Pre-Proposal Application Form
2018–2019 TWRI Graduate Student Research Programs

Which program are you applying for?
_X_ Mills Scholarship Program (Texas A&M, Galveston or Qatar student requesting tuition only)

1. **Title of pre-proposal**: Biogeochemistry of Urban, Suburban, and Rural Ponds and Lakes in South Central Texas, USA

2. **Student name**: Kirby Young (Maiden name: Peddicord)
Email / phone number: kirbypeddicord@tamu.edu
University / Department: Texas A&M University / Department of Geology and Geophysics
Degree being pursued: Master of Science in Water Management and Hydrological Science
Degree starting year: January 2016 // Expected year of graduation: May 2018

3. **Faculty advisor/committee chair name**: Jacqueline Aitkenhead-Peterson
Title: Associate Professor; **Email/phone number**: jacqui_a-p@tamu.edu / (979) 845-3682 (office)
University / Department: Texas A&M University Department of Soil and Crop Sciences

4. **Would these funds be initiating new research or supporting ongoing research? If ongoing, please briefly explain where you are at in the research and project timeline.**

These funds would be supporting ongoing research. I began working with Dr. Aitkenhead-Peterson and collecting data in March of 2017. I will continue data collection twice a month until I have a full year's worth of data, or until the end of February 2018. Currently, I am still collecting samples and analyzing them in the lab for a variety of parameters including *E. coli* and nutrients to track the monthly and seasonal variation of urban ponds and lakes throughout the Bryan/College Station area. I have been able to start on spring and summer seasonal statistics since I have collected enough data to begin analyzing categorical trends; however, I will not be able to complete an analysis for the dataset as a whole until the final sampling event is completed in February.

5. **Abstract: Please provide 200 words or less about your proposed research problem, methods and objectives and describe how your research will address the research priorities.**

Urban lotic surface waters have been extensively studied due to reported increases in their alkalinization, dissolved organic carbon (DOC), and bacteria, specifically *E. coli* (Aitkenhead-Peterson et al., 2009; McCrary et al., 2013; Harclerode et al., 2013; Steele and Aitkenhead-Peterson, 2011). The same cannot be said for urban lentic surface waters however, which are subject to the same United States Environmental Protection Agency (USEPA) standards for recreation and other classifications, yet have received much less attention. This study aims to gain a better understanding of the health of lentic surface waters across a growing city that may present ample opportunities for human recreation and interaction and subsequent potential health risks. This study analyzes 24 urban, suburban, and rural lakes and ponds throughout the Bryan/College Station, Texas area for *E. coli* (monthly), biogeochemistry including, but not limited to, DOC, DON, $SUVA_{254}$, NO_3-N, NH_4-N, and PO_4-P, BOD_5, and total suspended solids (TSS) (twice monthly) according to EPA-approved methodology for each parameter. Some of the lentic surface water bodies are for recreational activities, while others serve more simply as storm water retention ponds in neighborhoods or ponds on golf courses. Metals that are indicative of urban runoff, including Mn, Fe, Zn, Cu, and Cd, will also later be quantified.

6. **Description of the student's proposed research, emphasizing how it will address water resources-related concerns (particularly how, if possible, it will benefit Texas), including:**
a. **Statement of Critical Regional or State Water Problem.**

This study addresses the TWRI RFP research priority "(a)ddressing major water quality impairments in Texas, which includes bacteria, dissolved oxygen, mercury, and other hazardous contaminants" by further investigating major water quality impairments in the State of Texas in lentic water bodies, which are rarely studied compared to lotic water bodies. By focusing on a wide array of parameters that are part of the USEPA's Water Quality Criteria, this study offers a broad view of the health of various types of lentic water bodies in South Central Texas, including lakes and ponds with differing surroundings that are located in the Bryan/College Station area. This study will provide critical information to the general public and those in charge of caring for and improving the health of local water bodies by enabling their biogeochemical and biological nature to be better understood. Subsequently, the potential effects of contaminated water, such as gastrointestinal illnesses, reproductive problems, and neurological disorders (Calderon et al., 1991; Copeland, 2002; Soller et al., 2010), on humans that are unaware of the risks and interact with them, can be more effectively combated by implementing solutions in the future like best management practices (BMPs).

b. **Nature, Scope and Objectives of the Research, including a timeline of activities.**

The nature of the proposed research is to examine the biological, chemical, and physical attributes of ponds and lakes throughout the Bryan/College Station region. This quantitative research project encompasses 24 water bodies whose characteristics vary greatly; for example, Lake Bryan, a power plant cooling reservoir has recreational boating, swimming, and fishing, while a lake at the Wahlberg Golf Learning Center directly receives treated wastewater effluent that is rich in nitrogen and phosphorous. Other lentic areas include city ponds for fishing and ponds that are little more than storm water retention/detention ponds with hiking trails for aesthetic value in the cities' growing subdivisions. The variety of sampling sites within this study enables a broad array of lentic water bodies to be analyzed, better understood, and subsequently potentially used as analogs to similar lentic water bodies that are located around the State of Texas and potentially, nationally. The major objective of the research is to ensure that these types of lentic surface water bodies meet the same standards for recreation as expected of lotic surface waters in Texas. Sampling of the lakes and ponds commenced in March of 2017. Samples for chemical analyses are taken twice monthly while samples for *E. coli* are taken once each month. Sampling will be completed in February of 2018 and statistical analyses will be utilized to determine whether the type of water body, the size of water body, and/or the land use surrounding the water body has the greatest effect on chemical and biological conditions.

