Water Supply Reserve Account – Grant and Loan Program
Water Activity Summary Sheet
September 11-12, 2014
Agenda Item 13(d)

Applicant & Program Sponsor: El Paso County

Water Activity Name: El Paso County Groundwater Quality Study Phase 2c

Water Activity Purpose: Water Quality Study

County: El Paso

River Basin: Arkansas

Water Source: Upper Black Squirrel Creek

Total Amount Requested: $51,933

Source of Funds: $10,000 Arkansas Basin Account; $41,933 Statewide Account

Matching Funds: Basin Account Match ($10,000) = 19% of total grant request
Basin Account & Applicant Match ($112,950) = 218% of total grant request
Applicant Match ($102,950) = 67% of total study costs ($154,833)
(refer to *Funding Summary/Matching Funds*)

Staff Recommendation:
Staff recommends approval of up to $10,000 from the Arkansas Basin Account and $41,933 from the Statewide Account to help complete the study titled: El Paso County Groundwater Quality Study Phase 2c.

Water Activity Summary: The unincorporated area of El Paso County is the primary source of drinking water for many rural residents, as well as numerous municipal entities and their customers. More than 35,000 people depend on this groundwater supply, which is also in the same general area that oil and gas development companies have been writing leases with local landowners. The Groundwater Quality Study Committee is a group appointed by the Board of County Commissioners of El Paso County. In 2009 the Committee developed data necessary for the protection and enhancement of the alluvial storage space and groundwater dependent areas of the County. The mission of the coalition is to evaluate existing water quality data on nitrates and other contaminants, fill data gaps and explore land use and water resources planning implications. The County, under a shared funding arrangement with Committee partners, contracted with the Colorado Geologic Survey to conduct Phase 1 of the Groundwater Quality Study. The project is now ready to complete Phase 2c by building on the work of Phase 1 and work completed in 2011 and further water quality parameter sampling completed in 2013 & 2014 under Phase 2a and 2b, respectively. The US Geologic Survey was a technical advisor for Phase 1 and is the lead consultant for Phase 2. WSRA funds are requested for identification of and/or installation of monitoring wells to include in a long-term monitoring program, hydrologic evaluation, additional aquifer characteristics analysis and vulnerability potential, to provide for early detection of possible contamination that may be a risk to human health and the

environment. The El Paso County Groundwater Quality Study Phase 2c (Task 5) is the next step towards quantifying how much an enhanced storage and banking operation would protect water quality in the face of urbanized growth, oil and gas development and historic agricultural interests. Specific objectives are more thoroughly described in Task 5 in the attached Statement of Work.

Discussion:
Phase 1 was partially funded through a $35,000 WSRA grant in 2012.

Issues/Additional Needs:
No issues or additional needs have been identified.

Threshold and Evaluation Criteria:
The application meets all four Threshold Criteria

Tier 1-3 Evaluation Criteria:

Tier 1: (a) Numerous local entities and both local and State agencies will be able to utilize the Phase 2 baseline water quality study results and related age dating vulnerability assessment mapping for policy decisions and revisions that seek to address the goal of prolonging water supply and quality of El Paso County groundwater resources. The Arkansas Roundtable sees this as a project of Statewide significance given that the methodology used in the study for age dating the aquifer supply and correlating a groundwater pollution vulnerability and probability model is a tool that has been very valuable to this aquifer, to the Eagle River alluvial aquifer, and would likely be a valuable tool for many other alluvial aquifers throughout the state where competing uses and urbanization threaten to increase the gap through diminished water quality.

(b) The project is supported by the Cherokee Metropolitan District. Additional entities represented in the application include the local Designated Basin Management District (Upper Black Squirrel Creek), the Colorado Groundwater Commission, the El Paso County's Health Department and Development Services, and the Pikes Peak Regional Water Authority, whom are all vested in the long-term protection of the alluvial storage and water resources, but all recognize an insufficient data set on water quality, aquifer characteristics and vulnerability to contamination. The project will generate baseline water quality data that includes constituents of concern that may result from oil and gas development activities and in this respect the study has been scoped to promote cooperation and collaboration among traditionally competitive consumptive water interests and a blossoming energy sector.

(c) The collaborative protection and promotion of water quality and enhanced water storage will lead to greater cooperation, minimized evaporative losses from surface storage, better science based decisions, and utilization of El Paso County resources to meet El Paso County water demands, thereby reducing demand on the mainstem of the Arkansas and Platte Rivers and seeking to further develop efficient storage

that can reduce the Fountain Creek return flow and stormwater issues while making the most of any mainstem and/or trans-mountain water resources utilized in the County. This study will allow policy makers appropriate tools and resources in their decisions on how the basin is protected from potential contamination and further quantify how the basin could be used as enhanced storage and water making for future generations.

Tier 2: (d) The Phase 2 Groundwater Quality Study has a sizable scope of work with valuable deliverable which come at significant costs, for which there are very important long-range land use planning and supply security implications. Despite very significant local buy in from a wide variety of entities across a wide spectrum of industries and institutions, there is an unmet funding need. WSRA funding will provide measurable and significant leverage of the local dollars, allowing this valuable project to move forward.

(e) Local stakeholders have funded approximately 30% of the project, USGS matching funds can be leveraged up to 42% or $144,000 if the full stream of adequate matching funds can be developed on top of local stakeholder contributions. Additionally, numerous other entities are making and have committed to on-going in-kind technical and/or manpower contributions that are essential to the budget and success of the Phase 2 project. El Paso County Health Department has committed to provide an intern, as needed, to assist USGS, in addition to a multitude of land use, zoning, small area master planning, and transportation and growth prediction mapping resources essential to the interface of vulnerability assessment with land use. Municipal districts and the Groundwater Management District have committed their consultants, staff, laboratory facilities, well logs and other relevant records.

Tier 3: (f) The project is essential to the protection of multiple use source of supply that supports everything from agriculture to industry..

(g) n/a

(h) n/a

(i) The oil and gas specific work and its incorporation into a vulnerability assessment based on geosciences is a model that can be utilized across this state and beyond.

(j) n/a

Funding Overview/Matching Funds:

	Cash	In-kind	Total
WSRA Statewide Account	$41,933	n/a	$41,933
WSRA Arkansas Basin Account	$10,000	n/a	$10,000
El Paso County	$5,000	$0	$5,000
Cherokee Metro District	$17,500	$0	$17,500
Woodmen Hills Metro District	$5,000	$0	$5,000
Mountain View Electric Association	$5,000	$0	$5,000
State Land Board	$5,000	$0	$5,000
USGS	$65,450	$0	$65,450
Total	**$154,883**	**$0**	**$154,883**

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 will help promote the development of a common technical platform. In accordance with the revised WSRA Criteria and Guidelines, staff would like to highlight additional reporting and final deliverable requirements. The specific requirements are provided below.

Reporting and Final Deliverable: 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 scope of work including a description of any major issues that have occurred and any corrective action taken to address these issues. 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.

Engineering: All engineering work (as defined in the Engineers Practice Act (§12-25-102(10) C.R.S.)) performed under this grant shall be performed by or under the responsible charge of professional engineer licensed by the State of Colorado to practice Engineering.

Arkansas Basin Roundtable

PLANNING OUR WATER FUTURE

Colorado Water Conservation Board
Attn: Mr. Craig Godbout
Program Manager, Water Supply Planning Section
1580 Logan Street, Suite 200
Denver CO 80203

August 11, 2014

Re: WSRA Grant Recommendation - El Paso County Groundwater Quality Study Project Phase 2-C (Task no. 5)
Dear Mr. Godbout;

At its July 9, 2014 Arkansas Basin Roundtable meeting, the Roundtable unanimously supported the $51,932.50 WSRA grant for the El Paso County Groundwater Quality Study Project Phase 2-C (Task no. 5) and recommends $10,000 from the Ark Basin Funds, which supported a phase 1 study and prior aquifer storage capacity quantification study, and the remaining balance of $41,932.50 from the Statewide funds. The Roundtable believes that aquifer storage in the Arkansas, South Platte and Colorado River Basins is key to future water supply management, administration, and meeting the needs of a growing Colorado economy. The Study area in the El Paso County Phase 2 study is the Upper Black Squirrel Creek Groundwater Basin, which is one of Colorado's eight (8) designated groundwater basins and an alluvial storage resource of significance identified in SB 06-193.

The total phase 2 groundwater quality baseline data, age dating of supply, and infiltration rate based vulnerability to pollution modeling scope is approximately 70% complete and the proposed $51,932.50 WSRA grant will be paired with contributions from local stakeholders and USGS matching funds to complete the approximately $344,000 study in mid-2015.

The preservation of water quality in the Upper Black Squirrel Alluvium is critical for agricultural interests, municipal interests, and a growing population of rural residential citizen, Until now little baseline data or modeling had been done to ensure local land use planners and water supply technocrats have the tools to protect and preserve this water resource and future alluvial storage resource for future generations. The Roundtable sees this as a project of Statewide significance given that the methodology used in the study for age dating the aquifer supply and correlating a groundwater pollution vulnerability and probability model is a tool that has been very valuable to this aquifer, to the Eagle River alluvial aquifer, and would likely be a valuable tool for many other alluvial aquifers throughout the state where competing uses and urbanization threaten to increase the gap through diminished water quality. Further, the significance with this study site having been identified in the SB-06-193 work, its relatively large storage capacity estimated at approximately 500,000 AF, and its geographic proximity to major front range metropolitan areas makes it an asset of importance in solving the water supply and climate variability challenges of the 21st Century.

If you have any further questions regarding the Roundtables support, please don't hesitate to call me.

Regards,

E.L. Konarski, Chr.
Arkansas Basin Roundtable

COLORADO
DEPARTMENT OF NATURAL RESOURCES

COLORADO WATER CONSERVATION BOARD

WATER SUPPLY RESERVE ACCOUNT APPLICATION FORM

Groundwater Quality Study, Phase 2c - Upper Black Squirrel Creek Alluvial Aquifer, El Paso County, Colorado

Name of Water Activity/Project

El Paso County by/through the Board of County Commissioners of El Paso County, Colorado, on behalf of its Aquifer Health and Groundwater Quality Study Committee.

Name of Applicant

Arkansas Basin Roundtable

Amount from Statewide Account: $41,932.50

Amount from Basin Account(s): $10,000

Total WSRA Funds Requested: $51,932.50

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

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.

