Exhibit A

Scope of Work

South Platte Decision Support System Phase 2
Ground Water Component

October 30, 2003

Introduction

Following is the Phase 2 Scope of Work for the ground water component of the South Platte Decision Support System (SPDSS). The Scope of Work is based on the SPDSS Feasibility Study (FS) final report dated October 2001 and from work associated with Phase 1. The data collection and analysis activities will occur within the Denver Basin and Overlying Alluvium Region (hereafter referred to as the Denver Basin Region) and the Lower South Platte Alluvium Region (hereafter referred to as the Lower South Platte Region) and is an extension of data collection that occurred in Phase 1. The locations and extents of these regions are defined in the SPDSS FS.

The SPDSS implementation will occur in phases. The objectives of this Phase 2 ground water scope of work is to build on work that as done in Phase 1, are as follows:

- Design and implement the Phase 2 alluvial and bedrock well drilling and testing program based on knowledge gained from Phase 1,
- Conduct aquifer pumping tests,
- Collect water level data,
- Evaluate abandoned wells for conversion to monitoring wells,
- Take Phase I analysis and enhance based on Phase 2 data.

Table 1 lists the Phase 2 ground water activities identified in the SPDSS Feasibility Study to achieve these objectives. The Task numbers were assigned by the Colorado Water Conservation Board, the lead agency on this project, with activities corresponding to those listed in Appendix C of the SPDSS Feasibility Study. Cost and schedule to complete these Phase 1 tasks are presented in Exhibits D and E, respectively, which are attached at the end of this Scope of Work.

Table 1 - Phase 2 Ground Water Tasks	
Task 33	Workplan Revision and Update
Task 35	Construction and Testing of Alluvial Wells
Task 36	Construction and Testing of Bedrock Wells
Task 37	Aquifer Pumping Tests
Task 39	Collection of Water Level Data
Task 40	Evaluate Abandoned Wells for Conversion
Task 42	Aquifer Configuration Data Analysis
Task 43	Aquifer Property Data Analysis
Task 44	Water Level Data Analysis

Task 50	Development of a Data Centered Approach
Task 51	Phase 2 Management

A significant amount of work has been completed by previous investigators related to ground water conditions in the study area, as summarized in the SPDSS Feasibility Study and in Groundwater Phase 1 deliverables. The Phase 2 field data collection program (Tasks 33, 35, 36 and 37) is a continuation of the Phase 1 field data collection effort (see Phase 1 Tasks 33, 35 and 36) to fill data gaps identified after historical data were collected and analyzed (see Phase 1 Tasks 31, 32, 38, 42, 43 and 44). Data obtained from the Phase 2 field data collection program will be analyzed and added to the existing groundwater databases and maps (Tasks 42, 43, and 44). The databases and maps are expected to be used in future years to update the existing groundwater model of the Denver Basin Region (Task 47), and to support and expand modeling of the Lower South Platte Region (Task 48).

All deliverables will be consistent with the DSS design, including use of data structures and formats that are being developed by the Database DSS contractor. Deliverables will use DSS standards for memo formats, report formats, database design and program documentation, etc.

Task 33: Field Study Workplan Development

Objective:

The objective of this task is to develop a Phase 2 field program and workplan. This field program will fill some of the data gaps identified under Phase 1 Tasks 42, 43 and 44. This workplan will guide the drilling and construction of observation wells, and conducting of aquifer pumping tests in the Denver Basin and Lower South Platte Regions.

Approach:

Task 33.1 Phase 2 Data Collection Program Design.

- The Consultant will develop a Phase 2 data collection program based on Phase 1 outcomes. This will include drilling, installation and testing of up to 25 new alluvial aquifer observation wells and 1 new bedrock aquifer observation well; collecting water levels from existing wells; and conducting aquifer pumping tests. If existing wells are available and fill in data gaps, they may be used instead of installing and testing new wells and the number of new Phase 2 wells may be reduced.

- For new wells, the field procedures that were developed under Phase 1 (for site access, control and reclamation, well drilling, sampling and well construction, borehole and core sample testing; water level measurements, health and safety, field QA/QC protocols, and field documentation requirements) will be used. Additional procedures will be added to the workplan to address conditions or data collection activities that are new for Phase 2.

- Maps of the Denver Basin and Lower South Platte Regions developed in Phase 1 will be used to depict areas considered by the Consultant to be high priorities for collection of new hydrogeologic data, based on data collected during Phase 1 and based on data gaps identified

that may still exist. .. The maps will show the location of existing data points and the location of permitted wells. These high priority areas will be the focus for Phase 2 data collection.

- Locations for Phase 2 field data collection may be chosen based on cooperation with municipalities, water user groups and other well owners who agree to collaborate with the Consultant on data collection activities. The Consultant will meet once with up to four water user groups, including NCWCD, GASP, CCWCD and LSPWCD, to gain their perspectives on data gaps and data collection priorities that exist following the Phase 1 work..

- The Consultant will identify suitable locations and methods for up to 25 alluvial aquifer and up to 1 bedrock monitoring wells to be constructed during Phase 2. Existing wells and new wells being drilled and tested by others will be evaluated for use and testing in lieu of installing new wells.

- In subsequent years it is expected that the workplan will be amended further to include the procedures for new field tasks that will begin in that year, including streambed conductance testing in Phase 3.

