



**Texas State Soil and Water Conservation Board
 Total Maximum Daily Load Program
 FY 2008 Project 08-52**

TMDL PROJECT SUMMARY PAGE			
Title of Project:	Classification of Current Land Use/Land Cover for Certain Watersheds Where Total Maximum Daily Loads or Watershed Protection Plans Are In Development [Short Title – LULC for TMDLs and WPPs]		
Project Goals/Objectives:	To classify LULC for the Big Cypress Creek, middle Brazos River, Navasota River, Lake Granger, and Buck Creek watersheds for use in TMDL and WPP development.		
Project Tasks:	1) Project Administration, Coordination and Quality Assurance, 2) Classify LULC for Big Cypress Creek watershed, 3) Classify LULC for middle Brazos River watershed, 4) Classify LULC for Navasota River watershed, 5) Classify LULC for Lake Granger watershed, 6) Classify LULC for Buck Creek watershed, 7) Evaluate and apply geospatial data in the Bosque and Guadalupe watersheds to determine the most feasible areas for Water Supply Enhancement Program activities.		
Measures of Success:	LULC for Big Cypress Creek, Middle Brazos River, Navasota River, Lake Granger, and Buck Creek watersheds in shapefile or ArcGIS grid format. Evaluate and apply available geospatial data to the Bosque and Guadalupe River watersheds to indicate focus areas for the State's Water Supply Enhancement Program.		
Project Type:	Implementation (); Education (); Planning (); Assessment (X)		
Status of Water Body: 2004 Water Quality Inventory and 303(d) List	<u>Segment ID:</u> Big Cypress Creek (0404) Middle Brazos River (1242) Navasota River (1209) San Gabriel River (1248) Buck Creek (0207A) North Bosque River (1226) Upper North Bosque River (1255) Middle/South Bosque River (1246) Guadalupe River (1803, 1804, 1812, 1817, 1818)	<u>Parameter:</u> Bacteria Bacteria Bacteria TDS Bacteria N/A Bacteria N/A Bacteria (1806)	<u>Category:</u> 5c 5c 5c 5c 5c N/A 5c N/A 5a
Project Location: (Statewide or County and Watershed Name)	<ul style="list-style-type: none"> • Big Cypress Creek watershed (Segment 0404) in Camp, Morris, Titus and Upshur Counties • Middle Brazos River watershed (Segment 1242) in Bell, Brazos, Burleson, Falls, Hill, Limestone, McLennan, Milam, Robertson and Washington Counties • Navasota River watershed (Segments 1209, 1210, 1252 and 1253) in Brazos, Freestone, Grimes, Hill, Leon, Limestone, Madison and Robertson Counties • Lake Granger watershed (Segments 1247, 1248, 1249, 1250 and 1251) in Burnet and Williamson Counties • Buck Creek watershed (Segment 0207A) in Childress, Collingsworth and Donley Counties • Bosque River watershed in Erath, Comanche, Bosque, Coryell and Bell Counties • Guadalupe River watershed in Kerr, Gillespie, Bandera, Kendall, Blanco, Comal, Hays, Caldwell, Guadalupe, Fayette, Gonzales, Wilson, Karnes, DeWitt, Goliad and Victoria Counties 		
Key Project Activities:	Hire Staff (); Surface Water Quality Monitoring (); Technical Assistance (); Education (); Implementation (); BMP Effectiveness Monitoring (); Demonstration (); Planning (); Modeling (); Bacterial Source Tracking (); Other (X)		

NPS Management Program Elements:	<ul style="list-style-type: none"> • Short-Term Goal One – Data Collection and Assessment – Objective B – Ensure that monitoring procedures meet quality assurance requirements... • Short-Term Goal One – Data Collection and Assessment – Objective C – Conduct special studies to determine sources of NPS pollution and gain information to target...BMP implementation. • Short-Term Goal One – Data Collection and Assessment – Objective D – Develop...TMDLs...and WPPs to maintain and restore water quality in waterbodies...impacted by NPS pollution.
Project Costs:	\$130,000 (TSSWCB TMDL GR (\$100,000) and TSSWCB Water Supply Enhancement GR (\$30,000))
Project Management:	<ul style="list-style-type: none"> • Texas A&M AgriLife – Texas Water Resource Institute • Texas A&M University – Spatial Sciences Laboratory
Project Period:	January 1, 2008 – August 31, 2008