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

1.	Applicant Name(s):	El Paso County by its Board of County Commissioners and their appointed Groundwater Quality Study Committee		
	Mailing address:	Groundwater Quality Study Committee c/o Elaine Kleckner, Community Services Department 2002 Creek Crossing Colorado Springs, CO 80905		
	Taxpayer ID#:	84-6000764		
	Primary Contact:	Ms. Elaine Kleckner	Position/Title:	Project Administrator
	Email:	ElaineKleckner@elpasoco.com		
	Phone Numbers:	Cell: 719-499-1375	Office:	719-520-6999
	Alternate Contact:	Mr. Sean Chambers	Position/Title:	Committee Chair
	Email:	SChambers@Cherokeemetro.org		
	Phone Numbers:	Cell: 719-499-5430	Office:	719-597-5080

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

The Groundwater Quality Study Committee is a group appointed by the Board of County Commissioners of El Paso County. The BoCC established a Groundwater Quality Study Committee in 2009 to develop data necessary in the protection and enhancement of the alluvial storage space and groundwater dependent areas of the County. It is comprised of public, private and nonprofit sector members. Water providers and the Upper Black Squirrel Creek Groundwater Management District (UBSCGWMD) are active participants, and State and Federal agency representatives serve as technical advisors and project collaborators. The mission of this coalition is to evaluate existing water quality data on nitrates and other contaminants, fill data gaps and explore land use and water resources planning implications. (See attached Resolution.) The County, under a shared funding arrangement with Committee partners, contracted with the Colorado Geological Survey (CGS) to conduct Phase 1 of the Groundwater Quality Study. The report is available at:
http://adm.elpasoco.com/Development%20Services/Pages/AdvisoryBoardsandCommittees.aspx

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

N/A

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.

N/A

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)	
	Agricultural	
	Municipal/Industrial	
	Needs Assessment	
	Education	
X	Other	Explain: Water quality study project for the protection of all water resources and uses within the Basin, and for the enhancement of the alluvial groundwater storage asset and water quality for Site no. 6 identified in SB06-193 as having potential for underground storage for all uses.

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

   The study project has been scoped to generate baseline water quality data that will be useful to local health department, agricultural users, individual well and septic system homeowners, municipalities, and Upper Black Squirrel Creek Groundwater Management District and the Groundwater Commission.

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

X	Study		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)	
X	Existing Storage Preserved or Enhanced (acre-feet)	
	Length of Stream Restored or Protected (linear feet)	
	Length of Pipe/Canal Built or Improved (linear feet)	
	Efficiency Savings (acre-feet/year OR dollars/year – **circle one**)	
	Area of Restored or Preserved Habitat (acres)	
X	Other -- Explain:	Suitability and vulnerability of 500,000 AF Upper Black Squirrel

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

Latitude: 38.84 Longitude: -104.38

The Groundwater Quality Study Committee's area of interest is El Paso County, with an initial focus on the Upper Black Squirrel Creek drainage basin including the area immediately south of the UBSCGWMD boundary where oil and gas exploration is occurring. The basin encompasses approximately 350 square miles in east-central El Paso County, Colorado. The basin lies east of the City of Colorado Springs. (See attached map.)

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.

The purpose of the project is to build on Phase 1 and work completed in 2011 and further water quality parameter sampling work completed in 2013 & 2014 under Phase 2a and 2b respectively, to continue and complete phase 2c of the El Paso County Groundwater Quality Study (Scope of Work Attached):

1) to refine the distribution, geometry, and hydrology of the alluvial and shallow bedrock aquifers in the northwestern portion of the Upper Black Squirrel Creek basin, and 2) to establish a groundwater monitoring network to detect and quantify impacts to water quality resulting from existing and proposed land uses that may degrade water supplies.

El Paso County is expected to use the data and recommendations to inform land use planning and determine if changes to policies and regulations are warranted. The study will also help other entities, such as special districts and UBSCGWMD make informed decisions regarding infrastructure planning. Installation of monitoring wells and establishing a groundwater monitoring program will support both water quality protection and water supply planning in the future. Establishing a water-quality baseline for the alluvial aquifer will be needed before conjunctive use/aquifer storage and recovery can occur to meet the water supply gap that has been identified by El Paso County.

Phase 1 of the Groundwater Quality Study was completed in March, 2011. The Phase 1 report, prepared by CGS, consists of a literature review, existing water quality data compilation/analysis, identification of potential contaminant sources based on land use, and a recommendation to implement the next phase. The U.S. Geological Survey (USGS) was a technical advisor for Phase 1 and will be the lead consultant for Phase 2. The USGS has worked with the Groundwater Quality Study Committee to develop the scope of work for Phase 2.

With this grant application, the Groundwater Quality Study Committee seeks to augment Phase 2 funding. Funds are requested for identification of and/or installation of monitoring wells to include in a long-term monitoring program, hydrogeologic evaluation, additional analysis aquifer characteristics and vulnerability potential, to provide for early detection of potential contamination issues that could impact human health and the environment.

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]

   The project is consistent with the statute and shall not have any impact upon water rights or the existing system of adjudication. In fact, the Study's data set and land use tools be valuable assets in the long-range protection of water quality, sourcewater protections, land use planning, watershed health management, aquifer storage or water banking program parameter development and the overall enhancement of the all uses who rely upon the aquifer storage within the Basin.

   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.

[To be completed following 6/20/14 Basin R.T. Needs Assessment]

[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.

Groundwater resources and aquifer storage capacity are absolutely essential to the support and vitality of life, economic viability, public heath, agricultural way of life, high plains habitat and environmental health here in El Paso County and beyond. The preservation of El Paso County resources and in particular the water and alluvial storage resources of the Upper Black Squirrel Creek Basin are essential to the long-term efficient use of water and supply sustainability of water supplies in El Paso County. That sustainability and potential alluvial storage within the aquifer should reduce water waste via evaporation; allow for long-range water quality protection and land use planning tools, and the limitation on increased return flows down Fountain Creek and efforts to by El Paso County entities seeking water from the Arkansas River's main stem.

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)

There are significant in-kind contributions from El Paso County, its Development Services Division, its Health Department, its Citizen volunteers, the Upper Black Squirrel Creek Groundwater Management District and its consultants, the Cherokee Metropolitan District and its consultants, the Meridian Metro Service District and its consultants, the Paint Brush Hills Metro District, Members of the Housing and Building Association, Colorado State Board of Land Commissioners, Mountain View Electric Association and the City of Colorado Springs. Financial Matches exceeding the above stated requirements are detailed in the attached Exhibit A

[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.

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.

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.

The project meets theWSRA Tier 1 criteria in the following ways:

1. The project, its deliverable data set and the GIS groundwater vulnerabilty mapping (with currently land use, but amendable based upon changes to land use over time) will be essential tools that lead to more efficent use of the existing resources, protection of the storage vessel, and better long-term protection of the water resources and the alluvial storage resource that was quantified in the 2006 C.G.S. study by Ralf Topper.
2. Numerous local entities and both local and State agncies will be able to utilize the Phase 2 baseline water quality study results and related age dating vulnerability assment mapping for policy decisions and revisions that seek to address the goal of prolonging the supply and quality of El Paso County groundwater resources. The local Designated Basin Management District (Upper Black Squirrel Creek) and the Colorado Groundwater Commission oversee the Upper Black Squirrel Creek Basin, including areas of agricultural interests, the municipal interests, and the El Paso County's Health Department and Development Services and the Pikes Peak Regional Water Authority are all vested in the long-term protection of the alluvial storage and water resources, but all recognize an insuffient data set on water quality, aquifer characteristics and vulnerability to contamination, specifically in the Upper Black Squirrel Basin's northwest quadrant where rapid urbanization has taken place overtop of relatively shallow bedrock in the area of Falcon, Colorad.
3. This unincorporated area of El Paso County is the primary source of drinking water for many rural residents, as well as numerous municipal entities and their customers. More than 35,000 people depend on this particualr source of supply and it is also in this same genearl area that oil and gas development copmpanies have been active writing leases with local landowners. The project will generate baseline water quality data that includes those constituents of concern that may result from oil and gas development activities and in this respect the study has been scoped to promote cooperation and collaboration among tradionally competative consumptive water interests and a bloosoming energy sector.
4. The collaborative protection and promotion of water quality and enhanced water storage will lead to greter cooperation, minimized evaporative losses from surface storage, better science based decisions, and utilization of El Paso County resources to meet El Paso County water demands, thereby reducing demand on the mainstem of the Arkansas and Platte Rivers and seeking to further develop efficient storage that can reduce the Fountain Creek return flow and stormwater issues while making the most of any mainstem and / or trans-mountain water resources utilized in El Paso County.
   Letters of Support are attached.

The project meets the WSRA Tier 2 criteria in the following ways:

1. The Phase 2 Groundwater Quality Study has a sizable scope of work with valuable deliverables, which come at significant cost(s), but for which there are very important long-range land use planning and supply security implications. The total project study cost is approximately $343,350.00 and despite very significant local buy in from a wide variety of entities across a wide spectrum of industries and institutions, there is an unmet funding need and monies from the WSRA would provide measurable and signifiance leverage of the local dollars, allowing this very valuble project to get under way.
2. Local stakeholders, including El Paso County, Cherokee Metro, Meridian Service Metro, Woodmen Hills Metro, State Land Board, Mountain View Electric Assoc., and the Upper Black Squirrel Creek Groundwater Management District have funded approximately 30% of the project, USGS matching funds can be leveraged up to about 42 % or $144,000.00 if the full stream of adequate matching funds can be developed on top of the local stakeholder contributions. In addition to the seven (7) local entities making

financial contributions, numerous others (including Colorado Springs Utilities, Counsel of Organizations and Neighbors, Division of Water Resources, Bentgrass Metro District, Paint Brush Hills Metro District Protect Our Wells and El Paso County Dept. of Public and Environmental Health) are making and have committed to ongoing in-kind technical and / or manpower contributions that are essential to the budget and success of the Phase 2 project.

3. El Paso County Health Department has committed to provice an intern, as needed, to assist USGS as needed and their Development Services Department is prepared to make available a multitude of land use, zoning, small area master planning, transportation and growth prediction mapping resources essential to the interface of vulnerability assessment with land use. Further, some of the municipal districts and the Groundwater Management District have committed their consultants, staff, laboratory facilities, well logs and other relevant records relevant to the scope of work.

The project meets the WSRA Tier 3 Criteria in the following ways:

1 The project is essential to the protection of multiple use source of supply that supports everything from agriculture to industry. If these many competing uses are to continue on and co-exist, enhanced alluvial storage must be achieved and sourcewater protection must be implemented on a more scientific basis. This scope of work and the USGS as operators of the study have developed a data set and regression analysis , and continue to develop vulnerability mapping set that will allow policy makers appropriate tools and resources in their decisions on how the basin is protected from potential contamination and further quantify how the basin could be used as enhanced storage and water banking for future generations.

2 The project shall lead to further cooperation among competing users, better science for decision support, and the work product will be a recognized standard for the type of science necessary to on the water quality end of setting up an enhanced storage water banking system. The investment in alluvial storage and the complex relationship of administration with competing uses is contentious enough, good sciece must be the basis for policy that seeks to enhance the resource while avoiding a possible tragedy of the commons. The Upper Black Squirrel Creek Basin has been previoulsy determined to be a suitable storage location through the 2006 CGS work that was partially funded by Roundtable dollars and this work is the next step towards quantifying how such an enhanced storage and banking operation would protect water quality in the face of urbanized growth, oil and gas development and historic agricultural interests.

3 The oil and gas specific work and its incorporation into a vulnerability assessment the is based in geoscience is a model that can be utilized across this state and beyond. With much public concern revolving around impats to water quality, this study's technical approach offers part of the solutiona and so wo with a a within a technical platform. The rapid growth of oil and gas development has been slow, but ongoing within thestudy area, and this study will hold tremendeous value to other communities accrooss the state looking for a well designed technical model of how to protect all parties and water resources.