Deliverables:

Task 33.2 Phase 2 Field Study Workplan

- The Consultant will append the Phase 1 field study workplan with up to an additional 10 pages of information (with additional pages for appendices) that will include the following sections:

  - Target areas for Phase 2 well construction and associated data collection

  - Additional field protocols not already included in the Phase 1 workplan

  - Budget and schedule for the program, including an itemized engineer's estimate of well drilling and testing costs for each conceptual well design

- The Consultant will provide six hard copies and one digital copy (in MSWord and Adobe Acrobat PDF format) of the Draft Field Study Workplan for the State's review. The Consultant will incorporate the State's comments and recommendations and provide a Final Field Study Workplan. Six hard copies and one digital copy in MSWord and Adobe Acrobat PDF format of the Final Workplan will be provided to the State.

Task 35: Construction and Testing of Alluvial Wells

Objective:

- The objective of this task is to extend the collection of field measurements from wells that provided aquifer property and aquifer water level data for the alluvial ground water system in the Denver Basin and the Lower South Platte Regions from the Phase 1 effort. Existing wells and new wells being drilled and tested by others will be evaluated for use and testing in lieu of installing new wells.

Approach:

Task 35.1 Alluvial Well Construction and Testing in the Denver Basin and the Lower South Platte Regions.

Phase 2 Task program is an extension of Phase 1 and will include the installation, testing and monitoring at 25 alluvial aquifer locations, from wells completed in unconsolidated alluvial deposits. Existing wells and new wells that are being installed by others and that are located in areas where data gaps exist will be the focus for data collection activities. If access to the existing wells is unavailable or if after making reasonable effort to contact up to 75 well owners, there is no strong indication of cooperation, then up to 25 new wells will be installed by the Consultant.. The drilling, installation and testing of wells by the Consultant under this Task will commence after the State provides written approval of the Field Study Workplan (Task 33).

- Information on the location and the owners of wells drilled and installed by others in the areas of interest will be provided through well permit applications collected from the SEO. It is anticipated that the State will provide limited assistance to the Consultant, such as discussing the Consultant's purposes with the applicant and assisting the Consultant administratively with site access, as needed.

- Locations of new wells drilled by the Consultant will, if possible, be located on public rights-of-way and accessible for the duration of the SPDSS program and thereafter, under agreements to be negotiated by Consultant with assistance from the State. Sites will be selected that do not require grading for either road construction or drilling. The State will be consulted if suitable locations for drilling cannot be found on public rights-of-way.

- Approved site locations will be staked in the field and cleared for drilling by a commercial utility locating service.

- The Consultant will apply for monitoring well permits on behalf of the CWCB as owner, and will prepare a bid package consisting of well design, technical specifications, and contract documents for well drilling, sampling, logging, testing, and completion. As determined in Phase 1, fees for State Engineer's Office well permits are not required.

- Drilling and well installation will be performed by a qualified drilling subcontractor, with oversight provided by a registered Colorado professional engineer or a professional geologist according to CRS 34-1-201(3). It is anticipated that the driller selected for the Phase 1 sub-contract will be retained for the Phase 2 work. However, separate drilling contractors may be selected for different areas, at the Consultant's discretion and approval by the State.

- Drilling will commence when access is available at a sufficient number of sites to cost-effectively implement field mobilization, and when weather conditions are suitable. (All alluvial wells will be constructed using either direct-push technology or hollow-stem auger equipment, and if conditions warrant (i.e. heaving sands) drilling fluids may be used.

- All boreholes will be drilled to approximately thirty feet below the water table, with an estimated maximum depth of 80 feet, and an average depth of 60 feet.

- Drill cuttings will be disposed of at the site by spreading on the site and leveling, if compatible with the land-use and acceptable to the owner. Disturbed areas will be re-seeded with a dryland mix, if necessary.

- Aquifer materials in each borehole will be sampled and visually classified and described by a qualified geologist or engineer to characterize general lithology below the water table to the total borehole depth. Selected samples will be retained for geotechnical analysis, consisting of grain size determinations by the wet-sieve method at a maximum of 4 intervals per well. Cores will be photographed for additional documentation.

- As included in Exhibit D, Task Compensation, I Consultant's costs are based on an average drilling time of 1.5 days per well for the alluvial wells with the Consultant's on-site representative being present for up to an average of 1 day per well. The Consultant will maintain a log of all significant well construction and testing activities occurring in their presence.

- As included in Exhibit D, Task Compensation, the cost estimates for this Task are based on 17 wells that are expected to be installed using Direct Push drilling techniques, 3 wells that will be installed using Hollow Stem Auger drilling techniques, and 5 sites will have data collected using existing wells.

- All wells installed under this Task will be completed with a 20-foot screen interval, on average, with the actual screen length selected in the field by the Consultant based on the lithologies encountered.

- Wells will be constructed of either 1-inch or 2-inch ID PVC with a mill-slotted screen. Well completion will be in accordance with State regulations.

- The well will be developed by surging or pumping and the produced water discharged to the surface.

- A surveyor licensed in the State of Colorado will be selected and sub-contracted by the Consultant to provide vertical and horizontal coordinates using precision differential GPS methods with vertical accuracy within 0.1 feet and horizontal accuracy within 2.0 feet.

