Each full proposal shall consist of the following 19 elements.

1. Title. Evaluation and Characterization of Microplastics along an Ephemeral Stream

2. Project Type. Research

3. Focus Categories. WQL, NPP, SW

4. Research Category. Water Quality

5. Keywords. Microplastics; plastic debris; plastic pollution; water quality

6. Start Date. 3/1/2021

7. End Date. 2/28/2022

8. Principal investigator(s).

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9. Congressional District 20th

10. Abstract.

Increased plastic production and worldwide use over the past few decades has resulted in the accumulation of microplastics (MPs) in all ecosystems. Due to their physiochemical properties and durability, MPs present a hazard risk to environmental integrity and is a health concern for animals and humans. Freshwater systems serve as sink-sources for primary and secondary plastic sources (respectively) from surface runoff and effluent discharge events. Leon Creek Greenway (LCG) is an urban greenway, characterized by an ephemeral stream, in San Antonio that feeds into the San Antonio River. To date, no study has evaluated the MP profile of ephemeral streams and interactions of hydroperiod dynamics with the dispersion and mobilization of MPs. Water and sediment samples will be taken along a stretch of the LCG for six months. MP concentrations will be evaluated for type, size, and density to develop a spatiotemporal baseline profile. Characterizing and quantifying the spatiotemporal dispersion and mobilization of MPs will provide insight addressing interactions between land use and

surface water quality. Results from this study will aide initiatives aimed at improving surface and ground water quality, and regional organizations centered around tracking plastic debris from freshwater to marine systems.

11. Budget Breakdown,

Cost Category	Federal	Non-Federal	Total
1. Salaries and Wages - Principal Investigator(s) - Graduate Student(s) - Undergraduate Student(s) - Others Total Salaries and Wages	$500	$0	$500
2. Fringe Benefits - Principal Investigator(s) - Graduate Student(s) - Undergraduate Student(s) - Others Total Fringe Benefits	0	0	$0
3. Tuition - Graduate Student(s) - Undergraduate Student(s) Total Tuition	0	0	$0
4. Supplies	$1,910.00	0	$1,910.00
5. Equipment	$400.00	0	$400.00
6. Services or Consultants	0	0	0
7. Travel	$300.00	0	$300.00
8. Other direct costs	$1,000.00	0	$1,000.00
9. Total direct costs	$4,110.00	0	$4,110.00
10a. Indirect costs on federal share	XXXXXXXX XXXXXXXX	0	$0
10b. Indirect costs on non-federal share	XXXXXXXX XXXXXXXX	0	0
11. Total estimated costs	$4,110.00	$	$4,110.00
Total Costs at Campus of the University on which the Institute or Center is located.	$4,110.00	$0	$4,110.00

Total Costs at other University Campus Name of University:	$	$	$

12. Budget Justification,

Salaries and Wages for PIs. Provide personnel, title/position, estimated hours and the rate of compensation proposed for each individual.
Jeffrey Hutchinson, Ph.D. – Assistant Professor, Salary: $77,400. Estimated hours 0.15 of time during sampling campaign. No funds are requested for PI salary
Salaries and Wages for Graduate Students. Provide personnel, title/position, estimated hours and the rate of compensation proposed for each individual. (Other forms of compensation paid as or in lieu of wages to students performing necessary work are allowable provided that the other payments are reasonable compensation for the work performed and are conditioned explicitly upon the performance of necessary work. Also, note that tuition has its own category below and that health insurance, if provided, is to be included under fringe benefits.)
Andre Felton - doctoral student, 20 hrs., 1% rate of effort/compensation. No funds are requested for graduate student salaries.
Salaries and Wages for Undergraduate Students. Provide personnel, title/position, estimated hours and the rate of compensation proposed for each individual. (Other forms of compensation paid as or in lieu of wages to students performing necessary work are allowable provided that the other payments are reasonable compensation for the work performed and are conditioned explicitly upon the performance of necessary work. Also, note that tuition has its own category below and that health insurance, if provided, is to be included under fringe benefits.)
A total of $500 is requested to compensate honor's undergraduate student interns during field sampling and lab analysis. Up to two undergraduate interns are expected to assist in field sampling and laboratory analysis of microplastic concentrations.
Salaries and Wages for Others. Provide personnel, title/position, estimated hours and the rate of compensation proposed for each individual.
No funds are requested for other personnel.
Fringe Benefits for PIs. Provide the overall fringe benefit rate applicable to each category of employee proposed in the project. . Note: include health insurance here, if applicable.
31.61%. No Fringe benefits are requested for PI.
Fringe Benefits for Graduate Students. Provide the overall fringe benefit rate applicable to each category of employee proposed in the project. Note: include health insurance here, if applicable.
8.00%. No fringe benefits are requested for graduate student.
Fringe Benefits for Undergraduate Students. Provide the overall fringe benefit rate applicable to each category of employee proposed in the project. Note: include health insurance here, if applicable
No fringe benefits are requested for this grant. The fringe benefit amount for graduate students is $10, but is waived in graduate student grants.
Fringe Benefits for Others. Provide the overall fringe benefit rate applicable to each category of employee proposed in the project. . Note: include health insurance here, if applicable.
No funds for fringe benefits for other personnel are being requested
Tuition for Graduate Students.
No funds for tuition are being requested
Tuition for Undergraduate Students
No funds for tuition are being requested
Supplies. Indicate separately the amounts proposed for office, laboratory, computing, and field supplies. Provide a breakdown of the supplies in each category.

