

COUNCIL DECISION REQUEST

SUBJECT: Safe Yield Study for the Star Valley Area

MEETING DATE: July 20, 2006

CSP ITEM: Yes KRA 2 Objective 1 No

ITEM NO.:

TENTATIVE SCHEDULE: August 1, 2006, to January 31, 2007

SUBMITTED BY: Fred Carpenter

AMOUNT BUDGETED: \$50,000

**SUBMITTAL TO AGENDA
APPROVED BY TOWN MANAGER**

EXPENDITURE REQUIRED: \$50,000

CONT. FUNDING REQUIRED: N/A

EXHIBITS (If Applicable, To Be Attached):
Star Valley Safe Yield Study Scope of Work

RECOMMENDED MOTION

I move to approve the proposal of Clear Creek Associates to conduct a safe yield study for the Star Valley area for the cost of not to exceed \$50,000, subject to town attorney approval of the contract for services.

SUMMARY OF THE BASIS FOR RECOMMENDED MOTION:

Last year, Council directed staff to conduct a safe yield study for the Star Valley area. Staff solicited proposals and selected Clear Creek Associates for the study. Attached is the scope of work and cost estimate to conduct the study on a not to exceed basis in the amount of \$50,000. Staff discussed the attachment with Lanny Sloan, Star Valley town manager, who advised that the Town of Star Valley is in agreement with the study as outlined. Mike Ploughe, the Town's hydrogeologist, will be at the meeting along a representative from Clear Creek Associates.

If the scope of work is approved, the attorney's office will develop a contract for services.

PROS:

The study will develop extremely useful information as respects the safe yield withdrawal of groundwater from the Star Valley area.

CONS:

None

PUBLIC INPUT (if any):

JUL 20 2006 Sp. 3



*Practical Solutions
in Groundwater Science*

June 30, 2006

Mr. Michael Ploughe, P.G.
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Payson, Arizona 85541

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Scottsdale, Arizona 85251
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Re: Scope of Work and Cost Estimate for
Preliminary Estimation of Sustainable Groundwater Yield
Star Valley, Gila County, Arizona

Dear Mike:

Clear Creek Associates (Clear Creek) is pleased to provide this scope of work and cost estimate to the Town of Payson Water Department for completing a Preliminary Estimation of Sustainable Groundwater Yield for the Star Valley area. Our proposed scope of work is generally consistent with the scope of work described in our proposal dated October 17, 2005, except where otherwise noted. This scope of work and cost estimate was prepared in response to your request in our meeting on June 12, 2006. Our understanding of the project and proposed approach are described below, followed by our scope of work and cost estimate.

PROJECT UNDERSTANDING AND PROPOSED APPROACH

The Star Valley area is located adjacent to and east of Payson in Gila County, Arizona. Star Valley is located in the northern part of the Tonto Creek Basin within a small watershed that covers an area of approximately 30 square miles. The area is drained by Houston Creek and several tributaries. Groundwater occurs primarily within older, fractured granitic rocks that comprise the local aquifer. The primary source of recharge to the aquifer is natural recharge from precipitation.

The Star Valley area incorporated in late 2005. The Town of Payson originally considered the potential development of groundwater supplies from Star Valley for use within Payson; however, since the incorporation of Star Valley, the Town of Payson is now seeking an independent study to evaluate the long-term sustainable yield of the aquifer in the Star Valley area for use by the Town of Payson and the Town of Star Valley in developing sound, conservative water management practices. It is anticipated that the Town of Star Valley will participate in the study to some degree, by

contributing available groundwater data to the evaluation effort and/or reviewing intermediate and final work products through their consultant, Levine Fricke Recon (LFR).

The Star Valley sustainable yield evaluation described in this letter and in our proposal dated October 17, 2005, will be performed using available geologic, hydrogeologic and meteorological data, and the results of previous groundwater investigations in the Payson and Star Valley areas. Numerous investigations have been completed for the Town of Payson or local developers, some of which extend into Star Valley. It is anticipated that a substantial effort will be required to compile, review and evaluate the existing data and reports.

Various methods will be evaluated and considered for estimating the sustainable yield of the aquifer in Star Valley. Methods to be considered include, but may not be limited to: (1) calculating the annual volume of natural recharge derived from the average annual precipitation within the watershed, and (2) calculating recharge based on groundwater flux using a groundwater elevation contour map and the estimated thickness and transmissivity of the aquifer. In addition, previous sustainable yield estimates commissioned by the Town of Payson will be evaluated, including an estimate by Gookin Engineers in the early 1990s, and a more recent study by Southwest Ground-water Consultants, Inc. (SGC), in the late 1990s. The results of both studies will be reviewed for potential applicability to the Star Valley study.

