



**Texas State Soil and Water Conservation Board**  
**Total Maximum Daily Load Program**  
**FY 2008 Project 08-55**

TMDL PROJECT SUMMARY PAGE																				
Title of Project:	Modeling Support for Little Brazos River Tributaries Bacteria Assessment [Short Title: Modeling for LBR Tributaries Bacteria Assessment]																			
Project Goals/Objectives:	To assess contact recreation use impairments and support watershed planning for five tributaries of the Little Brazos River by 1) developing a comprehensive GIS inventory and conducting a watershed source survey, and 2) analyzing data using Load Duration Curves and spatially explicit modeling.																			
Project Tasks:	1) Project Administration; 2) Quality Assurance; 3) Data Analysis and Watershed Modeling																			
Measures of Success:	1) Decision-making for watershed planning activities, including data analysis, is founded on local stakeholder input. 2) Load Duration Curve analysis and spatially explicit modeling of the five segments in the study area is conducted using data of known and acceptable quality. 3) Bacteria loads are estimated for each of the five segments in the study area through the development of Load Duration Curves. 4) Bacteria loads are estimated from various contributing sources and critical loading areas within the watersheds are identified based on SELECT model output.																			
Project Type:	Implementation ( ); Education ( ); Planning ( ); Assessment (X)																			
Status of Water Body: 2006 Water Quality Inventory and 303(d) List	<table border="1"> <thead> <tr> <th><u>Segment ID:</u></th> <th><u>Parameter:</u></th> <th><u>Category:</u></th> </tr> </thead> <tbody> <tr> <td>1242I – Campbells Creek</td> <td>bacteria</td> <td>5c</td> </tr> <tr> <td>1242K – Mud Creek</td> <td>bacteria</td> <td>5c</td> </tr> <tr> <td>1242L – Pin Oak Creek</td> <td>bacteria</td> <td>5c</td> </tr> <tr> <td>1242M – Spring Creek</td> <td>bacteria</td> <td>5c</td> </tr> <tr> <td>1242O – Walnut Creek</td> <td>bacteria</td> <td>5c</td> </tr> </tbody> </table>	<u>Segment ID:</u>	<u>Parameter:</u>	<u>Category:</u>	1242I – Campbells Creek	bacteria	5c	1242K – Mud Creek	bacteria	5c	1242L – Pin Oak Creek	bacteria	5c	1242M – Spring Creek	bacteria	5c	1242O – Walnut Creek	bacteria	5c	
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Project Location: (Statewide or County and Watershed Name)	Robertson County, Little Brazos River Watershed																			
Key Project Activities:	Hire Staff ( ); Surface Water Quality Monitoring ( ); Technical Assistance ( ); Education ( ); Implementation ( ); BMP Effectiveness Monitoring ( ); Demonstration ( ); Planning ( ); Modeling (X); Bacterial Source Tracking ( ); Other ( )																			
NPS Management Program Elements:	<ul style="list-style-type: none"> <li>• Element One (STG 1B; STG 1C; STG 1D; STG 2A; MS B; MS C; MS D)</li> <li>• Element Two</li> <li>• Element Five</li> </ul>																			
Project Costs:	\$51,534 (TSSWCB TMDL GR)																			
Project Management:	<ul style="list-style-type: none"> <li>• Texas A&amp;M AgriLife – Texas Water Resources Institute</li> <li>• Texas A&amp;M University – Department of Biological and Agricultural Engineering</li> </ul>																			
Project Period:	June 1, 2008 – July 31, 2010																			

**Part I – Applicant Information**

Applicant							
Project Lead		B.L. Harris					
Title		Associate Director					
Organization		Texas A&M AgriLife – Texas Water Resources Institute					
E-mail Address		<a href="mailto:bl-harris@tamu.edu">bl-harris@tamu.edu</a>					
Street Address		1500 Research Parkway, Suite 240A 2118 TAMU					
City	College Station	County	Brazos	State	Texas	Zip Code	77843-2118
Telephone Number		(979) 845-1851		Fax Number		(979) 845-8554	