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.

Source of Supply is the alluvial aquifer of the Upper Black Squirrel Creek Designated Groundwater Basin. This alluvial resource has been adjudicated as non-tributary to the Arkansas River's main stem, but lies completely within Division 2, upstream of the Chico Basin system, and within the greater Arkansas Basin. The Upper Black Squirrel Creek groundwater resources have long been determined to be over appropriated, and between 1965 and 1985 there were consistent and significant declines in the alluvial aquifer's water levels, as documented in DWR and USGS depth to water level data sets. The alluvial aquifer is the sourcewater water supply for numerous cattle and livestock operations, irrigated feed crop farmers, commercial flower & vegetable growers and sod farmers who utilize the same source of supply as tens of thousands of rural residential homeowners living on parcels of various size from 2.5 acre parcels. Due to the proximity of the Basin to urban Colorado Springs, the alluvial water resources of the Upper Black Squirrel have long been the source of municipal diversions since the early 1960's and at present four major metropolitan districts and many smaller community water systems rely upon this source as a primary water supply.

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

The project would consist of new data collection and analysis, including groundwater sampling and testing, as recommended in the Phase 1 report by CGS, groundwater age dating and vulnerability assessment GIS mapping to support and expand upon the conclusions reached by CGS in their 2006 report on storage capacity. Candidate wells have been selected after analysis of well permit database; and several new monitoring wells were permitted through the Division of Water Resources and professionally installed. The study would also focus on the geometry, hydrology and quantification of the alluvial aquifer in the northern and western portions of the basin and the shallow bedrock alluvial aquifers, areas where little is known and were little baseline data currently exists. The preliminary data is and land use mapping is proving to be valuable and no further permitting is anticipated.

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.

Please see the official scope of work developed by the Committee in concert with input from Colorado Geological Survey and the USGS. That Scope includes a detailed budget and general project schedule by quarter for the Federal Fiscal Calendar. The Scope is broken into tasks with tasks having specific timelines for funding, work and completion.

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: *Recommended by Sean Chambers, Chair of the Committee, and President of the Pikes Peak Regional Water Authority, signing at the time of R.T. Needs Assessment for purpose of moving the application forward. Following needs assessment, the Board of County Commissioners will formally approve and execute the application prior to Roundtable.*

Print Applicant's Name: Dennis Hisey, Chair of the El Paso County Board of County Commissioners

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

Sean P. Chambers, General Manager

CHEROKEE METROPOLITAN DISTRICT

6250 Palmer Park Blvd, Colorado Springs, CO 80915-1721
Telephone: (719) 597-5080 FAX: (719) 597-5145

July 29, 2014

Mr. Greg Johnson – WSRA Application
Colorado Water Conservation Board
1580 Logan Street, Suite 200
Denver, CO 80203

Re: WSRA Grant Application – El Paso County Groundwater Quality Study – Phase 2

Dear Mr. Johnson,

On behalf of the members of the El Paso County Groundwater Quality Study, I am pleased to herewith submit this application for the $51,932.50 WSRA grant funds from combined sources of Arkansas Basin Roundtable Funds and the Statewide Funds. These funds will contribute to the Groundwater Quality Study, Phase 2C, which is the final phase of work in the regional study of the Upper Black Squirrel Creek Groundwater Alluvial Aquifer water quality and storage suitability analysis. The USGS has provided 41% of matching funds for the $345,000 scope, and local Pikes Peak Region stakeholders including various metro district small water providers, the local power coop, the State Board of Land Commissioners, El Paso County government, and the local Groundwater Management District, a political subdivision of the Groundwater Commission have all contributed financially, and others such as Colorado Springs Utilities, El Paso County Parks and Paint Brush Hills Metro District have contributed their time, technical resources and other in-kind contributions that demonstrate the broad base of support for the study and regional concern for the protection of this water supply and the alluvial storage capacity that may serve as a regional storage facility.

The following are highlights to our Phase 2c study at Cherokee Metropolitan District:

- The Phase 2 scope of work includes the sampling and analysis of Nitrate, Major ions (including fluoride), Chlorofluorocarbons (Freon, CFCs, GW age), Tritium (G.W. age), Also sampling for fuel compounds (BTEX) and dissolved gasses (methane, N2, Ar, CO2, O2) at each well to help establish baseline for oil/gas concerns.
- Upper Black Squirrel Basin; a Groundwater Management Act Designated Basin, is a major source of agricultural, municipal, and rural residential communities, and a known alluvial water supply storage resource as identified in SB06-193. The broad baseline data set, pollution impact vulnerability mapping and dynamic impact modeling will be essential tools for protecting this aquifer resource for future storage opportunities and ensuring that existing vested water rights don't need to acquire replacement supplies, presumably from surface supplies outside the Upper Black Squirrel Creek Basin.
- The modeling and vulnerability mapping deliverables from this Phase 2 Study will be used to identify areas or zones within the basin where impacts from land use to water quality are so highly correlated that further land use protections are needed. The County's land use rule making process needs quality

scientific data for initiating changes to land use policy; and the modeling from this phase 2 work product will be a valuable science based tool.

- Lastly, the Study has established a groundwater monitoring network and passionate citizen/stakeholder advisory committee that anticipates an ongoing sampling phase 3 program scope work in cooperation with the El Paso County Health Department and Upper Black Squirrel Creek Groundwater Management District.

The El Paso County Groundwater Quality Study Committee strongly encourages CWCB's Board support of this Water Supply Reserve Account Grant as recommended by the Study Committee and the Arkansas Basin Roundtable. We firmly believe the tools developed in this study have a statewide impact for all major alluvial aquifer systems and future groundwater storage projects. A brief presentation on the tools and study framework will be given within the groundwater track of the 2014 Sustaining Colorado Watersheds Conference on October 8, 2014, and we hope this distribution of information makes the study, process and tools more widely available for critique, review and implementation elsewhere.

Thank you in advance for your consideration and the opportunity to participate in the WSRA grant program. If you have any further questions, please don't hesitate to call or email me.

Best Regards,

Sean P. Chambers

Chair-El Paso County Groundwater Quality Study

General Manager, Cherokee Metropolitan District

Cc: Elaine Kleckner - Planning Manager, El Paso County Community Services Department
Randy Case Jr. – Vice Chair, El Paso County Groundwater Quality Study
David Mau, P.E. - Southeast Colorado Office Chief, U.S. Geological Survey
Zach Temple, EIT – Cherokee Metropolitan District
Tracy Doran- Office Manager, Upper Black Squirrel Creek Groundwater Management District
Betty Konarski – Chair, Arkansas Basin Roundtable

PEAK REGIONAL WATER AUTHORITY

P.O. Box 1976, Colorado Springs, CO 80901, (719) 660-0948

January 9, 2012

Via Electronic and/or Ordinary Mail

Colorado Water Conservation Board
1313 Sherman St., Room 721
Denver, CO 80203

Re: Support of Phase 2 Groundwater Quality Vulnerability Assessment Study

The Pikes Peak Regional Water Authority (PPRWA) took action at its January 4, 2012 Board Meeting to formally support the Phase 2 Groundwater Quality Vulnerability Assessment Study focused on the Upper Black Squirrel Basin. The Phase 2 study is the latest work in an ongoing effort to understand and protect the alluvial storage capacity and potential of the Upper Black Squirrel Creek Basin. The Phase 2 scope of work has been collaboratively developed by the stakeholder committee and the USGS over several months of meetings between the USGS and local agricultural, municipal, industrial, environmental and local government technocrats. Lastly it is important to note that the Phase 2 scope follows the recommendations from a 2010 Colorado Geological Survey Phase 1 literature review that was also funded by the stakeholder group.

The Phase 2 study project budget is $343,350.00; of which $110,000.00 is likely to come from local stakeholder entities and local governments (not including in-kind contributions from these entities) with another $89,000 possibly from State Severance Tax Grant and Water Supply Reserve Account Grants and the remaining approximately $145,000.00 likely to be Federal matching funds through USGS. The study is widely supported, with significant buy in from all stakeholders and local governments and will serve as a regional model for generating baseline water quality protection and vulnerability assessment data that can be used in the land planning, sourcewater protection planning and resource protection efforts. This project has an obvious regional impact to the Basin and its surrounding area, but vulnerability assessment GIS mapping and data results as a tool for land use decisions, oil and gas impact evaluations, and ISDS (septic system) policy decisions is a template that can be applied across the Arkansas Basin and the State of Colorado.

The PPRWA requests your consideration of financial support for this important on-going effort.

Please do not hesitate to contact me at (719) 322-2040 if you have any questions. Thank you for your consideration.

Sincerely,

Curtis A. Mitchell, P.E.
President

cc: PPRWA Directors

UPPER BLACK SQUIRREL CREEK
GROUND WATER MANAGEMENT DISTRICT
520 COLORADO AVENUE, SUITE C
CALHAN, COLORADO 80808
OFFICE (719) 347-0704 FAX (719) 347-9423

February 27, 2012

To whom it may concern:

The Upper Black Squirrel Creek Ground Water Management District (UBSCGWMD) and its Board of Directors would like to formally endorse the Phase II Water Quality Study as proposed by USGS for the El Paso County Water Quality Study Committee (WQSC). The WQSC was formed in large part because of UBSCGWMD's increasing concern about the water quality of the Upper Black Squirrel Creek Basins (UBSCB) alluvial aquifer, and the lack of data associated with it, and the district's ability to make informed decisions on both current and future water management rules and policies.

In 2006 the Board along with its consultants were responding to the El Paso County Planning and Land Use Department in regards to concerns that have been raised by the district for over 25 years in our records (See attachments).

In 2009 along with several Metropolitan Districts which rely on all or some alluvial water for their municipal customers took 12 or so samples in the main stem area of the UBSCB and had them tested for nitrate levels of which a large number were above the maximum allowable level. This information was taken to El Paso County BoCC and they then formed the WQSC. Phase I was the data compilation of existing data for UBSCB alluvial aquifer done by Colorado Geological Survey and completed with the help of several stake holder contributions. The UBSCGWMD contributed $5,000.00, plus an estimated amount of $5,000.00 to our geologist, who did additional pro bono work, estimated around $5,000.00. The UBSCGWMD Board of Directors is committed to Phase II for another $5,000.00 plus has already started with our in kind services. Our paid geologist has done extensive mapping of existing alluvial wells that will meet USGS's plan for monitoring wells which will help offset the need to drill monitoring wells.

In closing, the UBSCGWMD asks for your assistance to help fund what we feel is one of the most important studies this basin has ever undergone. We need to be able to form a baseline water quality of this precious resource, so that everyone can make sound fact based decisions going forward in how we manage and use the water and handle the discharges to the UBSC alluvial aquifer.

