A proposed work plan for evaluation of water resources of the Upper Big Wood River and Silver Creek basins, Idaho

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Presented
December 14, 2005
Hailey, ID

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Introduction

From 1990 to 2000, Blaine County in south-central Idaho experienced a forty percent population growth, and since 2000, the county population is growing at a 3.5percent annual rate. Most of this growth has occurred in the Big Wood River and Silver Creek basins (figure 1) where the current population of 20,000 is projected to increase to 50,000 by 2050 (Brown, 2000). In addition to permanent residents, thousands of people annually visit these basins for winter and summer recreation. Wells and springs are sources of public and domestic drinking-water supplies, and surface water is used for recreation and irrigation supplies. Ground- and surface-water systems are complex and interconnected.

Water managers and private landowners are increasingly concerned about the effects of population growth on water supplies in the basins, including sustainability of ground-water resources and effects of wastewater disposal on ground- and surface-water quality. Development in recent years has been moving to tributary canyons of the upper Big Wood River basin, and residents in some canyon areas have reported declining water levels. It is unclear at this time whether these lower water levels are due to increased development or are a response to several years of drought conditions. In June 2005 Blaine County Commissioners approved an interim moratorium on selected development activities while the impacts of growth, including water-resource concerns, are evaluated.

A current, holistic evaluation of water resources in these basins is needed to address concerns about current growth and development impacts and potential impacts of continued growth and development. In 2005, the U.S Geological Survey (USGS) completed a project to compile and review existing information and data on the upper Big Wood River and Silver Creek basins, identify gaps in information about water-resources, and prepare a work plan with priorities for data collection and interpretation to fill these gaps. Technical questions and priorities for future phases were presented to the Wood River Valley Steering Committee on October 26, 2005. A PowerPoint presentation from this meeting is available through the USGS website *http://id.water.usgs.gov/projects/wood_river_valley/index.html.*

WORK PLAN

Four phases of water-resource investigations are outlined: (1) Assessment of ground-water level and surface-water discharge conditions and development of recommendations for establishing a long-term observation/monitoring well network; (2) Assessment of water quality conditions and recommendations for a long-term ground- and surface-water quality monitoring network; (3) Hydrofacies and aquifer property definition; and (4) Development of a hydrologic budget. Common elements of these investigations are use of historic data and information as the foundation for assessment and recommendations, the need to investigate hydraulic relations between tributary canyons and the main Big Wood River valley, appreciation for the complex hydrogeologic framework of the area, and the need to differentiate the effects of climate change from land use, if possible.

OBJECTIVE

The objective of this Work Plan is to provide descriptive details and costs for the four phases of the proposed water-resource study. Objectives of the phases are to provide data and interpretations about the water resources of the upper Big Wood River and Silver Creek basins that would allow county and local governments to make informed decisions about land use and water-resource management.

DESCRIPTION OF THE AREA

The area of proposed investigations includes the Big Wood River basin above U.S. Highway 20 at Stanton Crossing and the Silver Creek basin (a tributary of the Little Wood River basin) above about Picabo. The area can be divided into two parts based on topography and land use—an upper and lower valley. The Big Wood River basin above about Bellevue (the upper valley) has steep mountain terrain; a narrow, alluvial Big Wood valley; and side canyons with perennial or ephemeral tributary streams. Land use in the upper valley includes sparsely developed rural rangeland, urban development with large homes on landscaped acreages, and the communities of Sun Valley, Ketchum, Hailey, and Bellevue. There are four wastewater treatment plants in the upper valley, but most suburban and rural homes have septic tank/leachate field systems for disposal of domestic wastes.

Hydrology of the upper valley includes the Big Wood River and a number of tributary streams including the North Fork Big Wood River, Warm Springs Creek, Trail Creek, and the East Fork Big Wood River. Ground water primarily exists in unconsolidated sediments under water-table (unconfined) conditions. Depth to water in the upper valley is commonly less than 10 ft, increasing to approximately 90 ft southward. Geothermal springs (water temperature greater than 85 °F) are located in several tributary canyons.

The Big Wood River valley below about Bellevue and the Silver Creek basin (the lower valley) includes foothills and a broad valley floor with clusters of suburban home development, surface- or ground-water irrigated cropland, ranches, and the small communities of Gannett and Picabo. The lower valley may have increasing suburban development pressure in the future.