Project Co-Lead		R. Karthikeyan					
Title		Assistant Professor					
Organization		Texas A&M University – Department of Biological and Agricultural Engineering					
E-mail Address		<a href="mailto:karthi@tamu.edu">karthi@tamu.edu</a>					
Street Address		306A Scoates Hall 2117 TAMU					
City	College Station	County	Brazos	State	Texas	Zip Code	77843-2117
Telephone Number		(979) 845-7951		Fax Number		(979) 862-3442	

Project Partners	
Names	Roles & Responsibilities
Texas State Soil and Water Conservation Board (TSSWCB)	Provide state oversight and management of all project activities and ensure coordination of activities with related projects and the Texas Commission on Environmental Quality (TCEQ).
Texas A&M AgriLife – Texas Water Resources Institute (TWRI)	Coordinate and manage all work described in Tasks. Project administration (Task 1). Quality Assurance (Task 2).
Texas A&M University – Department of Biological and Agricultural Engineering (BAEN)	Assist in developing GIS inventory (Subtask 3.1) and designing watershed source survey (Subtask 3.3). Perform LDC analysis (Subtasks 3.4-3.5) and spatially explicit modeling (Subtask 3.6).
Brazos River Authority (BRA)	Facilitate public participation and coordinate stakeholder involvement and collect water quality monitoring data through TSSWCB project 08-54.
Texas A&M University – Spatial Sciences Laboratory (SSL)	Classify land use (Subtask 3.2) through TSSWCB project 08-52
Robertson County Soil and Water Conservation District (SWCD 451)	Collaborate as a critical local stakeholder and play a lead role in communicating with other local stakeholders

**Part II – Project Information**

**Watershed Information**

Watershed Name	Hydrologic Unit Code (8 Digit)	Segment ID	305(b) Category	Size (Acres)
Campbells Creek	12070101	1242I	5c	22,598
Mud Creek		1242K	5c	49,886
Pin Oak Creek		1242L	5c	25,979
Spring Creek		1242M	5c	23,174
Walnut Creek		1242O	5c	87,538

**Water Quality Impairment**

Describe all known causes of water quality impairments from any of the following sources: 2006 Texas Water Quality Inventory and 303(d) List, or Other Documented Sources (i.e., Clean Rivers Program Basin Summary or Basin Highlights Reports).

2006 TWQI & 303(d) List

- 1242I – bacteria impairment – source unknown
- 1242K – bacteria impairment – municipal point source discharges; source unknown
- 1242L – bacteria impairment – livestock NPS (grazing or feeding operations)
- 1242M – bacteria impairment – livestock NPS (grazing or feeding operations)
- 1242O – bacteria impairment – source unknown

2007 BRA Clean Rivers Program Basin Summary Report

Sources of elevated bacteria levels prevalent through much of the watershed have not been determined. Rangeland runoff may be the main contributor, given the rural nature of most of the drainage area. Most of the unclassified waterbodies are small, rural streams with low to intermittent flow.

2006 BRA Clean Rivers Program Basin Highlights Report

The potential sources of elevated bacteria levels prevalent throughout this watershed have not been investigated. A review of land use and potential sources of bacteria is recommended with additional monitoring locations as needed to isolate potential sources of impacts.

2005 BRA Quality Water for the Brazos Community – Final Draft Management Plan

Possible sources [of fecal contamination] include inadequately treated sewage, improperly managed livestock waste, pet waste, aquatic birds and mammals, failing septic systems, and wildlife.

**Project Goals**

To assess contact recreation use impairments and support watershed planning for five tributaries of the Little Brazos River by developing a comprehensive GIS inventory and conducting a watershed source survey, and analyzing data using Load Duration Curves and spatially explicit modeling.

