Rio Grande Inter-Basin Roundtable
c/o San Luis Valley Water Conservancy District
623 Fourth Street
Alamosa, CO 81101
Telephone: (719) 589 – 2230
Email: slvwcdco1@qwestoffice.net

March 23, 2013

Mr. Michael King, Executive Director
Colorado Department of Natural Resources

Mr. Todd Doherty, Intrastate Water Management & Development
Colorado Water Conservation Board

Reference: Drip Irrigation Field Trial for Sustainable Potato Cropping in the San Luis Valley

Gentlemen:

The Rio Grande Inter-Basin Roundtable (R.G.R.T) has determined that the single, most critical water issue confronting the Rio Grande Basin (Basin) is the current unsustainable management of surface and ground water. The R.G.R.T. has made the decision that water activities that address this issue be favorably considered for funding from the Water Supply Reserve Account, SB 2005 -179 (WSRA Funds), providing the proposed water activities meet the SWSI findings for the Basin and the CWCB & IBCC Criteria and Guidelines for funding.

The **Drip Irrigation Field Trial for Sustainable Potato Cropping in the San Luis Valley** (Project) is an attempt to demonstrate an alternative method of irrigation to those methods that have been historically been used to raise potatoes and grain in the San Luis Valley (SLV).

The sponsor of the Project and applicant for the WSRA funding is the Colorado Potato Administrative Committee (CPAC). CPAC is a grower-based 501(c)(3) nonprofit organization founded in 1941 under Marketing Order 948 as a federal and state marketing organization for potatoes. The state marketing order authorizes CPAC to function as an administrative subdivision of the state and to represent the 170 potato growers in the SLV. CPAC is focused on unifying the industry to ensure long-term sustainability and profitability through research, promotion, and education. The committee, governed by 14 members elected from local growers and shippers, maintains the highest quality of potatoes by setting strict size and grade regulations and requiring government inspections for each load of potatoes leaving the SLV.

CPAC works closely with the Colorado State University (CSU) San Luis Valley Research Station to fund research on potato breeding and potato production issues. CPAC also promotes and advertises the quality and nutrition of Colorado grown potatoes. CPAC closely monitors agricultural issues that may impact growers and shippers and proactively works to educate growers, shippers, and others regarding these issues. CPAC members and staff work together for the sustainable future of the entire potato industry.
Through this Project, CPAC will investigate if drip irrigation can be a possible game changer in

the management of irrigation water for the SLV. The agricultural producers, through the Rio Grande Water Conservation District, and the Groundwater Management Subdistricts, are attempting to address the declining levels in the SLV's aquifers. This is being done through taking land out of agricultural production, through market based methods, including the USDA CREP program, and compensating farmers for reduced pumping of groundwater. In 2012, the amount of land fallowed was approximately 40,000 acres. As growers look to the future, the cost and availability of irrigation water is a major concern. The purpose of this Project is to demonstrate the feasibility of drip irrigation by determining if this technology will lead to cost and water use reductions for SLV growers. Agricultural producers need to know whether drip irrigation can become part of the solution, along with other practices such as retiring land.

CPAC is partnering with two local farmers on the Project. One of the farmers, Dennis Beiriger and his brothers, have wanted to turn 30 acres of their fourth-generation family farm in Hooper, Colorado, into a drip irrigation demonstration project for many years. They want to demonstrate to the SLV's drought-stricken potato growers that drip irrigation is possible, that it can be profitable on a large-scale, and that by burying drip-irrigation tape underground a grower can produce economically profitable yields using potentially 20% to 30% less water.

Through this Project, the partners will install the system, collect and analyze data, and develop a report on the feasibility of drip irrigation for the SLV. Consideration was given to having the CSU Experimental Research Center conduct this project on their test plots, but the farmers involved want to do this Project on their own farms, at a larger scale which they felt would be more appropriate to meeting their demonstration goals. NRCS was also approached to support the Project, but, due to the timing of the study, no NRCS funding is available. The decision was therefore made for CPAC to administer the Project.

Designed, engineered, and installed by Diversity D Inc., this Project will install two sub-surface agricultural drip irrigation systems on a total of 47 acres in the central part of the SLV. These installations will be on the Beiriger and on the Christensen farms near Hooper, within the boundaries of the Rio Grande Water Conservation District's Subdistrict No. 1.

The Project will include moisture monitoring, plant nutrition monitoring, and pest monitoring by Cactus Hill Ag Consulting and Agro Engineering. A Final Project report will evaluate the technology and suggest alternative potential extensions of the lessons learned from this trial. Dr. James Pritchett, CSU Extension Agricultural Economics Professor, will provide analysis and an economic feasibility study as an in-kind contribution from CSU. The project will also tap CSU's expertise from similar work in the Arkansas Valley. The Final Project Report will be submitted to CPAC in December, 2013, providing the analysis of one full growing season. This Final Report will be included in the final reporting on the use of WSRA funding.

The following Budget for Drip Irrigation Demonstration Project, gives a breakdown of the total Project costs and parties contributing to the Project, either in cash or in-kind contributions. As can be seen, in addition to the farmers making contributions, CPAC, Diversity D (equipment), Monte Vista Co-Op, Wilbur Ellis (fertilizer), Farm Fresh (packaging and shipping), the San Luis Valley Irrigation District, and CSU are also contributing to the cost of the Project. The Request for WSRA Basin Funds of $40,000.00 was unanimously approved by attending members of the Rio Grande Interbasin Roundtable at their meeting on March 12, 2013.

Budget for Drip Irrigation Demonstration Project

SYSTEM INSTALLATION	Third Party Contributions	GRANT	Total Project Cost	PARTICIPATION
Drip tape	$47,400	$0	$47,400	Diversity D, CPAC
Filter supplies	$0	$33,670	$33,670	
Chemigation valve and supplies	$7,082	$0	$7,082	Monte Vista Co-op
IPS pipe and supplies	$7,281	$0	$7,281	Beiriger, CPAC
Contollers	$6,904	$0	$6,904	CPAC
Electrical supplies	$4,449	$0	$4,449	CPAC, MV Co-op
Installation Labor	$33,592	$0	$33,592	Farm Fresh Direct, MV Co-op
Subtotal	$106,708	$33,670	$140,378	
AGRONOMIC MONITORING				
Hobo Data Loggers with mositure sensors	$1,300	$ 6,330	$7,600	CPAC
Complete petiole analysis	$1,850		$1,850	Christensen Farms
Petiole Nitrate analysis	$650	$ -	$650	Christensen Farms, CPAC
Monitoring Labor	$2,000	$ -	$2,000	SLV Irrigation Disrict
Summary Reporting	$1,850	$ -	$1,850	Wilbur Ellis, SLV Irr. Dist., CPAC
Subtotal	$7,650	$6,330	$13,950	
ECONOMIC STUDY	$2,000		$2,000	CSU Inkind
TOTAL PROJECT	**$116,328**	**$40,000**	**$156,328**	74.4% Total Project paid by Match funds

The requested $40,000.00 WSRA funds are some 25% of the Total Project costs.

While the attached Application does not state this, the Project proponents, and Members of the Rio Grande Interbasin Roundtable, realize that this demonstration project maybe the first of a broader effort to evaluate drip irrigation in the SLV and on crops other than potatoes.

The R.G.R.T. urges the CWCB Board to approve this request for $40,000.00 of Rio Grande Basin Funds for this demonstration of drip irrigation as applied to potato production in the SLV of Colorado.

The R.G.R.T. appreciates the support of the Department of Natural Resources, the Colorado Water Conservation Board, and the Interbasin Compact Commission in assisting in meeting the needs of all users of Colorado's water.

Sincerely,

Mike Gibson
Chair, Rio Grande Interbasin Roundtable

Attachment (1)

Jim Ehrlich, CPAC

COLORADO WATER CONSERVATION BOARD

WATER SUPPLY RESERVE ACCOUNT APPLICATION FORM

Drip Irrigation Field Trial for Sustainable Potato Cropping in the San Luis Valley

Name of Water Activity/Project

Colorado Potato Administrative Committee

Name of Applicant

Rio Grande Basin Roundtable

Approving Basin Roundtable(s)
(If multiple basins specify amounts in parentheses.)

Amount from Statewide Account: 0

Amount from Basin Account(s): $40,000

Total WSRA Funds Requested: $40,000

Application Content

Required Exhibits

A. Statement of Work, Budget, and Schedule
B. Project Map
C. As Needed (i.e. letters of support, photos, maps, etc.)

Appendices – Reference Material

1. Program Information
2. Insurance Requirements
3. WSRA Standard Contract Information (Required for Projects Over $100,000)
4. W-9 Form (Required for All Projects Prior to Contracting)

Instructions

To receive funding from the Water Supply Reserve Account (WSRA), a proposed water activity must be approved by the local Basin Roundtable **AND** the Colorado Water Conservation Board (CWCB). The process for Basin Roundtable consideration and approval is outlined in materials in Appendix 1.

Once approved by the local Basin Roundtable, the applicant should submit this application **with a detailed statement of work including budget and schedule as Exhibit A** to CWCB staff by the application deadline.

WSRA applications are due with the roundtable letter of support 60 calendar days prior to the bi-monthly Board meeting at which it will be considered. Board meetings are held in January, March, May, July, September, and November. Meeting details, including scheduled dates, agendas, etc. are posted on the CWCB website at: http://cwcb.state.co.us Applications to the WSRA Basin Account are considered at every board meeting, while applications to the WSRA Statewide Account are only considered at the March and September board meetings.

When completing this application, the applicant should refer to the WSRA Criteria and Guidelines available at: http://cwcb.state.co.us/LoansGrants/water-supply-reserve-account-grants/Documents/WSRACriteriaGuidelines.pdf

The application, statement of work, budget, and schedule **must be submitted in electronic format** (Microsoft Word or text-enabled PDF are preferred) and can be emailed or mailed on a disk to:

Greg Johnson – WSRA Application
Colorado Water Conservation Board
1580 Logan Street, Suite 200
Denver, CO 80203
gregory.johnson@state.co.us

If you have questions or need additional assistance, please contact Greg Johnson at: 303-866-3441 x3249 or gregory.johnson@state.co.us.