Sincerely,

Dave Doran
President of the UBSCGWMD

UPPER BLACK SQUIRREL CREEK
GROUND WATER MANAGEMENT DISTRICT
520 COLORADO AVENUE, SUITE C
CALHAN, COLORADO 80808
OFFICE (719) 347-0704 FAX (719) 347-9423

President
Kathy Hare
11410 Owl Lane
Falcon, Colorado 80831
(719) 495-3476

Legal Council
Kim Lawrence
Lind, Lawrence & Ottenhoff, LLP
355 Eastman Park Drive, Suite 200
Windsor, Colorado 80550
(970) 674-9888
Fax (970) 674-9535

August 10, 2006

El Paso County Developmental Services Department
2880 International Circle, Suite 110
Colorado Springs, CO 80910

Attention: Dick Anderwald, Director

Subject: Water Quality in the Upper Black Squirrel Creek Ground Water Management District

Dear Mr. Anderwald:

As you are aware, a recent Water Court ruling (Case No. 98 CW 80, Division 2) has raised some serious issues regarding water supply within the Upper Black Squirrel Creek Ground Water Management District (Black Squirrel District). This court ruling has raised the awareness of many people regarding water supply issues, and as a consequence, also water quality issues. The Board members are concerned about the present and future water quality of the Alluvial Aquifer within the basin.

Under our Rules and Regulations, the Black Squirrel District is charged with management of both water quantity and water quality (Reference 1). *"The District will recommend denial of any application for permit...or any other request for governmental approval...unless appropriate conditions for protection of the groundwater quality of the water resources in the Upper Black Squirrel Creek Designated Groundwater Basin are incorporated into any such permit, plan, permit amendment, or other request."* In addition the Black Squirrel District "Statement of Policy", states, *"The District encourages the use of central (municipal) water and wastewater systems, as opposed to the use of individual wells and septic systems in any proposed subdivision consisting of three or more lots, in order to minimize the possibility of contamination of the alluvial aquifer..."*.

Previous Studies

Our research, although limited at this time, indicates a potential degradation in the quality of the Alluvial Aquifer water (contamination), both now and in the future. The potential contamination is apparently mainly in the form of nitrates, although other chemicals may also be adding to the degradation. The Alluvial Aquifer supplies individual domestic wells and municipal wells, and supplies the water for thousands of people. Apparently, the last study of the water quality of the Alluvial Aquifer was conducted in 1996 (Reference 2). In the last ten years, since that study, much development has occurred within the Black Squirrel District. We are unsure of the impact of this new development on the water quality, and the impact of future development.

The 1996 United States Geological Survey (USGS) study of water quality (Reference 2) indicates the natural sources of nitrates to the Alluvial Aquifer are relatively small. Human practices are the common sources. These include: animal manure applied to croplands as fertilizer, commercial fertilizers, manure in feedlots and dairies, sewage effluent (from treatment plants), and septic leach field effluent. The hydrologic system ('water balance') is also apparently changing (Reference 3) since more water is being supplied by bedrock wells than before, more recharge to the aquifer is occurring by the use of sewage or septic effluent, and as more land is developed, less agricultural land is used.

The most recent (PPACG, 2003) study we have reviewed (Reference 4) indicates, *"Septic tank effluent is the most common water quality problem in rural areas that do not rely on central wastewater services."* The study also indicates, *"Within El Paso County, the number of septic systems has increased from about 300 in 1990 to about 2000 in 2000."* In the Conclusions of this study it states, *"Future development will need to be coordinated to minimize nonpoint source impacts and provide wastewater service in a cost effective and **environmentally sound manner**."* (Emphasis added). Under the Recommendations the PPACG study states, *"Further water quality monitoring data is needed to determine if nitrate levels are increasing or decreasing in the Upper Black Squirrel Creek alluvial aquifer. Other water quality monitoring also needs to be conducted including well levels. This information should be compared with proposed locations for septic systems. The last ground water study that was conducted in this area was by the USGS in 1997." "Regulations for Individual Sewage Disposal Systems should be reviewed to determine if they are adequately protecting against the possibility of systems increasing nutrient loading into surface water or ground water. This is critical especially where poor soils and high ground water tables contribute to septic system failure. This analysis will help evaluate if residential and commercial property should be connected to a central wastewater service."* Other Recommendations of the PPACG study include establishing the need for a well head protection program, utilization of Best Management Practices (BMPs) to minimize water quality impacts from storm water and urban runoff, and determinations of the cumulative effects of Wastewater Treatment Plants.

El Paso County Regulations

The Black Squirrel Districts review of the El Paso County Land Development Code (Reference 5) indicates that, *"Reports, data, and other evidence shall illustrate that the subdivision, at a minimum, achieves the following: Noncontamination of surface or subsurface water resources and waterforms."* (Section 49.2 M; see also Section 49.1, Section 51.2, Section 51.3, and Section 51.7 A, B, C). Unfortunately, the Black Squirrel District is not regularly supplied "the reports, data, and other evidence" to review or evaluate potential impacts to the water quality.

Request

The Black Squirrel District respectfully requests that the El Paso County Development Services Department schedule a work session with the Black Squirrel District so that water quality issues can be addressed. Since water quality of the Alluvial Aquifer is a significant concern, and the present or future quality is apparently not known, this work session should be conducted at the earliest opportunity.

UPPER BLACK SQUIRREL CREEK GROUND WATER MANAGEMENT DISTRICT

Kathy Hare, Board President

---

cc: El Paso County Planning Commission
Board of County Commissioners
El Paso County Soil Conservation District
El Paso County Department of Health & Environment
Colorado Water Quality Control Commission
USGS
Environmental Protection Agency

References

1. Upper Black Squirrel Creek Ground Water Management District. "Rules and Regulations and Statement of Policy". Amended Through June 1, 2004
2. Brendle, Daniel (1997). "Have Nitrate Concentrations Changed in Water in the Alluvial Aquifer of the Upper Black Squirrel Creek Basin Since 1984?." USGS Fact Sheet FS-072-97.
3. Buckles, D.R. and Watts, K.R. (1988). "Geohydrology, water quality, and Preliminary simulations of ground-water flow of the alluvial aquifer in the Upper Black Basin, El Paso County, Colorado." USGS Water Resources Investigations report 88-4017.
4. Pikes Peak Area Council of Governments Water Quality Management Plan, 2003 Update. Adopted in 2004 by PPACG and the Colorado Water Quality Control Commission.
5. El Paso County. "Land Development Code".

JOHN HIMMELREICH & ASSOCIATES

1010 So. Sierra Madre Street
Colorado Springs, Colorado 80903
Phone and FAX (719) 633-5842
Email, Himmelreich2@aol.com
Web Site www.geohazards.net

January 24, 2011 **DRAFT**

Upper Black Squirrel Creek Ground Water Management District
520 Colorado Avenue, Suite C
Calhan, CO 80808

Attention: Dave Doran, Board President

Subject: Contamination and Pollution Related to Land Use, Upper Black Squirrel Creek Alluvial Aquifer, El Paso County, Colorado
JHA File No. 09-115

Dear Mr. Doran:

The following presents a discussion of contamination and pollution related to land use in the Upper Black Squirrel Creek Alluvial Aquifer (UBSC Alluvial Aquifer), El Paso County, Colorado. **The discussion contained herein is not a legal opinion, nor a legal analysis.** You should consider obtaining a legal opinion from your legal counsel.

The "Specified Area" (boundaries), "Classifications", and "Ground Water Quality Standards" of the UBSC Alluvial Aquifer are defined in "Colorado Department of Public Health and Environment, Water Quality Control Commission, Regulation No. 42, Site-Specific Water Quality Classifications and Standards for Ground Water". The terms "Background Level" and "Contamination" are defined in "Colorado Department of Public Health and Environment, Water Quality Control Commission, 5 CCR 1002-41, Regulation No. 41, The Basic Standards for Ground Water". The term "Pollution" is defined in C.R.S. 25-8-103.

Brief History

As you know, the Upper Black Squirrel Creek Ground Water Management District (UBS District) has been concerned about the potential for groundwater contamination (especially from individual sewage disposal systems[1]) for over 25 years. These concerns are not without merit.

In 1974 'baseline' environmental studies were performed for El Paso County producing a series of reports and detailed maps ("Project Aquarius Reports", including "Environmental Resources Study for Teller and El Paso Counties, Colorado. Part A: Perspectives, Part B: Geology, Part C: Vegetation, Part D: Wildfire, Part E: Wildlife, Part F: Visual Resources, Part G: Climate, Part H: Environmental Hazards, Constraints and Limitations, and Detailed Soils Interpretive Maps. Resource Planning Associates, Inc.")

In 1977 detailed geologic and environmental maps, and tables for land use of El Paso County, (commonly called the "Robinson Maps") were produced as a result of 1974 State law (HB-1041). "El Paso County, Colorado, Potential Geologic Hazards and Surficial Deposits", Charles Robinson & Associates, Inc.

1. Individual Sewage Disposal Systems (ISDS) are also called septic systems, engineered systems, and most recently Onsite Wastewater Systems (OWS). 1

In 1979 Wm. Curtis Wells & Co. published a study prepared for the El Paso County Land Use Department entitled "Ground Water Recharge Areas Investigation of El Paso County, Colorado." Importantly, this study determined the areas of ground water recharge, and categorized the areas by type of aquifers, sources of recharge, and degree of importance of recharge. The study concludes, in part:

> "Aquifer recharge is important to maintaining viable ground water supplies. As alluvium is the major source of ground water, it's recharge area is of prime importance in planning land use changes (open dot pattern, Plate 3). Stream losses and man induced water is the principal source of aquifer recharge." The study concluded that alluvial aquifers covered approximately 17% of the entire County. In the sections on "Man-Induced Recharge" "Land Use Changes", and "Pollution From Recharge Water": "Septic system effluent from water bearing unsewered residential, commercial and industrial developments normally finds its way into alluvial or bedrock water bearing formation unless the system is of the evaporative type. As undeveloped land is altered to a regulated land use, the alteration can be programmed in the critical areas not to degrade aquifer recharge or wherever possible to improve recharge conditions. In assessing a particular land use change, the potential for ground water pollution through aquifer recharge should be carefully considered. Proposals for unsewered areas where residential or commercial developments will be on septic systems should be evaluated on the ability of the overburden soils to purify sewage effluent before it has an opportunity to percolate into water bearing formations. Although adequately designed septic systems normally have the ability to remove bacteria and other pathogens from the effluent, fluids are commonly high in nitrates and chlorides. If a water supply well is too close to a septic system, nitrate and chloride enriched fluids may be recycled into the water system. Even with well designed systems a dense population of septic fields could have an overall detrimental effect to fresh water aquifers. Potential pollution of alluvial aquifers is high, as surface water is directly connected to the ground water. It can easily be contaminated by agricultural fertilization, sewage return flows or low quality water running off residential developments containing greases and oils, as an example. Once the water reaches porous alluvium it immediately percolates to the water table reducing ground water quality. In the foregoing discussion we have touched on a few of the many countless numbers of conditions that could pollute or cut the rate of recharge water to water bearing formations."

Also in 1979 a rather illustrative description of septic system effluent was published in "Geology for Individual Sewage Disposal Systems", California Geology, September 1972, by Alvin L. Franks, Supervising Engineering Geologist, California State Water Resources Control Board.