A total of $1,210 in supplies is requested for the one year.

Field supplies: Supplies are needed to buy all the chemicals and biologicals to be used in the proposed study. Examples include, but are not limited to chemical reagents and kits for water quality analysis, glass bottles for bulk sampling, cooler, glass containers, plastic containers, shovels (2), and metal trays.

Laboratory supplies: Funds towards lab supplies include, but are not limited to 100% cotton lab coats (2), aluminum foil, glass petri dishes, disposable vacuum filtration kits, chemical reagents in charactization of MPs, centrifuge and class tubes, glass slides, goggles, reagents for density separation process, Kim wipes, cuvettes, microfibre glass filters, fluorescent polystyrene MPs, and Nile red dye.

Equipment. Identify non-expendable personal property having a useful life of more than one (1) year and an acquisition cost of more than $5,000 per unit. If fabrication of equipment is proposed, list parts and materials required for each, and show costs separately from the other items. A detailed breakdown is required.

A total of $1,100 is requested for equipment essential to sampling, processing, and analyzing water and sediment samples to extract microplastic particles.

- $615 for 2 sets of No. 4, 10, 18, 35, and 140 stainless steel sieves
- $448 for 1 hand core sediment sampler

Services or Consultants. Identify the specific tasks for which these services, consultants, or subcontracts would be used. Provide a detailed breakdown of the services or consultants to include personnel, time, salary, supplies, travel, etc.

No funds are requested for service or consultant fees.

Travel. Provide purpose and estimated costs for all travel. A breakdown should be provided to include location, number of personnel, number of days, per diem rate, lodging rate, mileage and mileage rate, airfare (whatever is applicable).

A total of $300 in funds is requested to support the travel of the PI, PhD students, and undergraduate interns between field sampling sites and laboratory sites for analysis. Funds requested are to be used completely throughout two sampling campaigns. Field sampling sites are within 30 min distance of UTSA aquatic ecology labs. This will allow for frequent trips during and immediately following precipitation events to collect data at all sites

Other Direct Costs. Itemize costs not included elsewhere, including publication costs. Costs for services and consultants should be included and justified under "Services or Consultants (above). Please provide a breakdown for costs listed under this category.

A total of $1000 in equipment replacement and sampling incidentals. Conditions in the field can result in the degradation or damage to equipment used to sample sediment and water. Examples include collecting sediment samples when water levels are too high to adequately inspect core location for large rocks or debris that can damage equipment. In addition to incidentals, working with undergraduate students that gain training and experience during the sampling season brings increased risks of unexpected, and unintended, breakage of equipment for sampling and/or analyzing samples.

Indirect Costs. Provide negotiated indirect ("Facilities and Administration") cost rate.

No request is being made for indirect cost. The IDC rate is 49.5% but graduate student grants are not charged

Items 13 through 19 shall not exceed 10 single-spaced pages, 12-point font, exclusive of resumes (item 19).

