COLORADO
Colorado Water Conservation Board
Department of Natural Resources

1313 Sherman Street, Room 718
Denver, CO 80203

May 26, 2016

Colorado State University
Co Climate Center, Co Division of Water Resources
Attn: Nolan Doesken, State Climatologist
2002 Campus Delivery
Fort Collins, CO 80523-2002

Colorado State University
1371 Campus Delivery
Fort Collins, CO 80523-1371

RE: Notice to Proceed – WSRA Grant – **POGG1 2016-799 – Lysimeter Operation in the Yampa River Basin**

Dear Nolan ,

This letter is to inform you that the purchase order (PO) to assist in the above WSRA grant project was approved on May 23, 2016. The attachments will serve as your original grant contracting documents.

With the executed PO, you are now able to proceed with the project and invoice the State of Colorado for costs incurred through December 31, 2020. Please provide the project name, PO number, and basin when corresponding with or invoicing for your project. Upon receipt of your invoice(s), the State of Colorado will provide payment no later than 30 days after review and signed approval of the project manager.

If an extension to the project is necessary, a formal letter of request must be submitted to the project manager along with a proposed completion date **30 days** prior to the current expiration date. There will be no prior notice from the CWCB grant manager informing the grantee that the project is approaching its deadline, therefore the grantee must monitor the completion progress accordingly.

If you have any questions or concerns regarding the project, please contact Craig Godbout, Project Manager at 303-866-3441 x3210 or at craig.godbout@state.co.us. You can contact me at 303-866-3441 ext. 3250 for invoicing and payment disbursement questions.

Thank you.

Sincerely,

//s//

Doriann Vigil
Program Assistant II
O 303-866-3441 ext. 3250
1313 Sherman Street, Rm. 719
Denver, CO 80203
Dori.vigil@state.co.us / cwcb.state.co.us

cc: Chris Sturm, Project Manager
Attachments

STATE OF COLORADO
Department of Natural Resources

ORDER
Number: POGG1 PDAA 20160000000000000799
Date: 05/23/16
Description:
WSRA PDAA2500 Lysimeter Oper in the Yampa River Basin
Effective Date: 05/23/16 Expiration Date: 12/31/20

BUYER
Buyer:
Email:

VENDOR
COLORADO STATE UNIVERSITY
2002 CAMPUS DELIVERY
FORT COLLINS, CO 80523 2002

Contact: N. Doeskin
Phone: .

**** IMPORTANT ****
The order number and line number must appear on all invoices, packing slips, cartons and correspondence

BILL TO
COLORADO WATER BOARD CONSERVATION
1313 SHERMAN STREET, ROOM 718
DENVER, CO 80203

SHIP TO
COLORADO WATER BOARD CONSERVATION
1313 SHERMAN STREET, ROOM 718
DENVER, CO 80203

SHIPPING INSTRUCTIONS
Delivery/Install Date:
F.O.B: FOB Dest, Freight Allowed
VENDOR INSTRUCTIONS:

Line Item	Commodity/Item Code	UOM	QTY	Unit Cost	Total Cost	MSDS Req.
1	G1000		0	0.00	$11,304.00	☐
Description: WSRA PDAA2500 Lysimeter Oper in the Yampa River Basin						
Service From: 05/23/16 Service To: 12/31/20						

Line Item	Commodity/Item Code	UOM	QTY	Unit Cost	Total Cost	MSDS Req.
2	G1000		0	0.00	$11,304.00	☐
Description: WSRA PDAA2500 Lysimeter Oper in the Yampa River Basin						
Service From: 05/23/16 Service To: 12/31/20						

TERMS AND CONDITIONS
https://www.colorado.gov/osc/purchase-order-terms-conditions

DOCUMENT TOTAL = $22,608.00

Exhibit A

Statement of Work
Date: 1 February 2016

WATER ACTIVITY NAME - Continuation of lysimeter operations and consumptive use quantification in high-altitude, irrigated meadows in the Yampa /White Basin.