Part I – Applicant Information

Applicant							
Project Lead	C. Allan Jones						
Title	Director						
Organization	Texas A&M AgriLife – Texas Water Resources Institute						
E-mail Address	cajones@ag.tamu.edu						
Street Address	1500 Research Pkwy, Ste A240 2118 TAMU						
City	College Station	County	Brazos	State	Texas	Zip Code	77843-2118
Telephone Number	979.845.1851			Fax Number	979.845.8554		

Project Partners	
Names	Roles & Responsibilities
Texas A&M University – Spatial Sciences Laboratory (SSL)	Classify LULC for Big Cypress Creek, Middle Brazos River, Navasota River, Lake Granger, and Buck Creek watersheds (Tasks 2-6)
Texas A&M AgriLife – Texas Water Resources Institute (TWRI)	Develop QAPP and Progress Reports (Task 1)
Texas State Soil and Water Conservation Board (TSSWCB)	Provide state oversight and management of all project activities and ensure coordination of activities with related TMDL and WPP development projects.

Part II – Project Information

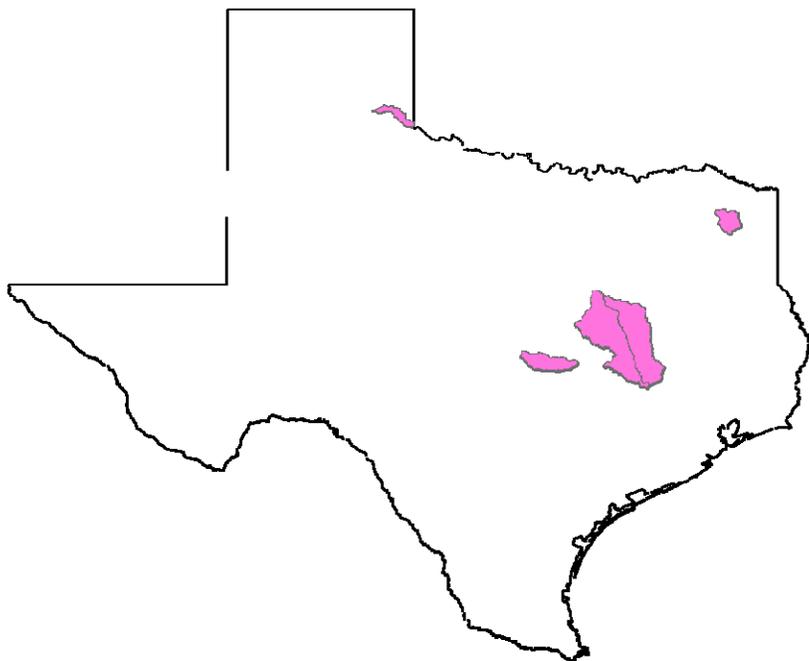
Watershed Information				
Watershed Name	Hydrologic Unit Code (8 Digit)	Segment ID	305(b) Category	Size (Acres)
Big Cypress Creek	11140305	0404 and various unclassified segments	5c	284,487
Middle Brazos River	12070101	1242 and various unclassified segments	5c	1,731,474
Navasota River	12070103	1209, 1210, 1252, 1253 and various unclassified segments	5c	1,438,834
Lake Granger	12070205	1247, 1248, 1249, 1250, 1251 and various unclassified segments	5c	466,587
Buck Creek	11120105	0207A	5c	192,580
Bosque River	12060203, 12060204	1226, 1246, 1255	5c (1255)	1,059,328
Guadalupe River	12100201, 12100202, 12100203, 12100204	1803, 1804, 1812, 1817, 1818	5a (1806)	3,813,360

Project Narrative

Problem/Need Statement

An important component to any watershed assessment is having up to date land use data. LULC data describe the vegetation, water, natural surface, and cultural features on the land surface LULC data is used to understand potential pollutant sources and to target pollutant abatement/remediation efforts. LULC data is a fundamental building block in sophisticated watershed models, such as SWAT.