13. Statement of regional or state water problem. Include an explanation of the need for the project, who wants it, and why.

MPs pose multiple physical and chemical differential risks to freshwater ecosystems. Concerns of MP contamination are exacerbated by how long the particles exist in the environment [5,16]. Such concerns have prompted various high-profile actions (i.e. international agreements/treaties) regarding plastic management in shared waterbodies. The longer MPs persist in the environment, MP leachate increases and can be transported via hyporheic zone to groundwater sources and other systems [15]. The prevalence, magnitude, adsorptive properties, and longevity of MP pollution diminishes water quality and poses a threat to animal and human health. Presently, there is a lack of understanding in how MPs breakdown and move in ephemeral streams where hydroperiods are largely driven by precipitation and stormwater runoff events. Furthermore, mitigation of MP contamination requires a baseline understanding of the dispersion and mobilization of MP particles through a freshwater system. Characterizing and quantifying the spatiotemporal dispersion and mobilization of surface, suspended, and sediment MPs will provide insight addressing surface and ground water quality.

14. Statement of results or benefits.

This study takes a proactive approach towards the protection and improvement of Texas greenway spaces and the Edwards Aquifer water quality by evaluating the densities and types of MPs coming from surface runoff. Upon the completion of the study, insights on the ability of ephemeral pools to trap, store, and degrade MPs will be provided. The information gained from this study will be transferable to other organizations and initiatives aimed at improving surface and ground water quality, as well as provide data for regional and national organizations focused on tracking plastic debris from freshwater to marine systems.

15. Nature, scope, and objectives of the project, including a timeline of activities.

The nature of this study is to address and assess ecological relevant levels of microplastic concentrations in ephemeral fluvial systems. The ubiquity of MP (material ranging in size from 100 nm - 5 mm) pollution across various ecosystems has emerged as a focus of global concern [1,2]. Freshwater systems, where MPs experience environmental weathering and degradation processes, simultaneously serve as sink-sources for primary and secondary source MPs [1,3]. Due to their physiochemical traits (hydrophobicity, density, charge, and size), MPs can inhabit on or near water surfaces, remain suspended in the water column, or become deposited or embedded in sediments [4,5]. Surface water MPs exhibit differential degradation rates and can harbor harmful pathogens as part of distinct microbial communities disparate from the immediate environmental microbial community [5,7]. Suspended MPs can concentrate environmental pollutants (polycyclic aromatic hydrocarbons - PAHs, heavy metals, endocrine disrupting chemicals - EDCs, persistent organic pollutants - POPs) that can leach into the water column, diminishing water quality and presenting health concerns [5,6]. Sediment MPs are capable of adsorbing heavy metals [5,8,15] to which its ecotoxicity is influenced by longevity and plastic polymer base [9]. Several studies have suggested that MPs can adsorb toxic chemicals which are ingested result in bioaccumulation in higher organisms [11], shift the balance of probiotics in the digestive tract, and compromise immunity and nutrition [7,10,11].

The scope of this study will be limited to Leon Creek Greenway within San Antonio, Texas. Ephemeral streams are essential and characteristic fluvial systems of the semi-arid North American southwest. Understanding how MPs behave in transit through ephemeral fluvial systems addresses a gap in our understanding of MPs deposition throughout habitats as they make their way to the ultimate sink – marine systems.

The objectives of this study are: 1) to assess the ability of ephemeral pools to serve as sinks for MPs; 2) characterize the spatiotemporal behavior (e.g. dispersion, sedimentation, resuspension) of MPs through several hydroperiods of an ephemeral stream; and 3) investigate degradation rates of MPs in ephemeral pools during drought periods.

Timeline:

No.	Task	Year 1 (4/1/21 - 3/31/22)		Year 2 (4/1/22 – 3/31/23)	
1	Identify LCG sites for sampling				
2	Purchase materials & collect samples				
3	Characterize MPs & evaluate MP profile				
4	Data analysis & dissemination of results				
5	Report write up				

16. Methods, procedures, and facilities. Provide enough information to permit evaluation of the technical adequacy of the approach to satisfy the objectives.

