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Colorado Water Conservation Board
Department of Natural Resources

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TO: Colorado Water Conservation Board Members

FROM: Andy Moore, Water Resources Engineer
Interstate, Federal, & Water Information Section

DATE: May 17-18, 2017 Board Meeting

AGENDA ITEM: 29. Underground Storage Pilot Projects – Grant Applications
a. Trout Creek Park Alluvial Aquifer Storage Pilot Project

Background

In Section 8 of the 2016 Projects Bill (SB16-174), Senator Sonnenberg placed a $200,000 appropriation for CWCB to conduct underground storage pilot projects "to further evaluate the suitability of various aquifers to store water, availability of water to be stored, and a conceptual framework to initiate an underground storage project."

The Upper Arkansas Water Conservancy District (District) has applied for $100,000 from this appropriation for Phase 1 of the Trout Creek alluvial aquifer storage pilot project, located just south of Buena Vista. The total project cost is $220,000; matching funds of $120,000 are being provided.

The District is currently moving forward with two multi-use projects focused on storage needs in the upper basin: the Lake Ranch and Trout Creek Park multi-use projects. The Trout Creek Park project is the principal project with potentially 10,000 to 20,000 acre-feet of available storage capacity in the alluvium. The objectives of this Phase 1 of the project are to install a delivery system to a recharge pond, install metering equipment, monitor recharge rates and groundwater levels, construct and monitor additional test wells, and develop a plan for Phase 2 of the project.

Note that the alluvial aquifer along the Arkansas River from Buena Vista to Salida was highly ranked for aquifer storage potential in the SB06-193 Underground Water Storage Study completed by CWCB in March 2007.

A detailed scope of work and estimated costs are attached.

Staff recommendation

CWCB Staff recommends that the Board approve this $100,000 grant to the District.

Exhibit A
Statement of Work & Cost Estimates

Date: 3/29/17

WATER ACTIVITY NAME –Trout Creek Park Alluvial Aquifer Storage Pilot Project- Phase 1

GRANT RECIPIENT – Upper Arkansas Water Conservancy District

FUNDING SOURCE – CWCB Underground Storage Pilot Project Funding

INTRODUCTION AND BACKGROUND

Multiple purpose water projects are necessary for providing additional needed water supplies in the Twenty First Century. Increasing supplies are essential for all uses of water—municipal, industrial, irrigation (agriculture), recreation and the environment. Storage and management of storage is the element common to all and is necessary to achieve success. Currently, the Upper Arkansas Water Conservancy District (the District) is moving forward with two multi-use projects that focus on the need for upper basin storage- The Lake Ranch Multi-Use Pilot Project and the Trout Creek Park Multi-Use Project. The Trout Creek Park Project is the principal project and the ranch property presents unique opportunities for water development, agricultural protection, enhancement of recreation and environmental benefits. The pressures from growth require additional water storage and is a clarion's call to preserve the social, cultural and environmental fabric unique to this part of Colorado. The District is moving forward with the alluvial aquifer storage component of the Trout Creek Park project. Preliminary engineering suggests 10,000 to 20,000 acre-feet of storage is available in the alluvium at the Trout Creek Park location.

Aquifer storage at Trout Creek Park will be achieved by establishing infiltration (or recharge) ponds on non-irrigated lands thus using the aquifer as a storage vessel. This type of aquifer storage can be viewed as a long-term recharge or return flow model. Fully consumable water is infiltrated through recharge ponds and travels along the thalweg until it reaches the river. The timing associated with this return flow is the storage component. Aquifer storage can also be used as (or viewed as) a water bank. Fully consumable water can be purchased in a wet year or water conserved through fallowed irrigation lands can be stored "banked' in the aquifer for a future use.