> "The liquid discharged from the tank to the leach line is more unpleasant than that going in. This fluid, now to be disposed of in the geologic environment, is an odoriferous fluid containing large quantities of anaerobic bacteria, nutrients, salts, suspended solids, and in some instances, pathogens. After the fluid passes from the leach field or seepage pit filter medium, it enters the external soil-water system. It is basically a complex, smelly, highly toxic, and potentially pathogenic fluid that must be treated and kept underground for sufficient time for it to become an indistinguishable part of the existing ground water

1. Individual Sewage Disposal Systems (ISDS) are also called septic systems, engineered systems, and most recently Onsite Wastewater Systems (OWS).

environment. Theoretically if you have a nitrogen sensitive environment, even one individual sewage disposal system will provide some adverse nutrients regardless of the distance from the surface stream or lake. However, because of the time and dilution factor in some watersheds, there is sufficient distance between the disposal system and the sensitive environment so that the small quantities of nutrients added to the ground water body, when compared with the natural nutrients and the volume of water, will be undetectable and thus will not significantly change the nutrient balance."

These 'small quantities' of return flows from individual sewage disposal systems, crop irrigation, and other return flows were the subject of a recent publication where the editorial likened them to ***"...the death by a thousand small cuts, if you will."*** ("Small Flows, Big Consequences", Colorado Water, The Water Center of Colorado State University, August/September 2007, by Reagan Waskom, Director, Colorado Water Resources Research Institute)

It is when you reach the margins of any developed resource that the small individual impacts aggregate to reach a critical mass - the death by a thousand small cuts, if you will.

UBS District Rules and Regulations (UBS District Rules, past and current) and the County's Land Development Code (LDC), since at least the mid-1980's, requires the potential for contamination (non-contamination = non-degradation) to be evaluated and addressed. The issue of cumulative impacts relative to septic systems is clearly stated in the County Policy Plan (Issue 10.3), **"While the specific impacts of individual well and septic facilities may be minimal, their cumulative environmental and health effects may be more significant. Cumulative impacts are an <u>especially significant issue</u> with non-point source pollution from septic systems and other land uses, such as streets, parking lots, and lawns."** (emphasis added) The Ellicott Valley Comprehensive Plan Policy 9.1 states **"Evaluate all land use proposals in the planning area in terms of both their individual and potential collective impact on the alluvial aquifers which provide the area with its water supply."** (emphasis added) The State of Colorado (CO) also requires water quality to be addressed in all replacement/augmentation plans, "Proof that the plan will not cause unreasonable impairment of water quality." ("State of Colorado, Ground Water Commission, Rules and Regulations for the Management and Control of Designated Ground Water, 2 CCR 410-1").

Please contact me if you have any questions or require additional information.

Respectfully,

JOHN HIMMELREICH & ASSOCIATES

John W. Himmelreich, Jr., P.G.

1. Individual Sewage Disposal Systems (ISDS) are also called septic systems, engineered systems, and most recently Onsite Wastewater Systems (OWS).

EL PASO COUNTY
COLORADO

PIKES PEAK
REGIONAL WATER
AUTHORITY

CHEROKEE METROPOLITAN DISTRICT

El Paso County Groundwater Quality Study - Phase 2 (2012 – 2015)

USGS Study of Upper Black Squirrel Creek Designated Basin Alluvial Aquifer Storage Water Quality in Cooperation with El Paso County Stakeholders

Statement of Work

Water Activity Name: **El Paso County Groundwater Quality Study – Phase 2 Aquifer Vulnerability Assessment and Modeling – Task 5**

Grant Recipient: El Paso County Board of County Commissioners and their Groundwater Quality Study

Funding Source Requested: $51,932.50

($10,000 from Arkansas Basin Funds and $41,932.50 from Statewide Funds)

Introduction and Background:

From the late 1990's through the mid-2000's there has been prolific development of rural residential property and suburban development overlying the Upper Black Squirrel Creek groundwater aquifer located in eastern El Paso County. In 2006 the aquifer was subject of a Colorado Geological Survey study that quantified the alluvial storage potential, capacity, and areas of geological suitability for future storage projects. The Basin's alluvial groundwater and storage opportunities were identified in Colorado SB.06-193 and again thereafter in 2013 before the Interim Water Resources Review

Committee as a likely candidate for a future large scale alluvial storage pilot project. In 2008 concerns from a diverse group of stakeholders over water quality and escalation of nitrate concentrations basin wide led to a limited scope Phase 1 literature review study, also by Colorado Geological Survey. Therein, Mr. Topper of CGS identified significant data gaps and areas of critical interest for establishing monitoring wells and additional data for the protection of the water supply and aquifer storage capacity. The Phase 1 literature review concluded that more data, mapping and tools were needed and made recommendations for a phase 2 sampling, analysis and mapping study.

The purpose of the project is to build on Phase 1 and work completed in 2011 and further water quality parameter sampling under phase 2, task 4 work completed in 2013 & 2014, to continue and complete phase 2c (task 5) of the El Paso County Groundwater Quality Study.

The U.S. Geological Survey (USGS) was a technical advisor for Phase 1 and is the consultant for Phase 2. The USGS worked closely with the El Paso County Groundwater Quality Study Committee, reviewing the Groundwater Quality, Age, and Probability of Contamination, Eagle River Watershed Valley-Fill Aquifer, North-Central Colorado 2006-2007 in their development of the Phase 2 scope of work and sampling plans (the comprehensive Scope of Work is attached hereto).

Objectives:

1) To refine the distribution, geometry, and hydrology of the alluvial and shallow bedrock aquifers in the northwestern portion of the Upper Black Squirrel Creek basin; and

2) To establish a groundwater monitoring network to detect and quantify impacts to water quality resulting from existing and proposed land uses that may degrade water supplies; and

3) To develop statistical modeling and associated mapping tools that are expected to be used to inform land use planning and determine if changes to policies and regulations are warranted based upon contamination probabilities.

4) To protect the alluvial storage resource from further degradation of water quality, which might render it unsuitable for aquifer storage and recover at a future date. Establishing a water-quality baseline for the alluvial aquifer will be needed before

conjunctive use/aquifer storage and recovery can occur to meet the water supply gap that has been identified by El Paso County.

5) To provide entities such as special districts and UBSCGWMD with better information, tools and data to make well informed decisions regarding infrastructure planning, collaboration, supply development, recharge and source water protection.

- The Phase 2 scope of work includes the sampling and analysis of Nitrate, Major ions (including fluoride), Chlorofluorocarbons (Freon, CFCs, GW age), Tritium (G.W. age), Also sampling for fuel compounds (BTEX) and dissolved gasses (methane, N2, Ar, CO2, O2) at each well to help establish baseline for oil/gas concerns.
- Upper Black Squirrel Basin; a Groundwater Management Act Designated Basin, is a major source of agricultural, municipal, and rural residential communities, and a known alluvial water supply storage resource as identified in SB06-193. The broad baseline data set, pollution impact vulnerability mapping and dynamic impact modeling will be essential tools for protecting this aquifer resource for future storage opportunities and ensuring that existing vested water rights don't need to acquire replacement supplies, presumably from surface supplies outside the Upper Black Squirrel Creek Basin.
- The modeling and vulnerability mapping deliverables from this Phase 2 Study will be used to identify areas or zones within the basin where impacts from land use to water quality are so highly correlated that further land use protections are needed. The County's land use rule making process needs quality scientific data for initiating changes to land use policy; and the modeling from this phase 2 work products will be a valuable science based tools.
- The Study's Task 2 and 3 have established a basin wide groundwater monitoring network and a strong passionate citizen/stakeholder advisory committee that anticipates an ongoing sampling phase 3 program scope work in cooperation with the El Paso County Health Department and Upper Black Squirrel Creek Groundwater Management District.

Groundwater Quality Study Phase 2 – USGS Study Tasks:

Task 1: Records Collection and Planning

Description of Task: Compilation of GIS Data, Researching DWR records for wells completed in the alluvial aquifer that could be sampled for the Phase 2 Study, development of 50 random polygons with equal alluvial material for location of random alluvial wells to be sampled, and the outreach communication and setting site visit appointments with well owners to establish sampling and access consent.

Method / Procedure: Data requests, telephone and web based research, computer aided random definition of 50 alluvial aquifer polygons to define study area and telephone and email connection with well owners to set appointments.

Deliverable: Sampling area map and randomly selected polygon mapping.

Task 2: Subject Well Identification, Inspection and Consent; and Database

Description of Task: Alluvial well site visits, inspections, consent and creation of inventory of wells and owners, and the creation of a well info database.

Method / Procedure: Well site inspections, securing consent to access and sample paperwork, database formatting and data entry.

Deliverable: Consent and access documents for approximately 40 existing alluvial wells, GIS mapping of well sites with cross referenced ID to well data, and well data database.

Task 3:

Description of Task: Identification of new monitoring well locations, permitting, monitoring well contracting, and installation of monitoring wells at approximately 8 new locations, most within the range recommended from the Phase 1 report.

Method / Procedure: Cross referencing Phase 1 recommendations with USGS random polygons that were without an alluvial well to sample, with County, State, and stakeholder land ownership to identify parcels of property in key areas that we could likely get access and consent to drill a monitoring well. Compilation of well design and construction standards, bid collection and contracting through Cherokee Metro District for the construction and development of up to 10 monitoring wells.

Deliverable: Monitoring well locations IDs, access agreements, permitting and constructed monitoring wells

Task 4:

Description of Task: USGS team sampling of wells for USGS Laboratory analysis of sampling, QAQC, and review of data internally and with Groundwater Study Committee.

Method / Procedure: Systematic sampling of the 48 alluvial study wells for Temperature, pH, Nitrate, conductivity and Major ions (including fluoride), Chlorofluorocarbons (Freon, CFCs, GW age), Tritium (G.W. age), and sampling for fuel compounds (BTEX) and

dissolved gasses (methane, N2, Ar, CO2, O2), Laboratory analysis, Quality Assurance and Control on sample results to ensure data was reliable and review of the data results and preliminary mapping of data.

Deliverable: Water Quality Data Sets, preliminary mapping, QAQC verification and study committee update briefing.

Task 5: ***Analyze water quality, groundwater age dating, soil porosity data and land use and precipitation data review, statistical modeling, committee communication and report drafting, peer review, publication and communication of final report to stakeholders, Arkansas Basin Roundtable and CWCB, along with ongoing basin water quality monitoring recommendations:***

Description of Task: **Compilation of groundwater quality data, development and testing of statistical correlation modeling with GIS data such as depth to groundwater, land use, soil porosity and precipitation.**

Development of GIS mapping showing precipitation patterns, groundwater age, land use, soil compositions, depth to groundwater and probability of groundwater contamination. Developing of Statistical modeling that is predictive of the probability of contamination of the alluvial groundwater aquifer.