In the lower valley, the major hydrologic features are the Big Wood River, Willow Creek, and Silver Creek. South of approximately Baseline Road a confined ground-water system underlies the shallow unconfined system. Water levels range from less than 10 ft to approximately 150 ft in the unconfined system. Many wells in the confined system flow and water from some is warm.

In both areas, the Big Wood River and Silver Creek gain or lose water with respect to the ground-water system, depending on local conditions. Ground-water recharge primarily is from infiltration of precipitation or leakage of surface water from streams, canals, and irrigated fields

RELEVANCE AND BENEFITS

Water-resources information provided by Work Plan investigations will give State, County, and local planners many of the tools needed to make land- and water-development decisions to meet multiple competing demands. The Work Plan will benefit the Nation and contribute to the U.S. Geological Survey (USGS) mission by increasing our knowledge of the available water resources and consequences of their use in the arid west. The Work Plan addresses aspects of four of the seven 2005 high priority issues for USGS Coop Program involvement and four of the nine priority water-resources issues listed in "Strategic Directions for the Water Resources Division, 1998-2008". Department of Interior interest in the basin includes resources managed by the Bureau of Land Management.

Phase 1: Assessment of ground-water level and surface-water discharge conditions

Phase 1 includes three tasks: documentation of current hydrologic conditions, comparison of current and historic data, and recommendation of sites and criteria for a long-term water-level monitoring network. This phase will evaluate if any changes have occurred in ground-water levels and surface-water discharge and if so, potential causes. It will also define current relations between ground and surface water in the study area.

BACKGROUND

Ground-water systems continually respond to changes in climate, pumpage, and land use. The main source of information about these stresses on an aquifer is the water level in wells. Ground-water levels provide information on how aquifer stresses can affect ground-water recharge, discharge, and storage. By systematically measuring water-levels over the long term, changes in the resource can be evaluated. In addition, such measurements are an essential component of ground-water models and can be used to “forecast trends and to design, implement, and monitor the effectiveness of ground-water management and protection programs.” (See Taylor and Alley, 2001.)

Because the ground- and surface-water systems are closely linked in the Wood River Valley a ground-water level map alone cannot describe ground-water conditions. Previous authors have defined reaches on the Big Wood River that gain or lose streamflow to the aquifer system and Silver Creek receives ground-water discharge from the aquifer system.

APPROACH

Task 1.1: Documentation of current hydrologic conditions

Documentation of current conditions requires a mass measurement of approximately 100 wells over a short time period and concurrent surface-water flow measurements.

Subtask 1.1.1: Mass measurement of current ground-water levels

- Hydrographs of ground-water levels and stream discharge from sites with long histories of data will be prepared to aid in the selection of wells and measurement timing (pre- or post-irrigation season).
- About 100 wells will be selected throughout the aquifer system for water-level measurement; wells located in tributary canyons are a priority.
- Well-owners will be contacted for permission to measure their well(s).
- Water levels will be measured in about 100 wells over a 1- or 2-week period in the fall, approximately after the end of the irrigation season.

Subtask 1.1.2: Measurement of surface-water discharge

- Stream sites will be selected for discharge measurement from existing data and permission to access stream sites will be obtained.
- Discharge will be measured at 13 Big Wood River and Silver Creek sites concurrent with the ground-water mass measurement.

Subtask 1.1.3: Data interpretation and map report preparation

- Elevations of water-level measurement points and surface-water discharge sites will be surveyed to an accuracy of less than 1 ft with a differential correction Global Positioning System (DGPS).
- Data will be stored in USGS databases and made available through the USGS project website *http://id.water.usgs.gov/projects/wood_river_valley/index.html*.
- A map will be prepared of current (2006) water levels.
- A map or table will be prepared of current (2006) streamflows and streamflow gains and losses.