Water Supply Reserve Account – Application Form
Revised December 2011

Part I. - Description of the Applicant (Project Sponsor or Owner);

1.	Applicant Name(s):	**Colorado Potato Administrative Committee (Area II)**		
	Mailing address:	1305 Park Ave., P.O. Box 348 Monte Vista, CO 81144		
	Taxpayer ID#:			
	Primary Contact:	Jim Ehrlich	Position/Title:	Executive Director
	Email:	jehrlich@coloradopotato.org		
	Phone Numbers:	Cell:	Office:	719-852-3322
	Alternate Contact:	Linda Weyers	Position/Title:	Administrator
	Email:	lweyers@coloradopotato.org		
	Phone Numbers:	Cell:	Office:	719-852-3322

2. Eligible entities for WSRA funds include the following. What type of entity is the Applicant?

X	Public (Government) – municipalities, enterprises, counties, and State of Colorado agencies. Federal agencies are encouraged to work with local entities and the local entity should be the grant recipient. Federal agencies are eligible, but only if they can make a compelling case for why a local partner cannot be the grant recipient.
	Public (Districts) – authorities, Title 32/special districts, (conservancy, conservation, and irrigation districts), and water activity enterprises.
	Private Incorporated – mutual ditch companies, homeowners associations, corporations.
	Private individuals, partnerships, and sole proprietors are eligible for funding from the Basin Accounts but not for funding from the Statewide Account.
	Non-governmental organizations – broadly defined as any organization that is not part of the government.

3. Provide a brief description of your organization

Governance: The Colorado Potato Administrative Committee (CPAC) is a grower-based 501(c)(3) nonprofit organization founded in 1941 under Marketing Order 948 as a federal and state marketing order for potatoes. The state marketing order authorizes CPAC to function as an administrative subdivision of the state and to represent the 170 potato growers in the San Luis Valley (SLV). CPAC is focused on unifying the industry to ensure long term sustainability and profitability through research, promotion, and education. The committee, governed by 14 members elected from local growers and shippers, maintains the highest quality by setting strict size and grade regulations and requiring government inspections for each load of potatoes leaving the San Luis Valley.

Industry Leaders: CPAC works closely with the Colorado State University San Luis Valley Research station to fund research on potato breeding and potato production issues. CPAC also promotes and advertises the quality and nutrition of Colorado grown potatoes. CPAC closely monitors agricultural issues that may impact growers and shippers and proactively works to educate growers, shippers, and others regarding these issues. CPAC members and staff work together for the sustainable future of the entire potato industry.

Growing Conditions: Unique in world topography, the elevation of the Valley floor is 7600 feet above sea level. Days are warm and sunny, with cool nights, providing a perfect growing season for fall-crop potatoes. The entire SLV crop is grown in Alamosa, Conejos, Costilla, Rio Grande, and Saguache counties. Potatoes are planted in May, harvested in September and October, and then marketed throughout the winter and into the following summer. About 98 percent of the harvest is stored in the Valley's 21 potato warehouses and is then packed and shipped to the nation's fresh potato market. The San Luis Valley is the #2 fresh potato shipper in the entire United States.

But there is a problem: the aquifer level has dropped 1.2 million AF since records were first kept. Located in the high semi-arid region of the SLV, with only 7" average precipitation on the Valley floor, agricultural output and the Valley's agronomic economy are heavily dependent on center-pivot irrigation. As the SLV and the Mid-West plains of the US struggle with a severe and prolonged drought, groundwater levels continue to drop, with portions of the Valley, particularly in Special Improvement Subdistrict #1 of the Rio Grande Conservation District (Subdistrict #1), experiencing severe irrigation water shortages. In 2012 runoff from snowmelt on the Rio Grande was at only 60% of long term average (see March 4 SNOTEL data). With a very dry growing season, diminished precipitation, and rising temperatures, the Valley's agricultural outlook does not currently appear to be sustainable. Farms around Hooper have experienced the worst drop in well-water flows on record. The Rio Grande Water Conservation District, under the Conservation Reserve Enhancement Program (CREP), proposes to compensate groundwater irrigators in Subdistrict #1 to fallow their land, with a goal of fallowing up to 40,000 acres.

There may be a solution: CPAC is investigating drip irrigation as a possible game changer in the management of water for the San Luis Valley**.** As growers look to the future, the cost and availability of irrigation water is a major concern. The purpose of this Project is to demonstrate the agronomic feasibility of drip irrigation by determining if this technology is economical for SLV growers. Agricultural producers need to know whether drip irrigation can become part of the solution, along with other practices such as retiring land.

CPAC is taking findings from the laboratory out into the field. For five years Dennis Beiriger and his brothers dreamed of turning 30 acres of their fourth-generation family farm in Hooper, Colorado, into a demonstration project. They wanted to demonstrate to the San Luis Valley's drought-stricken potato growers that drip irrigation is possible; that it can be profitable on a large-scale; and that by burying drip-irrigation tape underground a grower can produce economically profitable yields using 20% to 30% less water. This Project will install the system, develop the metrics, analyze the data, and field test the economics of drip irrigation for the San Luis Valley.

4. If the Contracting Entity is different then the Applicant (Project Sponsor or Owner) please describe the Contracting Entity here.

   (same)

5. Successful applicants will have to execute a contract with the CWCB prior to beginning work on the portion of the project funded by the WSRA grant. In order to expedite the contracting process the CWCB has established a standard contract with provisions the applicant must adhere to. A link to this standard contract is included in Appendix 3. Please review this contract and check the appropriate box.

   [x] The Applicant will be able to contract with the CWCB using the Standard Contract

   [ ] The Applicant has reviewed the standard contract and has some questions/issues/concerns. Please be aware that any deviation from the standard contract could result in a significant delay between grant approval and the funds being available.

6. The Tax Payer Bill of Rights (TABOR) may limit the amount of grant money an entity can receive. Please describe any relevant TABOR issues that may affect the applicant.

   (none)

Water Supply Reserve Account – Application Form
Revised December 2011

Part II. - Description of the Water Activity/Project

1. What is the primary purpose of this grant application? (Please check only one)

	Nonconsumptive (Environmental or Recreational)
XX	Agricultural
	Municipal/Industrial
	Needs Assessment
	Education
	Other Explain:

2. If you feel this project addresses multiple purposes please explain.

- Assesses viability of highly water-efficient method of irrigation
- Increases irrigation efficiencies from sprinkler irrigation's 80%-85% to drip irrigation's 95% to 98%
- Reduces evaporation and deep percolation losses
- Promotes water quality by reducing fertilizer, herbicide, and pesticide inputs
- Reduces Nitrate leaching
- Introduces practices and procedures to meet future water needs
- Decreases groundwater use by reducing ~~dependence on~~ well pumping

3. Is this project primarily a study or implementation of a water activity/project? (Please check only one)

	Study	X	Implementation

4. To catalog measurable results achieved with WSRA funds can you provide any of the following numbers?

	New Storage Created (acre-feet)
	New Annual Water Supplies Developed, Consumptive or Nonconsumptive (acre-feet)
	Existing Storage Preserved or Enhanced (acre-feet)
	Length of Stream Restored or Protected (linear feet)
	Length of Pipe/Canal Built or Improved (linear feet)
15%-18% System	Efficiency Savings (acre-feet/year OR dollars/year – **circle one**)
	Area of Restored or Preserved Habitat (acres)
	Other -- Explain:

4. To help us map WSRA projects please include a map (EF`xhibit B) and provide the general coordinates below:

Latitude:	37°73´N 37°74´N	Longitude:	106°04´W 105°88´W

5. Please provide an overview/summary of the proposed water activity (no more than one page). Include a description of the overall water activity and specifically what the WSRA funding will be used for. A full **Statement of Work** with a detailed budget and schedule is required as **Exhibit A** of this application.

(next page please)

This Project will be conducted and supervised by Colorado Potato Administration Committee (CPAC). Consideration was given to having the CSU Experimental Research Center oversee this project, but the farmers involved want to do this Project on their own farms, at a scale which they felt would be more appropriate to meeting their demonstration goals. The decision was therefore made for CPAC to administer the Project. NRCS was also approached to support the Project, but, due to the timing of the study, no NRCS funding was available.

Designed, engineered, and installed by Diversity D Inc., this Project will install two sub-surface agricultural drip irrigation systems on a total of 47 acres in the central part of the San Luis Valley (SLV or the Valley). These installations will be on the Beiriger and on the Christensen farms near Hooper, within the boundaries of Special Improvement Subdistrict #1 of the Rio Grande Water Conservation District (Subdistrict No. 1). This area has been hard hit by extremely dry weather, a below average snow pack, and heavy groundwater pumping, resulting in a critically diminishing water supply.

Given the Rio Grande Basin's limited reservoir storage, and with financial incentives offered to take land out of production, the cost and availability of irrigation water is the major concern for growers. If the Valley's economy and agricultural way of life are to survive, the long term future of the potato industry must be secured. What is needed is an effective and sustainable water delivery system, improved irrigation efficiencies, and a different approach to the management of water – with growers using less water, and using it as economically as possible.

CPAC has analyzed production and marketing patterns over the years. Given the continuing drought and diminishing water security, plus positive results of recent research, CPAC has concluded that sub-surface drip irrigation may be a solution. This proposal, with a total Project cost of $156,328 requests $40,000 from Basin funds to field test this proposition and to determine the practical and economic feasibility of drip irrigation for potato producers in the Valley. The matching component for this request pays for 74.4% of the Total Project Cost, with grant funds requested being only 25.6% of the Total Project Cost.

Different drip layouts will be set up in distinct zones of both the Beiriger and the Christensen sites on a total of 47 acres. At the Beiriger location, 500 gpm of the water will be conveyed to the center pivot system on the adjacent 40-acre field on the other side of State Highway 17. This will set up the trial to compare the amount of water the drip tape uses versus what the center pivot uses to water the crop. Similar to a home-based lawn system, each zone of the drip system is pressured up and watered in sequence for a couple of hours before moving on to the next section. In a 24 hour period the whole farm is watered and the system starts over.

The monitoring program for the drip trial will determine optimum performance of different depths of drip tape, different spacing of the rows, and three different layouts. Two different potato varieties will be planted within each section – the standard Norkota Russett, which is shallow rooted, and the deeper rooted Tabena.

The Project will include moisture monitoring, plant nutrition monitoring, and pest monitoring by Cactus Hill Ag Consulting and Agro Engineering. A Final Project report will evaluate the technology and suggest alternative potential extensions of the lessons learned from this trial. Dr. James Pritchett, CSU Extension Agricultural Economics Professor, will provide analysis and an economic feasibility study as an in-kind contribution from CSU. The project will also tap CSU's expertise from similar work in the Arkansas Valley. The Final Project Report will be submitted to CPAC in December, 2013, providing the analysis of one full growing season.

