



Research Project Statement 24-191 FY 2024 Annual Program

Title:	Synthesis: Hydrologic Approaches to Playa Lakes, Areas of Significant Karst Geology, and Arid Regions
The Problem:	<p>Playa lakes, karstic regions, and arid regions present distinct hydrologic design challenges for TxDOT in west and southeast Texas are characterized by playa lake hydrology. These playa features may be related to regions of karst geology. Furthermore, in arid regions of west Texas, even in the absence of significant playas or karst, because of the lack of gauges, it is challenging to determine suitable hydrologic parameters to appropriately characterize the rainfall-runoff relationship. Over half of Texas is within a known karst region.</p> <p>Playas present a confounding challenge because in higher-frequency events, they may act as hydrologic sinks, while in higher-magnitude events they may act as significant depression storage. Hydrologic and hydraulic (H&H) designers grapple on a project-by-project basis with judgment calls on how to parameterize the selected hydrologic method to account for storage and infiltration, including whether to assume a starting condition of a completely dry depression storage area. These decisions have a significant impact on the resultant sizing of cross-drainage structures.</p> <p>Karst terrain is characterized by sinkholes, depressions, caves, and underground drainage. Karst features can have a significant impact on peak flows and modifications to drainage patterns can induce dissolution and the formation of sinkholes. The existence and extent of such karst features presents challenges with drainage analysis and how to represent losses into sinkholes, fractures, and caves. TxDOT does not have a practice or standard for identifying whether karst is a significant concern or for managing the concern from an H&H design perspective.</p> <p>In arid regions, the standard hydrologic parameters for peak rate factors, storage and infiltration, do not produce the appropriate rainfall-runoff relationship, i.e., peak frequency flows, relative to basin size, which has resulted in either a lack of designed drainage structures or significant over- and under-sizing. As we develop energy corridor projects, these questions have been increasing without a consistent, scientifically based standard for resolving.</p>
Technical Objectives:	<p>The problems of arid region hydrology, playa lake hydrology, and karst impacts on H&H have long presented challenges to TxDOT. As the number of projects, most notably interstate corridor planning and energy corridor development increases, it has become increasingly essential that TxDOT provide guidance and standards of practice to facilitate the development of reliable transportation infrastructure.</p> <p>This synthesis project will include a comprehensive review of relevant literature, design guidance, and standards of practice from relevant entities and regions with similar challenges. Work may also include identifying and interviewing knowledgeable parties to develop a summary of the state of knowledge and the state of practice.</p> <p>The expected technology readiness level (TRL) for this project is 2.</p>
Anticipated Deliverables:	<ol style="list-style-type: none"> 1. Technical memorandum for each task completed. 2. Monthly progress reports. 3. Value of Research (VoR) that includes both qualitative and economic benefits, to be included in the final research report. This is not a stand-alone deliverable. 4. Research report documenting the findings of the research, including information to inform planning for potential future gauge installations, list of gauges, and specifications (types and vendors) that are most commonly used by other entities and countries and history of use. 5. Project Summary Report

Proposal Requirements:	<ol style="list-style-type: none">1. Project duration shall not exceed 12 months.2. Project budget shall not exceed \$65,000.3. Proposal Deadline: 12:00 p.m. Central Time, Monday, March 6, 2023.4. RFP#1 Q&A Deadline: 12:00 p.m. Central Time, Wednesday, February 1, 2023.5. Use the current “ProjAgre” and “PA Forms” templates located at the RTI Forms webpage.6. Proposals will be considered non-responsive and will not be accepted for technical evaluation if they are not received by the deadline or do not meet the requirements stated in RTI's University Handbook.7. Proposals should be submitted in PDF format; (1) PDF file per proposal. File name should include project name and university abbreviation.8. This project will be tracked during the life of the project using the Technology Readiness Level (TRL) scale.9. The 2021 Texas Legislative Session requires that universities be in compliance with Senate Bill 475 by submitting a completed and signed TxDOT Security Questionnaire (TSQ) to RTIMAIN@txdot.gov in advance of a proposal submission. Universities found to not submit a completed and signed TSQ in advance of proposal submitting will be held in non-compliance and unable to participate in the Program.
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