Task 1.2: Compare current and historic data

- Historic water-level and discharge data will be compiled.
- A date will be chosen to represent predevelopment conditions based on the availability of data—probably sometime between 1970-80.
- Historic precipitation data will be compiled.
- A statistical analysis of base-flow conditions, including an annual and monthly trend analysis, will be performed. Wells with sufficient measurements will be analyzed for trends and compared to precipitation.
- A map will be prepared showing pre-development water-level contours and graphs of discharge data.
- A water-level change map comparing pre-development to current (2006) data will be prepared.
- The current, pre-development, and water-level change maps with relevant supporting data such as hydrographs, precipitation, base-flow analysis and streamflow gain/loss measurements will be finalized and be published as a USGS on-line report and made available through the USGS project website *http://id.water.usgs.gov/projects/wood_river_valley/index.html*.

Task 1.3: Develop recommendations for establishing a long-term water-level monitoring network

- Current State and local water-level monitoring networks will be assessed and a ground-water monitoring plan will be developed, including wells completed in the confined and unconfined systems as well as areas most vulnerable to ground-water impacts.
- Areas where additional monitoring wells are needed will be identified. Ideally, these additional wells will be dedicated wells that are not pumped or near areas of significant pumping. An expanded network could include: existing unused wells with completion information, wells in current use, monitoring/observation wells drilled under separate funding.
- Recommendations will be made regarding measurement frequency which will vary between wells and with time. In some areas biannual measurements will provide sufficient data, while in others monthly measurements may be desirable. Continuous water-level recorders may be needed in a limited number of locations. Continual evaluation of data would allow the network to be adjusted for cost effectiveness and changing data needs as new information becomes available or questions evolve.

- The need for newly drilled, dedicated, observation/monitoring wells will be assessed. New wells should meet multiple objectives, including water-level or water-quality collection, lithologic/hydraulic-property data gaps, and geophysical verification. Such wells would be long-term investment—sites should be chosen for longevity. In areas of interest, wells could be instrumented with continuous recorders. Wells can be instrumented for real-time data collection and Web access if there are outreach or educational needs.

TIME FRAME
The study will begin on July 1, 2006 and end on March 30, 2007. Water level, streamflow, and GPS elevation measurements will be made in October or November 2006.

PERSONNEL
The project manager will be a hydrologist with the U.S. Geological Survey. The manager will be responsible for project planning, coordination of activities with USGS personnel, data management, design and preparation of reports, identification of monitoring network needs, and transfer of data and map coverages with metadata documentation.

REPORTS
Quarterly summary reports will be sent to co-operating agencies and groups. One or more map plates will be prepared showing current, historic, and change maps for ground-water levels; hydrographs and gain/loss data for surface water; and a hydrograph of historic precipitation data. The maps will be prepared as soon as data are compiled from fall measurements, and the map will be available through the USGS project website *http://id.water.usgs.gov/projects/wood_river_valley/index.html*. Data and relevant GIS coverages with metadata will be transferred to cooperators and made available online. Details of the ground-water monitoring plan will be presented to cooperators.

COSTS
The total cost of Phase 1 is $131,000 and the USGS may have matching funds available in fiscal year 2006 and 2007.

Phase 2: Assessment of water-quality conditions

The second phase of this water-resource work plan addresses potential changes in surface- and ground-water quality. It will evaluate surface- and ground-water quality conditions, including description of current water quality, comparison of current and historic data to identify possible changes or trends, identify areas having the greatest affects on water quality, and develop water-quality monitoring networks. The surface-water evaluation would begin in the first year and the ground-water evaluation would begin after Phase 1 is completed.

BACKGROUND

A common problem in many rapidly developing rural areas (such as Jefferson County west of Denver or the East Mountain area east of Albuquerque) is contamination of ground and surface water by domestic-waste disposal. Although there are four wastewater treatment plants in the study area, many homes rely on septic systems for wastewater disposal. Because depth to water in the upper and lower valley is commonly less than 10 ft, and the shallow soil may be frozen several months a year, there is potential for ground-water contamination by domestic wastewater disposal. In addition, because the shallow unconfined aquifer system discharges to Big Wood River and Silver Creek, surface-water could ultimately be affected by any such contamination.