Part III. – Threshold and Evaluation Criteria

1. Describe how the water activity meets these **Threshold Criteria.** (Detailed in Part 3 of the Water Supply Reserve Account Criteria and Guidelines.)

   a) The water activity is consistent with Section 37-75-102 Colorado Revised Statutes.[1]

   By performing the field tests and monitoring studies proposed in this Project, this water activity has no effect whatsoever on Colorado's current system of allocating water, nor does it in any manner affect the existing water rights adjudication system. The purpose of this study is rather to support those systems and those rights, providing valuable processes and procedures for creating a sustainable water delivery system for irrigation. Rather than causing any injury to vested water rights or decreed conditional water rights, this Project seeks new ways to protect water supplies and improve water quality by reducing deep percolation of chemicals.

   b) The water activity underwent an evaluation and approval process and was approved by the Basin Roundtable (BRT) and the application includes a description of the results of the BRTs evaluation and approval of the activity. At a minimum, the description must include the level of agreement reached by the roundtable, including any minority opinion(s) if there was not general agreement for the activity. The description must also include reasons why general agreement was not reached (if it was not), including who opposed the activity and why they opposed it. Note- If this information is included in the letter from the roundtable chair simply reference that letter.

   Please see letter from Mike Gibson, Chair of the Rio Grande Basin Roundtable.

[1] 37-75-102. Water rights - protections. (1) It is the policy of the General Assembly that the current system of allocating water within Colorado shall not be superseded, abrogated, or otherwise impaired by this article. Nothing in this article shall be interpreted to repeal or in any manner amend the existing water rights adjudication system. The General Assembly affirms the state constitution's recognition of water rights as a private usufructuary property right, and this article is not intended to restrict the ability of the holder of a water right to use or to dispose of that water right in any manner permitted under Colorado law. (2) The General Assembly affirms the protections for contractual and property rights recognized by the contract and takings protections under the state constitution and related statutes. This article shall not be implemented in any way that would diminish, impair, or cause injury to any property or contractual right created by intergovernmental agreements, contracts, stipulations among parties to water cases, terms and conditions in water decrees, or any other similar document related to the allocation or use of water. This article shall not be construed to supersede, abrogate, or cause injury to vested water rights or decreed conditional water rights. The General Assembly affirms that this article does not impair, limit, or otherwise affect the rights of persons or entities to enter into agreements, contracts, or memoranda of understanding with other persons or entities relating to the appropriation, movement, or use of water under other provisions of law.

c) The water activity meets the provisions of Section 37-75-104(2), Colorado Revised Statutes.[2] The Basin Roundtable Chairs shall include in their approval letters for particular WSRA grant applications a description of how the water activity will assist in meeting the water supply needs identified in the basin roundtable's consumptive and/or non-consumptive needs assessments.

This information is included in the letter from the Rio Grande Basin Roundtable Chair, which accompanies this proposal.

d) Matching Requirement: For requests from the **Statewide Fund**, the applicants is required to demonstrate a **20 percent** (or greater) match of the request from the Statewide Account. Statewide requests must also include a minimum match of **5 percent** of the total grant amount from Basin Funds. Sources of matching funds include but are not limited to Basin Funds, in-kind services, funding from other sources, and/or direct cash match. Past expenditures directly related to the project may be considered as matching funds if the expenditures occurred within 9 months of the date the application was submitted to the CWCB. Please describe the source(s) of matching funds. (NOTE: These matching funds should also be reflected in your Detailed Budget in **Exhibit A** of this application)

This Project seeks only Basin funds, so the matching requirement does not apply. Due to extremely high interest in this Project, however, many have come forward to participate, establishing a very generous matching component of 74.4% of Total Project Costs. This amount is currently committed and in place, as described in the Budget. Grant funds are needed in order to start and complete this project within the 2013 growing season.

[2] 37-75-104 (2)(c). Using data and information from the Statewide Water Supply Initiative and other appropriate sources and in cooperation with the on-going Statewide Water Supply Initiative, develop a basin-wide consumptive and nonconsumptive water supply needs assessment, conduct an analysis of available unappropriated waters within the basin, and propose projects or methods, both structural and nonstructural, for meeting those needs and utilizing those unappropriated waters where appropriate. Basin Roundtables shall actively seek the input and advice of affected local governments, water providers, and other interested stakeholders and persons in establishing its needs assessment, and shall propose projects or methods for meeting those needs. Recommendations from this assessment shall be forwarded to the Interbasin Compact Committee and other basin roundtables for analysis and consideration after the General Assembly has approved the Interbasin Compact Charter.

2. For Applications that include a request for funds from the **Statewide Account**, describe how the water activity/project meets all applicable **Evaluation Criteria.** (Detailed in Part 3 of the Water Supply Reserve Account Criteria and Guidelines and repeated below.) Projects will be assessed on how well they meet the Evaluation Criteria. **Please attach additional pages as necessary.**

Evaluation Criteria – the following criteria will be utilized to further evaluate the merits of the water activity proposed for funding from the Statewide Account. In evaluation of proposed water activities, preference will be given to projects that meet one or more criteria from each of the three "tiers" or categories. Each "tier" is grouped in level of importance. For instance, projects that meet Tier 1 criteria will outweigh projects that only meet Tier 3 criteria. WSRA grant requests for projects that may qualify for loans through the CWCB loan program will receive preference in the Statewide Evaluation Criteria if the grant request is part of a CWCB loan/WSRA grant package. For these CWCB loan/WSRA grant packages, the applicant must have a CWCB loan/WSRA grant ratio of 1:1 or higher. Preference will be given to those with a higher loan/grant ratio.

- **This Project only requests Rio Grande Basin funds, so this grant application requirement does not apply.**

~~Tier 1: Promoting Collaboration/Cooperation and Meeting Water Management Goals and Identified Water Needs~~

~~a. The water activity addresses multiple needs or issues, including consumptive and/or non-consumptive needs, or the needs and issues of multiple interests or multiple basins. This can be demonstrated by obtaining letters of support from other basin roundtables (in addition to an approval letter from the sponsoring basin).~~

~~b. The number and types of entities represented in the application and the degree to which the activity will promote cooperation and collaboration among traditional consumptive water interests and/or non-consumptive interests, and if applicable, the degree to which the water activity is effective in addressing intrabasin or interbasin needs or issues.~~

~~c. The water activity helps implement projects and processes identified as helping meet Colorado's future water needs, and/or addresses the gap areas between available water supply and future need as identified in SWSI or a roundtable's basin-wide water needs assessment.~~

~~Tier 2: Facilitating Water Activity Implementation~~

~~d. Funding from this Account will reduce the uncertainty that the water activity will be implemented. For this criterion the applicant should discuss how receiving funding from the Account will make a significant difference in the implementation of the water activity (i.e., how will receiving funding enable the water activity to move forward or the inability obtaining funding elsewhere).~~

e. The amount of matching funds provided by the applicant via direct contributions, demonstrable in-kind contributions, and/or other sources demonstrates a significant & appropriate commitment to the project.

  - **This Project includes a matching component of 74.4% of Total Project Costs. This amount is currently committed and in place, as described in the Budget.**

~~Tier 3: The Water Activity Addresses Other Issues of Statewide Value and Maximizes Benefits~~

~~f. The water activity helps sustain agriculture & open space, or meets environmental or recreational needs.~~

~~g. The water activity assists in the administration of compact-entitled waters or addresses problems related to compact entitled waters and compact compliance and the degree to which the activity promotes maximum utilization of state waters.~~

~~h. The water activity assists in the recovery of threatened and endangered wildlife species or Colorado State species of concern.~~

~~i. The water activity provides a high level of benefit to Colorado in relationship to the amount of funds requested.~~

~~j. The water activity is complimentary to or assists in the implementation of other CWCB programs.~~

Continued: Explanation of how the water activity/project meets all applicable **Evaluation Criteria**.

Please attach additional pages as necessary.

Although Basin fund requests do not require this application to provide the above details, this Project accomplishes the following:

Tier 1 - Participation in this Project includes CSU, CPAC, Monte Vista Co-op; San Luis Valley Irrigation District, Agro Engineering Inc. Cactus Hill Ag Consulting, Diversity D Inc., Farm Fresh Direct, Beiriger Farms, Christensen Farm, and Wilbur Ellis.

Tier 2 - The budget for this Project is sufficient to implement this Project, with a major proportion of the total Project costs borne by CPAC and its network of collaborators.

Tier 3 – The Water Activity Addresses Other Issues of Statewide Value and Maximizes Benefits

If this Project is successful, it will demonstrate the following:

- **Assesses viability of highly water-efficient method of irrigation**
- **Increases irrigation efficiencies from sprinkler irrigation's 80%-85% to drip irrigation's 95% to 98%**
- **Reduces evaporation and deep percolation losses**
- **Promotes water quality by reducing fertilizer, herbicide, and pesticide inputs**
- **Reduces Nitrate leaching**
- **Introduces practices and procedures to meet future water needs**
- **Decreases groundwater use by reducing the amount of well pumping**

Part IV. – Required Supporting Material

1. **Water Rights, Availability, and Sustainability** – This information is needed to assess the viability of the water project or activity. Please provide a description of the water supply source to be utilized, or the water body to be affected by, the water activity. This should include a description of applicable water rights, and water rights issues, and the name/location of water bodies affected by the water activity.
   - **Water supply source to be utilized –** Both sites will use ground water from irrigation wells as the source. They have surface water which is used purely for augmentation. The Beiriger trial will be supplied by two wells, the unconfined aquifer, with permit numbers 10262-R-R and 26339-F, which is supplemental to the first. Each is adjudicated for 500 gpm. The Christensen trial will be supplied by Permit 22525 F location is /SE/2/40N/8E/N, Which is in the Farmers Union.
   - **Water body to be affected by this activity** – The unconfined aquifer.
   - **Applicable water rights, water rights issues** - The state will soon implement rules and regulations within the SLV that will impact how much a well owner will be able to pump from their well. This will, in effect, limit their water right in the future.
   - **Name and location of water bodies affected by the water activity –** Unconfined Aquifer of the Closed Basin and Subdistrict #1.

For this trial, both farmers will use their existing water rights, the same as they use in their usual potato production. The intent is not to increase consumptive use but to maintain or to reduce overall consumptive use while maintaining similar or improved potato production. This Project continues a long history of scientific and

academic collaboration between CPAC and CSU Extension Service, as noted below. The final economic analysis will have the benefit of many years of research and data generated worldwide in this field of study.

This Project will dedicate 200gpm to the 35-acre drip irrigation Project at Hooper. In addition, there is a pivot on the east side of State Highway 17 that will have a nozzle package of 500gpm for the 40 acres of potatoes that will be planted under this pivot. 200gpm on this drip irrigation Project has the capability to deliver .286 inches per day. 500gpm has the capability to deliver .6625 inches per day. With center pivot irrigation there is a 25% loss due to evaporation, therefore .286 / .75 = .381 inches per day. This should meet peak Et of the potato crop.

2. Please provide a brief narrative of any related studies or permitting issues.

No permitting issues are involved in this Project.

