FY05 SVRP WORKPLAN TASKS

1.0 Complete the compilation, review, and evaluation of published reports, models, and database records describing geology, hydrogeology, aquifer characteristics, and water budget components of the SVRP aquifer, and adjacent geologic units

1.1 Compile and evaluate information describing the areal extent, thickness, and lithologic composition of the SVRP aquifer, aquifer boundary conditions, the spatial distribution of aquifer hydraulic properties based on aquifer tests and analysis of specific capacity data, and ground-water levels in the SVRP aquifer.
Existing geologic mapping will be compiled into one generalized surficial geologic map for the study area, and areas where additional surficial geologic mapping may be needed will be identified. Existing hydrogeologic framework information from previous ground-water studies will be evaluated, including geophysical surveys (seismic and gravity); geologic and or hydrogeologic sections; extent, thickness, and lithologic characteristics of the SVRP aquifer; description and hydrogeologic properties of adjacent hydrogeologic units; and depth to bedrock beneath the aquifer. Identify areas within or adjacent to the aquifer where additional data collection (eg. drilling or geophysical surveys) would further refine the hydrogeologic framework. Work with the modeling team, TAC, and PTLT to determine what additional characterization of the hydrogeologic framework is warranted given available funding and schedule constraints. Develop geospatial coverages of existing information.

1.2 Compile available aquifer recharge data: precipitation leakage from surface water features, anthropogenic return flows from irrigation and septic systems, and inflows from tributary basins and adjacent uplands. Develop geospatial coverages of recharge.

1.3 Compile available aquifer discharge data: withdrawals from wells, baseflow to surface water features, evapotranspiration estimates, and underflow to adjacent units. Develop geospatial coverages of discharge.

1.4 Compile and evaluate existing land-cover/land-use data including the designation of crop type, irrigated versus nonirrigated lands, and irrigation type. May also include septic versus sewered areas. Utilize existing geospatial coverages.

1.5 Continue to update annotated bibliography of reference materials used.

1.6 Place reviewed information and geospatial coverages on the file transfer protocol (ftp) site with appropriate metadata.

2.0 Continue data collection at established ground- and surface-water sites and establish new data collection sites where necessary

2.1 Collect continuous water-level data from instrumented wells and monthly water levels from monitoring network wells. This information will be combined with additional data collected by other agencies.

2.2 Conduct synoptic ground-water-level measurements (200-250 wells) during the Spring of 2005. Evaluate the need for a similar effort again in the Fall of 2005 on the basis of 2004 synoptic data; conduct if necessary.

2.3 Increase the number of instrumented wells, select additional existing wells, and install additional monitoring and synoptic wells for more complete areal and vertical coverage of the SVRP aquifer and adjacent unconsolidated and bedrock units in accordance with TAC, Modeling Team, and other recommendations.

2.4 Establish necessary instrumentation to characterize ground- and surface-water inflows from selected tributary basins and adjacent uplands into the SVRP aquifer. Measured inflows from selected tributary basins and adjacent uplands will be used to estimate fluxes for other non-characterized areas.

2.5 Collect discharge and stage data from established gages on the Spokane and Little Spokane Rivers, Hangman Creek, and area lakes. WADOE will work with USGS to establish and collect data from additional discharge measurement sites.

2.6 Conduct seepage runs on the Spokane and Little Spokane Rivers, and Hangman and Deadman Creeks during the Spring of 2005 and again in the Fall of 2005 (if needed) coincident with synoptic ground-water-level measurements. Stage in lakes and discharge from large springs will be measured during seepage runs.

2.7 Thermal and specific electrical conductance profiles of the Spokane River may be conducted during the seepage runs to identify locations of gw/sw exchange.

2.8 Review and enter all data into appropriate database(s).

2.9 DGPS Survey - Accurate elevations using a consistent datum are required in order to construct water-table maps, determine ground-water flow directions, and examine the dynamics of ground-water/surface-water interaction in the area. Accurate land surface elevations at about 270 well locations and approximately 6 staff gages within the Spokane Valley / Rathdrum Prairie aquifer hydrologic study area will be measured using a Trimble 5700 Total Station Real Time Kinematics Global Positioning Satellite survey system available from the USGS.