## 2005 Texas Nonpoint Source Management Program References (Expand from Summary Page)

- Element 1 – Explicit short-...term goals, objectives and strategies [milestones] that protect surface...water.
  - Short-Term Goal One – Data Collection and Assessment – Objective B – Ensure that...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 TMDL activities and BMP implementation.
  - Short-Term Goal One – Data Collection and Assessment – Objective D – Develop...TMDLs, I-Plans and WPPs to maintain and restore water quality in waterbodies...impacted by NPS pollution.
  - Short-Term Goal Two – Implementation – Objective A - ...determine priority areas and develop...strategies to address NPS pollution in those areas.
  - Milestone B – Complete the assessment of pollutant problems by reviewing existing water quality data, conducting an inventory of point/nonpoint sources, land use data, and all known stressors influencing water quality.
  - Milestone C – Analyze [water quality monitoring] data, assess loadings, and determine the origin and distribution of pollutants.
  - Milestone D – Develop and apply models to determine numerical load allocations...[and] recommend...strategies for implementation.
- Element 2 – Working partnerships...[with] appropriate state,...regional, and local entities, private sector groups, and federal agencies.
- Element 5 – The State...identifies waters...impaired by NPS pollution and...establishes a process to progressively address these...waters by conducting more detailed watershed assessments...

## Measures of Success

- Decision-making for watershed planning activities, including data analysis, is founded on local stakeholder input.
- Load Duration Curve analysis and spatially explicit modeling of the five segments in the study area is conducted using data of known and acceptable quality.
- Bacteria loads are estimated for each of the five segments in the study area through the development of Load Duration Curves.
- Bacteria loads are estimated from various contributing sources and critical loading areas within the watersheds are identified based on SELECT model output.

## Project Narrative

### Problem/Need Statement

The central watershed of the Brazos River consists of one classified water body, the Brazos River above Navasota River (Segment 1242), and a number of unclassified waterbodies on tributary systems. This segment extends from the Lake Brazos Dam in Waco 183 miles downstream to its confluence with the Navasota River southeast of College Station and its watershed encompasses approximately 2,705 mi<sup>2</sup>. With the exception of the Waco and Bryan/College Station urban areas, land use in the watershed is generally agricultural with a few large industrial facilities and quarries.

In 2002, a water quality data analysis determined that eight unclassified water bodies within the central watershed had bacteria concentrations that exceed state water quality standards for contact recreation. As a result, these waterbodies were placed on the *Texas §303(d) List of Impaired Waters*. Three additional unclassified segments were added to the *2006 §303(d) List* bringing the total number of water quality impairments (bacteria) on segment 1242 to eleven.

Of those waterbodies impaired for bacteria, five are located within a very close proximity of each other in Robertson County and share similar land use and water quality characteristics. In addition, they are all tributaries to the Little Brazos River (Segment 1242E). The five waterbodies in this project's study area are Campbells Creek (Segment 1242I), Mud Creek (Segment 1242K), Pin Oak Creek (Segment 1242L), Spring Creek (Segment 1242M), and Walnut Creek (Segment 1242O). The study area encompasses 327 , almost entirely within Robertson County. The land use in the area is primarily agricultural (range and pastureland with mixed areas of cultivated cropland) with several small communities.

The *2006 §303(d) List* identifies all five segments in the study area as Category 5c, meaning that the waterbody does not meet applicable water quality standards for one or more designated uses by one or more pollutants and that additional data and information will be collected before a TMDL is scheduled.