Related studies include the following:

- *A Response to Sustainable Crop Production In a Region Facing a Decline In Groundwater Aquifer Levels* Essah, Samuel Y.C., Horticulture, Colorado State University, San Luis Valley Research Center. sessah@lamar.colostate.edu and Delgado, Jorge A., Soil Plant Nutrient Research Unit, USDA, Agricultural Research Service, Fort Collins, CO 80526, July 11, 2008.

    - Drip irrigation supplies the required amount of water close to the plant root, and avoids the potential of water loss through drift and evaporation which are some of the inefficiencies in the conventional overhead irrigation system.

    - The effect of drip irrigation on potato tuber yield and quality was also evaluated. Treatments consisted of surface drip irrigation (drip tapes buried at 5 to 7.5 cm below the soil surface), subsurface drip irrigation with drip tapes buried at 20 and 35 cm below the soil surface, and an overhead irrigation system which served as the control. Between 68 to 74 % of overhead irrigation water was used in the drip irrigation system for potato production.

    - Surface drip irrigation produced 11% more marketable size (114 to 454 g) tubers and 91% more large marketable size (284 to 454 g) tubers, compared to overhead irrigation for the cultivar Rio Grande Russet. Drip irrigation produced 92% more tubers with diameter > 5 cm and > 284 g in weight and 18% more of the longer (> 8.8 cm) tubers, compared to overhead irrigation. Tuber specific gravity was high (1.090) under drip irrigation, compared to overhead irrigation (1.085).

    - Results of this study indicate that potato production can be sustained in the San Luis Valley with about 26 to 32% less irrigation water through the use of drip irrigation system. This technology can improve the production of premium size and quality tubers. Gravity was high (1.090) under drip irrigation, compared to overhead irrigation (1.085).

    - Results of this study indicate that potato production can be sustained in the San Luis Valley with about 26 to 32% less irrigation water through the use of drip irrigation system. This technology can improve the production of premium size and quality tubers.

- Essah, Samuel Y.C. - San Luis Valley Research Center *Nitrogen Application and Drip Irrigation* - Colorado Potato Administrative Committee 6-03-2008

- Essah, Samuel Y.C. - San Luis Valley Research Center *Nitrogen Application and Drip Irrigation* - Colorado Potato Administrative Committee 7-13-2009

- Essah, Samuel Y.C. - San Luis Valley Research Center *Reducing Irrigation Water and Nitrogen Fertilizer Use for Improved Potato Production in the San Luis Valley of Colorado* - USDA-NRCS 04-12-2007

- Essah, Samuel Y.C. - San Luis Valley Research Center *Using Drip Irrigation Technology to Reduce Irrigation Water and Nitrogen Fertilizer Use, and Minimize Nitrate Nitrogen Movement and Leaching Into Ground* - USDA- Agricultural Research Service

- Reich, R. Godin, J.L. Chávez, I. Broner, *Subsurface Drip Irrigation (SDI): Quick Facts. 3/09*

    - Subsurface drip (SDI) is a low-pressure, high efficiency irrigation system that uses buried drip tubes or drip tape to meet crop water needs.

    - Subsurface irrigation saves water and improves yields by eliminating surface water evaporation and reducing the incidence of disease and weeds.

    - A subsurface drip system may require higher initial investment, and cost will vary due to water source, quality, filtration need, choice of material, soil characteristics and degree of automation desired.

    - Subsurface drip (SDI) is a low-pressure, high efficiency irrigation system that uses buried drip tubes or drip tape to meet crop water needs. SDI technologies have been a part of irrigated agriculture since the 1960s; with the technology advancing rapidly in the last two decades. An SDI system is flexible and can provide frequent light irrigations. This is especially suitable for arid, semi-arid, hot, and windy areas with limited water supply. Farm operations also become free of impediments that normally exist above ground with any other pressurized irrigation system.

    - Since the water is applied below the soil surface, the effect of surface infiltration characteristics, such as crusting, saturated condition of ponding water, and potential surface runoff (including soil erosion) are eliminated during irrigation. With an appropriately sized and well-maintained SDI system, water application is highly uniform and efficient. Wetting occurs around the tube and water moves out in all directions.

    - Subsurface irrigation saves water and improves yields by eliminating surface water evaporation and reducing the incidence of disease and weeds. Water is applied directly to the root zone of the crop and not to the soil surface where most weed seeds winter over. As a result, germination of annual weed seed is greatly reduced, and lowers weed pressure on beneficial crops. In addition, some crops may benefit from the additional heat provided by dry surface conditions, producing more crop biomass, provided water is sufficient in the root zone. When managed properly, water and fertilizer application efficiencies are

enhanced, and labor needs are reduced. Field operations are also possible, even when irrigation is applied.

3. Statement of Work, Detailed Budget, and Project Schedule

The statement of work will form the basis for the contract between the Applicant and the State of Colorado. In short, the Applicant is agreeing to undertake the work for the compensation outlined in the statement of work and budget, and in return, the State of Colorado is receiving the deliverables/products specified. **Please note that costs incurred prior to execution of a contract or purchase order are not subject to reimbursement**. All WSRA funds are disbursed on a reimbursement basis after review invoices and appropriate backup material.

Please provide a detailed statement of work using the template in Exhibit A. Additional sections or modifications may be included as necessary. Please define all acronyms and include page numbers.

(Exhibit A follows the signature page)

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.

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.

The above statements are true to the best of my knowledge:

Signature of Applicant:

Print Applicant's Name:

Project Title:

Return an electronic version (hardcopy may also be submitted) of this application to:

Greg Johnson – WSRA Application
Colorado Water Conservation Board
1580 Logan Street, Suite 200
Denver, CO 80203
gregory.johnson@state.co.us

Exhibit A
Statement of Work

WATER ACTIVITY NAME – Drip Irrigation Field Trial for Sustainable Potato Cropping in the San Luis Valley

GRANT RECIPIENT – Colorado Potato Administrative Committee – Area II

FUNDING SOURCE - $40,000 Rio Grande Basin Account (No Statewide funds requested)

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)

The Colorado Potato Administration Committee (CPAC), working with Colorado State University (CSU) and numerous investigators, has researched subsurface drip irrigation (SDI) as potential alternative to center-pivot irrigation practices. With a concern for the long-term future of the potato industry, particularly in the seriously drought-impacted San Luis Valley (SLV), CPAC seeks $40,000 in Rio Grande Basin WSRA funds to conduct a "*Drip Irrigation Field Trial for Sustainable Potato Cropping in the San Luis Valley."* Long-term sustainability of the aquifer and effective groundwater management are Rio Grande Basin priorities. This demonstration is essentially a pilot project to field test SDI, and to discover whether it offers a practical, effective, economically viable, and sustainable water delivery system. Within the current growing season, CPAC, together with Beiriger Farms, Christensen Farm, and CSU, hopes to demonstrate SDI's improved irrigation efficiencies. As potentially an alternative approach to the management of water in the San Luis Valley, SDI uses 20%-30% less water and potentially produces significantly better potato crop yields. With a total Project cost of $156,328, CPAC requests $40,000 from Basin funds, with 27% matching funds, to field test this proposition and determine the practical and economic feasibility of drip irrigation for potato producers in the Valley.

OBJECTIVES
List the objectives of the Project

To field test subsurface drip irrigation on two potato farms over one growing season, and to determine the practical and economic feasibility of drip irrigation for potato producers in the Valley.

TASKS

Provide a detailed description of each task using the following format

TASK 1 – Preparation

Description of Task - Measure each field and conform the layout to the plan provided by Diversity D (Ross Roberts) per the attached engineering drawings.

Method/Procedure – Confirm measurements and lay out the dripline plan.

Deliverable – Ready to install the SDI system.

TASK 2 – System Installation

Description of Task – Create the taperows

Method/Procedure - Plow along driplines and inject the tape per specifications of Diversity D. Verify taperows and confirm/adjust with design. Trench along the end of the dripper lines and install water lines to each field.

Deliverable – Ready to plant.

TASK 3 – Growing and Harvesting (specifications to follow)

Description of Task – Adjust irrigation scheduling as indicated by monitoring and plant needs.

Method/Procedure – Reprogram the drip system controller to achieve the desired results. Achieve water movement to the surface by doing short irrigations multiple times in a 24-hour period.

Deliverable – Proactively respond to the plant's needs by adjusting fertiziler, pesticide, and herbicide applications. Provide basis for studies of water use, plant nutrition, and requirements for herbicides/pesticides and fertilizer.

TASK 3a – Agronomic Monitoring

Description of Task – Monitoring effectiveness of stripline design for subsurface drip irrigation.

Method/Procedure – The Beiriger Drip trial will be set up in different drip layouts to look at optimum success methods. One bank of the field will have buried drip line (permanent installation) underneath each row (34 inch spacing) and buried below potato digger level. Another section will have wider spacing, also buried, but at a shallower depth. Finally, one section will have drip tape over the top (shallow placement) that will be installed after planting. The shallow installation will be "retrievable" and tape will be rolled up for next season's use prior to digging the potatoes. Two

different potato varieties planted in 3 different layouts within each section, the standard Norkota Russett (shallow rooted) and the Tabena (deeper rooted).

(i) Moisture Monitoring - Cactus Hill Ag Consulting and Agro Engineering will document moisture status in different parts of the field on a weekly basis with twice weekly monitoring during critical times. This monitoring will use the "feel" method for moisture readings at different depths.

In addition to the visual documentation, Hobo Data Loggers for moisture monitoring will be installed at 3 depths within each treatment. The data loggers record moisture readings at preset intervals (hourly?) and store these readings until they are downloaded to a computer each week. Moisture probes will be placed in the root zone (6"); directly below the root zone (12-16") and at 2 feet at each location.

(ii) Plant Nutrition Monitoring - Petiole samples will be taken for tissue nutrient analysis 4 times during the season from each "treatment". These will be compared graphically and used to predict nitrogen needs for the potato crop.

(iii) Pest Monitoring – Weekly visits for moisture monitoring will include pest scouting of each treatment as well as a numerical evaluation twice during the season of foliar incidence of early blight.

(iv) Monitoring Final Report - A Summary report of the above monitoring will be completed by December 2013, and presented to CPAC and to other partners in this Project, upon approval by CPAC. This report will be included in the final Project report to CWCB, and will include evaluation of the technology and potential extension of the lessons learned from this trial.

Deliverable – Monitoring Time is estimated at 20 weeks X 1.5 Hours, additional time, if required, has been offered as an In-Kind donation. The Monitoring Final Report will be delivered to CPAC, CSU, to Project partners, and to CWCB.

TASK 4 – Economic Study

Description of Task – Determine practicality, economic feasibility, and long-range implications for sustainability of potato production using SDI as compared to center-pivot irrigation.