3.0 Additional data collection, evaluation, and interpretation to provide an

improved understanding of the physical dimensions, lithologic composition, hydraulic properties, and water budget components of the SVRP aquifer. The scope of each task will be developed with Modeling Team, TAC, and PTLT input, and as needed, technical support from agencies and institutions. Previous investigations have focused on characterization of the Spokane Valley part of the aquifer system, and additional information may need to be collected in the area of the Rathdrum Prairie in order to adequately characterize the entire SVRP aquifer.

3.1 Hydrogeologic Framework

3.1.1 Revised three-dimensional hydrogeologic framework- Using previous investigations, additional data, geologic maps, and the lithologic information from drillers' logs, hydrogeologic cross sections for the entire study area will be constructed. After the sections are constructed and the major hydrogeologic units have been identified, maps of the thickness and extent of the SVRP aquifer and adjacent unconsolidated sediments will be constructed.

3.1.2 Drilling- Installation of boreholes and monitoring wells to identify variations in SVRP aquifer lithology, delineate the base of the SVRP aquifer (bedrock surface), and provide additional locations for the measurement of ground-water levels and examine vertical head distribution. Boreholes may be located along geophysical surveys to aid in the interpretation of the surveys. Some boreholes will be completed for long-term water-level monitoring and water sampling of multiple aquifer layers. Rock samples from boreholes may be evaluated in the laboratory for hydraulic properties (permeability, porosity, etc.). Monitoring wells will be located in areas with insufficient water level data, areas where discharge/recharge relationships are critical, or areas where geologic controls are lacking.

3.1.3 Aquifer Properties- Estimates of transmissivity/hydraulic conductivity and storativity/specific yield will be compiled from existing aquifer test data and specific capacity analyses. GIS coverages of these data and information about well yields and aquifer deposits (sieve analysis, drillers logs, geophysics) will be created and evaluated. Potential locations for conducting aquifer tests will be identified using a GIS coverage of production wells and nearby potential observation wells, such as wellhead protection wells near municipal supply wells in Spokane Valley. Higher yield irrigation wells with nearby potential observation wells also may be considered. Aquifer test design could be controlled or take advantage of normal operation schedules (pump on/off); well owners may be able to vary normal schedules to accommodate testing.

Estimation of aquifer properties from conventional aquifer tests is difficult because drawdown is minimal in many portions of the aquifer. Values of transmissivity/hydraulic conductivity may be estimated on a regional basis by utilizing ground-water-level responses to flow events in the Spokane River. This analysis requires continuous water-level data from a transect of observation wells located at various distances from the river, and an estimate of water flow from the river to the aquifer. Specific yield (storativity) estimates can be obtained from the procedure described above, as well as from lab analysis of field samples of aquifer material.

3.2 Water Budget

3.2.1 Recharge- Recharge to the aquifer will be estimated from infiltration and percolation of precipitation, return flow from water applied at land surface (consumptive use will have to be calculated), leakage from sewers and septic systems, leakage from adjacent lakes and the Spokane and Little Spokane Rivers, and surface water and ground water inflow from tributary basins and adjacent uplands. The distribution of precipitation recharge may be evaluated using numerical watershed models (eg. Precipitation-Runoff Modeling System-PRMS; Deep Percolation Model-DPM). Lake or stream recharge may be estimated by focused field studies, drilling, and small-scale modeling.

3.2.2 Discharge- Discharge from the aquifer will be estimated from losses to evapotranspiration (ET), baseflow to the Spokane and Little Spokane Rivers, outflow to adjacent geologic units, and anthropogenic water use. ET from the SVRP aquifer may be estimated using PRMS and DPM. SEBAL, a remote sensing technique for estimating ET, also may be used. Historical water use data (ground-water withdrawals and surface-water diversions) have been previously compiled for the Washington portion of the SVRP aquifer. These data will be updated to reflect current usage, and similar data will be collected for the Idaho portion of the SVRP aquifer. Estimates for municipal, rural domestic, commercial/industrial, and agricultural irrigation withdrawals will be made on the basis of ground-water pumping (where available), population census, and land use data, water rights information, and industry standards.