Preliminary Engineering at Trout Creek Park

A recharge response timing analysis was performed using the IDS AWAS model, which is based on the "Analytical Stream Depletion Model.". The recharge path was determined based on the interpretation of groundwater potentiometric surface contours developed from groundwater monitoring wells, and the location of the Trout Creek historic thalweg which shows a southerly flow path. Depletion (i.e., recharge) distance, from the recharge pond to the river, was measured at 11,485 feet, and the aquifer width was measured at 13,301 feet. Aquifer width is measured from the river to an impermeable boundary, in this case located at the alluvium/bedrock boundary.

In partnership with land and water rights owner Mr. Paul Moltz, a recharge pond has been recently constructed at the Trout Creek Park location and the District has received administrative approval from the Division of Water Resources to divert and store fully consumable water in the alluvium under its Rule 14 plan. The Trout Creek Park Recharge project will divert water from Cottonwood Creek at the Trout Creek Ditch Company headgate, convey the water down the ditch, into the Moltz stabilization pond, and then into Moltz's existing infrastructure. From the existing pipeline, a new pipeline will be connected to deliver the water to the newly-constructed recharge pond. From there, water will then infiltrate into the aquifer and then accrete to the river approximately along the recharge path.

The Web Soil Survey tool identifies the soil at the pond to be gravelly alluvial with a saturated hydraulic conductivity of approximately 8 feet per day, which should provide adequate recharge infiltration for the pond. Depth to groundwater is estimated to be 30-60 feet, based on monitoring (well) data in the vicinity. This should provide adequate storage space for all recharge deliveries and should not adversely impact any surface activities along the recharge path. Engineering analysis of the return flows from the recharge ponds to the Arkansas River are approximately 256 months with peak accretions hitting the river after 6 years. This lag time allows water managers to plan well into the future and will secure a reliable water source for future use.

Purpose

The purpose of this proposal is to secure funding to further investigate the aquifer storage potential at Trout Creek Park. Our preliminary engineering analysis has provided us with a positive outlook for aquifer storage, but at this point, most of the analysis has only been done on paper. Funding is needed to deliver physical water to the recharge pond and investigate what happens in a real case scenario. Engineering calculations and evaluation can only take you so far. At this point, we are ready to place fully consumable water in the recharge pond and monitor the results. Once we have successfully delivered water to the recharge pond, we can monitor the infiltration rates and groundwater levels. The results of this study will allow us to accurately determine the available storage space in the aquifer and return flow timing. This pilot project can serve as an example of the innovative ways that we are addressing our future water challenges and can provide a demonstration that can be transferable across the State on how to implement alluvial aquifer storage projects of the future.

Phase Two- Future Work

Phase two of this project (not included in this grant application) will be to develop groundwater modeling. The groundwater modeling will be compared with the results of the Glover Model (used in preliminary engineering) to analyze the limitations or accuracy of using the Glover Model for alluvial aquifer storage. The deliverable will be the results of this comparison and a detailed modeling system that can be used to accurately implement alluvial aquifer storage projects across the State.

Phase 2 will also investigate the construction and delivery systems needed for multiple recharge ponds along the historic thalweg. Additional recharge ponds would allow for flexibility of retiming of water for storage and additional recharge facilities. The Helena Ditch, which delivers water from the Main Stem of the Arkansas, will be analyzed as a potential future delivery system that can be utilized to increase the flexibility of the system and develop sustainability for increased use of the aquifer as a storage vessel.

OBJECTIVES

- Purchase and construct delivery system (piping) from existing infrastructure to recharge pond
- Purchase and install metering equipment
- Monitor recharge rates at the recharge pond
- Monitor groundwater levels through existing test wells across the project area
- Construct and monitor localized test wells to provide detailed analysis of the aquifer
- Phase 2 Strategic Plan- Funding from this grant will be used to develop a strategic plan for Phase 2 of this project. Elements of Phase 2 include:
    - Development of detailed groundwater modeling for the Trout Creek Park location
    - Groundwater modeling and Glover model analysis and comparison
    - Investigation and feasibility of the construction of additional recharge ponds and delivery systems along historic thalweg at Trout Creek Park
    - Investigation and feasibility of the use of the Helena Ditch for Main-Stem deliveries to recharge sites
    - Legal considerations to maximize the use of the aquifer storage potential at Trout Creek Park location.