c. **Methods, procedures and facilities.**

The surface water quality monitoring (SWQM) methods used throughout this study are USEPA-approved for water quality analyses and are conducted according to the *TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods* (TCEQ 2012). Samples are collected from each site in 500 mL high density polyethylene (HDPE) bottles and monthly bacteria samples are collected in sterile 120 mL IDEXX sample bottles that contain sodium thiosulfate to remove any potential chlorine. Once all 24 samples are collected, they are transported back to Texas A&M University (TAMU) within approximately 4 hours to undergo analyses. Bacteriological analyses utilizing the IDEXX method are conducted in the Soil and Aquatic Microbiology Laboratory (SAML) at TAMU and chemical analyses are conducted in the Nutrient and Water Analysis (NaWA) Laboratory at TAMU. pH and electrical conductivity are quantified on unfiltered samples. Up to 200 mL of each sample are filtered through pre-weighed Whatman GF/F filters, oven dried (60° C for 3 days), and then weighed to determine total suspended solids (TSS). Portions of each sample are transferred to biological oxygen demand (BOD) bottles and dissolved oxygen at t=0 and t=5 are recorded to assess sample BOD. Sub-samples are analyzed as following: Dissolved organic carbon (DOC) and total dissolved nitrogen (TDN) are measured using high-temperature Pt-catalyzed combustion with a Shimadzu TOC-VCSH and Shimadzu total measuring unit TNM-1 (Shimadzu Corp. Houston, TX, USA). Dissolved organic carbon (DOC) is measured as non-purgeable carbon using USEPA Method 415.1, which entails acidifying the sample (2 M HCl to pH 2) and sparging it for 4 minutes with carbon-free air. Ammonium-N is analyzed

using the phenate hypochlorite method with sodium nitroprusside enhancement (USEPA Method 350.1). Nitrate-N is analyzed using Cadmium-Copper (Cd-Cu) reduction (USEPA Method 353.3). Orthophosphate-P is quantified using the ascorbic acid, molybdate blue method. Colorimetric methods were performed with a Smartchem Discrete Analyzer (Model 200 Westco Scientific Instruments Inc., Brookfield, CT, USA). Dissolved organic nitrogen (DON) is the difference of total dissolved nitrogen minus the sum of ammonium-N and nitrate-N [TDN – (NH_4-N + NO_3-N)]. For all chemical analyses, NIST traceables, laboratory standards, and replicate samples are included in instrument runs after every 10 samples to monitor instrument precision. SUVA254, a measure of refractory carbon, is analyzed using a Shimadzu Spectrophotometer Model UV-1280. Analyses of sediment for heavy metals, including Mn, Fe, Zn, Cu, and Cd, have not yet been conducted, but will most likely be quantified using X-Ray Fluorescence of air-dried sediment in Dr. Paul Schwab's laboratory.

d. **Statement of expected results or benefits.**

Data to date suggests that some lentic waters used for recreational purposes in the Bryan/College Station area are above USEPA standards for *E. coli* at certain times of the year. Furthermore, some of these waters have high BOD_5 levels and nutrient concentrations that may encourage low dissolved oxygen for fishing ponds and potential microcystin release through enhanced algal production. As an initial examination of a wide variety of urban, suburban, and rural lakes and ponds located within a region of Texas characterized by rapid growth, this study will enable cities to be made aware of the data collected with the hopes of the future implementation of mitigation efforts, the pursuit of closer examinations of lentic surface water health, and the avoidance of potential health risks associated with human interaction with these types of water bodies around the state and potentially the county.

7. **Please indicate your specific funding needs:** _X_ Tuition support is needed

Category	**Request**	**Match**	**Justification**
Salary	$0	$0	
Fringe Benefits	$0	$0	
Travel	$0	$0	
Supplies	$0	$2312.48	Costs for sample analyses
Tuition	$1,156.24	$0	Spring 2018 tuition and fees for 2 hours of classes
Other	$0	$0	
Total Direct	n/a	**$2312.48**	
Indirect Costs (IDC)	n/a	$0	
Unrecovered IDC	n/a	$0	
Total	**$1,156.24**	**$2312.48**	

8. **Intended career path the student anticipates pursuing.**

During my time as a graduate student at Texas A&M University, I began working as a Graduate Research Assistant for the Texas Water Resources Institute (TWRI), the state of Texas' official water resources institute. In June of this year, I started working full-time for TWRI as a Research Assistant. With my background being in geosciences and initially wanting to pursue a career as a geologist after I graduated with my undergraduate degree from Trinity University, my eyes were opened to an entirely different world as I learned about and witnessed the complexity of the Earth's water resources and our duty to be good stewards. As I approach graduating with my master's degree in the near future, I hope to be able to combine my newfound passion in water resources with my long-time love for geology throughout my career. Additionally, I am planning on obtaining my Professional Geoscientist (PG) License in the next few years by combining my Geoscientist-in-Training (GIT) Certification with additional professional experience.

References

Aitkenhead-Peterson JA and Steele MK (2016) DOC and DON exports upstream and downstream of the Dallas/Fort Worth Metropolis, Texas, USA. Invited Paper, Marine and Freshwater Research 67(9): 1326-1337.

Aitkenhead-Peterson J.A., Steele M.K., Nahar N. and Santhy K. (2009). Dissolved organic carbon and nitrogen in urban and rural watersheds of south-central Texas: land use and land management influences. Biogeochemistry: 96: 119-129 DOI: 10.1007/s10533-009-9348-2.

Calderon, R.L., Mood, E.W., Dufour, A.P. (1991). Health effects of swimmers and non-point sources of contaminated water. International Journal of Environmental Health Research, 1:1, pp. 21-31.

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