- As included in Exhibit D, Task Compensation, multi-well aquifer pumping tests will be conducted at 20 of the sites targeted for Phase 2 field data collection, with single-well tests conducted at the remaining 5 sites, which will be located in areas to collect regional background water level data. The final number sites used for multi-well tests may be revised in Task 33 if recommended by the Consultant and approved in writing by the State.

- For sites where a multi-well aquifer pumping test will be conducted, an observation well will be located near an existing large capacity well, which will serve as the pumping well during the aquifer test. As included in Exhibit D, Task Compensation, pumping will be conducted at a sustainable constant rate for a period not less than 8 hours and for up to 72 hours based on an average test duration of 24 hours. Water from testing will be discharged by the owner of the existing large capacity well, with an effort made to have this water conveyed away from the observation well so as to minimize its effects on aquifer drawdown due to pumping.

- In cases where an observation well is not coupled with an existing high capacity well, a single borehole aquifer performance test will be conducted. Water from the single-well testing will be discharged to overland flow without treatment.

- As determined in Phase 1, no discharge permits will be sought for water produced during the aquifer testing since no water will be discharged to surface water bodies.

- In both the single-well and multi-well tests, water level data will be recorded during the pumping and recovery phases using a pressure transducer and data logger. Aquifer testing results will be reduced and interpreted using industry standard analysis techniques after adjusting for regional effects.

- An in-well pressure transducer and data logger will be installed in each of the 25 sites and operated for at least 6 months and up to a 12-month period to characterize seasonal effects on water levels. The data will be recorded at an hourly interval and normalized to elevation for reporting. After initial installation and confirmation of operation over a two-week start-up period, data will be retrieved on a quarterly to semi-annual basis.

- Following aquifer testing, the in-well pressure transducer and data logger from the test location may be moved from the observation well in which it was originally installed, to another existing monitoring well (such as one operated by a cooperating entity or by the State) located in an area that has been determined a higher priority for continuous water level monitoring. This is intended to allow optimal use of the in-well pressure transducer and data logger and avoid water-level data bias resulting from monitoring the localized drawdown of the originally paired irrigation well, after aquifer testing is completed.

- The data collected during the installation and testing of the observation wells will be analyzed under Tasks 42, 43 and 44 for aquifer configuration, aquifer properties and aquifer water levels, respectively.

Deliverables:

Task 35.2 Phase 2 Denver Basin Region Alluvial Well Construction and Testing Technical Memorandum

- A single Technical Memorandum will be prepared for the alluvial wells constructed in the Denver Basin Region during Phase 2 of up to 10 pages in length (with additional pages for figures, tables and appendices, as needed). This Technical Memorandum will focus on information collected during Phase 2 and will be an update to the Task 35.2 Phase 1 Technical Memorandum.

- This memorandum will include the following:

    - an executive summary of the Denver Basin Alluvial Well Construction and testing

    - a description of the chronology of well construction

    - summary of Denver Basin alluvial well drilling

- drafted geologic well logs and well completion diagrams
- geotechnical laboratory reports
- analyzed results of the aquifer pumping tests
- map of well locations
- plot of curve fitting results

- All data will be maintained in a database and provided to the State in a format that meets the DSS database standards being developed by another consultant.
- The Consultant will provide six hard copies and one digital copy (in MSWord and Adobe Acrobat PDF format) of the Draft Technical Memorandum for the State's review. The Consultant will incorporate the State's comments and recommendations and provide a Final Technical Memorandum. Six hard copies and one digital copy in MSWord and Adobe Acrobat PDF format of the Final Technical Memorandum will be provided. It is anticipated that the State will provide a summary of the aquifer test data and results for a given test to the well owner who collaborated with the well testing.

Task 35.3 Phase 2 Lower South Platte Region Alluvial Well Construction and Testing Technical Memorandum

- A single Technical Memorandum will be prepared for the Phase 2 alluvial wells constructed in the Lower South Platte Region of up to 10 pages in length (with additional pages for figures, tables and appendices, as needed). This Technical Memorandum will focus on information collected during Phase 2 and will be an update to the Task 35.3 Phase 1 Technical Memorandum.
- This memorandum will include the following:
  - an executive summary of the Lower South Platte Alluvial well construction and testing
  - summary of Denver Basin alluvial well drilling
  - a description of the chronology of well construction
  - drafted geologic well logs and well completion diagrams
  - geotechnical laboratory reports
  - analyzed results of the aquifer pumping tests
  - map of well locations
  - plot of curve fitting results
- All data will be maintained in database and provided to the State in a format that meets the DSS database standards being developed by another consultant.

- The Consultant will provide six hard copies and one digital copy (in MSWord and Adobe Acrobat PDF format) of the Draft Technical Memorandum for the State's review. The Consultant will incorporate the State's comments and recommendations and provide a Final Technical Memorandum. Six hard copies and one digital copy in MSWord and Adobe Acrobat PDF format of the Final Technical Memorandum will be provided. It is anticipated that the State will provide a summary of the aquifer test data and results for a given test to the well owner who collaborated with the well testing.

Task 36: Construction and Testing of Bedrock Wells

Objective:

The objective of this task is to extend Phase 1 collection of new aquifer property and water level field data from the bedrock ground water system in the Denver Basin Region. This will be accomplished through the use and testing of existing wells and/or through the construction and testing of a new well. This task will further address the SB-74 recommendations regarding the collection of data to better define aquifer properties of the Denver Basin Region bedrock aquifers.