TASKS

TASK A – Delivery of Water to Existing Pond

Description of Task
Delivery system materials (piping) are needed to deliver water to the newly constructed recharge pond. Piping will be added to the existing infrastructure to gravity feed the water from the existing pipeline to the recharge pond. Metering equipment is needed to accurately monitor the amount of water delivered. Preliminary engineering has identified the type and length of pipe needed for the delivery system and identified the metering equipment that will be used.

Method/Procedure
- Purchase all delivery system materials and metering equipment needed
- Work with land and water rights owner Mr. Paul Moltz to construct the delivery system
- Establish when water can be delivered through the system per existing water rights and operations of the Trout Creek Ditch Company Ditch
- Deliver water through the newly constructed delivery system and into the recharge pond

Deliverable
Water will be delivered through the delivery system and will begin filling the recharge pond. Water will infiltrate into the aquifer and accrue back to river over time. The deliveries will be metered, monitored and reported as part of this analysis.

TASK B- Monitoring of Intake Rates of the Recharge Pond

Description of Task
The recharge pond will be monitored on a regular basis. Physical measurements will be taken to determine the recharge rate of the pond over a 2-year period.

Method/Procedure
- A measurement schedule will be determined based on delivery of water to the recharge pond
- Measurements will be taken continuously after water has been delivered
- Analysis will be based on delivery schedule and measurement results
- Recharge rates or infiltration rates will be determined for the recharge pond

Deliverable
Accurate calculation of recharge rates for the recharge pond will be established. Recharge rates will be used to determine the return flow timing back to the river and establish the storage potential in the aquifer. The recharge rates established from monitoring will be compared against preliminary engineering recharge rate results in Phase 2 of the project and will assist in the development of groundwater modeling.

TASK C- Monitoring of Groundwater Levels Using Existing Wells

Description of Task
Groundwater levels will be monitored using existing piezometers that are located throughout the project area. Groundwater levels will be measured on a regular basis based on water delivery schedule to the recharge pond.

Method/Procedure
- Monthly measurement will be taken for 2 years
- Measurements will be plotted and analyzed

- Results will be used to establish return flow rates and storage potential

Deliverable
Results will be used to develop preliminary groundwater modeling that will implemented as part of Phase 2 of this project

TASK D- Localized Monitoring Around Recharge Pond- Piezometers

Description of Task
Construction of new test wells (piezometers) are needed around the recharge pond area. Existing wells are a considerable distance from the recharge pond and will not provide the detailed information needed for accurate groundwater modeling in the localized area. Localized piezometers will be used to study the aquifers return flow timing, disbursement of water, flow path and potential storage.

Method/Procedure
- Construct test wells around the recharge pond and along the historic flow path
- Monitor the piezometers on a regular basis for 2 years
- Measurements will be plotted and analyzed
- Identify flow path, timing, and disbursement of water in the aquifer

Deliverable
Results will be used to develop preliminary groundwater modeling that will implemented as part of Phase 2 of this project

TASK E- Development of Strategic Plan for Phase 2

Description of Task
Preliminary data collection, feasibility analysis and strategic planning will be established for Phase 2.

Method/Procedure
- Research on comparison strategies for groundwater modeling and Glover Model analysis
- Research on the use of additional recharge ponds and delivery systems
- Research on the use of the Helena Ditch

Deliverable
Final Strategic Plan for Phase 2 of the alluvial aquifer storage pilot project

Task F- Project Management

Description of Task
Project Management will be conducted by UAWCD Project Manager Chelsey Nutter. Project management will consist of coordination between all parties including land owner Mr. Paul Moltz, Colorado River Engineering, CWCB, and UAWCD Staff. The Project Manager will be responsible for task management, correspondence, reporting, conducting meeting, grant management, and any other additional items that are needed to implement Phase 1 of the project.