SCOPE OF WORK

The scope of work for the Star Valley sustainable yield evaluation will consist of: (1) attending three meetings in Payson, (2) compiling and reviewing available data, (3) electronically scanning documents provided by the Town of Payson, (4) evaluating the data to estimate the sustainable yield of the aquifer in the Star Valley area, (5) developing an preliminary water budget, and (6) summarizing the results of the evaluation in a report for the Town of Payson. The scope of work for each task is described below.

Task 1 – Project Meetings and Management

It is anticipated that Clear Creek Associates will attend three meetings in Payson over the course of the project. An initial meeting will be held in Payson early on in the project, after most of the available data have been compiled and reviewed (Task 2). This initial meeting will include a visit to

Star Valley to meet with citizens, officials and local water providers, observe key physical and geologic features, and confirm the locations and condition of key groundwater supply wells. A second meeting will be held halfway through the project to update the Town of Payson on the progress and preliminary findings of the study. A third meeting will be held near the end of the project to present the final report to the Town of Payson and the Town of Star Valley. Additional budget will be included under this task for project management activities, such as contracting, coordination and financial tracking.

Task 2 – Data Compilation and Review

Clear Creek Associates received approximately 15 bound reports from the Town of Payson at our meeting on June 12, 2006. Most of the reports were prepared by consultants for the Town of Payson, developers or property owners, and present the results of various groundwater investigations in the Payson area. It is anticipated that additional reports and groundwater data will be obtained from the Town of Payson, the Town of Star Valley, local Star Valley water providers and property owners, and other publicly available sources. Sources of information will include, but may not be limited to, the Arizona Department of Water Resources (ADWR), the U.S. Geological Survey (USGS), and the Arizona Geological Survey (AGS). The types of data and information required for the Star Valley sustainable yield evaluation include:

- Precipitation Data
- Well Location and Construction Data
- Lithologic Logs
- Water Level Data
- Aquifer Test and/or Specific Capacity Data
- Geologic and Hydrogeologic Maps and Reports

Precipitation data will be obtained from the National Weather Service or other available sources. Groundwater data will be obtained from local sources in Payson, as described above, and from the following databases maintained by ADWR:

- **Ground Water Site Inventory (GWSI) Database.** The GWSI database contains groundwater data for ADWR-inventoried wells statewide, including well location, construction, ownership, water level, specific capacity and water quality data.

- **Well Registry Database.** The Well Registry database, also known as the “55 File”, contains records of all registered wells, including well location, construction, and ownership. The information is reported by the well owner and is not verified by ADWR.
- **Imaged Records Database.** The Imaged Records database, maintained on the ADWR website, contains scanned documents from the Well Registry database and is used to obtain well logs, verify well construction, and track changes in well ownership.
- **Arizona Water Commission (AWC) Well Registry Database.** Also known as the “35 File”, this database (maintained by ADWR) contains electronic data and imaged records for wells registered with the AWC prior to the establishment of ADWR in 1980.

Geologic maps of the Star Valley area will be obtained from the USGS, AGS or other sources, including the Town of Payson. Hydrogeologic maps and reports will be obtained from the USGS and ADWR. Geologic and hydrogeologic information will also be obtained from the ongoing Mogollon Rim Water Management Study (MRWMS) coordinated by the U.S. Bureau of Reclamation.

Task 3 – Electronic Scanning of Documents

As requested by the Town of Payson, Clear Creek Associates will electronically scan all of the reports and other documents provided at the June 12, 2006 meeting, as well as any additional documents provided by the City. The documents will be scanned into Portable Document Format (PDF) files using Adobe Acrobat, and provided to the Town of Payson on Compact Disc (CD), or via e-mail.

Task 4 – Estimation of Sustainable Yield

The data compiled under Task 2 will be evaluated to estimate the sustainable yield of the aquifer in Star Valley, using various methods. Methods to be considered include: (1) calculating the annual volume of natural recharge derived from the average annual precipitation within the watershed, (2) calculating recharge based on groundwater flux using a groundwater elevation contour map and the estimated thickness and transmissivity of the aquifer, and (3) other methods, as described below.