Comment:

This Task is coupled with Task 37, Aquifer Pumping Tests. In the SPDSS FS a total of 4 bedrock wells were recommended to be drilled. One well was installed in Phase 1. Based on the data collection effort in Phase 1, only one additional well is recommended for Phase 2. As included in Exhibit D, Task Compensation , one bedrock well will be constructed under this Task and 10 bedrock aquifer pumping tests using existing wells will be performed under Task 37. However, if more than ten sites are identified in Task 37 where existing wells can be used to collect aquifer property data (that the Consultant determines to be of sufficient quality), then the Consultant will meet with the State to discuss the use of the existing wells from which to collect aquifer property data instead of drilling the new well. If the proposed new bedrock well is not drilled, then up to ten additional aquifer pumping tests will be performed under Task 37 at no change in cost from that presented in Exhibit D, Task Compensation.

Approach:

Task 36.1 Bedrock Well Construction and Testing

The Phase 2 program may include the installation, testing and monitoring of water levels in a single well completed by the Consultant in the Denver Basin Region bedrock aquifers. The drilling, installation and testing of wells by the Consultant under this Task will commence after the State provides written approval the Phase 2 Field Study Workplan (Task 33). All construction techniques will be in accordance with State Statutes. If any of the following approach items are found to conflict with such statutes, the State Statutes shall prevail.

- The well drilled and constructed by the Consultant will be located near an existing high-capacity well and will be used to collect data from an aquifer pumping test from the operation of the high-capacity well. The location of the well constructed under this Task will be dependent on cooperation of owners of the high-capacity wells, on the existence of data gaps, and on the well construction characteristics of candidate high-capacity wells.

- The well drilled by the Consultant will be located on public right-of-way and accessible for the duration of the drilling and monitoring. The well installation site will be selected that does not require grading for road construction or drilling. The State will be consulted if a suitable location for drilling cannot be found on a public right of way.

- The approved site location will be staked in the field and cleared for drilling by a commercial utility locating service.

- The Consultant will apply for a monitoring well permit on behalf of the CWCB as owner, and will prepare a bid package consisting of well design, technical specifications, and contract documents for well drilling, sampling, logging, testing, and completion. As determined in Phase 1, no well permit fees are expected.

- Well drilling and installation will be sub-contracted to a drilling contractor who is qualified for this work in the State of Colorado, with oversight provided by a registered Colorado professional engineer or a professional geologist according to CRS 34-1-201(3). Well contractors submitting bids on the work will be required to obtain a performance bond for the well construction work.

- Drilling will commence when access is available to cost-effectively implement a field mobilization, and when weather conditions are suitable.

- Drilling is expected to be with mud rotary drilling techniques.

- Costs for this task assume that the well will be up to 740 feet in depth and will be completed in the same bedrock aquifer that is screened by the adjacent high-capacity well.

- Sample collection will not commence until unweathered bedrock is reached. The uppermost 25 feet of the bedrock formation will be cored using a nominal 2-inch or greater core barrel. The borehole will then be reamed and advanced to the target aquifer using a rotary bit, with cuttings descriptions used to define the geology.

- Core samples up to 10 feet in length will be collected from the uppermost aquifer and from the target completion depth of the well, as identified by the onsite field geologist or engineer.

- At the completion of drilling, a suite of geophysical logs including, at a minimum, resistivity, natural gamma and spontaneous potential will be run to assist in hydrostratigraphic characterization.

- Materials encountered in each borehole will be visually classified and described by a qualified geologist or engineer from the drill cuttings.

- The Consultant's on-site representative will be present for at least 75 percent of all drilling activities. The on-site representative will maintain a log of all significant well construction and testing activities that occur in their presence. Cores will be photographed for additional documentation and stored in waterproof cardboard core boxes. Individual samples collected for laboratory testing will be preserved in a manner consistent with the planned testing.

- Laboratory testing of vertical permeability will be conducted on 2 samples of representative lithologies from the upper core run. One moisture retention curve and 2 horizontal permeability tests will be conducted on samples from each of the cores collected in the uppermost aquifer and from the target completion depths. The objective of the vertical permeability assessment in the upper bedrock interval is to assist in determination of vertical leakance characteristics. The horizontal permeability and moisture retention curves are to assist in determination of hydraulic properties of the bedrock aquifers.

- Drilling mud and cuttings will be disposed of off-site. The site will be graded and a dryland seed mix spread, if required.

- The well will be completed with up to 5-inch diameter Schedule 80 PVC casing and a screen length of no more than 200 feet Well completion will be in accordance with State regulations. The well screen of the observation well will be installed to a depth corresponding to the producing aquifer of the high-capacity bedrock well.

- The well will be developed by surging and pumping and the produced water discharged to the surface in accordance with state regulations.

- A surveyor licensed in the State of Colorado will be selected and sub-contracted by the Consultant to provide vertical and horizontal coordinates using precision differential GPS methods that provide vertical accuracy within 0.1 feet and horizontal accuracy within 2.0 feet.