To address pollutant source assessment needs, SSL will classify the current land use for the Big Cypress Creek, Middle Brazos River, Navasota River, Lake Granger, and Buck Creek watersheds. The results of this effort will be used in the decision-making processes as a part of the TMDL or WPP development in these watersheds.



The Big Cypress Creek watershed contains Segment 0404 and its unclassified tributaries. A bacteria TMDL project is being initiated for this watershed (TSSWCB funding). This is also the contributing watershed for Lake O' the Pines, for which a dissolved oxygen TMDL has been adopted.

The middle Brazos River watershed contains Segment 1242 and its unclassified tributaries. Numerous waterbodies are impaired for bacteria and a TMDL project is being initiated for five of those impaired streams (TSSWCB funding).

The Navasota River watershed contains Segments 1209, 1210, 1252, 1253 and their unclassified tributaries. Numerous waterbodies are impaired for bacteria and a TMDL project is being initiated for one of those impaired streams (TCEQ funding).

The Lake Granger watershed contains Segments 1247, 1248, 1249, 1250, 1251 and their unclassified tributaries. A WPP project is currently underway (TSSWCB CWA §319(h) project 05-09) focusing on sediment and nutrient concerns and bacteria impairments.

The Buck Creek watershed contains Segment 0207A and its tributaries. A WPP project is currently underway (TSSWCB CWA §319(h) project 06-11) focusing on nutrient concerns and a bacteria impairment.

The State's Water Supply Enhancement Program is charged with expending appropriated dollars to eliminate brush with the goal of increasing water yield from rangelands in Texas. A GIS based methodology to identify the areas within a specified watershed that will likely yield the most water as a result of brush removal is needed to expedite this site selection process. A GIS based framework will direct TSSWCB Water Supply Enhancement Program staff to priority areas of a watershed and reduce their time in locating feasible brush removal sites and result in more cost-effective use of program funds.

Project Narrative

General Project Description

The project will classify current land use for Big Cypress Creek, Middle Brazos River, Navasota River, Lake Granger, and Buck Creek watersheds. This will be done through a combination of satellite based image (2004-2006) classification schemes and where needed “heads-up digitizing” of the 2004-2006 National Agriculture Imagery Program (NAIP) aerial photos of the area in ESRI’s ArcGIS 9.x software. Individual LULC classes will be identified and delineated in shapefile or ArcGIS grid format with a minimum mapping unit of 2 ac on screen and verified through field sampling to an accuracy of 80% or greater. Ground control points used in the field sampling will be collected for at least ten locations per land use type per watershed using GPS units with an accuracy of 1-10 m. NAIP provides two main products: 1 meter ground sample distance (GSD) ortho imagery rectified to a horizontal accuracy of within +/- 3 meters of reference digital ortho quarter quads (DOQQs) from the National Digital Orthophoto Program (NDOP) (2004 imagery); and, 2 meter GSD ortho imagery rectified to within +/- 20 meters of reference DOQQs (2005 imagery). The tiling format of NAIP imagery is based on a 3.75' x 3.75' quarter quadrangle with a 360 meter buffer on all four sides. NAIP quarter quads are rectified to the UTM coordinate system, NAD 83 and cast into a single predetermined UTM zone.

As a point of comparison, USGS National Land Cover Data (NLCD) is created with Landsat Thematic Mapper images. Each image is precision terrain-corrected using 3-arc-second digital terrain elevation data (DTED), and georegistered using ground control points. The resulting root mean square registration error is less than 1 pixel, or 30 meters.

The land use classification scheme to be used in this delineation will include:

- Developed Open Space - Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20% of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.
- Developed Low Intensity - Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-49% of total cover. These areas most commonly include single-family housing units.
- Developed Medium Intensity - Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50-79% of the total cover. These areas most commonly include single-family housing units.
- Developed High Intensity- Includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80-100% of the total cover.
- Open Water - All areas of open water, generally with less than 25% cover of vegetation or soil
- Barren Land - (Rock/Sand/Clay) - Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover and includes transitional areas.
- Forested Land – Areas dominated by trees generally greater than 5 meters tall, and greater than 50% of total vegetation cover.
- Near Riparian Forested Land – Areas dominated by trees generally greater than 5 meters tall, and greater than 50% of total vegetation cover. These areas are found following in near proximity (within 30-60 m) to streams, creeks and/or rivers.
- Mixed Forest - Areas dominated by trees generally greater than 5 meters tall, and greater than 20% but less than 50% of total vegetation cover.
- Rangeland – Areas of unmanaged shrubs, grasses, or shrub-grass mixtures
- Pasture/Hay - Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20% of total vegetation.
- Cultivated Crops - Areas used for the production of annual crops, such as corn, soybeans, vegetables, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20% of total vegetation. This class also includes all land being actively tilled.