Method/Procedure - Dr. James Pritchett, CSU Agricultural Economics professor, will provide analysis and an economic feasibility study as an in-kind contribution from CSU. The Project will also tap CSU's expertise from similar work in the Arkansas Valley.

Deliverable – The Final Project Report will be submitted to CPAC in December, 2013, providing the analysis of one full growing season.

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.

(next page please)

Budget for Drip Irrigation Demonstration Project

SYSTEM INSTALLATION	Eqip- ment	Labor	In-Kind	Matching	Total Contribution	GRANT	Total Project Cost	PARTICIPATION
Drip tape	$47,400		$39,377	$8,023		$0	$47,400	Diversity D, CPAC
Filter supplies	$33,670		$0	$0		$33,670	$33,670	
Chemigation valve and supplies	$7,082			$7,082		$0	$7,082	Monte Vista Co-op
IPS pipe and supplies	$7,281			$7,281		$0	$7,281	Beiriger, CPAC
Contollers	$6,904			$6,904		$0	$6,904	CPAC
Electrical supplies	$4,449			$4,449		$0	$4,449	CPAC, MV Co-op
Installation Labor		$33,592	$21,969	$11,623		$0	$33,592	Farm Fresh Direct, MV Co-op
Subtotal	$106,786	$33,592	$61,346	$45,362		$33,670	$140,378	
AGRONOMIC MONITORING								
Hobo Data Loggers with mositure sensors	$7,600			$1,270		$ 6,330	$7,600	CPAC
Complete petiole analysis	$1,850			$1,850			$1,850	Christensen Farms
Petiole Nitrate analysis	$650			$650		$ -	$650	Christensen Farms, CPAC
Monitoring Labor		$2,000		$2,000		$ -	$2,000	SLV Irrigation Disrict
Summary Reporting		$1,850		$1,850		$ -	$1,850	Wilbur Ellis, SLV Irr. Dist., CPAC
Subtotal	$10,100	$3,850	$0	$7,620		$6,330	$13,950	
ECONOMIC STUDY	$0	$2,000	$2,000	$0			$2,000	CSU Inkind
TOTAL PROJECT	**$116,886**	**$39,442**	**$63,346**	**$52,982**	**$116,328**	**$40,000**	**$156,328**	74.4% Total Project paid by Match funds

DIVERSITY D INC.
SPECIALIZING IN DRIP IRRIGATION
2023 FM 1698
Brownfield, TX 79316

Estimate 1579

Date	Revised & Current
3/5/2013	
Approved	S/O-P/O No.

Name / Address

Colorado State Irrigation
PO Box 307
Rocky Ford. CO 81067

Project / Location / Ship To

Roger Christianson

Sales Rep	Designer	Spacing / Acres	GPM
RR	RR	34" / 12.74	

Qty	Item	Description	Cost	Total
200	NON-INV-AG	Typhoon 630 13 mil .18 gph @ 16" (06TSF13636.18-16) 36 coils	65.98	13,196.00
2	140518618	518 x 618 Polyethylene Riser Tubing - 1000 ft. coil / price per 1000 / 36.4#	87.64	175.28
		Subtotal		13,371.28
25	15CONT-8-P	Control Tubing 5/16" (8mm) PARTIAL Roll - per foot	0.32	8.00
25	15CONT-6-P	Control Tubing 1/4" (6mm) PARTIAL Roll - per foot	0.26	6.50
600	H520IAPVC-B	.520 Ins.Adapter to PVC w/.680 Grommet (50 per bag)	1.79	1,074.00
1	61PSNO323PL-G	323 Press.Sust.N.O.Valve w/Gemsol Solenoid - Nylon Thread - G	610.00	610.00
8	V3202DGT004C02	2" Press.Reduc.Elect.Valve w/61NETR SOLENOID - Nylon Thread - Y	397.00	3,176.00
1	26LP2PP2120AC	2" x 2 Unit LP Disc-Kleen Filt.Batt. 50-160 gpm 120 mesh	6,254.00	6,254.00
1	31OCT3F-AF	3" ARAD Octave Ultrasonic Flow Meter 1-500 GPM 2.1 psi - Flanged / Acre Feet	2,536.00	2,536.00
2	55P4664802	8 mm x 1/8" Female Connector	3.47	6.94
1	65ARIB2PP	2" Comb.Air/Vac Rel.&Cont.Act.Vent 150 psi-Poly	183.00	183.00
3	65ARIA2	2" Guardian Air/Vac.Rel.Vent 150psi-Nylon	51.00	153.00
14	65ARIA100S	1" Guardian Air/Vac.Rel.Vent 150psi-Nylon W/Shrader	47.00	658.00
1	TDBIT16.5	Drill Bit for PVC 16.5 mm	27.13	27.13
		Subtotal		14,692.57
700	16700020	Stepless Ear Clamp 18.5 mm (Range .602" - .728") (for Drip Tube) 100 per bag	0.34	238.00
1	GALCHEM-FL-03	3" Galvanized Chemigation Valve - Flanged	478.96	478.96
4	940-299	2" PVC Ball Valve - s x s	12.75	51.00
6	FLAG-M6	Mesh Marker Flag 16 x 16 w/Fiberglass Pole	12.86	77.16
8	PVC-717-Q	717 Weld-On PVC Gray Cement - QUART	23.00	184.00
8	PVC-9336S	9300 Clear Primer - QUART	19.51	156.08
4	DAUBER-L	Replacement Large Dauber Metal for Quart Can	1.75	7.00
2	NBS-5/8X3	Nut & Bolt Set 5/8 x 3 ST x PVC Flanges 4" & 6"	15.68	31.36
4	FG-04-1/8	4" Flange Gasket 1/8"	5.06	20.24
1	B-BIBB-3/4	3/4" Brass Hose Bibb (Faucet) - Male	6.00	6.00
2	M-GVC-4	4" Steel Grooved Coupling	22.84	45.68
2	890-040PG	4 x 4 IPS Sch.80 Grooved Nipple - pe x g	22.86	45.72
1	M-GVC-2	2" Steel Grooved Coupling	16.62	16.62
1	887-040PG	2 x 4 Grooved Nipple - pe x g	6.90	6.90
2	887-005	2 x Close IPS Sch.80 Nipple	3.26	6.52
1	880-005	1/4 x Close IPS Sch.80 Nipple	0.94	0.94
1	CONT-STAND	Controller Stand	150.00	150.00
1	BASE-C	Concrete Base for Controller Stand	85.00	85.00
2	PIPE-STAND-12	12" (MD) Steel Pipe Stand / Filtration pipe support	85.00	170.00
		Subtotal		1,777.18

	Price per Acre	Total

Phone 806.637.0593 Fax 806.288.6200 sales@diversityd.com www.diversityd.com

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PO Box 307
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Roger Christianson

Sales Rep	Designer	Spacing / Acres	GPM
RR	RR	34" / 12.74	

Qty	Item	Description	Cost	Total
6	429-040	4" IPS Coupling - s x s	11.52	69.12
1	401-422	4 x 4 x 3 IPS Reducing Tee - s x s x s	37.26	37.26
1	406-040	4" IPS Elbow 90 deg - s x s	25.10	25.10
1	438-420	4 x 2 IPS Reducer Bushing - s x th	15.20	15.20
3	437-422	4 x 3 IPS Reducer Bushing - s x s	15.24	45.72
2	429-030	3" IPS Coupling - s x s	7.96	15.92
2	436-030	3" IPS Male Adapter - th x s	10.68	21.36
14	406-030	3" IPS Elbow 90 deg. - s x s	14.04	196.56
8	401-030	3" IPS Tee - s x s x s	20.60	164.80
9	447-030	3" IPS Cap - s	6.90	62.10
2	420-030	3" IPS Cross - s	29.22	58.44
8	401-338	3 x 3 x 2 IPS Reducing Tee - s x s x s	22.36	178.88
8	437-338	3 x 2 IPS Reducer Bushing - s x s	6.80	54.40
2	438-338	3 x 2 IPS Reducer Bushing - s x th	6.80	13.60
8	438-335	3 x 1 IPS Reducer Bushing - s x th	6.80	54.40
4	447-020	2" IPS Cap - s	1.98	7.92
7	406-020	2" IPS Elbow 90 deg - s x s	3.86	27.02
4	401-020	2" IPS Tee - s x s x s	4.76	19.04
4	438-249	2 x 1 IPS Reducer Bushing - s x th	4.08	16.32
1	450-005	1/2" IPS Plug - th	1.74	1.74
		Subtotal		1,084.90
40	4-40IPS-BE	4" IPS Schedule 40 Pipe	2.25	90.00
1,500	3-100IPS-BE	3" IPS Pipe 100 psi / SDR-41 - BE	0.77	1,155.00
1,000	2-125IPS-BE	2" IPS Pipe 125 psi / SDR-32.5 - BE	0.39	390.00
		Subtotal		1,635.00
800	18/2-MC	18/2 Multi-Conductor (Solid) Insulated Direct Burial Sprinkler Wire 300V Copper	0.14	112.00
1,000	14/1-SO/SDT-O	14/1 SOLID VNTC Insulated Direct Burial 600V Copper Wire - ORANGE	0.14	140.00
50	14/4-ST/SDT	14/4 Stranded VNTC (Tray Cable) Insulated Direct Burial 600V Copper Wire	0.95	47.50
		Subtotal		299.50
1	31NMCJRSPLC	NMC-64 JUNIOR Controller DOUBLE DOOR BOX - 15 Out/24VAC, MemKey BKUp, 24VAC Transf., 115VAC Surge Supp.	3,452.00	3,452.00
		Subtotal		3,452.00
2	80-ELL-200	2" UL 90 deg. Elbow Sched.80 - Standard Radius Sweep	3.00	6.00
30	CABLE-1/8GALV	Galvanized Cable 1/8" / Price per foot	0.25	7.50
1	TB-3/4X12	3/4 X 12 Turnbuckle	42.66	42.66

