	Project Title
	Contract 12064 - Aquitard Study
	Year 1 Deliverables
1	Assess impact of known breaches in the Sheahan well field; determine presence of unidentified breaches in the well field; and assess impact of the former Custom Cleaners site.
2	Determine potential breach locations proximal to the Wolf River focusing on the section from Collierville-Arlington to Highway 51. Methodologies to be examined include riverbed seepage measurements, detailed discharge measurements, thermal imaging surveys, and developing well transects to monitor groundwater/surface water exchange.
3	Continue aquifer characterization across Shelby County to better constrain numerical model parameter estimation.
4	Continue geophysical surveys of aquitard breaches on President's Island and Pigeon Industrial Park (a.k.a., Ensley bottoms) with impact to the Davis and Allen well fields.
5	Continued research using stochastic modeling to determine the effectiveness of using groundwater pumping optimization to minimize contaminant movement from the water table aquifer to Memphis Aquifer.
	Year 2 Deliverables
1	Use of geophysical well records to investigate hypothetical paleo-drainage network atop the Upper Claiborne confining unit to help identify additional breach locations and better inform numerical groundwater flow simulations.
2	Subsurface mapping of geologic units to identify the presence of aquitard breaches and characterize the hydraulic properties of identified breaches using geophysical techniques in conjunction with other traditional methods.
3	Conduct multi-scale investigation of surface water-groundwater interactions along the Loosahatchie River and Nonconnah Creek using a variety of methodologies to identify breaches. Incorporate these findings plus those of the Wolf River (ongoing research) into Shelby County numerical groundwater model.
4	Development of hypothetical groundwater models focusing on groundwater sustainability including modeling the fate and transport of various contaminants and conducting bench scale testing of retardation reactions.
5	Build upon existing Davis well field age-dating data to further refine and quantify source waters to the Memphis aquifer at the Davis well field through sampling water chemistry, groundwater age-dating, characterization of the hydrogeologic properties of a known breach impacting Davis, and development of a conceptual model of groundwater flow for later incorporation into a numerical model.

6	Determine *in-situ* riverbed properties (hydraulic conductivity and thickness) for the Loosahatchie River, Wolf River and Nonconnah Creek to further constrain the Shelby County numerical groundwater model and for site-scale hydrogeologic analyses.
7	Investigate Shaw well field to determine source waters and potential for modern water migration into the Memphis aquifer, development of unconfined conditions and vulnerability to nearby contaminated sites.
8	Determine numerical modeling best practice for simulating groundwater conditions in the shallow aquifer that better represent groundwater levels and flow direction, vertical leakage through aquitard breaches, and avoiding inherent cell flooding (too much recharge) and drying (thin saturation depths).
9	Determine recharge mechanisms and rates to the shallow aquifer within Shelby County that contributes to its replenishment and source of additional inflow to the Memphis aquifer through aquitard breaches.
10	Use numerical modeling to correlate age-dating and geochemical observations to known/potential breaches that will include possible paleo-drainage atop the Upper Claiborne confining unit.
11	Formulate and test methodology(ies) to reduce or eliminate preferential inter-aquifer exchange
Year 3 Deliverables	
1	Investigate McCord well field to determine source waters and potential for modern water migration into the Memphis aquifer field through sampling water chemistry, groundwater age-dating, mapping of the subsurface stratigraphy, and development of a conceptual model of groundwater flow for later incorporation into a numerical model.
2	Investigate Mallory well field to determine source waters and potential for modern water migration into the Memphis aquifer field through sampling water chemistry, groundwater age-dating, mapping of the subsurface stratigraphy, and development of a conceptual model of groundwater flow for later incorporation into a numerical model.
3	Incorporate more complete age-dating of Sheahan production wells into numerical model to resolve the probable location of breach(es) in the southern portion of the well field with attempted validation through geophysical techniques or drilling of an observation well.
4	Conduct a county-wide water level survey of the shallow aquifer.
Year 4 Deliverables	

1	Develop lithologic database of well logs for Shelby County for 3D representation and use for stratigraphic mapping and other upscaling tasks
2	Fly AEM (airborne electromagntism) over section of north Shelby County that includes a suspected breach location

Year 5 Deliverables	
1	

Status	Student Level
Final Deliverable Date	
Completed	Master's
Completed	Master's
Completed	Master's
Completed	Master's
May 2022	PhD
Final Deliverable Date	
June 2023	PhD
June 2023	PhD
June 2023	PhD
June 2023	PhD
Delayed until August 2021 (COVID impacted H3/He3 laboratory)	Master's

Delayed until December 2021 (Waiting on wet season deployment results, huge amounts of samples and data still to process)	Master's
Delayed until Dec 2021 (COVID impacted H3/He3 laboratory)	Master's
Delayed until August 2021 (Student taking longer than expected)	Master's
Delayed until August 2022 (1st student removed from effort, COVID delayed VISA and arrival of replacement student was a semester late)	Master's
June 2023	PhD
June 2023	PhD
Final Deliverable Date	
Delayed untl Dec 2022 (COVID caused delay in VISA and student arriving a semester late)	Master's
May 2022	Master's
May 2022	Master's
May 2022	Master's

Final Deliverable Date	

June 2023	
Dec. 2021	

Final Deliverable Date	