The USGS water-quality database includes 336 analyses from 167 wells or springs in the upper and lower valley areas. These data represent water samples collected and analyzed from 1929 to 2005 and include analyses from 17 wells in the on-going Idaho Statewide Ground Water Quality Monitoring Program. Objectives of the Statewide Monitoring Program, a cooperative effort between the USGS and IDWR, are to characterize the ground-water quality of the state's major aquifers, identify trends and changes in ground-water quality, and identify potential ground-water quality problem areas. Water samples in this program were initially collected in 1990, and samples are periodically collected from selected wells in the network either annually or every four or five years. Depths of wells sampled for the program in study area range from 34 to 325 feet. Water temperature ranges from 41 to 68 ^{o}F and specific conductance, an indicator of dissolved ion concentrations in water, ranges from 177 to 741 µs/cm (microsiemens per centimeter at 25 ^{o}C). Dissolved nitrate concentrations, ranges from less than 0.05 to 3.91 mg/L (milligrams per liter). Currently, only one of the 17 wells (a 42-ft deep well near Ketchum) in this program is resampled annually.

The USGS database includes 706 analyses from 22 surface-water sites, with data representing sample analyses from 1964 to 2004. There are currently two active sites in the IDEQ/USGS surface-water quality network: Big Wood River near Bellevue and Silver Creek at Sportsman Access, near Picabo. A third, Silver Creek Nature Conservancy Preserve, was sampled using the same protocols but is not part of the network. Data collected from 1990 through 2001 at Bellevue covered more low-flow than high-flow conditions and indicated that State of Idaho maximum water temperature and maximum turbidity criteria were sometimes exceeded. Nutrient concentrations were generally low compared to other Idaho rivers in the network and data may show a downward trend in pH. Data collected from 1990 through 2001 on Silver Creek suggest that State of Idaho maximum water temperature, copper, and lead criteria were sometimes exceeded. Nitrogen concentrations are relatively high compared to other Idaho rivers in the network. Data suggest possible downward trends in nitrogen, dissolved oxygen, and pH (Hardy and others, 2005).

APPROACH

Surface water

Surface-water quality would be assessed in three tasks: annual monitoring of selected biological communities, intensive water quality assessments at mainstem and tributary sites, and continuous monitoring of water quality at the Big Wood River near Bellevue. In all cases, water-quality sampling and analyses will be compatible with State of Idaho/USGS methods, protocols, and quality-assurance procedures. The USGS will work with local, State, and other Federal programs to avoid duplication of effort.

Task 2.1: Annual biological community monitoring

Biological communities integrate the effects of river quality over time and are helpful for determining significant river-quality changes that might not be shown by instantaneous water-quality measurements. Three new sampling sites (Big Wood River above Ketchum, Big Wood River below Ketchum, and Big Wood River below Hailey) will be added to the two current IDEQ/USGS sites (Big Wood River near Bellevue and Silver Creek at Sportsman Access).

- Benthic-invertebrate communities and chlorophyll and biomass content of periphyton communities will be evaluated at four sites on the Wood River and one site on Silver Creek in the fall of each year.
- Benthic invertebrates will be enumerated and voucher collections archived.
- Data will stored in USGS databases and made available through the USGS project website *http://id.water.usgs.gov/projects/wood_river_valley/index.html*.
- Data will be interpreted and presented in the appropriate USGS report format.

Task 2.2: Intensive water quality assessments at main stem and tributary sites

Intensive water-quality assessments will be conducted during high- and base-flow conditions in the first year, eventually to be repeated every 4 to 5 years. Data from these will provide "snapshots" of conditions; helping determine where problems might occur and where the most significant loads of problem constituents may originate. Repeating the assessments periodically will identify temporal trends in water quality. Costs are projected for four sites on the Wood River, ten tributary sites, and one site on Silver Creek.

- Stream discharge plus concentrations of constituents shown in table 1 will be measured at each site.
- Data will be stored in USGS databases and made available through the USGS project website *http://id.water.usgs.gov/projects/wood_river_valley/index.html*.
- Data will be interpreted and presented in the appropriate USGS report format.

Task 2.3: Continuous monitoring of water quality at the Wood River near Bellevue

Monthly monitoring of water quality at the Wood River near Bellevue gage will provide an indication of water-quality variation between high-flow and low-flow assessments.

- Concentrations of the constituents shown in table 1 will be measured at each site. Combined with the historical water-quality monitoring at this site, this monitoring will provide another method for identifying temporal trends in water quality.