Method/ Procedure
- Work as primary contact for all project needs
- Hold preliminary, progress, and final meetings with Mr. Moltz, Co. River Engineers, and UAWCD

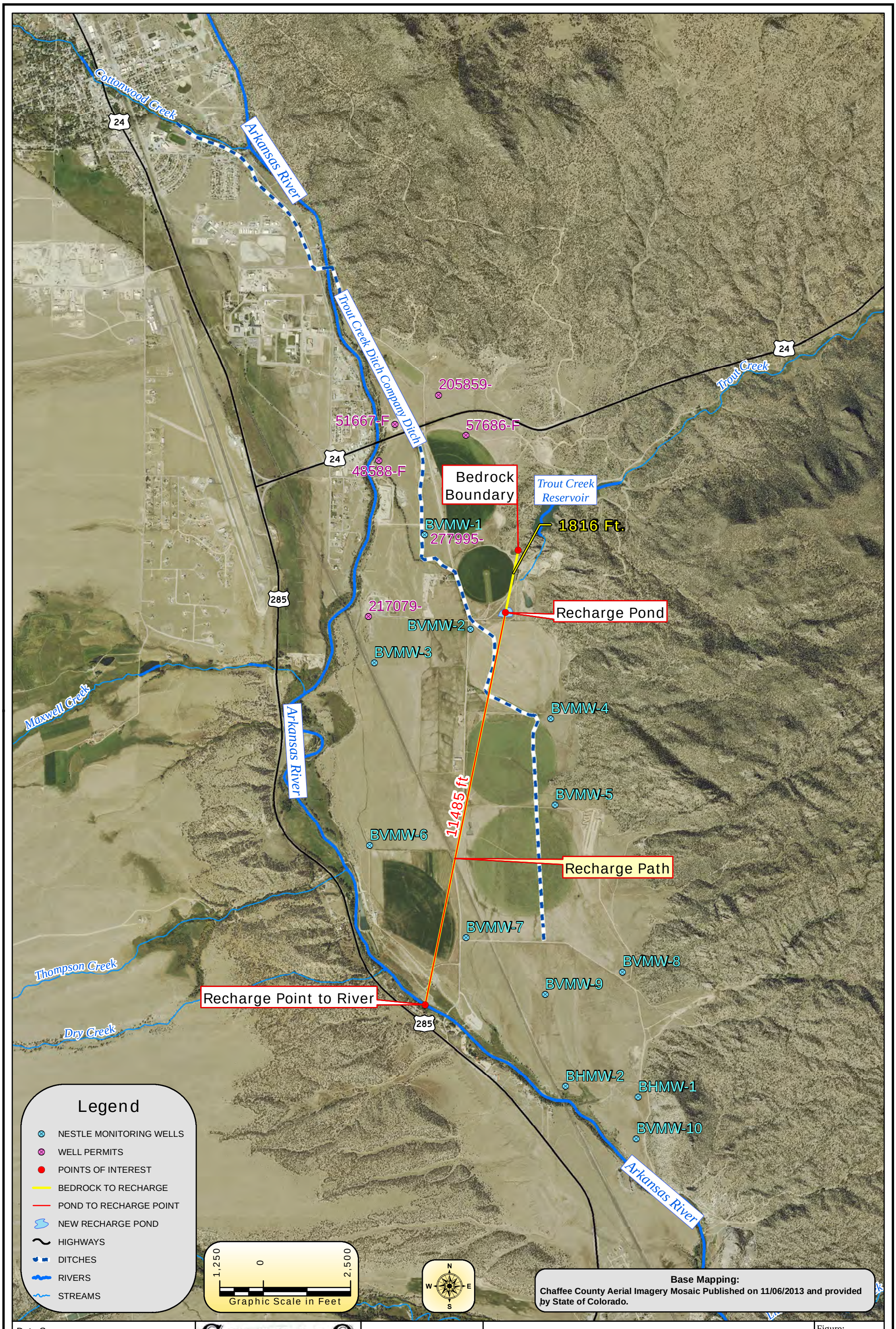
- Provide regular progress reporting to CWCB staff
- Provide task management
- Provide grant management
- Provide final reporting and presentation to all interested parties