GRANT RECIPIENT – Colorado Climate Center and Colorado Division of Water Resources

FUNDING SOURCE - – Water Supply Reserve Account
Statewide Account: $11,304
Basin Account: $11,304
Total Funds: $22,608

INTRODUCTION AND BACKGROUND

Provide a brief description of the project. (Please limit to **no more than 200 words**; this will be used to inform reviewers and the public about your proposal)

This project will continue efforts to improve lysimeter operations in the Yampa Basin and to come up with better crop coefficients that can be applied to weather-based calculations of grass-reference ET. In late 2010, the Yampa-White Roundtable provided support for instrumentation, operation and maintenance for an integrated data collection system consisting of an automated weather station specifically designed for estimating evapotranspiration via the ASCE Standardized Penman-Monteith method and small bucket lysimeters designed to directly measure the amount of water lost from the soil due to evapotranspiration. The weather station was purchased and installed in 2011. Severe drought conditions in 2012 limited vegetation growth and establishment, delaying the lysimeters use, but by 2013 the vegetation was established enough to allow representative ET measurements to begin.
This project will allow 5 years of uninterrupted lysimeter data to be collected and another lysimeter load cell to be purchased for accurate weighing of the buckets. From the lysimeter data a more accurate crop coefficients can be calculated, which can then be applied to the weather station data for accurate ET estimates for the Yampa basin.

OBJECTIVES

- Review lysimeter data collection to date and identify data quality issues and the likely causes of data quality deficiencies.
- Review lysimeter operations plan and instructions.
- Obtain new load cell to assure high quality bucket weight measurements.
- Perform daily quality control assessment of Hayden CoAgMet (Colorado Agricultural Meteorological Network) weather station data.
- Conduct annual maintenance and calibration of all meteorological sensors.
- Perform emergency maintenance and calibration as needed based on weather station performance to assure high quality and continuous data collection, particularly during the growing season.

- Based on lysimeter measurements and in collaboration with the staff of the Colorado Division of Water Resources Division 6, compute crop water use for each bucket at the end of each growing season year. Intercompare data and compare to weather station ET (Evapotranspiration) estimates. Also compare with preliminary results from the ongoing North Platte Roundtable ET study.
- As opportunities appear, also use data to assist and support other ET research currently underway in the Upper Colorado River Basin (in collaboration with Dr. Perry Cabot).
- Make annual estimates of hay meadow consumptive use, sample variability and relationship to weather data-based methods. Estimate appropriate crop coefficients and compare to other available estimates. Provide updates to the Yampa-White Roundtable.

TASKS
Provide a detailed description of each task using the following format

TASK 1 – Continue data collection from lysimeters and CoAgMet weather station

Description of Task – Continue collecting data during the growing season from bucket lysimeter plots at the Carpenter Ranch. Continue data collection, quality control and maintenance of the co-located Hayden CoAgMet weather station.

Method/Procedure – Carpenter Ranch and Division 6 Water Resources staff will maintain the lysimeters and take observations. The Colorado Climate Center staff will continue to collect data and perform daily quality control of the data. Normal CoAgMet annual maintenance will be on the weather station by CoAgMet staff. Every year, wind bearings will be changed and all equipment checked. Every other year, the temperature/relative humidity sensor and pyranometer will be replaced and recalibrated to ensure data quality. Along with annual visits, emergency maintenance and calibration will be conducted when needed.

Deliverable –Data lysimeter for use in crop coefficient calculation and publicly available data access to weather station in daily and hourly increments.

TASK 2 – Development of Crop Coefficients

Description of Task - Use data from the bucket lysimeters to calculate crop coefficients. These coefficients can then be applied to any future weather-based calculations of ET.

Method/Procedure- The use of two different species on the plots will provide both a grass ET reference and a crop ET reference. From these two measurements, crop coefficients can be determined directly.

Deliverable – Yampa Basin specific crop coefficients.

TASK 3 –Calculate Crop ET

Description of Task - Calibration of ASCE ET weather based calculations to temperature-based Hargreaves method.

Method/Procedure - Use weather station data to calculate ASCE standardized equation grass reference ET. These estimates will then be calibrated to the Hargreaves temperature based method. Once this relationship is established and crop coefficients are determined, crop ET can be determined anywhere in the basin temperature is monitored.

Deliverable- Summary of findings.

REPORTING AND FINAL DELIVERABLE

Reporting: The applicant shall provide the CWCB a progress report every 6 months, beginning from the date of the executed contract. The progress report shall describe the completion or partial completion of the tasks identified in the statement of work including a description of any major issues that have occurred and any corrective action taken to address these issues.