Method / Procedure: **Development of Statistical Regression Models based upon water quality sampling, groundwater age dating analysis, precipitation, soils, land use, among other factors to determine what variable where most highly correlated to infiltration rates and probability of possible contamination. Development of GIS mapping tools to represent the statistical modeling, which can be updated or manipulated to reflect changes in variable conditions. Report writing, charting, graphing and data base refinement in preparation for publication. Formatting to USGS standards of publication and the review of outcomes to formulate recommendations for ongoing sampling sites of critical importance and updates to the modeling.**

Deliverable: **Final groundwater age dating data analysis, pollution probability statistical modeling, final GIS mapping, committee report out, draft final report for committee and internal review, final USGS SIR report publication, GIS mapping publication as USGS Open File reports and recommendations for future monitoring.**

GROUNDWATER QUALITY STUDY, PHASE 2 - BUDGET ALLOCATION PER YEAR (BASED ON USGS WORK PLAN)

Task	Scope of Tasks	NON-WSRA Funds	WSRA Funds	Total Funds
1 and 2	(1). Compile GIS Data; Identify Wells (2). Site visits and inventory wells; Enter well information into database	$47,700.00	$0.00	$47,700.00
3 and 4	(3). Install new monitoring wells (4). Sample wells; Enter field data into database; Receive data from labs and review data	$95,650.00	$35,000.00	$130,650.00
5	(5). Analyze data; Draft report preperation; Develop monitoring plan. USGS report review process; Final report preperation; Final report publication; GIS map publication	$102,950.00	$51,932.50	$154,882.50
TOTAL ($)		**$246,300.00**	**$86,932.50**	**$333,232.50**

***Note: Refer to Exhibit for more detailed scope of Tasks (1-5).**

WATER RESOURCES DISCIPLINE
CENTRAL REGION
COLORADO WATER SCIENCE CENTER
January 30, 2012

A. TITLE

Groundwater Susceptibility Assessment for the Upper Black Squirrel Creek Basin Area, El Paso County, Colorado, Phase 2

B. SUMMARY

The alluvial aquifer of the upper Black Squirrel Creek Basin, about 25 miles east of Colorado Springs, supplies most of the water for irrigation and domestic use in the basin and, since 1964, supplies water for export to the Colorado Springs area. The alluvial aquifer overlies the Denver Basin bedrock aquifers: the Dawson, Denver, Arapahoe, and Laramie-Fox Hills aquifers. Substantial growth of subdivisions in the upper Black Squirrel Creek Basin, and the development of many of these subdivisions on 2.5 acre lots that utilize domestic septic systems, has led to considerable concern related to potential contamination of groundwater and to the municipal wells used to supply the smaller communities in the basin. Potential groundwater contamination from agricultural activities, unregulated industrial waste disposal, fueling facilities, and stormwater runoff is also a concern. Furthermore, there is interest in artificially recharging the groundwater in the alluvial aquifer in the future to help augment the existing groundwater resources; maintaining the quality of the groundwater resource is important to preserve options.

The objective of this project is to gain a better understanding of groundwater resources in the upper Black Squirrel Creek Basin to aid in planning, decision making, and public education related to groundwater and drinking water supplies and to provide for long-term water-resource protection and management. The results of this project will help to determine the age and flow directions of the groundwater and identify areas sensitive to groundwater contamination.

C. PROBLEM

The alluvial aquifer of the upper Black Squirrel Creek Basin, about 25 miles east of Colorado Springs, supplies most of the water for irrigation and domestic use in the basin and, since 1964, supplies water for export to the Colorado Springs area. The alluvial aquifer overlies the Denver Basin bedrock aquifers: the Dawson, Denver, Arapahoe, and Laramie-Fox Hills aquifers. Land use impacts, including substantial growth of subdivisions in the upper Black Squirrel Creek Basin, and the development of many of these subdivisions on 2.5-acre lots that include domestic septic systems, has led to considerable concern related to potential contamination of groundwater and to the municipal wells used to supply the smaller communities in the basin. Because of those concerns, the El Paso County Board of County Commissioners held work sessions in early 2009 to discuss potential changes to the El Paso County Land Development Code. The work sessions led to adoption by the Board of Resolution No. 09-202, which provided staff direction to develop and implement a work plan to conduct a groundwater contamination study. The work plan that was subsequently developed by County staff, in consultation with a volunteer committee of individuals with the appropriate technical skills, recommended a three-phased study. The board then

established the Groundwater Quality Study Committee, and work commenced during mid-2009. The first phase of the study, completed in April 2011, was a summary of the available data and literature search of studies completed in the basin (Topper and Horn, 2011). The recommendation from Phase 1 of the study:

"Due to the spatial and temporal limitations of the compiled water-quality data, this study was only partially successful in meeting the objectives established by the study committee. Unfortunately, there is no groundwater quality data available in the northwest portion of the basin, where urban land uses and ISDS's are concentrated and continued development is expected. Decision makers in El Paso County attempting to assess the vulnerability of the groundwater resource currently lack a complete understanding of the hydrogeology of the aquifer system and the associated anthropogenic effects controlling the source, transport, and fate of potential contaminants. To address this gap, we recommend implementing a Phase 2 investigation focusing on refining our understanding of the groundwater flow system and acquiring the water quality data needed to support and scientifically defend land use planning decisions."(Topper and Horn, 2011).

Following the completion of the first phase of the study, the U.S. Geological Survey (USGS) was asked by the Groundwater Quality Study Committee to develop a proposed study for the second phase of the study that would address the recommendations put forth from the first phase. Phase 2 (the subject of this proposal) will locate and identify existing wells for groundwater-quality sampling, install monitoring wells in areas where it is important to collect data but where no wells exist, and sample groundwater from those existing and installed wells. Once sampling is complete, Phase 2 will make statistical correlations between groundwater quality and factors such as depth to groundwater, land use, and soils, and then develop maps that predict the predisposition of areas to groundwater contamination. Phase 2 also will identify a subset of the sampled wells that are suitable for long-term water-quality sampling.

Phase 3, which may be performed after Phase 2 is completed (as directed by the Board of County Commissioners), will utilize the information gained during Phase 1 and Phase 2 to develop recommendations on topics such as:

- land-use planning and subsequent development of regulations, if warranted,
- voluntary water-quality protection programs,
- public education and outreach,
- county administration and refinement of onsite wastewater system regulations,
- future aquifer recharge projects,
- areas of special concern for oil and gas drilling,
- zones for wellhead protection,
- long-term sampling of wells to monitor the potential effects from land-use development and oil and gas exploration, and
- future susceptibility assessments in the Denver Basin bedrock aquifers.

D. OBJECTIVES AND SCOPE

The objective of Phase 2 is to gain a better understanding of groundwater resources in the upper Black Squirrel Creek Basin to aid in planning, decision making and public education

related to groundwater and drinking water supplies to provide for long-term water-resource protection and management. The results of Phase 2 will help to determine the age and flow directions of the groundwater, and identify areas sensitive to groundwater contamination. Maps that show the predisposition of the alluvial aquifer in the upper Black Squirrel Creek Basin to groundwater contamination will be developed. These maps can be used by resource managers to focus groundwater-sampling programs in areas of greatest potential for contamination and focus pollution-prevention programs in areas of greatest concern. For example, the maps generated from this project can support the next phase of the project (Phase 3), which may determine wellhead protection zones.

The scope of this project includes identifying existing wells completed in the alluvial aquifer that are suitable for geochemical sampling. The scope also includes installation of up to 10 new monitoring wells where no wells exist. Water from at least 50 new and existing wells will be analyzed for fluoride, major ions, nitrate, and groundwater age dating constituents such as chlorofluorocarbons, dissolved gasses, and tritium. The southern boundary of the study area may be extended south of the boundary used during the Phase 1 report to incorporate wells owned by the State of Colorado. Maps predicting the probability of groundwater contamination by constituents such as nitrate will be developed based upon statistical correlations between groundwater quality data and factors such as depth to groundwater, land use, and soils. Wells suitable for long-term groundwater-quality sampling during Phase 3 will be identified.

There is concern that proposed oil and gas exploration activities could adversely affect groundwater quality in the study area. One of the primary objectives of Phase 2 is to develop maps predicting the pre-disposition of groundwater contamination from nonpoint sources of contamination such as nitrate. Assessing the potential impacts from site-specific oil and gas exploration activities are beyond the scope of this proposal. However, it is within the scope of Phase 2 to establish baseline groundwater quality in the alluvial aquifer. Water from the same 50 wells sampled by Phase 2 will be analyzed for additional compounds that are indicators of potential contamination resulting from oil and gas activities. These compounds include benzene, toluene, ethylbenzene, and xylenes (BTEX, see Table 1), and methane (determined with a dissolved gas analysis).

Making land use decisions such as determining maximum densities of domestic septic systems is beyond the scope of Phase 2, because Phase 2 is a regional study designed to evaluate nonpoint–source pollution across the entire study area. However, the results of Phase 2 can provide the foundational information for making land use and public health decisions during Phase 3.

E. APPROACH

A staged approach will be used during Phase 2 that allows specific components of the project to be completed in a sequential manner. This staged approach was successfully accomplished in a similar study in Eagle County. If only partial funds can be obtained during any particular year, the staged approach allows tasks to be completed in a sequential manner, and the timelines of the next tasks to be pushed forward until additional funds can be obtained. The timelines for each task can be modified depending on the availability of

funds. The cost estimates were performed using 2012 cost estimates. If it takes longer than anticipated to get all tasks funded, the costs estimates may have to be recalculated to account for inflation.

The first task will include carefully examining the Colorado Division of Water Resources Well Permit database to identify 'candidate' wells that are completed in the alluvial aquifer in the study area. All data associated with the candidate wells will be compiled, including well logs, well depths, screened intervals, well permits, and well owner information. All relevant GIS data for the study area such as land use, geology, and soils data will also be compiled. The datasets associated with this information will be downloaded into a central data repository (such as a relational database) so that efficient retrieval and linkages to other attributes can be done to meet the project objectives. Cooperator support is required, and will include in-kind services to assist with retrieving well permit data, identifying wells completed in the alluvial aquifer, locating wells logs and matching those with candidate wells, obtaining well owner information, and obtaining GIS data from local agencies (Table 2).

The first task of Phase 2 will also select a subset of the candidate wells using a stratified random sampling procedure. Existing GIS data such as land use, geology, and soils will be used to identify the full range of land use and hydrogeologic factors present in the study area. The stratified random sampling procedure will select wells that sample a wide range of those factors in a statistically random manner. Because of the complex nature of this analysis, the USGS would lead this task of Phase 2.

The second task will perform a site visit of the randomly selected wells to determine their suitability for geochemical sampling. The suitability for sampling will be based upon factors such as the ability to measure the water level, permission to sample from the well owner, and the presence of a sample port located prior to any filtration, treatment, or pressure tanks. If the site is deemed suitable for sampling, it will be inventoried, the water level will be measured, and all relevant information will be entered into the USGS NWIS database. The USGS will lead this effort, but cooperator assistance is required to contact well owners and arrange site visits.