Analysis of Natural Recharge

Natural recharge will be estimated from the average annual precipitation within the Star Valley watershed. Historic precipitation data from the nearest weather stations will be obtained from the National Weather Service and other sources, if necessary. The precipitation data will be evaluated and processed to calculate a value for long-term, average annual precipitation. Natural recharge (and by inference, sustainable yield) will then be calculated as a percentage of average annual precipitation using one or more published climatic methods for calculating natural recharge. Methods that will be considered include, but may not be limited to, the Maxey-Eakin method (Eakin, 1966), which assumes that the percentage of precipitation that is recharged increases with elevation, and other methods (Gates, 1963, 1965; Feth and others, 1966) that incorporate runoff and/or evapotranspiration. The method(s) ultimately selected will depend on the amount of data available for analysis and the applicability of each method to the Star Valley study.

Analysis of Groundwater Flux

Natural recharge also will be estimated by calculating the groundwater flux across an established section of the aquifer using Darcy's Law ($Q=KiA$). To apply this method, the well location and groundwater level data compiled under Task 1 will be used to prepare a groundwater elevation contour map of the Star Valley area. Available aquifer test and/or specific capacity data will be used to calculate aquifer transmissivity and hydraulic conductivity. The groundwater flux (Q) will be calculated by multiplying the hydraulic conductivity (K) by the hydraulic gradient (i) derived from the groundwater elevation contours and the cross sectional area (A).

The usefulness of the groundwater flux method for estimating natural recharge is based on the assumption that the recharge rate is greater in the higher elevations near the margins of the watershed, and that the groundwater flow direction generally follows the topography. The applicability of this method to estimating the sustainable yield of the Star Valley area will therefore depend on the groundwater flow direction after the groundwater elevation contour map has been completed.

Other Methods

The Town of Payson has a policy that groundwater development cannot exceed the sustainable yield of the aquifer (i.e., net recharge). Because of this, Payson has previously commissioned at least two sustainable yield estimates, including an estimate by Gookin Engineers (1992) and one by SGC

(1998). The Gookin study yielded a net recharge value of 16 percent of precipitation, which is generally considered to be high. The SGC study yielded a lower value using a different method; the Town of Payson currently uses 80 percent of the SGC value for planning purposes. Clear Creek Associates will critically review the methods and results of those studies for potential applicability to the Star Valley study. In addition, Clear Creek Associates may develop and propose an alternate method for estimating sustainable yield.

Task 5 – Preliminary Water Budget

A preliminary water budget will be developed for the Star Valley area after the sustainable yield estimates have been completed. The water budget will allow a comparison of the total inflow (recharge) and the total outflow (groundwater pumpage) to provide an estimate of how much additional groundwater can be pumped before the sustainable yield is exceeded. To complete the water budget, groundwater pumpage will be estimated by identifying the total number of pumping wells in the area and the total population served. We assume that population figures can be obtained through the Town of Payson and/or Gila County. The Star Valley water budget will be combined with the existing water budget for Payson (prepared by SGC) to form an overall water budget for the Payson / Star Valley area.

As part of this effort, the water level data compiled under Task 2 will be used to generate a series of water level hydrographs for wells with long-term periods of record. The hydrographs will be used to evaluate water level trends, and can assist in identifying groundwater decline rates, if any.

Task 6 – Sustainable Yield Report

Clear Creek Associates will prepare a report for the Town of Payson and the Town of Star Valley summarizing the results of the Star Valley sustainable yield evaluation after the data evaluation has been completed. The report will provide an overview of groundwater conditions in the Star Valley area, and will include the groundwater elevation contour map prepared under Task 4. Maps presented in the report will be prepared in GIS (ArcView). A table of existing wells and construction data will be provided, along with a table of water level data. Available aquifer test and/or specific capacity results also will be provided. The preliminary estimated sustainable yield of the aquifer will be presented, along with the method(s) used in the calculations. If applicable, the report also will include the preliminary water budget and water

level hydrographs, as described under Task 5. The report will be provided to Payson in draft form, and finalized after comments have been received. An electronic copy of the final report will be prepared and provided to Payson and Star Valley on a CD at the end of the project.

COST ESTIMATE

Clear Creek Associates will complete the scope of work described above for a total amount not to exceed \$50,000. Our cost estimate is summarized by phase and task in Attachment A. Our estimate includes Clear Creek Associates labor, and charges for equipment and miscellaneous expenses (listed collectively in the table as Other Direct Costs). A schedule of hourly billing rates and equipment rates is provided in Attachment B.

SCHEDULE

Based on the scope of work, we estimate that approximately six months will be required to complete the project. Assuming a start date of July 1, 2006, we anticipate that the project will be completed by December 31, 2006. Clear Creek Associates is prepared to begin work upon receipt of authorization from the Town of Payson.