Project Narrative

General Project Description

Funding supplied thru this project will be used to evaluate the Bosque and Guadalupe River watersheds using currently available geospatial data to identify areas within these watersheds that are likely to show the most positive impacts as a result of brush removal and appropriate follow up management. This geospatial analysis will assess the watersheds based on landuse/landcover, slope, distance to the receiving waterbody, soil characteristics and other pertinent information. Initially, a GIS methodology will be developed and refined using input from TSSWCB Water Supply Enhancement Program staff. This methodology will then be applied to the Bosque and Guadalupe river watersheds.

Water Quality Impairment

Describe all known causes of water quality impairments from any of the following sources: 2004 Water Quality Inventory and 303(d) List, or Other Documented Sources (i.e., Clean Rivers Program Basin Summary or Basin Highlights Reports).

<u>Waterbody</u>	<u>Parameter</u>	<u>PS</u>	<u>NPS</u>
Big Cypress Creek (0404)	Bacteria	Y	Y
Middle Brazos River (1242)	Bacteria	Y	Y
Navasota River (1209)	Bacteria	Y	Y
Lake Granger (1247)	Nutrient Enrichment	Y	Y
San Gabriel River (1248)	TDS	Y	Y
Buck Creek (0207A)	Bacteria	Y	Y

Project Goals

- To classify LULC for the Big Cypress Creek, middle Brazos River, Navasota River, Lake Granger, and Buck Creek watersheds for use in TMDL and WPP development
- To develop a GIS-based methodology for selecting brush removal sites and apply it to the Bosque and Guadalupe River watersheds.

Tasks, Objectives and Schedules			
Task 1:	Project Administration, Coordination and Quality Assurance		
Costs:	\$3,500		
Objective:	To effectively coordinate and monitor all work performed under this project including technical and financial supervision and preparation of status reports. To develop and implement Data Quality Objectives (DQOs) and QA/QC activities to ensure LULC data of known and acceptable quality are generated through this project.		
Subtask 1.1:	TWRI will develop a QAPP for activities in Tasks 2-6 consistent with <i>EPA Requirements for Quality Assurance Project Plans (QA/R-5)</i> (May 2006) and the <i>TSSWCB Environmental Data Quality Management Plan</i> (August 2007). The QAPP shall also be consistent with <i>EPA Guidance for Geospatial Data Quality Assurance Project Plans (G-5G)</i> (March 2003).		
	Start Date:	Month 1	Completion Date: Month 2
Subtask 1.2:	TWRI will provide revisions and necessary amendments to the QAPP as needed.		
	Start Date:	Month 2	Completion Date: Month 8
Subtask 1.3:	TWRI will prepare electronic quarterly progress reports for submission to the TSSWCB. QPRs shall document all activities performed within a quarter and shall be submitted by the 15 th of December, March, June and September.		
	Start Date:	Month 1	Completion Date: Month 8
Subtask 1.4	TWRI will perform accounting functions for project funds and will submit appropriate Reimbursement Forms to TSSWCB at least quarterly.		
	Start Date:	Month 1	Completion Date: Month 8
Deliverables	<ul style="list-style-type: none"> QAPP for Tasks 2-6 approved by TSSWCB in both electronic and hard copy formats Approved revisions and amendments to QAPP Quarterly Progress Reports in electronic format Reimbursement Forms in either electronic or hard copy format 		