The third task will install new monitoring wells, if needed. Phase 1 recommended that eight new monitoring wells be installed by this project, but at the time of this writing, it is not known if geologic conditions will allow installation of the wells. Information learned during Task 1 and 2 of Phase 2 will be used to determine if these wells should be installed. Cherokee Metro District has offered their assistance to complete this Task. Cherokee will contact landowners and get permanent site access, set up contracting with the well drilling contractor, and assist drillers during well drilling and development. The drilling contractors will be responsible for locating utilities, obtaining well permits from the State of Colorado, purchasing supplies, installing the wells, and developing the wells to assure they provide sufficient groundwater for sampling. The USGS will recommend the locations for installed wells. If less than 8 monitoring wells are installed, then any leftover funds could be used to pay for additional geochemical sampling.

The fourth task of this project will consist of groundwater-quality sampling at 50 wells for BTEX, chlorofluorocarbons (CFC's), dissolved gasses, fluoride, major ions, nitrate, and tritium. Data from multiple geochemical tools will compliment each other, helping to verify the results. CFC's and tritium are good age-dating tools for waters less than 50 years old (Plummer and Friedman, 1999). Dissolved gasses (N_2, Ar, CH_4, CO_2, and O_2) will be analyzed at all the sampled sites to provide groundwater recharge temperature data required for CFC age dating. The potential impacts from oil and gas exploration are a concern, so BTEX (Table 1) and methane (from the dissolved gas analysis) will be analyzed in water from all sampled sites. High concentrations of fluoride have been reported in the study area, so Phase 2 will help identify problem areas. Major ions can be used as geochemical tracers, and possibly to identify impacts from oil and gas activities. Nitrate is of high concern for local residents, and will be used to calibrate the probability maps. Field parameters, which will be collected at each site, will include water level, dissolved oxygen, pH, specific conductance, and temperature. Dissolved oxygen provides important information on the reduction and oxidation (redox) characteristics of the groundwater, which helps determine how persistent nitrate will be in the groundwater. Cooperator assistance is required to arrange well access, help with sampling logistics, and possibly provide field staff.

The fifth task of this project will compile and analyze all data collected by this project along with Phase 1 data. Groundwater geochemistry, groundwater age, and elevations of the groundwater will be evaluated and a conceptual model of the groundwater age and flow directions will be developed. Maps showing the water table elevations and depth to groundwater will be developed. Groundwater probability model(s) and map(s) will be developed based upon correlations between the groundwater-quality data and GIS data such as depth to groundwater, land use, and soils. Statistical models will be developed that predict the predisposition of the alluvial aquifer to groundwater contamination, similar to that done by Rupert (1998, 2001, and 2003) and Rupert and Plummer (2009). Two types of probability models/maps will be developed. The first will develop a probability model/map using only hydrogeologic variables such as depth to groundwater and soils (hydrogeologic susceptibility). The first model/map can be used in land use applications or public health reviews so that appropriate conditions or technology can be required in highly sensitive areas. The second probability model/map will combine land use variables with the hydrogeologic susceptibility variables (groundwater vulnerability). This second model/map will help identify if there is a correlation between certain land uses and contamination, and it can be used by planners to create zoning and land use plans. The final report will describe the: 1) groundwater quality, 2) groundwater age, 3) groundwater flow directions, and 4) correlations between groundwater quality and GIS data. The final report will define the predisposition of the alluvial aquifer to groundwater contamination by incorporating methods used by Rupert (1998, 2001, 2003), and Rupert and Plummer (2009). Task 5 will also produce a groundwater-monitoring plan for future sampling of the alluvial aquifer. This groundwater-monitoring plan will include a list of wells sampled during Phase 2 that are suitable for long-term sampling, a list of analytes, sampling frequency, and estimated costs. This monitoring plan may be useful for long-term baseline monitoring of the effects of land use development, including the potential effects from oil and gas exploration and production in the area.

F. QUALITY-ASSURANCE PLAN

All new data-collection sites will be inventoried and the data will be entered into the National Water Information System (NWIS) database in accordance with standards specified by the Colorado Water Science Center (http://co.water.usgs.gov/usgs/datamgmt/site_file_POLICY.doc). Groundwater levels will be measured in accordance with the groundwater technical procedures of the U.S. Geological Survey (Cunningham and Schalk, 2011). All groundwater-quality data will be collected in full accordance with the USGS Colorado Water Science Center QA/QC plan (http://co.water.usgs.gov/usgs/QA/CO_Water_Quality_QA_Plan.pdf) using standard USGS sampling methods (http://water.usgs.gov/owq/FieldManual/) and methods specified by the USGS chlorofluorocarbon laboratory (http://water.usgs.gov/lab/cfc/sampling/).

Chlorofluorocarbon samples will be analyzed by the USGS Chlorofluorocarbon lab in Reston, VA. All other water-quality samples will be analyzed by the U.S. Geological Survey National Water Quality laboratory and all data will be entered into the USGS National Water Information System database.

The QA/QC program for water-quality sample collection will consist of 5 replicate CFC samples collected at each site, replicate samples for major ions, nutrients, and tritium collected at 10 percent of the sites, and equipment blank samples for major ions and nutrients collected at 10 percent of the sites. Duplicate samples for dissolved gasses will be collected at each site. BTEX trip blank and replicate samples will be collected at 10 percent of the sites.

Metadata will be created for all ARC/INFO coverages, shapefiles, and geodatasets that are developed by this project. This metadata and the associated ARC/INFO data files will undergo colleague review and USGS approval prior to being released to the public. The metadata will meet Federal Geographic Data Committee standards as specified at http://water.usgs.gov/usgs/gis/metadata.html.

G. PRODUCTS

A comprehensive USGS Scientific Investigations Report (SIR) will be written at the completion of Phase 2 that summarizes the results of all tasks of the project. The GIS data layer(s) of the groundwater probability map(s) developed by this study will be published as Open File reports and posted on the World Wide Web for use by the public. All other original GIS data layers developed by this study (such as depth to ground water and water table) will be published as USGS Open File reports and posted on the World Wide Web. Text from the SIR will be used to develop the metadata for the original GIS data layers so there is consistency between the final report and the associated data layers.

All GIS data layers that were used as building blocks for the probability maps, but not necessarily developed by this project (such as land cover and soils) will be transmitted to El

Paso County so that all the building blocks that went into the probability maps can be archived, and updated probability maps can be produced in the future.

All well inventory and groundwater-quality data collected during Phase 2 will be entered in the U.S. Geological Survey National Water Information System (NWIS) database and served on the World Wide Web (except for well owner and public supply well information, which will be kept confidential). A copy of the well database will also be transmitted to El Paso County, with a confidentiality clause because it may contain well owner information.

A groundwater monitoring plan for future sampling of the alluvial aquifer will be developed. This groundwater-monitoring plan will include a list of wells sampled during Phase 2 that are suitable for long-term sampling, a potential list of analytes, sampling frequency, and estimated costs. This monitoring plan may be useful for long-term baseline monitoring of the effects of land use development, including the potential effects from oil and gas exploration and production in the area.

H. PROJECT MANAGEMENT

A final project schedule will be arranged at the time the USGS Joint Funding Agreement is signed by both parties. Once the project begins, written status updates will be provided by the USGS on a quarterly basis. If requested, the USGS will attend the monthly committee meetings to give verbal status reports. The USGS arranges billing on a fixed-cost basis, with bills submitted quarterly.

I. REFERENCES

Cunningham, W.L., and Schalk, C.W., comps., 2011, Groundwater technical procedures of the U.S. Geological Survey: U.S. Geological Survey Techniques and Methods 1–A1, 151 p. (available only online at http://pubs.usgs.gov/tm/1a1/)

Plummer, L.N., and Friedman, L.C., 1999, Tracing and dating young ground water: U.S. Geological Survey Fact Sheet FS–134–99.

Rupert, M.G., 1998, Probability of atrazine/desethyl-atrazine and elevated concentrations of nitrate (NO2+NO3-N) in ground water in the Idaho part of the upper Snake River Basin: U.S. Geological Survey Water-Resources Investigations Report 98-4203, 1 plate, 32 p., http://idaho.usgs.gov/PDF/wri984203/index.html.

Rupert, M.G., 2001, Calibration of the DRASTIC ground-water vulnerability mapping method: Ground Water, July-August 2001, vol. 39, no. 4, p. 625-630.

Rupert, M.G., 2003, Probability of detecting atrazine/desethyl-atrazine and elevated nitrate concentrations in ground water in Colorado: U.S. Geological Survey Water-Resources Investigations Report 02-4269, 35 p., 18 figs, http://water.usgs.gov/pubs/wri/wri02-4269/.

Rupert, M.G., and Plummer, L.N., 2009, Groundwater quality, age, and probability of contamination, Eagle River watershed valley-fill aquifer, north-central Colorado, 2006–2007: U.S. Geological Survey Scientific Investigations Report 2009–5082, 59 p., http://pubs.usgs.gov/sir/2009/5082/.

Topper, Ralf, and Horn, Andy, 2011, El Paso County Groundwater Quality Study – Phase: Prepared for El Paso County Groundwater Quality Study Committee, available from Colorado Geological Survey web site http://geosurvey.state.co.us/water/Water%20Quality/Pages/WaterQuality.aspx.

Table 1. List of constituents (and their reporting limits) analyzed by USGS Lab Schedule 4025, Gasoline Oxygenates & BTEX.

Schedule 4025

Description: Gasoline Oxygenates & BTEX, Acidified, Wat, Unf - 3 vials
[RL, Laboratory Reporting Limit]

Analyte		Parameter Code	CAS Number	RL	Unit	RL Type	C A
tert-Amyl alcohol		77073	75-85-4	0.6	ug/L	lrl	
Methyl acetate		77032	79-20-9	0.46	ug/L	lrl	
Acetone		81552	67-64-1	1.6	ug/L	lrl	
Benzene		34030	71-43-2	0.040	ug/L	lrl	
1,4-Bromofluorobenzene		99834	460-00-4		pct		
Ethylbenzene		34371	100-41-4	0.032	ug/L	lrl	
1,2-Dichloroethane-d4		99832	17060-07-0		pct		
Ethyl tert-butyl ether		50004	637-92-3	0.046	ug/L	lrl	
Isobutyl alcohol-d6		62835	72182-69-5		pct		
Diisopropyl ether		81577	108-20-3	0.044	ug/L	lrl	
m- and p-Xylene		85795	179601-23-1	0.050	ug/L	lrl	
tert-Butyl methyl ether		78032	1634-04-4	0.060	ug/L	lrl	
o-Xylene		77135	95-47-6	0.028	ug/L	lrl	
tert-Butyl alcohol		77035	75-65-0	0.8	ug/L	lrl	
tert-Pentyl methyl ether		50005	994-05-8	0.044	ug/L	lrl	
Toluene		34010	108-88-3	0.020	ug/L	lrl	
Toluene-d8		99833	2037-26-5		pct		

CAS Registry Number® is a Registered Trademark of the American Chemical Society. CAS recommends the verification of the CASRNs through CAS Client Services.

Table 2. Timeline of primary Tasks of the Phase 2 study, estimated costs, and list of duties for the cooperating agencies and the USGS.

