1. 2017-2018 TWRI Graduate Student Research Programs – Pre-proposal

2. Student: Wan-Yi Wei, EIT, CFM (Texas Board), Ph-D student (September, 2016 – May, 2020)
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4. The funding will be used to initiate a new Low Impact Development (LID) research project. The project is currently in the initial stage. A pilot scale bioretention system is available at the Texas A&M AgriLife Center in Dallas, TX for this research project.

5. Abstract:
   Flooding is a common natural disaster in the United State due to extreme and intensive rainfall events that have been observed with increasing frequency in recent years. It is expected that with increased Greenhouse Gas (GHG) in the atmosphere and its impact on climate change, more frequently extreme events will be observed resulting in more flooding events. The State of Texas is one of the most frequently flooded areas in the United States based on NOAA's storm events database (1996-2013). There are approximately 18 massive flooding events that have been observed from March 2015 to the present. Water quality is also a primary concern during and after the flood. Hazardous materials might travel along with flood water from one site to another. The goal of the study is to investigate the reduction of runoff in urban areas as well as to improve water quality using one of the LID Best Management Practices (BMPs) – Bioretention cells. Both stormwater runoff quantity and quality will be examined using field investigations and numerical modeling to determine the best ratio of permeable area to impermeable area in urban watersheds. The most suitable engineered soil using soil media, gravel and wood mulch, will be selected by laboratory column testing. Hydrology models which investigate the impact of potential weather patterns predicted from climate change at the bioretention level will be developed. The flood water quality and quantity will be monitored at the inflow and outflow of the bioretention columns simultaneously. The goal will be to reduce concentration of Total Suspended Soil (TSS), nitrate and phosphorus to improve water quality as well as to provide high infiltration capacity.

6. Proposal Statement:
   a. Statement of Critical Regional or State Water Problem:
      Flooding is one of the critical water problems in the State of Texas. The City of Austin and the City of San Antonio claim that they are "one of the most flood-prone regions in North America". Severe flooding events were observed recently in the City

of Houston. From 1996 to 2011, the impervious pavement increased approximately 25% in the City of Houston due to concentrated urban development. The flooding events rapidly increased in urban areas not only because of the high ratio of impervious pavement to pervious surfaces but also because of the intensive rainfall events resulting from climate change. This research will benefit the urban watershed management decision makers in municipalities that are adapting to climate change in advance, and furthermore mitigate the impact from flooding and protect citizens' life and property.

b. Objectives and Timelines:
   - Task 1 – Perform Laboratory column testing to select permeable materials of bioretention cell (January, 2017 – May, 2017)
   - Task 2 – Modeling study to determine the best ratio of permeable area to impermeable area of pilot urban area with rainfall patterns by adapting climate change (May, 2017 – December, 2017)

c. Methods, Procedures and facilities:
   - Task 1 – The laboratory column testing will be performed in the Price-Hobgood Building at Texas A&M University main campus using several mixed permeable and sorbent materials. There will be 4 types of soil mixtures selected for the column testing. The soil mixtures will be packed into plastic columns. The length of the column will be 15 cm and the diameter 7.62 cm. The column test will repeat 3 times for each soil mixture. The soil characteristics, such as hydraulic conductivity, porosity, and water holding capacity, of each soil mixture will be examined. The TSS concentrations and loads will be quantified at the inflow and outflow in the lab for each column. The concentrations of nitrate and phosphorus will also be measured in water samples for each column at the inflow and out flow. The main objective of task 1 is to find the optimized engineered soil for TSS, nitrate and phosphorus reduction and for infiltration rates improvement.
   - Task 2 – The hydrology model SWAT will be used to simulate the experimental urban environment. Data from the column study will be used in the model. Five different ratios of permeable surface to impermeable surface in the urban watershed will be investigated to find the best ratio which produces lowest runoff rates. Rainfall patterns which adopt prediction of climate change will be utilized for the models to evaluate extreme weather events.

d. Statement of expected results or benefits:
   The ideal engineered soil will be selected based on the laboratory column testing to improve water quality and reduce runoff rate. The selected engineered soil will be employed in the hydrology model. The model results from SWAT will be tabled and the characteristics, such as precipitation rate, infiltration rate and runoff rate, will be compared among the five ratios of permeable surface to impermeable surface in the bioretention cells. The optimized ratio of permeable surface to impermeable surface in urban watersheds will be later chosen to conduct pilot scale bioretention test at the Texas A&M AgriLife Center in Dallas (beyond the scope of this project). The data collected in the pilot test field will be analyzed. The results will be employed to

develop bioretention cells design which is targeted on flooding management and control.

7. Budget Plan

   a. Please indicate your specific funding needs:
      i. _x_ Tuition support is needed
      ii. ___ Other costs (salary, fringe, travel, other) is needed
      iii. ___ Either source of funds would be applicable to my project.

   b. Proposed use of funds by category, not to exceed $5,000 requested. Indirect costs are not allowed per the prime sponsor agreement.

Category	**Request**	**Match**	**Justification**
Salary	$	$ 8,183	*Dr. Jaber's one month salary*
Fringe Benefits	$	$ 2,154	*Dr. Jaber's Medical fringe and Insurance coverage rates*
Travel	$		
Supplies	$		
Tuition	$ 5,000		*51% of annually in-state tuition*
Other	$		
Total	**$ 5,000**	$ 10337	

   c. Matching funds of 2:1. Please see above table for details.

8. Career Path

   I expect to become a stormwater management expert that focuses on flooding control and to devote myself to continue improving BMP design to adapt extreme flooding events due the global climate change. I would like to pursuit my professional career in academia to develop a research group specialized in reducing flood hazards in urban areas.