	Price per Acre	Total

Phone 806.637.0593 Fax 806.288.6200 sales@diversityd.com www.diversityd.com

Page 2

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Roger Christianson

Sales Rep	Designer	Spacing / Acres	GPM
RR	RR	34" / 12.74	

Qty	Item	Description	Cost	Total
2	CABLE-1/8GALV	Galvanized Cable 1/8" / Price per foot	0.25	0.50
1	PAINT-SET	Paint, Acetone & Brush Set	42.00	42.00
1	C15N404X000V00	B-W Chem-Feed Pump C1500N - 4.9 gph 10.6 oz/min 115V - 70 psi	355.00	355.00
1	PCORD-25	Power Cord for Fertilizer Pump	25.00	25.00
1	GRNDROD-5/8	Ground Rod 5/8 x 8 ft.	19.60	19.60
1	GRNDCLAMP-5/8	Ground Rod Clamp (Sizes up to 5/8")	3.00	3.00
1	ABS-14X10X6	ABS Enclosure 14 x 10 x 6 - Fiberglass / Weatherproof	65.00	65.00
2	750XBXM4L-24A	Ice Cube Relay - 24V/10amp - 8 pin	25.00	50.00
2	8501NR51	8-pin Socket - SINGLE Tier - 10A-300V	8.50	17.00
100	FLEX-050	1/2" Flexible PVC Conduit	0.95	95.00
25	FLEX-END-S-050	1/2" Flexible PVC Straight End	4.55	113.75
2	CORDGRIP.50-2847	1/2" Cord Grip w/Seal Ring & Nut (.28-.47)	2.50	5.00
1	HPKILL	High Pressure Kill Switch	135.00	135.00
1	PRDIFF	Pressure Differential Switch - 0 - 15 psid	235.00	235.00
3	O-BOX/1-A3	Outlet Box Aluminum - Single 1/2" Knock Outs x 3	5.00	15.00
3	B-PLATE-A-1	Blank Plate/Cover - Aluminum - Single	1.50	4.50
2	CIRCBRK-10A-1P	Chint Mini Circuit Breaker D-Curve10A 1-Pole 277VAC 5kA IR (for 110V)	12.00	24.00
1	D-RAIL	D-Rail, Din Mounting Track, Alum.35mm (price per ft)	11.00	11.00
1	2KVA	2.0 KVA Transformer - Single Phase - 240 x 480 - 120/240 V	260.00	260.00
1	CIRCBRK-10A-2P	Chint Mini Circuit Breaker D-Curve 10A 2-Pole 480VAC 5kA IR	25.00	25.00
		Subtotal		1,556.51
	DISC-1	GROWER Parts Discount-Ag	-13,498.78	-13,498.78
	INSTALL-D	System Installation	10,623.47	10,623.47
	1-ALTERATION	**Any alteration or deviation from above specifications involving extra costs will become an extra charge over and above the estimate. All agreements contingent upon delays beyond our control.		
	2-LIMIT	**Estimate Pricing Good for 20 DAYS unless stated otherwise.		
	3A-PIPE	**Pipe prices are subject to change without notice. We are unable to guarantee prices because of unstable resin costs.		
	4-DITCH	**Additional charges will be incurred if ditching in rocky soils.		
	5-RIP	**Pre-Ripping or other preparation of soil prior to injection of tape is NOT included in this estimate.		
	6-LIABILITY	**Tractor for injection plow is NOT provided. Grower must make accomodations to supply tractor AND operator.		
	7-ELECTRICIAN	**Any charges incurred resulting from electrical work that requires a certified electrician will be the customer's responsibility and will be added to the final bill.		
	8-ENGINEER	**If an engineer's approval is required by any federal or state agencies, all costs incurred will be the customer's responsibility and will be added to the final bill.		

	Price per Acre	Total

Phone 806.637.0593 Fax 806.288.6200 sales@diversityd.com www.diversityd.com

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DIVERSITY D INC.
SPECIALIZING IN DRIP IRRIGATION
2023 FM 1698
Brownfield, TX 79316

Estimate **1579**

Date	Revised & Current
3/5/2013	
Approved	S/O-P/O No.

Name / Address

Colorado State Irrigation
PO Box 307
Rocky Ford. CO 81067

Project / Location / Ship To

Roger Christianson

Sales Rep	Designer	Spacing / Acres	GPM
RR	RR	34" / 12.74	

Qty	Item	Description	Cost	Total
	9-INJECTION	**Pending water sample: It may be necessary to treat water to control iron precipitants. Injection equipment may be necessary, and is NOT included on this estimate.		
	10A-SHIPPING	**Any applicable shipping charges will be included on the final invoice.		
	10B-PUMP	**Must verify and approve the pump listed above for correct pump specifications needed on customer's given application. Pumps are made-to-order and cannot be returned.		
	11A-PAYMENTS	**Upon approval of bid, payments are to be made as outlined in Payment Terms agreement.		
	12-READ	I HAVE READ AND UNDERSTAND ABOVE EXCEPTIONS AND CONDITIONS _____DATE_____		

	Price per Acre	Total	$34,993.63

Phone 806.637.0593 Fax 806.288.6200 sales@diversityd.com www.diversityd.com

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SCHEDULE

ACTION / 2013	DESIGN & PREP	NTP	INSTALL	MONITOR	PLANT	GROW	HARVEST	ANALYZE	REPORT
March									
April									
May									
June									
July									
August									
September									
October									
November									
December									

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.