TASK	TIME TO COMPLETE TASK	COOPERATOR COST (estimates based on 2012 estimates. Costs may go up in future years due to inflation)	USGS COST (estimates based on 2012 estimates. Costs may go up in future years due to inflation)	TOTAL	RESPONSIBILITIES
Task 1: Compile GIS data not collected during Phase 1 such as soils and domestic septic systems. Identify wells completed in alluvial aquifer. Perform stratified randon selection of wells.	2 months	$6,900	$5,700	$12,600	Cooperator assistance: retrieve well permit data, identify wells completed in the alluvial aquifer, locate well logs and match those with candidate wells, obtain well owner information, and obtain GIS data from local agencies such as density of domestic septic systems. USGS Tasks: Compile GIS data not collected during Phase 1 such as soils and density of domestic septic systems. Organize GIS and well data into central repository. Identify wells completed in the alluvial aquifer. Overlay alluvial wells with GIS data such as depth to ground water, land use, and soils. Perform stratified random selection of candidate wells.
Task 2: Site visit and inventory of wells	2 months	$19,300	$15,800	$35,100	Cooperator assistance: Contact well owners, arrange permission to visit well site. USGS Tasks: Inventory wells, measure water levels, enter all well information into the USGS NWIS database.
Task 3: Install new monitoring wells	2 months	$21,650 (not part of USGS funding agreement)	$0	$21,650	Cooperator assistance: Cherokee Metro District estimated total costs of $21,650 to install 10 monitoring wells. Cherokee will arrange drilling independently of this proposal. Cherokee Metro District will contact land owners and get permanent site access, set up contracting with the well drilling contractor, and assist drillers during well drilling and development. Drilling contractors will be responsible for locating utilities, obtaining well permits from the State of Colorado, purchasing supplies, installing wells, and developing wells to assure they provide sufficient groundwater for sampling. USGS Tasks: Recommend locations for installed wells.
Task 4a: Sample 50 wells for chlorofluorocarbons (CFC's), fluoride, major ions, nitrate, and tritium.	2 months to sample, up to 6 additional months to get data back from labs.	$60,250	$49,300	$109,550	Cooperator assistance: Arrange well access, assist with sampling logistics, possibly provide field staff. USGS Tasks: Sample wells, ship samples to specialized USGS laboratories for analysis, enter field and laboratory data into USGS NWIS database.
Task 4b: Additional sampling of 50 wells for BTEX and dissolved gasses (indicators of oil and gas activities).	See Task 4a	$11,600	$9,500	$21,100	Cooperator assistance: Arrange well access, assist with sampling logistics, possibly provide field staff. USGS Tasks: Sample wells, ship samples to specialized USGS laboratories for analysis, enter field and laboratory data into USGS NWIS database.
Task 5: Analyze data and publish final reports	18 months	$78,850	$64,500	$143,350	USGS Tasks: Compile groundwater quality data, make statistical correlations with GIS data such as depth to groundwater, land use, and soils. Develop maps showing the probability of groundwater contamination. Publish the study results in a USGS SIR report, and publish the GIS maps as USGS Open-File reports. Develop a groundwater monitoring plan for long-term groundwater-quality monitoring in the basin.
TOTAL COST		$198,550	$144,800	$343,350	TOTAL COST

Note: If total funding is not available at the start of Phase 2, individual tasks can be completed in a sequential manner as funding allows.

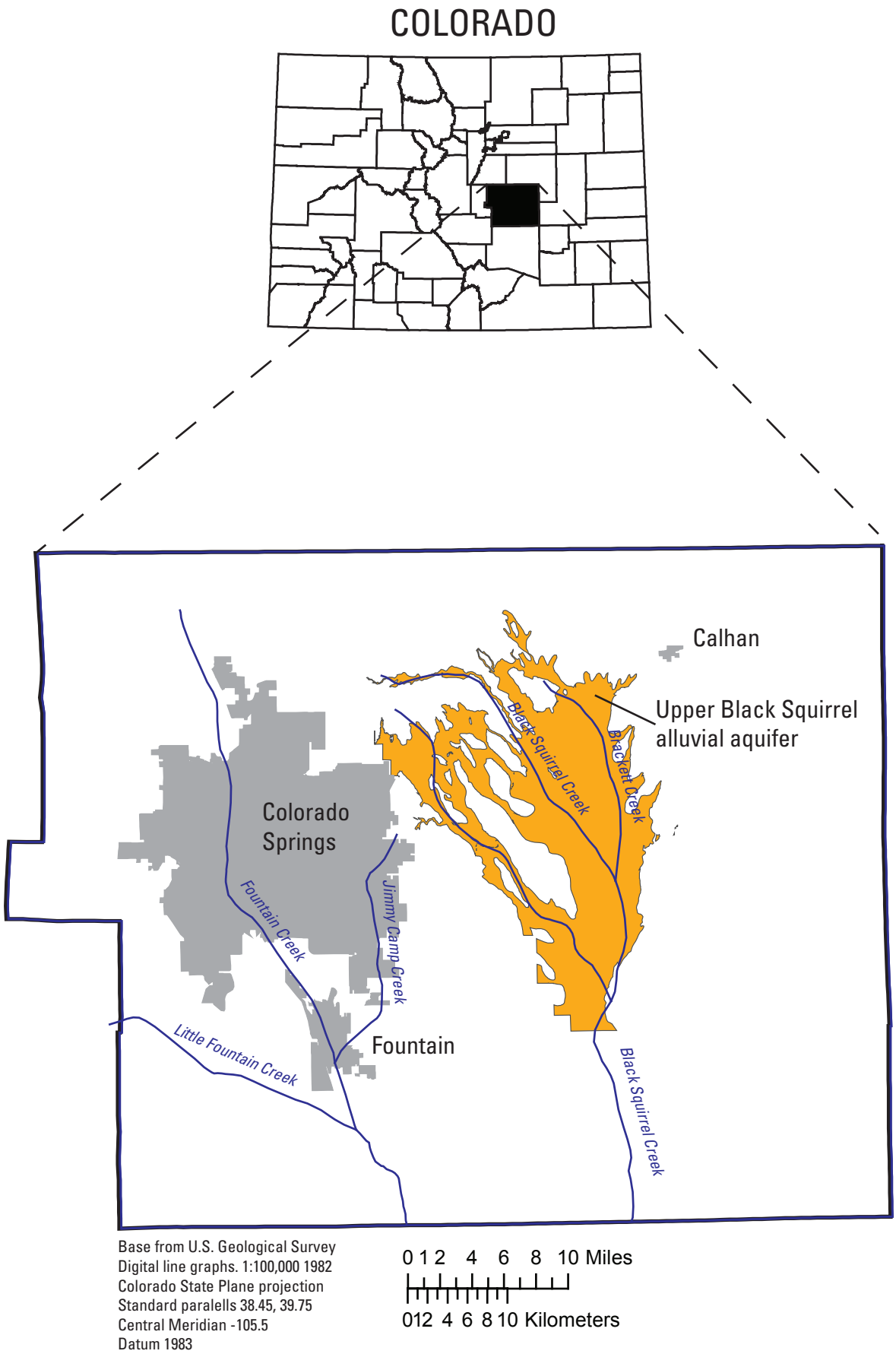

Figure 1. Locations of creeks, towns, and the Upper Black Squirrel Creek Basin alluvial aquifer.

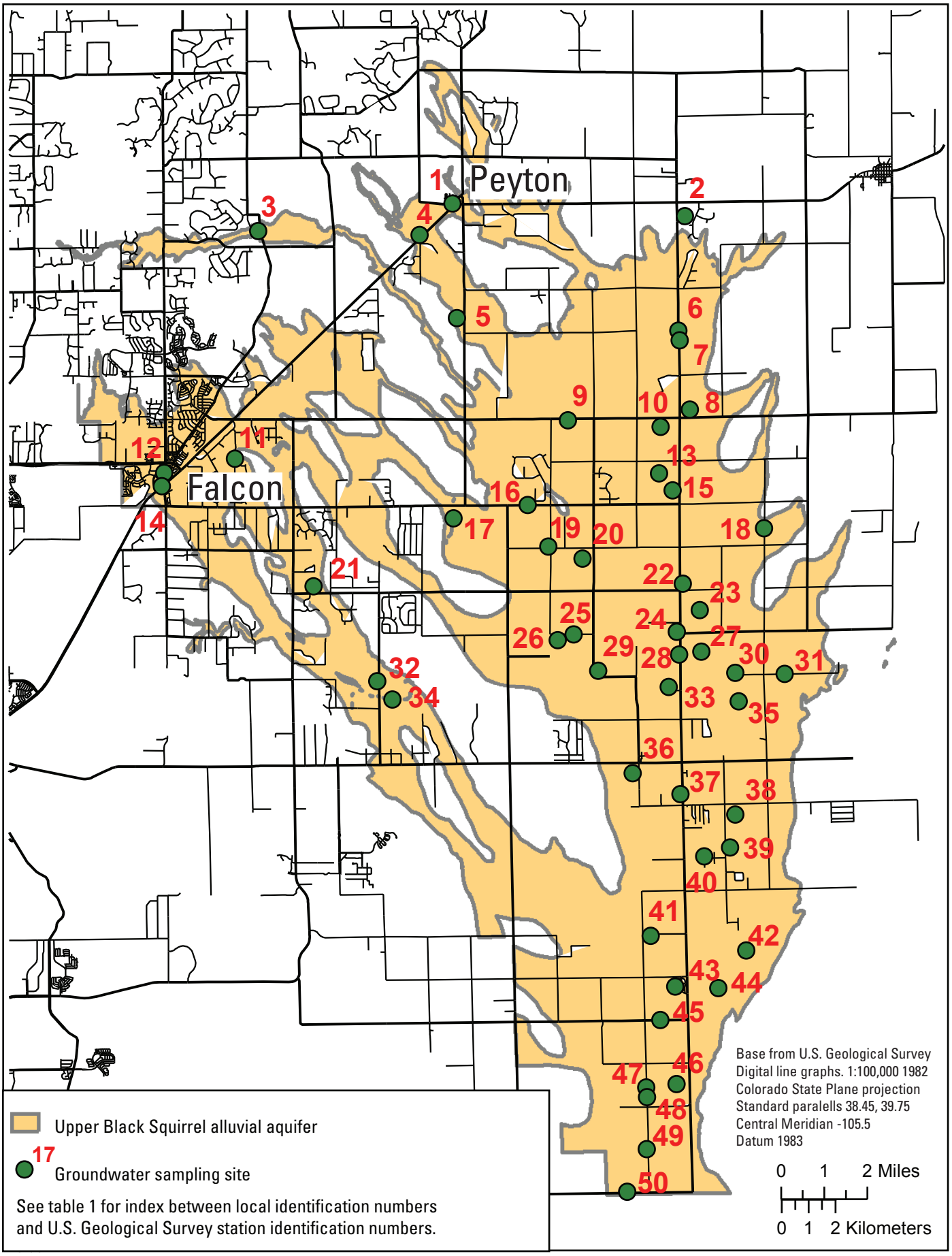

Figure 2. Local identification numbers of groundwater sampling sites, Upper Black Squirrel Creek Basin alluvial aquifer, El Paso County, Colorado, 2013.