Site Selection: San Antonio is highly urbanized and one of the fastest growing cities in the United States over recent years. As a result of this exponential growth, areas of the city are undergoing rapid development and increased impervious land cover and water usage, both of which impact the water quality of streams, greenways, and retention ponds that feed into the Edwards Aquifer. In addition to development, greenways constructed to provide recreational retreats are used by the city's population for exercise, leisure, and education. Leon Creek greenway (LCG) is an ephemeral headwater stream that runs northwest to southeast through San Antonio. Following precipitation and flood events, LCG serves as one of several greenway drainages receiving surface runoff from surrounding impervious areas and sewage overflow. Flood levels reside within 24 hours and continuous flow in the dry creeks no longer occurs after 3-7 days, and multiple ephemeral pools are formed along the dry creek beds. The hydrological period of these ephemeral pools ranges from < 5 days to > 6 months naturally, and year-round in manipulated landscapes. Six sites will be used along the LCG located in northern San Antonio to evaluate and quantify macro- and micro-plastic composition and density from surface runoff. Evaluations will be taken of both the water quality and sediment (streambed, pool, riparian).

Sampling of MPs: A combination of water and sediment sample will be taken along runs and pools of the stream to evaluate MPs. Sites will be sampled following precipitation events (up to 5 days) and four times monthly for 6 months. All water samples will be immediately transported to UTSA and processed for MP extraction and characterization. Samples will be analyzed for typical water quality parameters [i.e. pH, temperature, chemical oxygen demand (COD), total organic content (TOC), nitrate, phosphate, and total coliforms]. Water samples will then be wet-sieved and filtered through 10 μm filters. Any particulate matter will be rinsed from the filters into a glass bottle using Milli-Q water and labeled for MP extraction.

MP extraction: MPs will be extracted by enzymatic digestion to remove organic material. After digestion, density separation and MP characterization will follow modified wet-sieving methods and in compliance with commonly used SOPs for analysis of MPs [3,17].

MP characterization: MPs will then be separated into two size classes (< 1 mm and > 1 mm) using modified wet-sieving. The size, shape, chemical composition, and density of the extracted particles will be determined with Fourier-Transform Infrared Spectroscopy (FTIR) [3,17].

Statistical analysis: Variables that will be collected include: polymer type, size, shape, density (MPs m^{-3} for sediment and MPs L^{-1} for water), hydrophobicity and charge. Descriptive statistics (means and standard errors) will be calculated for all variables. Tables and appropriate graphs will be composed for all variables. Various statistical tests will be used to analyze data that include correlation analysis, analysis of variance, analysis of covariance, linear and non-linear regressions, and principal component analysis. All data will be tested at a p-value of 0.05 to determine if statistical differences exist.

17. Related research. (Research projects only) Show by literature and communication citations the similarities and dissimilarities of the proposed project to completed or on-going work on the same topic.

At this time there are no ongoing projects or completed project related to MP in the aquatic ecology lab of UTSA. Similar sites have been used for previous studies addressing macro-invertebrate and fish biodiversity along Leon Creek Greenway [18, 19]. Additionally, sites along Leon Creek Greenway where water samples will be collected have been included in a completed 12-month algae survey and some unpublished baseline data on water quality and hydroperiods of temporary pools. The USGS maintains a depth gage at northern reach of suggested sample sites (https://waterdata.usgs.gov/nwis/inventory?agency_code=USGS&site_no=08180995).

Outside of the UTSA aquatic lab, MP monitoring studies are few within the United States. To that extent, all monitoring studies are focused on perennial rivers and/or lotic systems used for aquaculture. This study will be the first to investigate and report of MPs behavior in ephemeral fluvial systems.

18. Training potential. Estimate the number of graduate and undergraduate students, by degree level, who are expected to receive training in the project.

Graduate students:

Ph.D. degree

1 to 2 students are expected to receive training in MP sampling and analysis in this project. The primary investigator of this project is a doctoral student proposing this research as part of a dissertation. The second potential doctoral student would be a fellow in the Hutchinson lab that may assist with analysis or data collection when not conducting their own dissertation research.