Final Deliverable: At completion of the project, the applicant shall provide the CWCB a final report that summarizes the project and documents how the project was completed. This report may contain photographs, summaries of meetings and engineering reports/designs.

BUDGET

Provide a detailed budget by task including number of hours and rates for labor and unit costs for other direct costs (i.e. mileage, $/unit of material for construction, etc.). A detailed and perfectly balanced budget that shows all costs is required for the State's contracting and purchase order processes. Sample budget tables are provided below. Please note that these budget tables are examples and will need to be adapted to fit each individual application. Tasks should correspond to the tasks described above.

Total Costs				
	Labor	Other Direct Costs	Matching Funds (If Applicable)	Total Project Costs
Task 1 - Continue data collection from lysimeters and CoAgMet weather station	$7,952.00	$8,388.00		$16,340.00
Task 2 - Development of Crop Coefficients	$5,336.00	$32.00		$5,368.00
Task 3 - Calculate Crop ET	$475.00	$425.00		$900.00
In-Kind Contributions				
Total Costs:	$13,763.00	$8,845.00		$22,608.00

Total Costs			
	Matching Funds In-kind Contributions	WSRA Funds	Total Project Costs
Task 1 - Continue data collection from lysimeters and CoAgMet weather station	$19,004	$16,340.00	$35,344.00
Task 2 - Development of Crop Coefficients	$7,850	$5,368.00	$13,218.00
Task 3 - Calculate Crop ET		$900.00	$900.00
Total Costs:	$26,854	$22,608.00	$49,462.00

Project Personnel: Hourly Rate:	Project Manager $65.30	Project Supervisor $30.74		Total Costs
Task 1 - Continue data collection from lysimeters and CoAgMet weather station	$2,249.00	$5,703.00		$7,952.00
Task 2 - Development of Crop Coefficients	$1,313.00	$4,023.00		$5,336.00
Task 3 – Calculate Crop ET	$100.00	$375.00		$475.00
Total Hours:	48.8	285.7		
Cost:	$3,663.00	$10,100.00		$13,763.00*

*Hourly rate does not include 15% IDC, dollar amounts include 15% IDC rate.

Other Direct Costs						
Item: Units: Unit Cost:	Travel $340.00	Materials Parts N/A	Equipment/ Supplies N/A	Computer Network Fee Person Months $42		Total
Task 1 - Continue data collection from lysimeters and CoAgMet weather station	$2,310.00	$6,026.00	$0.00	$52.00		$8,388.00
Task 2 – Development of Crop Coefficients	$0.00	$0.00	$0.00	$32.00		$32.00
Task 3 – Calculate Crop ET	$421.00	$0.00	$0.00	$4.00		$425.00
Total Units:	7					
Total Cost:	$2,731.00	$6,026.00	$0.00	$86.00		$8,845.00*

*Amounts include 15% IDC rate

In-Kind Contributions (If Applicable)				
Project Personnel: Hourly Rate:	Lead WC $39.25	Deputy WC $28.62		 Total
Task 1 -	$10,990	$8,014		$19,004
Task 2 -	$7,850			$7,850
Total Hours:	480	280		760
Total Cost:	$18,840	$8,014		$26,854

SCHEDULE

Provide a project schedule including key milestones for each task and the completion dates or time period from the Notice to Proceed (NTP). This dating method allows flexibility in the event of potential delays from the procurement process. Sample schedules are provided below. Please note that these schedules are examples and will need to be adapted to fit each individual application.

Task	Start Date	Finish Date
1	Upon NTP	Through end of project
2	Upon NTP	May – October 2016, 2017, 2018, 2019 and 2020
3	Upon NTP	Final report deliverable 2020

NTP = Notice to Proceed

PAYMENT

Payment will be made based on actual expenditures and invoicing by the applicant. Invoices from any other entity (i.e. subcontractors) cannot be processed by the State. The request for payment must include a description of the work accomplished by major task, and estimate of the percent completion for individual tasks and the entire water activity in relation to the percentage of budget spent, identification of any major issues and proposed or implemented corrective actions. The last 5 percent of the entire water activity budget will be withheld until final project/water activity documentation is completed. All products, data and information developed as a result of this grant must be provided to the CWCB in hard copy and electronic format as part of the project documentation. This information will in turn be made widely available to Basin Roundtables and the general public and help promote the development of a common technical platform.