Exhibit B

Project Maps

Project Location Aerial Photo

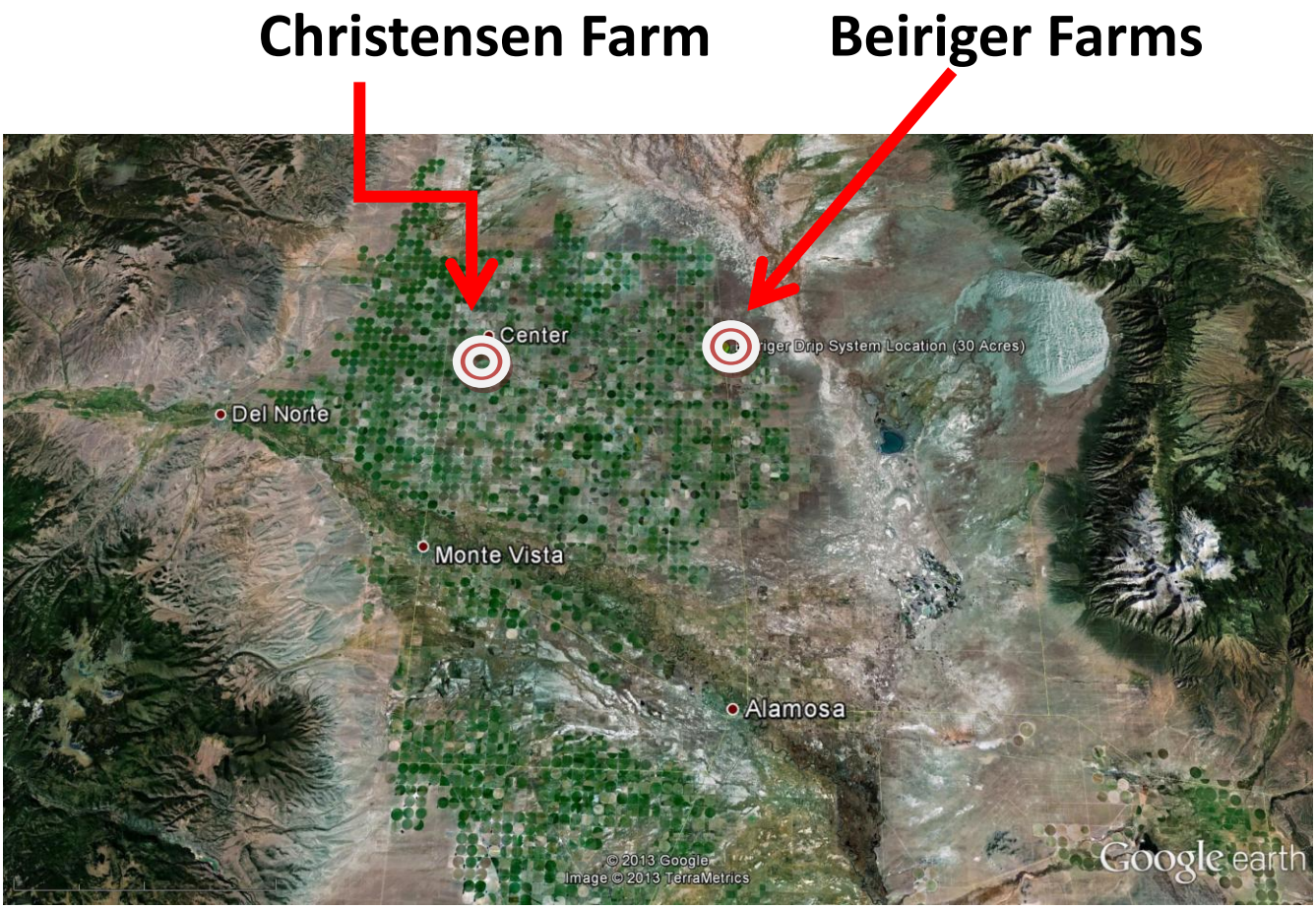

Exhibit B

Project Maps

Christensen Farm Aerial Photo

Exhibit B

Project Maps

Beiriger Farms Aerial Photo

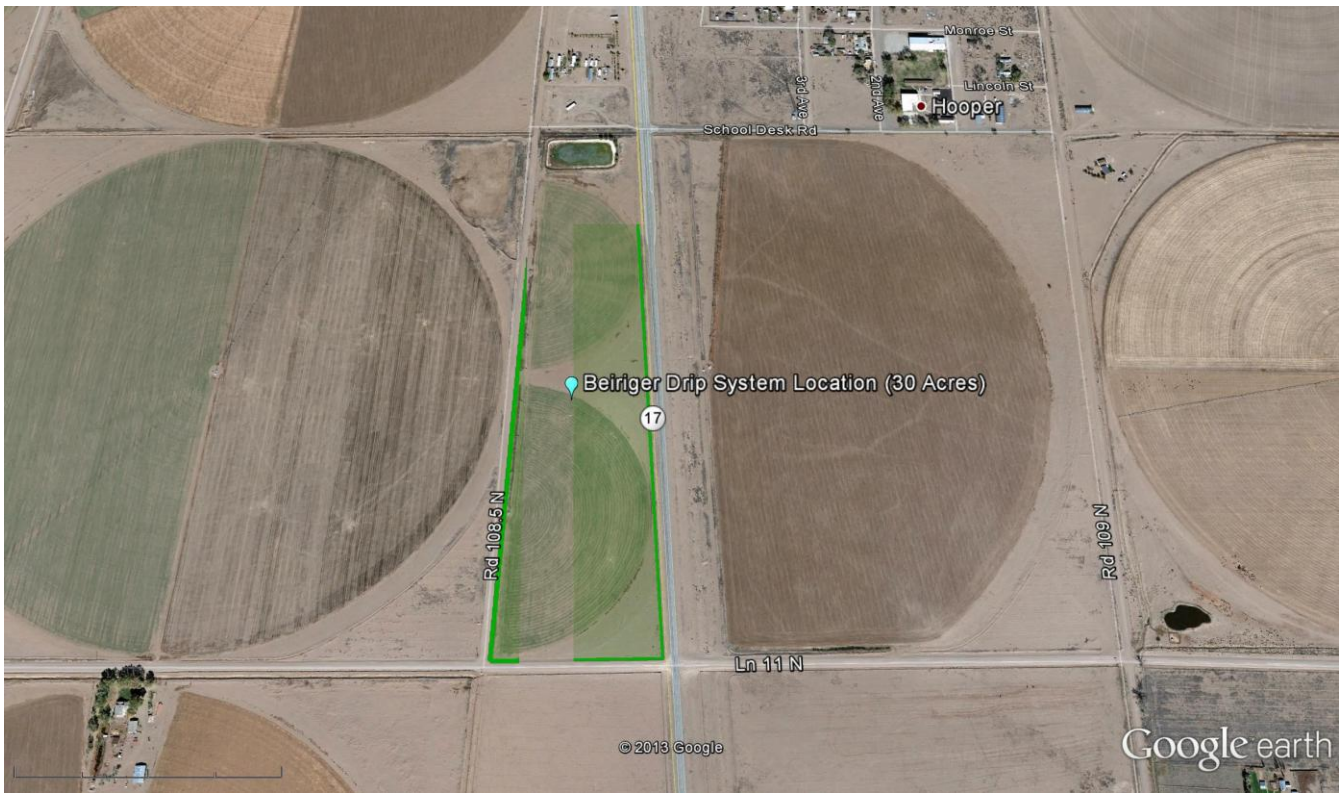

Exhibit C

NRCS Snowpack Historical Data

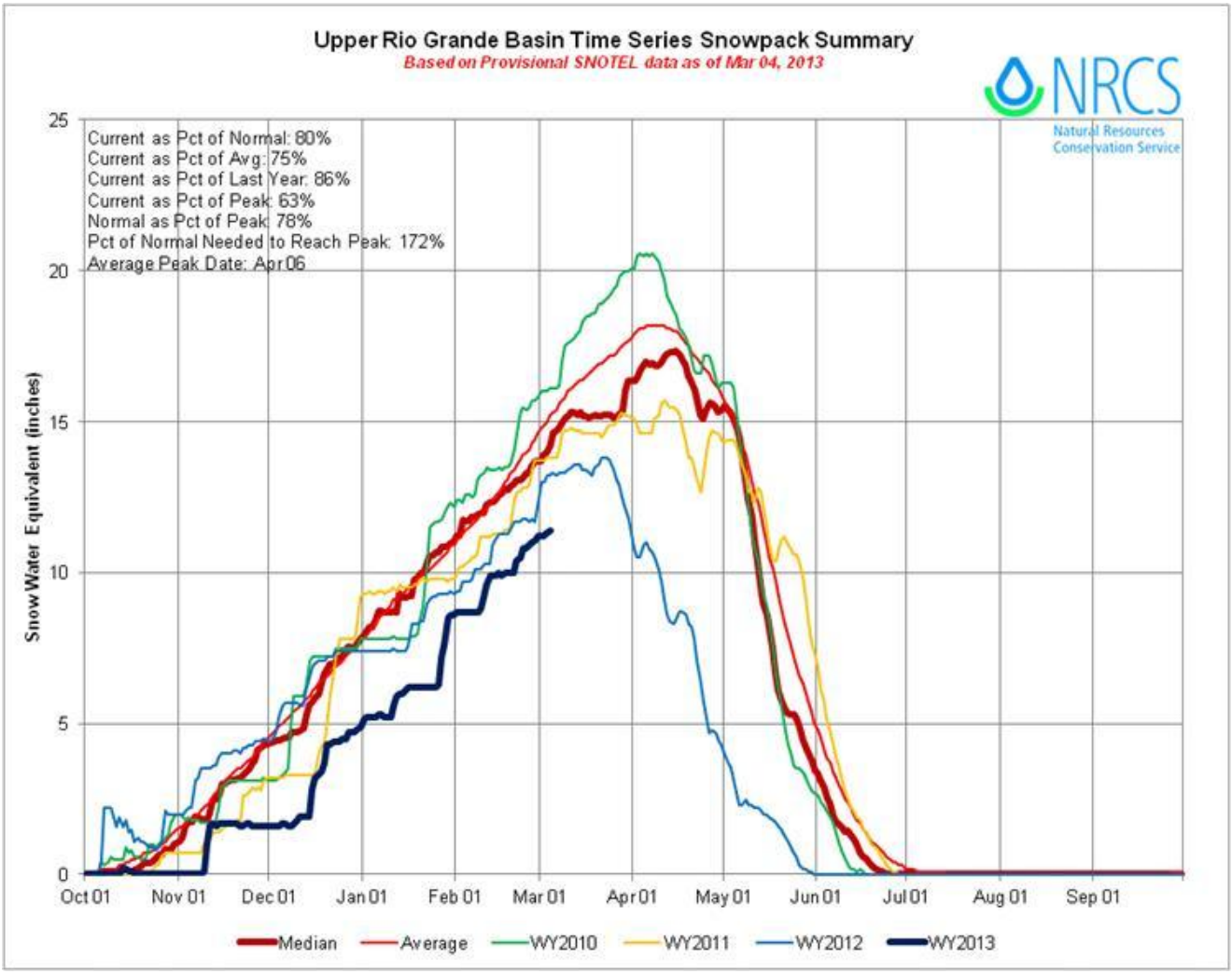

Exhibit C

Project Design – Beiriger Farms

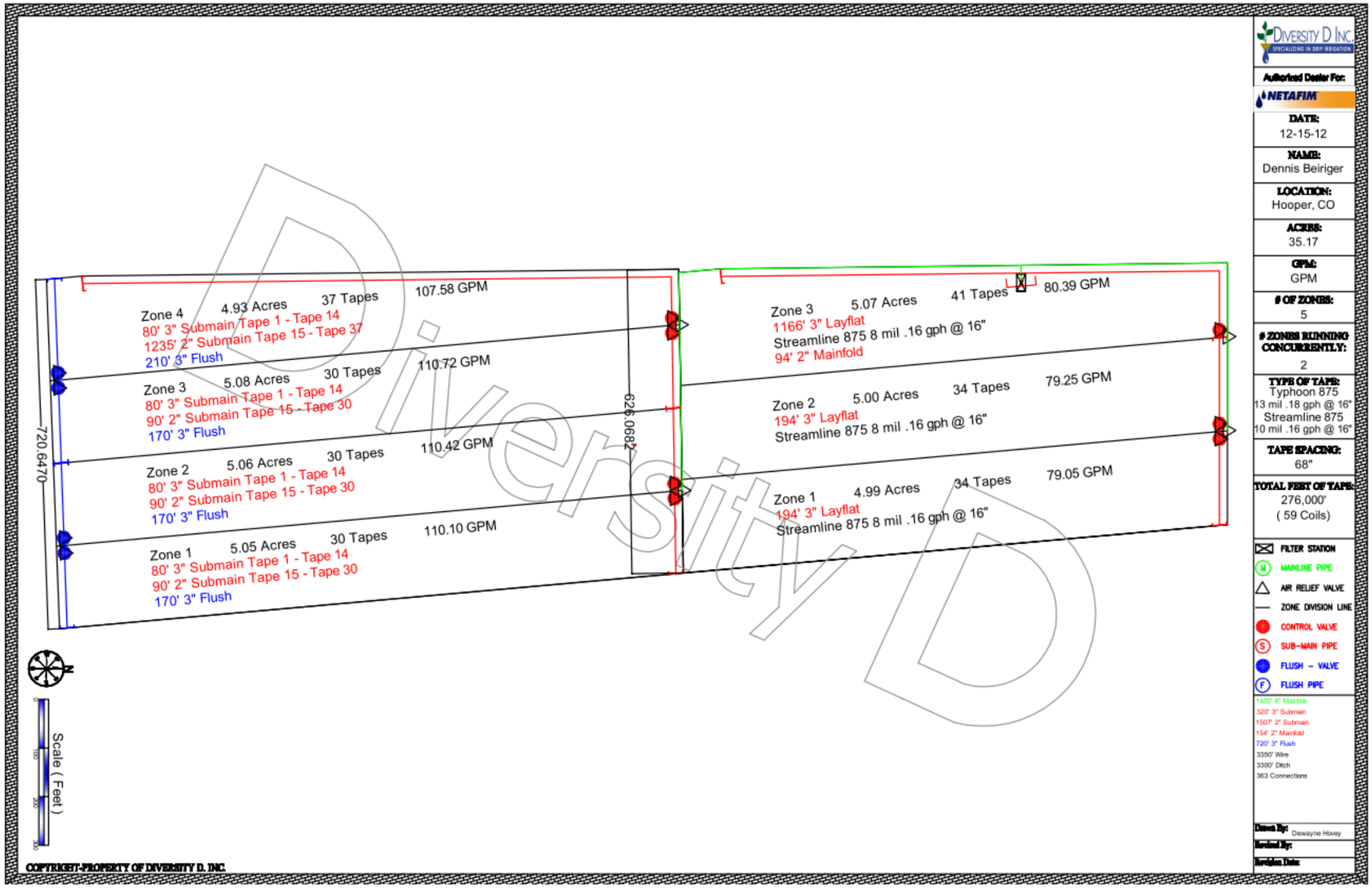

Exhibit C

Project Design – Christensen Farm

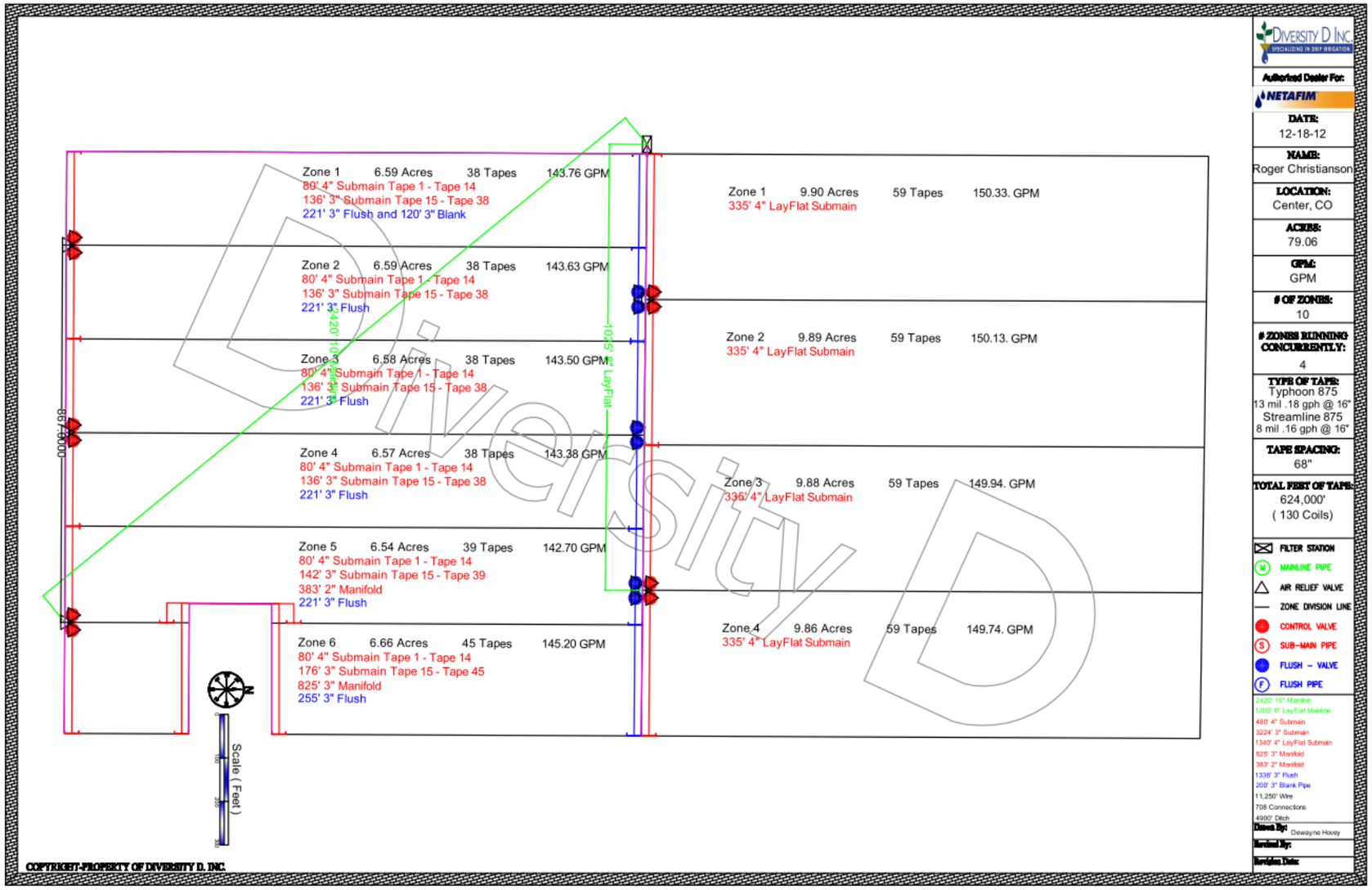

Exhibit C

Photos

Exhibit C

Supplemental Information

Efficiency of Subsurface Drip Irrigation for Potato Production under Different Dry Stress Conditions

- M. A. BADR, S. D. ABOU HUSSEIN, W. A. EL-TOHAMY, N. GRUDA

Abstract

Efficient water delivery systems such as drip irrigation can contribute towards increasing crop yield potential, improving crop water and fertilizer use efficiency. However, critical management considerations such as subsurface drip irrigation are necessary to attain improved irrigation efficiencies and production benefits particularly under arid regions. The objective of this study was to determine the effect of two irrigation methods, surface and subsurface drip irrigation combined with four irrigation levels, 100, 80, 60 and 40% of crop evapotranspiration on yield and yield components of potato grown on sandy soil. The field experiments were conducted in the years 2008 and 2009. In terms of soil water availability to plants, subsurface drip provided more favorable growth conditions for plant growth and maintained higher soil water content at the root zone, which resulted in a significant higher potato yield compared to surface drip irrigation. The difference between the two irrigation methods on yield components was concentrated on the mean tuber weight per plant, while no significant difference was found on the tuber number per plant. Reducing the amounts of applied water significantly decreased total potato yield and its components. Under subsurface drip irrigation, reducing amounts of applied water to 80% ETc gave comparable yield and yield components to surface drip at full irrigation supply, indicating that 20% irrigation water can be saved without affecting the potato yield. At all irrigation levels, subsurface drip recorded higher water use efficiency (WUE) over surface drip. Maximum value was observed at 40% ETc. Fertilizer use efficiency (FUE) was also higher under subsurface drip and reduced significantly under both irrigation methods with increasing water deficit. These results suggested that subsurface drip offers the potential of better water management with respect to saving and distribution of water in the root zone and to obtain maximum yield accompanied by highest water and FUE.

Appendix 1
Reference Information

The following information is available via the internet. The reference information provides additional detail and background information.

- Water Supply Reserve Account main webpage:
  - http://cwcb.state.co.us/LoansGrants/water-supply-reserve-account-grants/Pages/main.aspx
- Water Supply Reserve Account – Basin Fund Application Details:
  - http://cwcb.state.co.us/LoansGrants/water-supply-reserve-account-grants/Pages/BasinWaterSupplyReserveAccountGrants.aspx
- Water Supply Reserve Account – Statewide Fund Application Details:
  - http://cwcb.state.co.us/LoansGrants/water-supply-reserve-account-grants/Pages/StatewideWaterSupplyReserveAccountGrants.aspx
- Colorado Water Conservation Board main website:
  - http://cwcb.state.co.us/
- Interbasin Compact Committee and Basin Roundtables:
  - http://cwcb.state.co.us/about-us/about-the-ibcc-brts/Pages/main.aspx/Templates/BasinHome.aspx
- House Bill 05-1177 – (Also known as the Water for the 21st Century Act):
  - http://cwcbweblink.state.co.us/DocView.aspx?id=105662&searchhandle=28318
- House Bill 06-1400 – (Adopted the Interbasin Compact Committee Charter):
  - http://cwcbweblink.state.co.us/DocView.aspx?id=21291&searchhandle=12911
- Senate Bill 06-179 – (Created the Water Supply Reserve Account):
  - http://cwcbweblink.state.co.us/DocView.aspx?id=21379&searchhan

dle=12911

- Statewide Water Supply Initiative 2010:
    - http://cwcb.state.co.us/water-management/water-supply-planning/Pages/SWSI2010.aspx

Appendix 2
Insurance Requirements

NOTE: The following insurance requirements taken from the standard contract apply to WSRA projects that exceed $25,000 in accordance with the policies of the State Controller's Office. Proof of insurance as stated below is necessary prior to the execution of a contract.

13. INSURANCE

Grantee and its Sub-grantees shall obtain and maintain insurance as specified in this section at all times during the term of this Grant: All policies evidencing the insurance coverage required hereunder shall be issued by insurance companies satisfactory to Grantee and the State.

A. Grantee

i. Public Entities