- Data will be archived in USGS databases and made available through the USGS project website *http://id.water.usgs.gov/projects/wood_river_valley/index.html*.
- If Task 2.2 is performed, an interpretation of this data will be included in that USGS report. If not, a separate interpretation of data will be written and presented in a separate USGS report.

Ground water

Information learned in Phase 1 will be used to select wells for ground-water quality sampling. A synoptic sampling of these wells will provide a snapshot of current conditions and help refine site selection for a monitoring network. Information gained from such sampling will be of immediate benefit to planners and decision makers by documenting current water-quality conditions.

Task 2.4: Synoptic measurement—Snapshot of current conditions

Ground-water quality will be assessed using existing wells in the basin. About 50 wells will be selected using information from Phase 1, locations of known water-quality issues, and information on projected growth. The wells selected will be coordinated with the current IDWR/USGS Statewide and the Blaine County Networks. Initially, 50 wells will be sampled once while a subset of about 10 wells will be sampled four times. Constituents to be analyzed are those shown in table 1. The secondary goal, assessing sub-annual variations in water quality (due to factors such as seasonal land-use changes and water-level fluctuations), will be used to optimize the design of a cost-effective network for long-term monitoring of ground-water quality.

- Constituents to be analyzed for every sample are shown in table 1.
- Data will be archived in USGS databases and made available through the USGS project website *http://id.water.usgs.gov/projects/wood_river_valley/index.html*.
- Data will be interpreted and presented in the appropriate USGS report format.

Task 2.5: Network sampling—Trends

On the basis of data and interpretations from Phase 1 and Phase 2, recommendations will be made on the design of a long-term monitoring network, wells to be included, appropriate analyses, and sampling intervals.

Time Frame

Tasks 2.1-2.3 will take place concurrently with Phase 1, beginning on July 1, 2006 and ending on December 31, 2007. Tasks 2.4-2.5 will be performed over 18 months, either concurrently or following tasks 2.1-2.3

Personnel

The project manager will be a hydrologist with the U.S. Geological Survey. The manager will be responsible for project planning, coordination of activities with USGS personnel, data management, design and preparation of reports, identification of monitoring network needs, and transfer of data and map coverages with metadata documentation.

Reports
Quarterly summary reports will be sent to co-operating agencies and groups. One or more USGS reports will be prepared. The reports will be available through the USGS project website *http://id.water.usgs.gov/projects/wood_river_valley/index.html*. Data and relevant GIS coverages with metadata will be transferred to cooperators and made available online. Details of this phase will be presented to cooperators.

Costs
The total cost for all tasks of Phase 2 is $277,000. Though all five tasks are desirable, they can be performed independently for the following costs:

- Task 2.1 Biological community monitoring: $ 27,500
- Task 2.2, Intensive Water Quality Assessments: $ 96,000
- Task 2.3, Monitoring at the Wood River near Bellevue, ID: $ 39,000
- Task 2.4, Synoptic measurement: $ 115,000
- Task 2.5, Network recommendations: none

Depending on tasks chosen, costs for reports and project management may need to be slightly increased or decreased.

Phase 3: Hydrofacies and aquifer property definition

The third phase of this water-resource work plan will address how aquifer properties vary throughout the valley and, with information from Phases 1 and 2, ascertain to what degree tributary canyons are in hydraulic communication with the main valley. Because this phase relies on data and interpretations from Phases 1 and 2, it can be started concurrently or after their completions.

BACKGROUND

Differences in sediment texture control how water moves through the aquifer system and thus influences well yield and contaminant transport. Defining and mapping hydrofacies (aquifer units with differing lithologic and hydraulic properties) in the subsurface (along with ground-water level maps, water quality, and streamflow measurements) leads to a better understanding of how water moves through the system and interacts with surface water. It is also a necessary step in the construction of a ground-water flow model if such were needed in the future.

APPROACH

The proposed work is divided into three tasks: definition of hydrofacies and preparation of preliminary maps and cross sections with existing information (primarily drillers' logs), data collection to fill selected data gaps, and incorporation of this new data into finalized hydrofacies maps and cross sections.