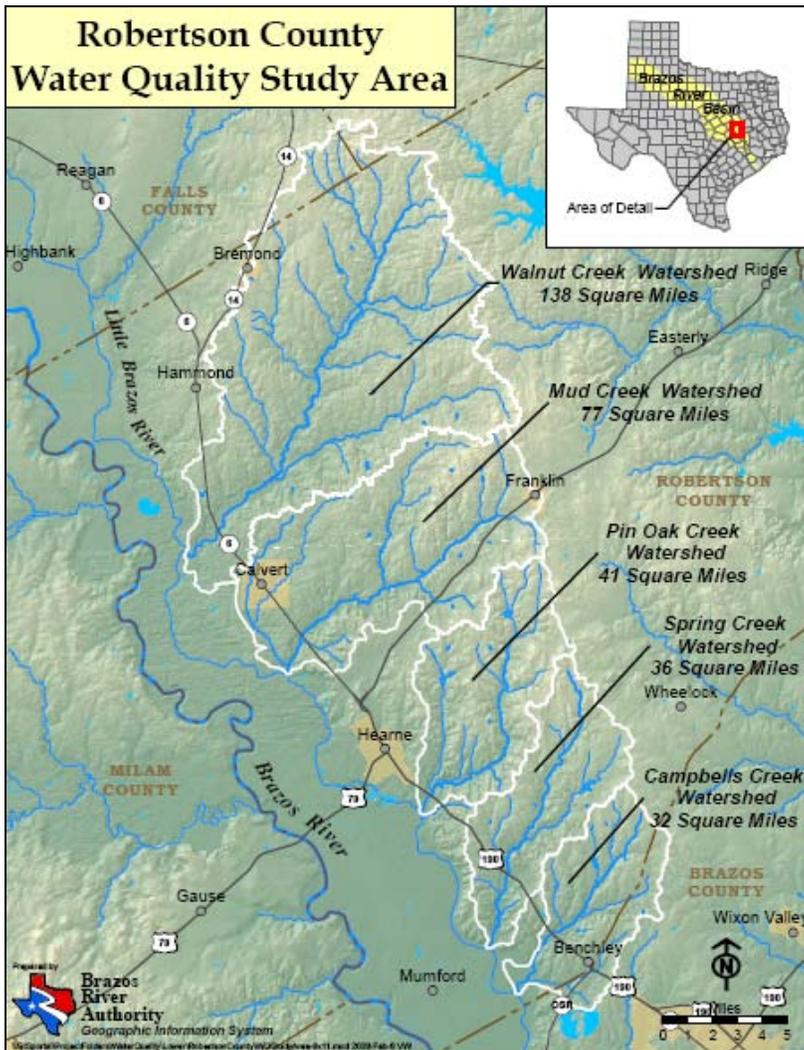
The TCEQ and the TSSWCB established a joint, technical Task Force on Bacteria TMDLs in September 2006 charged with making recommendations on cost-effective and time-efficient bacteria TMDL development methodologies. The Task Force recommended the use of a three-tier approach that is designed to be scientifically credible and accountable to watershed stakeholders. The tiers move through increasingly aggressive levels of data collection and analysis in order to achieve stakeholder consensus on needed load reductions and strategies to achieve those reductions. In June 2007, the TCEQ and the TSSWCB adopted the principles and general process recommended by the Task Force and directed agency staff to incorporate the principles of the recommendations into an updated joint-agency TMDL guidance document.

In accordance with the *Memorandum of Agreement Between the TCEQ and the TSSWCB Regarding TMDLs, Implementation Plans, and Watershed Protection Plans*, the TSSWCB has agreed to take the lead role in addressing the bacteria impairments for the five segments in the study area. Through this and associated projects, the TSSWCB, TWRI and BAEN will work with local stakeholders to progress through the data collection and analysis components of the first two tiers of the Task Force recommended three-tier approach.

## Project Narrative

### General Project Description (Include Project Location Map)

In order to communicate project goals, activities, results and accomplishments to affected parties, TWRI and BAEN will participate in public stakeholder meetings as needed. At a minimum, public stakeholder meetings shall consist of an organizational/kick-off meeting, a source survey design meeting, a meeting presenting results from initial data analysis and the GIS inventory, a Texas Watershed Steward Program workshop, two project update meetings during the middle of the project, a meeting presenting data analysis results, and a meeting presenting final technical reports.



BAEN will cooperate with BRA to develop a comprehensive GIS inventory for the study area through TSSWCB project 08-54, *Assessment of Contact Recreation Use Impairments and Watershed Planning for Five Tributaries of the Little Brazos River*.

TSSWCB, in cooperation with SSL, will provide BAEN a current land use classification, based on 2004-2006 imagery, for the study area through TSSWCB project 08-52, *Classification of Current Land Use/Land Cover for Certain Watersheds Where TMDLs or WPPs Are In Development*.

TWRI will develop a Quality Assurance Project Plan (QAPP) to ensure data of known and acceptable quality are generated and used in this project. The QAPP will be consistent with the TSSWCB *Environmental Data Quality Management Plan*.

In order to apply knowledge gained through TSSWCB project 07-06, *Fate and Transport of E. coli in Rural Texas Landscapes and Streams*, BAEN will assist BRA in designing a watershed source survey, to be conducted through TSSWCB project 08-54, that better characterizes the possible sources of bacteria loadings in the study area.