- A multi-well aquifer pumping test will be conducted after the well is completed and developed. A nearby large-capacity well will be used as the pumping well, with the well constructed by the Consultant used as the observation well. As included in Exhibit D, Task Compensation, pumping from the high-capacity well will be conducted at a constant rate for a period between 8 and 72 hours based on an anticipated test duration of 36 hours. Water level data will be recorded during the pumping and recovery phases using a pressure transducer and data logger. Aquifer testing results will be reduced and interpreted using industry standard analysis techniques that include appropriate adjustments for regional water level changes, and other factors.

- An in-well pressure transducer and data logger will be installed in each observation well and operated for at least 6 months and up to a 12-month period to characterize seasonal effects on water levels. The data will be recorded at an hourly interval and normalized to elevation for reporting. After initial installation and confirmation of operation over a two-week start-up period, data will be retrieved on a quarterly to semi-annual basis.

- Following aquifer testing, the in-well pressure transducer and data logger from the test location may be moved from the observation well in which it was originally installed, to another existing monitoring well (such as one operated by a cooperating entity or by the State)

located in an area that has been determined a higher priority for continuous water level monitoring. This is intended to allow optimal use of the in-well pressure transducer and data logger and avoid water-level data bias resulting from monitoring the localized drawdown of the originally paired irrigation well, after aquifer testing is completed.

- The data collected during the installation and testing of the wells will be analyzed under Tasks 42, 43 and 44 for aquifer configuration, aquifer properties and aquifer water levels, respectively.

Deliverables:

Task 36.2 Phase 2 Denver Basin Region Bedrock Well Construction and Testing Technical Memorandum

- The Task 36.2 Technical Memorandum written in Phase 1 will be updated to include the Phase 2 bedrock well, if constructed by the Consultant. It will consist of up to 10 pages in length (with additional pages for figures, tables and appendices, as needed).
- This memorandum, if necessary, will include the following:
    - an executive summary of the Denver Basin Bedrock well construction and testing
    - a description of the chronology of well construction
    - drafted geologic well log and well completion diagram
    - geotechnical laboratory reports
    - analyzed results of the aquifer performance tests
    - summary of SPDSS bedrock drilling effort
    - map of well locations
    - plot of curve fitting results
- All data will be maintained in database provided to the State in a format that meets the DSS database standards being developed by another consultant.
- The Consultant will provide six hard copies and one digital copy (in MSWord and Adobe Acrobat PDF format) of the Draft Technical Memorandum for the State's review. The Consultant will incorporate the State's comments and recommendations on the Draft and provide six hard copies and one digital copy (in MSWord and Adobe Acrobat PDF format) of the Final Technical Memorandum.

Task 37: Aquifer Pumping Tests

Objective:

This task, in conjunction with the effort from Phase 1, will continue to fill data gaps for aquifer property data within the Denver Basin bedrock aquifers, by conducting and analyzing the data collected from aquifer pumping tests.

Comment:

This Task is coupled with but is expected to occur prior to Task 36, Construction and Testing of Bedrock Wells. Aquifer pumping tests will be designed and implemented after performing a detailed analysis of the existing but unpublished aquifer testing data contained in SEO well permits. Analysis of the well permit data from the Denver Basin Region bedrock aquifers will reduce data gaps and allow identification of locations for additional aquifer testing. The aquifer tests then will be conducted, by using existing high-capacity wells and/or wells being constructed by others in the Denver Basin bedrock aquifers. Municipalities will primarily be targeted for this data collection effort. It is anticipated that in most locations single-well pumping and recovery tests will be conducted. However, in locations where other wells such as nearby production, monitoring wells, and/or wells proposed for abandonment can feasibly be used as observation wells, multi-well tests will be performed.

One bedrock well is planned for installation and testing under Task 36 and 10 aquifer pumping tests using existing wells are planned under this Task. However, if more than ten sites are identified in this Task where existing wells can be used to collect aquifer property data (that the Consultant determines to be of sufficient quality), then the Consultant will meet with the State to discuss the use of the additional existing wells from which to collect aquifer property data in lieu of drilling any new wells in Task 36. If the Consultant recommends that the proposed new bedrock well not be drilled and if this is approved in writing by the State, then up to ten additional aquifer pumping tests will be performed under this Task.

The aquifer testing and water level data collection will help address the SB 96-74 recommendations regarding aquifer pumping tests and aquifer properties of the Denver Basin Region bedrock aquifers.

Task 37.1 Bedrock Aquifer Property Data Collection

- The SEO Division 1 well permit database will be evaluated for bedrock wells within the Denver Basin Region that are located in data-gap areas and have well completion information Those wells with screened and/or perforated intervals at depths greater than 100 feet below ground surface and within a single bedrock aquifer will be cataloged for further analysis. Copies of the well permits for the cataloged bedrock wells will be requested from the SEO. The SEO will provide the requested bedrock well permits in a scanned electronic format. It is anticipated that approximately 5000 bedrock well permits will be reviewed.