3.2.3 GW/SW Exchange- Integrate seepage, stage, thermal profile, near-stream ground-water elevation data, and additional information to fully characterize gw/sw interactions and provide a data set to constrain model calibration (steady state and transient conditions). Additional data may include characterization of river bed sediments (composition, thickness, and hydraulic properties), isotope analysis, river bed topography (LIDAR) for use with MODFLOW 2000 SFR.

3.3 Potential data collection based on data gaps identified in task 1.0 and initial model sensitivity and parameter uncertainty determinations.

3.3.1 Geophysical investigations- Surface and sub-surface geophysical investigations may be used to identify variations in SVRP aquifer lithology, and delineate the base of the SVRP aquifer (bedrock surface). Geophysical techniques may include seismic reflection and refraction, geophysical well logging, and micro-gravity. Other geophysical techniques may be utilized as appropriate.

3.3.2 Geochemical investigations- Water chemistry may be used to characterize ground-water flow, investigate the potential occurrence of ground-water inflow from the surrounding bedrock, and to investigate ground-water/surface-water interactions. Geochemical techniques may include the use of environmental isotopes and tracers to characterize ground-water movement in the SVRP aquifer. Other geochemical techniques may be utilized as appropriate.

4.0 . Continue ground-water/surface-water model development for the SVRP aquifer. The SVRP Modeling Team (see below) will:

4.1 Complete the review of existing gw/sw model documentation for the study area to evaluate conceptual model elements (boundary conditions, recharge/discharge, etc.); refine the conceptual model of the gw/sw system in the SVRP study area based on published data; and continue to work with project partners to help identify additional data requirements for numerical model development.

4.2 Construct an initial numerical model (MODFLOW 2000) based on the current conceptual model, using data from previously published work and estimates, where necessary. Determine model boundaries, import data layers (hydrogeologic units, hydraulic conductivity/storativity; ET/recharge/withdrawals; gw elevations; sw stage and flow; land cover; and boundary conditions), and select the model transient period to facilitate estimates of aquifer recharge and discharge and data collection. Conduct initial model calibration to steady state conditions using parameter estimation and sensitivity software (MODFLOW 2000 OSP). Model calibration will be constrained by observed data (gw levels, sw stage and flow, gw/sw interactions).

4.3 Identify additional data needs based on initial model sensitivity and parameter uncertainty determinations. Model refinement may take place as new data and updated data layers become available.

SVRP Modeling Team: IWRRI Donna Cosgrove; WWRC Mike Barber/Akram Hossain; USGS Matt Ely

5.0 Public Outreach activities, coordinated by the PAC, to raise the public's level of understanding about water resource issues in the SVRP area.

5.1 Plan and sponsor a major public meeting during the year to provide an update of SVRP aquifer study accomplishments and describe future project plans (PAC and project staff).

5.2 Coordinate the production and distribution of news releases, fact sheets, and other informational materials designed to inform the public about the SVRP aquifer study and water resource issues in the SVRP area (PAC and project staff).

6.0 Initial reporting of technical information will focus on description of the hydrogeologic framework of the SVRP aquifer, adjacent geologic units, and associated surface water system.

6.1 Complete a draft report (text, tables, figures, plates) summarizing the results of the review and evaluation of previously published (see tasks 1.0 and 2.0) and recently collected (see task 3.0) data describing the hydrogeologic framework and water budget components of the SVRP aquifer and adjacent geologic units. The draft report will be modified as newly collected data (see task 3.0) become available and are evaluated. The report is expected to be published in early FY06.

SVRP Reports

- Summary of Previously and Recently Published Data
- Hydrogeologic Framework and Conceptual Model
- Numerical Model and Results