Task 3.1: Hydrofacies definition and mapping from existing data

A primary goal of Task 3.1 is definition of hydrofacies in the study area, though it is possible that mappable units cannot be defined due to variability in the depositional system. Special attention will be paid to tributary canyons. One limitation of drillers' logs for domestic wells is that few are completed more than 50 ft below the water table.

- A preliminary generalized hydrofacies map and cross sections will be prepared using drillers' logs submitted to IDWR, information from previous work (including consultant reports), and data from Phase 1.
- Where sufficient data exists, hydraulic properties will be assigned to mappable hydrofacies units using information from existing aquifer tests and drillers' logs.
- Data gaps will be identified and planning begun to collect a limited amount of new data.
- If this initial task suggests that hydrofacies are not mappable, results will be reported and no further work will be done.

Task 3.2: Additional data collection

If task 3.1 indicates that hydrofacies in the aquifer system can be mapped with sufficient detail using driller's logs, additional data will be collected in previously identified data-poor areas. This additional data collection will utilize surficial geophysical methods primarily to identify the aquifer base in tributary canyons.

- Geophysical surveys will likely take the form of a limited number of short seismic-refraction survey lines, however, electromagnetic methods may be used. Seismic surveys would utilize a low energy source such as sledgehammer blows, weight drops, or shotgun shells. Seismic surveys will primarily be of use in defining the aquifer base in tributary canyons; electromagnetic methods are useful for identifying lithologic changes.

- Geophysical data will be processed and interpreted.

Task 3.3: Finalize and publish hydrofacies maps and cross sections
This final task will finalize the hydrofacies map and cross sections using data collected and compiled in task 3.2.

- Geophysical interpretations from task 3.2 and any additional data identified after the initial compilation (such as dedicated monitoring/observation wells installed for a ground-water level or water-quality network or other new wells) will be compiled and evaluated.
- A hydrofacies map and cross sections will be finalized.
- The map and cross sections will be published as a USGS on-line report and made available through the USGS project website *http://id.water.usgs.gov/projects/wood_river_valley/index.html*. Data and relevant GIS coverages with metadata will be transferred to cooperators and made available online.

TIME FRAME
The study will be completed over a 1-year period with a published report at the end of the year. Depending on when the study is funded, this time may have to be extended—the geophysical surveys cannot be done in winter.

PERSONNEL
This work would make an ideal geology thesis and thus it is envisioned being performed by a student under the close supervision of a USGS hydrologist who will act as project manager. The manager will be responsible for project planning, supervision of the student, coordination of activities with other USGS personnel, data management, design and preparation of reports, and transfer of data and map coverages with metadata documentation.

REPORTS
Quarterly summary reports will be sent to co-operating agencies and groups. A plate with a map, cross sections, and explanatory text map of plate will be prepared. The report will be available through the USGS project website *http://id.water.usgs.gov/projects/wood_river_valley/index.html*. Data and relevant GIS coverages with metadata will be transferred to cooperators and made available online.

COSTS
Estimated Phase 3 cost for Federal fiscal year 2006 is $144,000. If postponed, costs in future years will increase due to inflation.

Phase 4: Hydrologic budget development

Phase 4 of this water-resource work plan will use data and interpretations from Phases 1-3, other new information, and previous work to develop an updated hydrologic budget for the Wood River Valley. Because this phase relies on data and interpretations from earlier phases it will be started after their completions.

Background

There has been a great deal of discussion in the hydrologic literature about the concept of "safe yield," "sustainable yield," or "sustainable ground-water development." Some authors have rejected the concept on the basis that adverse effects, while variable, happen to some degree with any ground-water use. However, because aquifers will be developed, as with other natural resources society must weigh the benefits against the consequences of such use. The key then, is to develop tools that allow water managers to evaluate probable effects of withdrawal. One such tool is a hydrologic budget—an accounting of the inflow to, outflow from, and storage in a ground-water system. Its purpose is to quantify these components and improve understanding of the ground-water system. However, as with most tools, it has limitations, and it is important to understand these limitations.