- The requested bedrock well permits will be reviewed for well screen/perforation and lithologic information, well log and aquifer test information including pumping rate, static water level,

pumping drawdown and pumping duration. Information from the bedrock well permits containing the required information will be added to an electronic database. If not already included, the SEO will provide X,Y coordinate information for these wells based on the Township/Range/Section information provided in the original permit. It is anticipated that approximately 500 bedrock well permits will contain the information needed for subsequent analyses

- The aquifer test data contained in the bedrock well permits will be converted to specific capacity values. These results will be converted to aquifer transmissivity by developing a correlation against available published bedrock transmissivity data obtained from aquifer pumping tests of at least 4 hours in duration. The resulting data will be plotted by aquifer and evaluated in terms of remaining datagaps

- Up to 50 municipalities or other entities will be contacted to obtain existing bedrock aquifer pumping test data. The Consultant will contact the individual entities twice to obtain the data before removing them from the contact list. It is anticipated that up to 10 sets of bedrock aquifer test data will be provided to the Consultant for the purposes of the SPDSS. These data will be reviewed by the Consultant for data quality and, as deemed by the Consultant, the summary results will be incorporated into the database.

- Documentation for the analyses and the results will be undertaken as described in Task 37.3.

Task 37.2 Bedrock Aquifer Testing

Approach

- Test locations within the Denver Basin Region bedrock aquifers will be determined based on existing gaps in aquifer property data identified from Phase 1 and in Tasks 33 and 37.1 and if the owners of existing high-capacity bedrock wells are willing to cooperate in this effort by allowing their wells to be used in an aquifer pumping test.

- Information on the location and the owners of bedrock wells drilled and installed by others will be provided through well permit applications provided by the SEO to the Consultant. Municipalities will primarily be targeted for this cooperative effort. Up to 50 municipalities or other entities will be contacted. The Consultant will contact individual applicants twice to discuss details of collaborative data gathering activities before removing them from the contact list. It is anticipated that the State will provide limited assistance to the Consultant, such as discussing the Consultant's purposes with the applicant and assisting the Consultant administratively with site access, as needed.

- The existing high-capacity bedrock wells will need to satisfy a set of criteria before they will be accepted for use in the test. These criteria include:

  - The willingness of the operator to shut down the well before and after the test for a suitable period to allow water level recovery,

- existence of a well log containing lithologic or geophysical logs and well construction information,
- the well being screened within one bedrock aquifer as defined by the Denver Basin Rules,
- the presence of an in-line flow meter capable of certification by the State,
- the ability to collect water level measurements in the pumped well.

- As included in Exhibit D, Task Compensation cost estimates for this task are based on 10 pumping tests being conducted in existing wells completed in bedrock aquifers in the Denver Basin Region, provided this many entities are willing to cooperate. As conditions and budget allows, additional tests may be undertaken in wells completed in the bedrock aquifers.

- In cases where observation well(s) exist in the vicinity of a high capacity well, they will be used in the aquifer tests provided they meet certain criteria, such as having a well completion diagram, lithologic or geophysical logs and being screened in the same aquifer as the nearby high-capacity well.

- If not already equipped, the high-capacity wells and the observation wells will be outfitted with continuous water level recording devices to monitor changes in groundwater levels during the aquifer pumping test. It is anticipated that water levels in each pumping well and in one other well that can serve as an observation well, if present, will be monitored for at least one week prior to the start of the aquifer test and for a total of up to one month. The aquifer test will consist of water level measurements recorded in three phases: pretest, pumping phase, and recovery phase. During the pretest phase, water level measurements will define ambient conditions. During the pumping phase, the high-capacity bedrock well will pump at a constant rate over the duration of this phase and water levels in the observation well will decline as a cone of depression forms around the pumped well. During the recovery phase, the high-capacity well will be shut down and water levels allowed to rise back towards prepumping levels.

- Discharge will be measured periodically during the test to ensure that a constant pumping rate is maintained. Discharge measurements will be made with an in-line flow meter or other method acceptable to the State Engineer's Office. The pumping phase will last for at least 8 hours and may extend up to one week in duration. Up to one week may be required to measure the recovery in aquifer water levels once pumping stops.

- The water level data will be analyzed using standard aquifer test analysis methods that are appropriate for the type of aquifer being tested (unconfined, confined or leaky). The data analysis will be used to obtain estimates of aquifer transmissivity, storage coefficient (for tests with observation wells) and, where aquifer saturated thickness data are readily available to the Consultant, hydraulic conductivity.

Deliverables:

Task 37.3 Phase 2 Denver Basin Region Aquifer Testing Technical Memorandum

- The Consultant will update the Technical Memorandum written in Phase 1 up to 10 pages in length (with additional pages for figures, tables and appendices, as needed) that describes:
  - the analysis methods and results obtained from the SEO well permit data,
  - discusses previously unpublished aquifer test results obtained from others,
  - summarizes the field work, explains the analysis procedures, and presents the results of the aquifer tests.
  - Summaries the SPDSS bedrock aquifer testing effort and how these data address the SB-74 recommendations.
- The Consultant will provide six hard copies and one digital copy (in MSWord and Adobe Acrobat PDF format) of the Draft Technical Memorandum for the State's review. The Consultant will incorporate the State's comments and recommendations from the Draft and provide six hard copies and one digital copy (in MSWord and Adobe Acrobat PDF format) of the Final Technical Memorandum. It is anticipated that the State will provide a summary of the aquifer test data and results for a given test to each collaborating well owner.

Task 39: Collect Water Level Data

Objective:

This task will enhance the State's groundwater database by continuing the Phase 1 collection of measurements during the fall season after agricultural pumping has ceased and will add to the understanding of seasonal changes in groundwater levels when compared to the SEO's spring season measurements. This Task will help fulfill one of the recommendations of the SB 96-74 Review Committee.