Tasks, Objectives and Schedules			
Task 2:	Classify LULC for Big Cypress Creek watershed		
Costs:	\$10,000		
Objective:	To classify current land use for the Big Cypress Creek watershed through a combination of satellite based image classification schemes and where needed “heads-up digitizing” of NAIP aerial photos of the area.		
Subtask 2.1:	Perform a combination of satellite based image (2004-2006) classification schemes and where needed “heads-up digitizing” of the 2004-2006 NAIP aerial photos of the Big Cypress Creek watershed using ESRI’s ArcGIS 9.x software.		
	Start Date:	Month 2	Completion Date: Month 8
Subtask 2.2:	Identify individual LULC classes and delineate them in shapefile or ArcGIS grid format with a minimum mapping unit of 2 ac on screen.		
	Start Date:	Month 2	Completion Date: Month 8
Subtask 2.3:	Verify LULC through field sampling to an accuracy of 80% or greater. Ground control points used in the field sampling will be collected for at least ten locations per land use type using GPS units with an accuracy of 1-10 m.		
	Start Date:	Month 2	Completion Date: Month 8
Deliverables	<ul style="list-style-type: none"> LULC for Big Cypress Creek watershed in shapefile or ArcGIS grid format 		

Tasks, Objectives and Schedules			
Task 3:	Classify LULC for middle Brazos River watershed		
Costs:	\$30,000		
Objective:	To classify current land use for the middle Brazos River watershed through a combination of satellite based image classification schemes and where needed “heads-up digitizing” of NAIP aerial photos of the area.		
Subtask 3.1:	Perform a combination of satellite based image (2004-2006) classification schemes and where needed “heads-up digitizing” of the 2004-2006 NAIP aerial photos of the middle Brazos River watershed using ESRI’s ArcGIS 9.x software.		
	Start Date:	Month 2	Completion Date: Month 8
Subtask 3.2:	Identify individual LULC classes and delineate them in shapefile or ArcGIS grid format with a minimum mapping unit of 2 ac on screen.		
	Start Date:	Month 2	Completion Date: Month 8
Subtask 3.3:	Verify LULC through field sampling to an accuracy of 80% or greater. Ground control points used in the field sampling will be collected for at least ten locations per land use type using GPS units with an accuracy of 1-10 m.		
	Start Date:	Month 2	Completion Date: Month 8
Deliverables	<ul style="list-style-type: none"> LULC for middle Brazos River watershed in shapefile or ArcGIS grid format 		

Tasks, Objectives and Schedules			
Task 4:	Classify LULC for Navasota River watershed		
Costs:	\$28,000		
Objective:	To classify current land use for the Navasota River watershed through a combination of satellite based image classification schemes and where needed “heads-up digitizing” of NAIP aerial photos of the area.		
Subtask 4.1:	Perform a combination of satellite based image (2004-2006) classification schemes and where needed “heads-up digitizing” of the 2004-2006 NAIP aerial photos of the Navasota River watershed using ESRI’s ArcGIS 9.x software.		
	Start Date:	Month 2	Completion Date: Month 8
Subtask 4.2:	Identify individual LULC classes and delineate them in shapefile or ArcGIS grid format with a minimum mapping unit of 2 ac on screen.		
	Start Date:	Month 2	Completion Date: Month 8
Subtask 4.3:	Verify LULC through field sampling to an accuracy of 80% or greater. Ground control points used in the field sampling will be collected for at least ten locations per land use type using GPS units with an accuracy of 1-10 m.		
	Start Date:	Month 2	Completion Date: Month 8
Deliverables	<ul style="list-style-type: none"> LULC for Navasota River watershed in shapefile or ArcGIS grid format 		

Tasks, Objectives and Schedules			
Task 5:	Classify LULC for Lake Granger watershed		
Costs:	\$15,000		
Objective:	To classify current land use for the Lake Granger watershed through a combination of satellite based image classification schemes and where needed “heads-up digitizing” of NAIP aerial photos of the area.		
Subtask 5.1:	Perform a combination of satellite based image (2004-2006) classification schemes and where needed “heads-up digitizing” of the 2004-2006 NAIP aerial photos of the Lake Granger watershed using ESRI’s ArcGIS 9.x software.		
	Start Date:	Month 2	Completion Date: Month 8
Subtask 5.2:	Identify individual LULC classes and delineate them in shapefile or ArcGIS grid format with a minimum mapping unit of 2 ac on screen.		
	Start Date:	Month 2	Completion Date: Month 8
Subtask 5.3:	Verify LULC through field sampling to an accuracy of 80% or greater. Ground control points used in the field sampling will be collected for at least ten locations per land use type using GPS units with an accuracy of 1-10 m.		
	Start Date:	Month 2	Completion Date: Month 8
Deliverables	<ul style="list-style-type: none"> LULC for Lake Granger watershed in shapefile or ArcGIS grid format 		