We look forward to the opportunity to work with you on this project. If you have questions concerning any of the information presented in this letter, please contact me or Doug Bartlett at (480) 659-7131.

Sincerely,

CLEAR CREEK ASSOCIATES, PLC



David A. Carr, R.G.
Senior Hydrogeologist

Attachment A – Cost Estimate Summary

Attachment B – Schedule of Hourly Billing Rates and Other Direct Costs



ATTACHMENT A
COST ESTIMATE SUMMARY
PRELIMINARY ESTIMATION OF
SUSTAINABLE GROUNDWATER YIELD
STAR VALLEY, GILA COUNTY, ARIZONA

Task	Days	Cost Estimate			Total Cost	
		Personnel Cost	Other Direct Cost	Subcontractors		
1	Project Meetings and Management	64	\$ 7,900	\$ 400	\$ -	\$ 8,300
2	Data Compilation and Review	84	\$ 9,200	\$ 100	\$ -	\$ 9,300
3	Electronic Scanning of Documents	16	\$ 1,100	\$ -	\$ -	\$ 1,100
4	Estimation of Sustainable Yield	88	\$ 9,700	\$ -	\$ -	\$ 9,700
5	Preliminary Water Budget	42	\$ 4,600	\$ -	\$ -	\$ 4,600
6	Sustainable Yield Report	186	\$ 16,700	\$ 300	\$ -	\$ 17,000
	TOTAL	480	\$ 49,200	\$ 800	\$ -	\$ 50,000

NOTES:

1. Task 1 includes costs for preparing for and attending three meetings in Payson (two Clear Creek staff), and project management.
2. Task 2 is for compiling and reviewing reports from the Town of Payson and other sources, and compiling and tabulating electronic groundwater data from ADWR and other sources.
3. Task 3 is for scanning reports and documents provided by the Town of Payson into PDF files and providing the electronic files on a CD.
4. Task 4 includes costs for evaluating various methodologies for estimating sustainable yield, and estimating the sustainable yield for Star Valley using one or more methods.
5. Task 5 is for developing a preliminary water budget for Star Valley, and incorporating the results into an overall water budget for the Payon / Star Valley area.
6. Task 6 assumes that a draft and final report will be issued. Six copies of the final report will be provided to the Town of Payson and Star Valley, along with an electronic copy on CD.



ATTACHMENT B
CLEAR CREEK ASSOCIATES, PLC
SCHEDULE OF HOURLY BILLING RATES AND FEES

HOURLY BILLING RATES	
Position	Hourly Billing Rate
Principal Hydrologist/Geologist	\$140
Senior Hydrologist/Geologist	\$130
Senior Project Hydrologist/Geologist	\$120
Project Hydrologist/Geologist	\$100
Staff Hydrologist/Geologist	\$85
Assistant Hydrologist/Geologist	\$70
CADD Operator	\$50
Clerical	\$50

Notes: Effective through December 31, 2006.
Hourly billing rates are revised annually to reflect changes in the cost of doing business.
A 50% surcharge will be added to the above rates for expert testimony.

ATTACHMENT B (cont.)

EQUIPMENT		
Item	Cost Per Day	Cost Per Week
Water Level Indicator	\$25	\$100
pH/EC/Temperature Meter	\$15	\$60
Bailer, Teflon or SS	\$15	\$60
Bailer, Disposable	\$12	\$12
Camera (video)	\$40	\$160
Camera (35-mm)	\$5	\$20
Cellular Telephone (local)	\$10	\$40
Cellular Telephone (out-of-town)	\$15	\$60
Computer, Field	\$15	\$60
Flow Meter	\$25	\$100
Generator	\$50	\$200
GPS	\$20	\$80
Pressure Transducer and Data Logger	\$150	\$600
Additional Transducer	\$25	\$100
Brunton Compass	\$10	\$40
Chromium Test Kit	\$15	\$60

MISCELLANEOUS EXPENSES		
Item	Unit	Unit Cost
Black and White Photocopies	Page	\$0.10
Color Photocopies	Page	\$1.00
CADD Services	Hour	\$40.00
Color Printing	Page	\$1.00
Automobile Mileage	Mile	\$0.405
Color Graphics – Bond	Square Foot	\$1.45
Color Graphics – Vellum	Square Foot	\$1.85
Color Graphics – Film	Square Foot	\$2.85
Subcontractors and Other Expenses		15%

Note: Effective through December 31, 2006.