees, and textbooks in 2011/2012 academic year.

INTENDED CAREER PATH

My career goal is to integrate my knowledge with natural resources management and GIS techniques to resolve the planning of environmental issues at regional, local, and national levels. Once I obtain my master in Water Management and Hydrological Science at Texas A&M University, I will continue to pursue a PhD in the same program. My research interests cover river restoration, climate variability, and watershed management.