If Grantee is a "public entity" within the meaning of the Colorado Governmental Immunity Act, CRS §24-10-101, et seq., as amended (the "GIA"), then Grantee shall maintain at all times during the term of this Grant such liability insurance, by commercial policy or self-insurance, as is necessary to meet its liabilities under the GIA. Grantee shall show proof of such insurance satisfactory to the State, if requested by the State. Grantee shall require each Grant with Sub-grantees that are public entities, providing Goods or Services hereunder, to include the insurance requirements necessary to meet Sub-grantee's liabilities under the GIA.

ii. Non-Public Entities

If Grantee is not a "public entity" within the meaning of the GIA, Grantee shall obtain and maintain during the term of this Grant insurance coverage and policies meeting the same requirements set forth in **§13(B)** with respect to sub-Grantees that are not "public entities".

B. Sub-Grantees

Grantee shall require each Grant with Sub-grantees, other than those that are public entities, providing Goods or Services in connection with this Grant, to include insurance requirements substantially similar to the following:

i. Worker's Compensation

Worker's Compensation Insurance as required by State statute, and Employer's Liability Insurance covering all of Grantee and Sub-grantee employees acting within the course and scope of their employment.

ii. General Liability

Commercial General Liability Insurance written on ISO occurrence form CG 00 01 10/93 or equivalent, covering premises operations, fire damage, independent Grantees, products and completed operations, blanket Grantual liability, personal injury, and advertising liability with minimum limits as follows: **(a)**$1,000,000 each occurrence; **(b)** $1,000,000 general aggregate; **(c)**

$1,000,000 products and completed operations aggregate; and **(d)** $50,000 any one fire. If any aggregate limit is reduced below $1,000,000 because of claims made or paid, Sub-grantee shall immediately obtain additional insurance to restore the full aggregate limit and furnish to Grantee a certificate or other document satisfactory to Grantee showing compliance with this provision.

iii. Automobile Liability

Automobile Liability Insurance covering any auto (including owned, hired and non-owned autos) with a minimum limit of $1,000,000 each accident combined single limit.

iv. Additional Insured

Grantee and the State shall be named as additional insured on the Commercial General Liability and Automobile Liability Insurance policies (leases and construction Grants require additional insured coverage for completed operations on endorsements CG 2010 11/85, CG 2037, or equivalent).

v. Primacy of Coverage

Coverage required of Grantee and Sub-grantees shall be primary over any insurance or self-insurance program carried by Grantee or the State.

vi. Cancellation

The above insurance policies shall include provisions preventing cancellation or non-renewal without at least 45 days prior notice to the Grantee and the State by certified mail.

vii. Subrogation Waiver

All insurance policies in any way related to this Grant and secured and maintained by Grantee or its Sub-grantees as required herein shall include clauses stating that each carrier shall waive all rights of recovery, under subrogation or otherwise, against Grantee or the State, its agencies, institutions, organizations, officers, agents, employees, and volunteers.

C. Certificates

Grantee and all Sub-grantees shall provide certificates showing insurance coverage required hereunder to the State within seven business days of the Effective Date of this Grant. No later than 15 days prior to the expiration date of any such coverage, Grantee and each Sub-grantee shall deliver to the State or Grantee certificates of insurance evidencing renewals thereof. In addition, upon request by the State at any other time during the term of this Grant or any sub-grant, Grantee and each Sub-grantee shall, within 10 days of such request, supply to the State evidence satisfactory to the State of compliance with the provisions of this **§13**.

Appendix 3
Water Supply Reserve Account Standard Contract Information

NOTE: The standard contract is required for WSRA projects that exceed $100,000. (Projects under this amount will normally be funded through a purchase order process.) Applicants are encouraged to review the standard contract to understand the terms and conditions required by the State in the event a WSRA grant is awarded. Significant changes to the standard contract require approval of the State Controller's Office and often prolong the contracting process.

It should also be noted that grant funds to be used for the purchase of real property (e.g. water rights, land, conservation easements, etc.) will require additional review and approval. In such cases applicants should expect the grant contracting process to take approximately 3 to 6 months from the date of CWCB approval.

The standard contract is available here under the header "Additional Resources" on the right side:
http://cwcb.state.co.us/LoansGrants/water-supply-reserve-account-grants/Pages/BasinWaterSupplyReserveAccountGrants.aspx

Appendix 4
W-9 Form

NOTE: A completed W-9 form is required for all WSRA projects prior execution of a contract or purchase order. Please submit this form with the completed application.