Under natural conditions recharge to an aquifer system equals discharge, however, any pumpage upsets this equilibrium. The source of water for this pumpage is either increased recharge, decreased discharge, removal of water from storage, or some combination of the above. In the Wood River Valley the intimate connection of the surface and ground-water systems, may indicate that recharge and discharge will be affected more than storage. Thus, estimation of recharge to the ground-water system will not determine the amount of sustainable ground-water development. Determination of sustainable development is significantly more complex and the potential impacts on each of these sources should be evaluated. Currently, the only possible sources for increased recharge are streams, resulting in decreased streamflows, at least in some reaches. Most discharge from the ground-water system is to the Big Wood River, Silver Creek, and their tributaries so a decrease in discharge would also result in decreased streamflows. A reduction of ground water in storage would result in water-level declines. The situation is further complicated by such factors as variations in climate and how much ground-water pumpage is used consumptively and where the remainder is returned to the system.

If it is assumed that some level of reduction in streamflow is unacceptable, a hydrologic budget can be used to roughly determine the amount of sustainable development. However, such an estimate will have unavoidable uncertainty with the largest sources of error being evapotranspiration (ET), pumpage volumes, and recharge around the aquifer boundary. Evapotranspiration is difficult to measure directly and can vary significantly over a short distance. Even with the Agrimet station at Picabo, ET values are approximations. Pumpage is also problematic because the pumpage volume from the large number of unmetered domestic wells in the valley must be estimated. In addition, consumptive use and return flows require a further estimate. Recharge around the aquifer boundary must also be estimated with attendant uncertainties.

Although a hydrologic budget can yield an approximate value of sustainable pumpage, it will be for the entire aquifer system. It cannot predict site-specific affects or predict the effect of a given well on the resource. A detailed ground-water flow model could make such forecasts; however, the same data (and limiting assumptions) are required. If a ground-water flow model is constructed in the future, a hydrologic budget will serve as a foundation for many of the model inputs.

APPROACH

An updated hydrologic budget of the study area would utilize new data and tools unavailable to previous workers (such as PRISM precipitation data, AgriMet stations, and GIS analysis). The water-level and water-level change maps will provide estimates of ground-water storage changes. These maps, in tandem with streamflow measurements, can determine ground-water flow directions and trends in discharge.

- Available data will be used to develop an updated hydrologic budget of the study area.
- The hydrologic budget will be presented will be published as a USGS on-line report or Fact-Sheet and made available through the USGS project website *http://id.water.usgs.gov/projects/wood_river_valley/index.html.*

TIME FRAME

The study will be completed over a 9-month period with a published report at the end of that time.

PERSONNEL

This work will be performed by a USGS hydrologist who will act as project manager. The manager will be responsible for project planning, coordination of activities with USGS personnel, data management, design and preparation of reports, and transfer of data and map coverages with metadata documentation. A GIS specialist will be utilized for some spatial data analysis.

REPORTS

Quarterly summary reports will be sent to co-operating agencies and groups. An on-line USGS report or Fact-Sheet will be prepared discussing water budget components and volumes, uncertainties, and management implications. The report will be available through the USGS project website *http://id.water.usgs.gov/projects/wood_river_valley/index.html.* Data and relevant GIS coverages with metadata will be transferred to cooperators and made available online. Details of the project will be presented to cooperators.

COSTS

Estimated Phase 4 cost for Federal fiscal year 2006 is $125,000. Cost in future years will increase due to inflation.

References cited

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Taylor, C.J., and Alley, W.M., 2001, Ground-water-level monitoring and the importance of long-term water-level data: U.S. Geological Survey Circular 1217, 68 p., Available online at URL: http://pubs.er.usgs.gov/pubs/cir/cir1217

A more complete list of references for the Wood River Valley is available online at URL: *http://id.water.usgs.gov/projects/wood_river_valley/references.html*