To determine bacteria load reductions needed to achieve water quality standards, BAEN, with assistance from BRA, will conduct a Load Duration Curve (LDC) analysis of all historic and existing water quality monitoring data from the study area. LDCs will be developed for at least one critical index site per segment. LDCs shall be consistent with both EPA's *An Approach for Using Load Duration Curves in the Development of TMDLs* and EPA's *Options for Expressing Daily Loads in TMDLs*. Then, using water quality monitoring data collected by BRA through TSSWCB project 08-54, BAEN will refine the developed LDCs.

To estimate loadings from various sources and to identify critical loading areas within the watersheds, BAEN, again with assistance from BRA, will conduct watershed modeling for the study area. Utilizing information from the GIS inventory, watershed source survey, and water quality monitoring, and in combination with the LDCs, BAEN will develop a spatially explicit or mass balance model, such as SELECT, for each of the five watersheds in the study area.

<b>Tasks, Objectives and Schedules</b>			
Task 1:	Project Administration		
Costs:	\$ 5,388		
Objective:	To effectively administer, coordinate, and monitor all work performed under this project including technical and financial supervision and preparation of status reports.		
Subtask 1.1:	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 <sup>th</sup> of December, March, June and September. QPRs shall be provided to all project partners.		
	Start Date:	Month 1	Completion Date: Month 26
Subtask 1.2:	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 26
Subtask 1.3:	TWRI and BAEN will participate in coordination meetings or conference calls with TSSWCB, and any project partners as appropriate, at least quarterly to discuss project activities, project schedule, communication needs, deliverables and other requirements. Coordination with TSSWCB project 08-54, <i>Assessment of Contact Recreation Use Impairments and Watershed Planning for Five Tributaries of the Little Brazos River</i> , will be especially critical to achieve project goals.		
	Start Date:	Month 1	Completion Date: Month 26
Subtask 1.4:	In order to communicate project goals, activities, results and accomplishments to affected parties, TWRI and BAEN will participate in public stakeholder meetings as needed. At a minimum, public stakeholder meetings shall consist of an organizational/kick-off meeting (month 3), a source survey design meeting (Subtask 3.3) (month 4), a meeting presenting results from initial LDCs and the GIS inventory (month 6), Texas Watershed Steward Program workshop (month 9), two project update meetings (months 12 and 18), a meeting presenting data analysis results (month 21), and a meeting presenting final technical reports (month 26).		
	Start Date:	Month 1	Completion Date: Month 26
Deliverables	<ul style="list-style-type: none"> <li>• Quarterly Progress Reports in electronic format</li> <li>• Reimbursement Forms in either electronic or hard copy format</li> </ul>		

<b>Tasks, Objectives and Schedules</b>			
Task 2:	Quality Assurance		
Costs:	\$ 4,000		
Objective:	To develop and implement data quality objectives (DQOs) and quality assurance/control (QA/QC) activities to ensure data of known and acceptable quality are generated through this project.		
Subtask 2.1:	TWRI will develop a QAPP for activities in Task 3 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).		
	Start Date:	Month 1	Completion Date: Month 2
Subtask 2.2:	TWRI will submit revisions and necessary amendments to the QAPP as needed.		
	Start Date:	Month 3	Completion Date: Month 24
Deliverables	<ul style="list-style-type: none"> <li>• QAPP for Task 3 approved by TSSWCB in both electronic and hard copy formats</li> <li>• Approved revisions and amendments to QAPP</li> </ul>		