Tasks, Objectives and Schedules			
Task 6:	Classify LULC for Buck Creek watershed		
Costs:	\$15,000		
Objective:	To classify current land use for the Buck Creek watershed through a combination of satellite based image classification schemes and where needed “heads-up digitizing” of NAIP aerial photos of the area.		
Subtask 6.1:	Perform a combination of satellite based image (2004-2006) classification schemes and where needed “heads-up digitizing” of the 2004-2006 NAIP aerial photos of the Buck Creek watershed using ESRI’s ArcGIS 9.x software.		
	Start Date:	Month 2	Completion Date: Month 8
Subtask 6.2:	Identify individual LULC classes and delineate them in shapefile or ArcGIS grid format with a minimum mapping unit of 2 ac on screen.		
	Start Date:	Month 2	Completion Date: Month 8
Subtask 6.3:	Verify LULC through field sampling to an accuracy of 80% or greater. Ground control points used in the field sampling will be collected for at least ten locations per land use type using GPS units with an accuracy of 1-10 m.		
	Start Date:	Month 2	Completion Date: Month 8
Deliverables	<ul style="list-style-type: none"> LULC for Buck Creek watershed in shapefile or ArcGIS grid format 		

Tasks, Objectives and Schedules			
Task 7:	Develop a methodology for identifying priority areas of a watershed where brush removal will yield the most water savings and demonstrate the approach.		
Costs:	\$28,500		
Objective:	To develop a modeling framework that will identify areas of a watershed where brush removal will likely yield the most water savings and apply it to two watersheds.		
Subtask 7.1:	Develop a GIS-based methodology using available geospatial data that will identify specific areas of a watershed where brush removal will likely yield the greatest water salvage for that landscape.		
	Start Date:	Month 2	Completion Date: Month 8
Subtask 7.2:	Apply the developed methodology to the Bosque River watershed and develop maps showing priority brush removal areas.		
	Start Date:	Month 2	Completion Date: Month 8
Subtask 7.3:	Apply the developed methodology to the Guadalupe River watershed and develop maps showing priority brush removal areas.		
	Start Date:	Month 2	Completion Date: Month 8
Deliverables	<ul style="list-style-type: none"> Finalized framework for assessing watershed for water yield enhancement Maps of the Bosque and Guadalupe River watersheds highlighting areas where brush removal is most feasible 		

Measures of Success
<ul style="list-style-type: none"> LULC for Big Cypress Creek, Middle Brazos River, Navasota River, Lake Granger, and Buck Creek watersheds in shapefile or ArcGIS grid format Maps produced that highlight the most feasible areas for brush removal in the Bosque and Guadalupe River watersheds

Part III – Financial Information

Budget Summary	
Category	Costs
Personnel	\$ -
Fringe Benefits	\$ -
Subtotal Personnel & Fringe	\$ -
Travel	\$ -
Equipment	\$ -
Supplies	\$ -
Contractual	\$ 113,043
Construction	\$ -
Other	\$ -
Subtotal	\$ 113,043
Total Direct Costs	\$ 113,043
Indirect Costs (≤15%)	\$ 16,957
Total Project Costs	\$130,000

Budget Justification		
Category	Costs	Justification
Personnel & Fringe	\$	
Travel	\$	
Equipment	\$	
Supplies	\$	
Contractual	\$ 113,043	TWRI <ul style="list-style-type: none"> • QAPP and Progress Reports (\$2,975) SSL <ul style="list-style-type: none"> • Big Cypress Creek watershed LULC (\$8,696) • Middle Brazos River watershed LULC (\$26,087) • Navasota River watershed LULC (\$24,348) • Lake Granger watershed LULC (\$13,043) • Buck Creek watershed LULC (\$13,043) • GIS framework (\$15,000) • Bosque Assessment and Maps (\$4,926) • Guadalupe Assessment and Maps (\$4,925)
Construction	\$	
Other	\$	
Indirect	\$16,957	15% of Total Direct Costs