M.S. degree

1 to 2 students may gain training in MP analysis from this project. The lab in which the FTIR spectroscopy analysis will be conducted contains multiple M.S. thesis students that may utilize spectroscopy for different research questions regarding microplastic pollution.

Undergraduate students:

2 undergraduate students are expected to gain training in water and MP sampling during field sampling campaigns. Furthermore, it is budgeted in the request to provide some financial compensation for undergraduate participation during the summer in sampling and/or analysis.

19. Investigator's qualifications. Include resume(s) of the principal investigator(s). No resume shall exceed two pages or list more than 15 pertinent publications.

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A. Education and Training

Univ. of Maryland – Baltimore County, Baltimore, MD	B.S. Env. Science	2007
Towson Univ., Towson, MD	M.S. Thesis Biology	2009
Univ. of Connecticut, Storrs, CT		2009-2011
Univ. of Texas at San Antonio, San Antonio, TX	Ph.D. Env. Science & Ecology	2020-

B. Employment History and Academic Appointment

8/2019-Present	Adjunct Instructor, Department of Natural & Physical Sciences, Northwest Vista College, San Antonio, TX
1/2019-8/2019	Chemistry Instructor, Science Department, KIPP UPrep, San Antonio, TX
8/2015-8/2017	Expert Biology Instructor, Science Department, BASIS ed., San Antonio, TX
4/2012-11/2012	Research Assistant, Ohio State University, Columbus, OH
3/2012-7/2012	Biological Field Technician, WEST Environmental & Statistical Inc., Fort Payne, IN

C. Professional and Synergistic Activities

- Session Leader, UTSA ASSIST – Science Identity workshop, 2020
- Science Judge, UTSA Honors College Experiential Learning Fair, 2020
- Research Advisor, BSANC Cubes in Space Committee, 2016-2017
- Director, BSANC Upper School Genes in Space competition team, 2016-2017

- Technical and Scientific Advisor, Texas Water Exchange Inc., 2013-2014
- Member, American Association for Advancement of Science, 2013-present
- Member, Business Networking International, San Antonio RIM Referrals, 2013-2014
- Graduate Student Representative to Faculty Council, Department of Ecology & Evolutionary Biology, University of Connecticut, 2009-2011
- Co-Chairman, Towson Greenhouse Gas Emissions Inventory Conference, 2009
- Member, American Society of Mammalogy, 2008-present

D. Honors and Awards

2020	Graduate Research Assistantship, UTSA Dept. of Environmental Engineering & Ecology
2020	Supplemental Graduate Research Assistantship, UTSA Graduate School
2015-2016	BASIS Honored Teacher Award, BASIS San Antonio North Central Campus
2011	Honorable Mention Award, Ford Foundation Predoctoral Fellowship
2009-2011	Multicultural Fellowship Award, Univ. of Connecticut
2007-2008	Graduate Research Assistantship, Towson University Biology Department

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(a) Professional Preparation

University of Florida	Gainesville, FL	Wildlife ecology	Bachelor's of Science 1994
University of Kentucky	Lexington, KY	Forestry	Master's of Science 1998
University of Florida	Gainesville, FL	Agronomy	Doctorate of Philosophy 2010

(b) Appointments

2016-Present	Assistant Professor, College of Science - Environmental Science Program, University of Texas at San Antonio
2012-2016	Botanist (GS12) - United States Fish and Wildlife Service, San Marcos Aquatic Resources Center, San Marcos, Texas
2010-2012	Post-Doctoral Research Associate, University of Florida
2004-2010	Ph.D. Graduate Research Assistant, University of Florida
2002-2004	Land Manager, Archbold Biological Station, Lake Placid, Florida
1999-2002	District Biologist, Florida Park Service, Hobe Sound, Florida

(c) Products

(i) Five Related Publications

Bohn , K., G. Brundu, D. Chapman, I. Dancza, D. Frohlich, J. Hutchinson, S. Miller, J. Van Valkenburg, and R. Tanner. 2018. Pest risk analysis for *Lygodium japonicum* (Thunb.) Sw. European and Mediterranean Plant Protection Organization, Paris, FR. Available at: http://www.iap-risk.eu/media/files /pra_exp_LYFJA.pdf.