Deliverable
Successful completion of Phase 1 and successful delivery of all reporting to CWCB staff.

Final Deliverables for Phase 1- Alluvial Aquifer Storage Pilot Project

The final deliverable will consist of a report of all findings from tasks A thru D and the strategic plan for Phase 2 of the project. Final reports and strategic plans will be sent to the CWCB for review. Presentations on our findings for the Trout Creek Park Alluvial Aquifer Storage Project will be made for the Arkansas Basin Roundtable and the Colorado Water Conservation Board.

Trout Creek Park Alluvial Aquifer Storage Pilot Project - Phase 1 Budget								
Cost Estimates						Funding Request		
		Qty	Units	Unit/cost	Cost	CWCB	UAWCD/3rd Party Match	
Task A- Water Delivery								
1	12" Pipe	4700	feet	$ 10	$ 47,000		$	47,000
2	Pipe installation, earthwork	4700	feet	$ 12	$ 56,400	$ 3,400	$	53,000
3	Manholes, Valves, & Flow Meter	1	Lump sum	$ 10,000	$ 10,000	$ 10,000		
4	Engineering Design, const observation	66	hrs	$ 100	$ 6,600	$ 6,600		
				Task A Total	$ 120,000	$ 20,000	$	100,000
Task B- Recharge Rates								
1	Drawdown Observations (8 visits @ 10 Hours)	80	hrs	$ 100	$ 8,000	$ 8,000		
2	Report summary inflow, drawdowns, evap	15	hrs	$ 130	$ 2,000	$ 2,000		
				Task B Total	$ 10,000	$ 10,000	$	-
Task C- Groundwater Monitoring Aquifer								
1	Groundwater Observations (24 visits @ 10 Hours)	240	hrs	$ 100	$ 24,000	$ 24,000		
2	Analyze data, Report summary	46	hrs	$ 130	$ 6,000	$ 6,000		
				Task C Total	$ 30,000	$ 30,000	$	-
Task D Groundwater Monitoring at Recharge site								
1	Observations (24 visits @ 5 Hours)	120	hrs	$ 100	$ 12,000	$ 12,000		
2	Analyze data, Report summary	46	hrs	$ 130	$ 6,000	$ 6,000		
3	Twpo piezometers	2	LS	$ 6,000	$ 12,000	$ 12,000		
				Task D Total	$ 30,000	$ 30,000	$	-
Task E- Strategic Plan Phase 2 Scope of Work								
1	Report summary, scope of work, meetings	77	hrs	$ 130	$ 10,000	$ 10,000		
				Task E Total	$ 10,000	$ 10,000	$	-
Task F- Project Management (In-Kind UAWCD)								
1	Task Management, Coordination between all Parties, Management of Schedules and Meetings, Administration, Grant Management, and Reporting.	10	%	$ 200,000	$ 20,000		$	20,000
				Task F Total	$ 20,000	$ -	$	20,000
				Grand Total	**$ 220,000**	**$ 100,000**	**$**	**120,000**



Data Sources:
U.S. Bureau of Land Management
U.S. Census Bureau
U.S. Department of Agriculture
U.S. Geological Survey
CO Department of Water Resources
CO Department of Transportation

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Trout Creek Recharge Project

Figure: 1

Document Name: Rule_14_Recharge2.mxd

Drawn by: JT | Approved by: CM | Date: 3/22/2016

Client: UAWCD