Approach:

Task 39.1 Water Level Measurements

- The SEO water level measurement databases for the Denver Basin and South Platte Regions will be reviewed to identify candidate wells for autumn post-irrigation season water level measurement. Criteria for evaluating candidate wells includes the well location, aquifer screened by the well, existence of adequate well control (location and measuring-point elevation) data, historic record of measurements, and whether measurements are currently collected in the autumn by SEO staff or other cooperating entities.
- Candidate wells will be discussed with SEO staff knowledgeable with the existing water level monitoring program during a single half-day meeting. Issues such as site access,

measurement procedures, and prior experience at the candidate locations will be discussed. Alternate sites may be selected based on this meeting.

- As included in Exhibit D, Task Compensation , costs estimated for this Task are based on 60 wells being measured once during this Task, with the specific number of wells and their location in the Denver Basin and Lower South Platte Regions defined after the Consultant evaluates the existing data gaps and meets with SEO staff.

- Sites selected for monitoring will be finalized and the listing sent to the State for approval. Copies of field notes from the sites will be provided by SEO staff to the Consultant. It is anticipated that the Consultant will not need to contact any of the well owners, that access to the wells will be straightforward, and that separate site visits will not be needed prior to collecting the water level field data.

- The Consultant will collect measurements of the depth to water at each site using methods comparable to those currently used by the State during their spring-season measurements. The measurement date, time, site identification number, measuring point location, casing stickup and other descriptive information pertinent to the measurements will be noted and recorded in a field notebook.

- The measurements tabulated in a field notebook will be entered into an existing electronic database of water level measurements by consultant. Following data QC, the electronic data will be added to HydroBase in a format consistent with previous ground water level data.

Deliverables:

Task 39.2 Phase 2 Denver Basin Region Water Level Measurement Technical Memorandum

- The Consultant will develop a submittal of up to 5 pages in length (with additional pages for data tables and appendices) that contains a description of the field data collection effort, a summary of the results, and appendices containing copies of the raw data. There will be no mapping of the data in this Task; mapping of the data and discussion of how this data helps satisfy the SB-74 recommendations on water level data collection will be provided under Task 44.

- The Consultant will provide six hard copies and one digital copy (in MSWord and Adobe Acrobat PDF format) of the Draft Technical Memorandum for the State's review. The Consultant will incorporate the State's comments and recommendations and provide a Final Technical Memorandum. Six hard copies and one digital copy in MSWord and Adobe Acrobat PDF format of the Final Technical Memorandum will be provided.

Task 39.3 Phase 2 Lower South Platte Region Water Level Measurement Technical Memorandum

- The Consultant will develop a submittal of up to 5 pages in length (with additional pages for data tables and appendices) that contains a description of the field data collection effort, a summary of the results, and appendices containing copies of the raw data. There will be no mapping of the data in this Task; mapping of the data and discussion of how this data helps satisfy the SB-74 recommendations on water level data collection will be provided under Task 44.

- The Consultant will provide six hard copies and one digital copy (in MSWord and Adobe Acrobat PDF format) of the Draft Technical Memorandum for the State's review. The Consultant will incorporate the State's comments and recommendations and provide a Final Technical Memorandum. Six hard copies and one digital copy in MSWord and Adobe Acrobat PDF format of the Final Technical Memorandum will be provided.

Task 40: Identify Abandoned Wells for Conversion to Monitoring Wells

Objective:

This task will be used to increase the number of wells included in the SEO's water level monitoring network, by identifying wells scheduled for abandonment and evaluating the feasibility of converting these wells into permanent monitoring wells for the State's use. This task will help satisfy one of the SB 96-74 study recommendations to increase the number of wells monitored for water levels in the Denver Basin Region.

Approach:

Task 40.1 Identification of Abandoned Wells for Conversion to Monitoring Wells

- The SEO will be contacted once during the Phase 2 study period to provide a listing of wells which have been proposed for or otherwise have been listed for abandonment. It is anticipated that this list will be transmitted electronically to the Consultant.

- The Consultant will meet with the SEO to understand the procedural requirements to remove a well from the abandonment list.

- The Consultant will review the listed wells with respect to their location, well depth, well completion information, well screen interval, casing and cementing information, aquifer intersected, historic use, well owner contact information and availability of a driller's or geophysical log to assess their suitability for addition to the network of existing wells monitored by the State.

- The Consultant will draft a form letter for the SEO, to owners of candidate wells that will indicate the proposed action, explain the procedures and request additional information of

actions needed by the well owner should they be interested. The SEO will review this form letter one time before it is first issued.

- Wells determined by the Consultant that may be suitable for conversion will be identified and a list of these wells sent to the SEO project contact and State project manager for review and discussion. As included in Exhibit D, Task Compensation, it is anticipated that up to 100 wells that may be suitable for conversion. The Consultant will then send the form letter to the well owners requesting conversion. Responses will be sent to the SEO, who will forward these to the Consultant. The wells whose owners agree to conversion will be identified by the Consultant and brought to the attention of the SEO.