Hutchinson, J.T. 2018. *Ex situ* phenology of *Zizania texana*, an endangered aquatic macrophyte, under different water velocities. Aquatic Botany 153:88-94.

Wilson, W., J.T. Hutchinson, and K.G. Ostrand. 2017. Genetic diversity assessment of wild and refugia Texas wild rice (*Zizania texana*) populations, an endangered plant. Aquatic Botany 136:212-219.

Hutchinson, J.T. 2017. Propagation protocol for the endangered aquatic plant – Texas wildrice (*Zizania texana* Hitchc.). Native Plant Journal 18:77-85.

Hutchinson, J.T. and K.G. Ostrand. 2017. Evaluation of copper on Texas wild rice, creeping primrose-willow and water star-grass. Journal of Aquatic Plant Management 55:113-115.

(ii) Five Other Significant Products

Evaluation of the vegetation along roadways in Edwards Aquifer recharge and contributing zones for storm water management and water quality improvement - CoPI with Vikram Kapoor (2019). Source: City of San Antonio's Proposition 1 Funding. Amount Requested: $789,636.

Evaluation of the vegetation and soils to improve carbon sequestration and ecosystem services at the University of Texas at San Antonio main campus - CoPI with Vikram Kapoor (2019). Source: UTSA Office of Sustainability. Amount Requested: $82,619.

Project ASSIST: Advancing and Strengthening Science Identity through Systematic Training - Co-PI with Janis Bush, Sue Hum, Amaury Nora, Juliet Ray, Kenneth Walker, and Gwen Young (2018). Source: United States Department of Agriculture. Amount Received: $274,991.

Advancing and Strengthening Science Identity through Systematic Training (ASSIST) - CoPI with Janis Bush, Sue Hum, Amaury Nora, Juliet Ray, Kenneth Walker, and Gwen Young (2018). Source: National Science Foundation. 2018. Amount Received: $499,997.

Evaluation and enhancement of carbon sequestration potential, bioenergy production and ecosystem services of existing vegetation along roadsides - CoPI with Vikram Kapoor (2017). Source: Transportation Consortium of South Central States (Tran-SET). Amount Received: $50,000.

(iii) Synergistic Activities

Committee member, Doctoral Studies Committee, Environmental Engineering and Environmental Science, University of Texas at San Antonio, (2016-present).

Committee member, Graduate Studies Committee, Environmental Science, University of Texas at San Antonio, (2016-present).

Department Representative, UTSA Faculty Senate, University of Texas at San Antonio, (2017-2020).

UTSA Classes taught - Natural Resource Policy and Administration, Aquatic Ecology, Water Pollution Control, Graduate Student Seminar, and Graduate Student Colloquium (2016-present).

Texas Aquatic Plant Management Society - Board Member (2019-present).

Associate editor - Southwestern Naturalist (2015-present).

Instructor - University of Florida's Extension Service's Natural Area and Aquatic Weed Management Certification Courses (2005-2012).

Literature cited

1. Andrady, A. L. (2011). Microplastics in the marine environment. *Marine Pollution Bulletin*, *62*(8), 1596–1605.
2. Eerkes-Medrano, D., Thompson, R. C., & Aldridge, D. C. (2015). Microplastics in freshwater systems: A review of the emerging threats, identification of knowledge gaps and prioritisation of research needs. *Water Research*, *75*, 63–82.
3. Olesen, K. B., Alst, N. Van, Simon, M., & Vianello, A. (2017). Analysis of Microplastics using FTIR Imaging. Application Note, Environmental Agilent Technologies, pp6.Prokić, M. D., Radovanović, T. B., Gavrić, J. P., & Faggio, C. (2019). Ecotoxicological effects of microplastics: Examination of biomarkers, current state and future perspectives. *TrAC - Trends in Analytical Chemistry*, *111*, 37–46.
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10. Xu, S., Ma, J., Ji, R., Pan, K., & Miao, A. J. (2020). Microplastics in aquatic environments: Occurrence, accumulation, and biological effects. *Science of the Total Environment*, *703*, 134699.
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18. Buchanan, Madeliene. 2020. Northern Leon Creek Greenway fish community surveys to enhance urban fishing. M.S. Thesis, University of Texas at San Antonio.