<b>Tasks, Objectives and Schedules</b>			
Task 3:	Data Analysis and Watershed Modeling		
Costs:	\$ 42,146		
Objective:	To develop a comprehensive GIS inventory for the study area and to assess the possible sources of bacteria loadings by conducting a watershed source survey. To analyze and interpret data using Load Duration Curves and spatially explicit modeling to determine bacteria load reductions needed to achieve water quality standards and estimate loadings from various sources.		
Subtask 3.1:	BAEN will cooperate with BRA to develop a comprehensive GIS inventory for the study area through TSSWCB project 08-54. Data should include the most recent information available on land use, elevation, soils, stream networks, reservoirs, roads, municipalities and satellite imagery or aerial photography. Locations of SWQM stations, USGS gages, public access points to the waterbodies, floodwater-retarding structures, wetlands, TPDES permittees (including WWTFs, CAFOs and MS4s), and subdivisions should also be included. Locations of possible bacteria sources, identified in the source survey (Subtask 3.3), should be incorporated. The cumulative impact of TSSWCB-certified WQMPs on the management of agricultural and silvicultural lands should be documented.		
	Start Date:	Month 1	Completion Date: Month 3
Subtask 3.2:	TSSWCB, in coordination with SSL, will provide BAEN a current land use classification for the study area through TSSWCB project 08-52, <i>Classification of Current Land Use/Land Cover for Certain Watersheds Where TMDLs or WPPs Are In Development</i> .		
	Start Date:	Month 1	Completion Date: Month 3
Subtask 3.3:	In order to apply knowledge gained through TSSWCB project 07-06, <i>Fate and Transport of E. coli in Rural Texas Landscapes and Streams</i> , BAEN will assist BRA in designing a watershed source survey, to be conducted through TSSWCB project 08-54, that better characterizes the possible sources of bacteria loadings in the study area.		
	Start Date:	Month 1	Completion Date: Month 4
Subtask 3.4:	BAEN, with assistance from BRA through TSSWCB project 08-54, will conduct a LDC analysis of all historic and existing water quality monitoring data from the study area. LDCs will be developed for at least one critical index site per segment. LDCs shall be consistent with both EPA's <i>An Approach for Using Load Duration Curves in the Development of TMDLs</i> and EPA's <i>Options for Expressing Daily Loads in TMDLs</i> .		
	Start Date:	Month 3	Completion Date: Month 6
Subtask 3.5:	Using water quality monitoring data collected by BRA through TSSWCB project 08-54, BAEN, with assistance from BRA, will refine LDCs developed in subtask 3.4. LDCs will be used to determine bacteria load reductions needed to achieve water quality standards.		
	Start Date:	Month 7	Completion Date: Month 21
Subtask 3.6	BAEN, with assistance from BRA through TSSWCB project 08-54, will conduct watershed modeling for the study area. Utilizing information from the GIS inventory (Subtask 3.1), the source survey (Subtask 3.3), and water quality monitoring (TSSWCB project 08-54), and in combination with LDCs from Subtasks 3.4-3.5, BAEN will develop a spatially explicit or mass balance model, such as SELECT, for each of the five watersheds in the study area. Modeling will be used to estimate loadings from various sources and to identify critical loading areas within the watersheds.		
	Start Date:	Month 7	Completion Date: Month 21
Deliverables	<ul style="list-style-type: none"> <li>• Draft Technical Report detailing preliminary LDC analysis</li> <li>• Technical Report detailing final LDC analysis</li> <li>• Technical Report describing watershed modeling results</li> </ul>		

**Part III – Financial Information**

<b>Budget Summary</b>	
<b>Category</b>	<b>Costs</b>
Personnel	\$ 38,092
Fringe Benefits	\$ 3,467
Subtotal Personnel & Fringe	\$ 41,559
Travel	\$ 1,253
Equipment	\$ 0
Supplies	\$ 1800
Contractual	\$ 0
Construction	\$ 0
Other	\$ 200
Subtotal	\$ 3,253
Total Direct Costs	\$ 44,812
Indirect Costs (≤15%)	\$ 6,722
<b>Total Project Costs</b>	<b>\$ 51,534</b>

<b>Budget Justification</b>		
<b>Category</b>	<b>Costs</b>	<b>Justification</b>
Personnel & Fringe	\$ 41,559	<ul style="list-style-type: none"> <li>• TWRI Project Manager @ 10% Effort</li> <li>• BAEN Research Associate @ 66% Effort</li> </ul>
Travel	\$ 1,453	<ul style="list-style-type: none"> <li>• 5 trips for TWRI Project Manager and BAEN Research Associate to project meetings</li> <li>• 1 trip for BAEN Research Associate to present results at a national conference</li> </ul>
Equipment	\$ 0	
Supplies	\$ 1,800	BAEN miscellaneous supplies
Contractual	\$ 0	
Construction	\$ 0	
Other	\$ 0	
Indirect	\$ 6,722	15% of Total Direct Costs