Figure

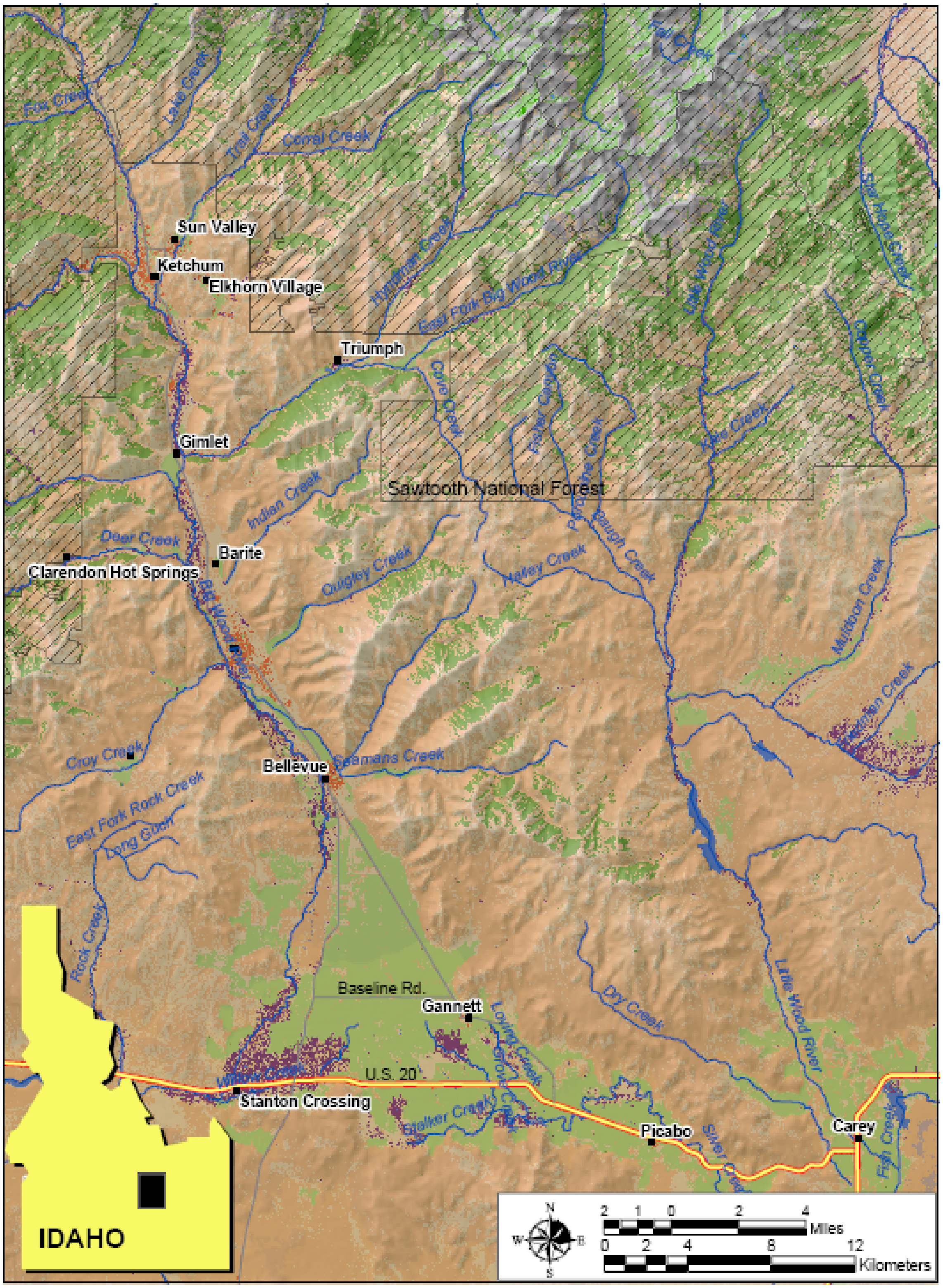

Figure 1.--Location of the Wood River Valley, south central Idaho

Table

Table 1.— Field measurements, major ions, and nutrients to be analyzed in water for the Wood River basin monitoring and intensive assessments.

Field	Major Ions	Nutrients
Temperature	Acid Neutralizing Capacity	Ammonia, dissolved
specific conductance	Calcium, dissolved	Nitrite plus nitrate, dissolved
pH	Chloride, dissolved	Nitrogen, total
Dissolved Oxygen	Fluoride, dissolved	Phosphorus, total
Barometric Pressure	Iron, dissolved	
	Magnesium, dissolved	
	Manganese, dissolved	
	Potassium, dissolved	
	Silica, dissolved	
	Sodium, dissolved	
	Sulfate, dissolved	