Deliverables:

Task 40.2 Phase 2 Conversion of Abandoned Wells Technical Memorandum

- The Consultant will develop a single submittal of up to 5 pages in length (with additional pages for tables, maps and appendices, if presented), that contains a description of the processes used to identify wells scheduled for abandonment with the Denver Basin Region, identifies the wells whose owners are willing to be converted to monitoring wells, and includes summary tables of the well data, including permit number, location, depth, completion information and aquifer intervals monitored for wells expected to be converted. The Technical Memorandum will include a discussion of how the conversion of wells will satisfy one of the SB-74 recommendations of expanding the groundwater monitoring program.

- The Consultant will provide six hard copies and one digital copy (in MSWord and Adobe Acrobat PDF format) of the Draft Technical Memorandum for the State's review. The Consultant will incorporate the State's comments and recommendations and provide a Final Technical Memorandum. Six hard copies and one digital copy in MSWord and Adobe Acrobat PDF format of the Final Technical Memorandum will be provided.

Task 42: Analysis and Mapping of Aquifer Configuration Data

Objective:

The objective of this task is to evaluate the aquifer configuration data collected during Phase 2, to add to the Phase 1 analyses and mapping, and to enhance HydroBase with these data.

Approach:

Task 42.1 Analyze and Map Aquifer Configuration Data

- This is a continuation of Phase 1 effort, that allows the additional data collected during Phase 2 to be included. These new data will be evaluated to determine if they may provide an

enhanced understanding of the Denver Basin and Lower South Platte Regions' ground water systems. As included in Exhibit D, Task Compensation, the Consultant will review all data and include data that the Consultant determines to be beneficial for the SPDSS. These data will be converted to an electronic format appropriate for incorporation into HydroBase. Data collected under Tasks 35, 36, 37, 39 and 40 during Phase 2 also will be converted to an electronic format appropriate for incorporation into HydroBase.

- The database developed under Phase 1 will be updated with Phase 2 data. The updated database will be summarized for descriptive purposes, including the database fields, number of entries in each field by aquifer, and sources of data.

- Digital contour maps that were developed under Phase 1 will be updated and finalized under the SPDSS, with Phase 2 data. For the alluvial aquifer this includes maps of aquifer bottom elevation. For the bedrock aquifers this includes maps of (a) aquifer bottom and top elevations and (b) aquifer sand thickness . The maps will include the location of Phase 2 data used in the contouring.

- If Phase 2 data are located along the lines of the cross-sections developed during Phase 1, then those cross-section maps with new data will be updated and finalized with the Phase 2 data and be reproduced.

- The maps will be evaluated and finalized under the SPDSS, based on the presence of outliers, comparison to existing contour maps, consultation with SEO and CWCB staff familiar with the data, and Consultant's professional judgment.

Deliverables:

Task 42.2 Phase 2 Denver Basin Region Aquifer Configuration Technical Memorandum

- The Consultant will develop a submittal of up to 10 pages (with additional pages for maps and appendices), consisting of a description of the Phase 2 aquifer configuration database from the Denver Basin Region and its analysis, as described in Task 42.1. This Technical Memorandum will focus on information collected during Phase 2 and will be an update to the Task 42.2 Phase 1 Technical Memorandum. This task further addresses the SB-74 recommendation of mapping the alluvial aquifer

- The Technical Memorandum will include the following:

    - a discussion of the Phase 2 data sources, analysis methods, and results

    - a summary of the HydroBase-compatible database fields, structure and contents

    - an electronic HydroBase-compatible version of the aquifer configuration database

    - aquifer configuration maps as described in Section 42.1 for the alluvial aquifer and for each bedrock, presented in 11x17 inch hardcopy format

- The Consultant will provide six hard copies and one digital copy (in MSWord and Adobe Acrobat PDF format) of the Draft Technical Memorandum for the State's review. The Consultant will incorporate the State's comments and recommendations and provide a Final Technical Memorandum. Six hard copies and one digital copy in MSWord and Adobe Acrobat PDF format of the Final Technical Memorandum will be provided.

Task 42.3 Phase 2 Lower South Platte Region Aquifer Configuration Technical Memorandum

- The Consultant will develop a submittal of up to 10 pages (with additional pages for maps and appendices), consisting of a description of the Phase 2 aquifer configuration database from the Lower South Platte Region and its analysis, as described in Task 42.1. This Technical Memorandum will focus on information collected during Phase 2 and will be an update to the Task 42.3 Phase 1 Technical Memorandum.
- The Technical Memorandum will include the following:
    - a discussion of the Phase 2 data sources, analysis methods, and results
    - a summary of the HydroBase-compatible database fields, structure and contents
    - an electronic HydroBase-compatible version of the aquifer configuration database
    - aquifer configuration maps for the alluvial aquifer as described in Section 42.1, presented in 11x17 inch hardcopy format
    - summary of the SPDSS aquifer configuration effort.
- The Consultant will provide six hard copies and one digital copy (in MSWord and Adobe Acrobat PDF format) of the Draft Technical Memorandum for the State's review. The Consultant will incorporate the State's comments and recommendations and provide a Final Technical Memorandum. Six hard copies and one digital copy in MSWord and Adobe Acrobat PDF format of the Final Technical Memorandum will be provided.

Task 43: Analysis and Mapping of Aquifer Property Data

Objective:

The objective of this task is to evaluate the aquifer property data collected under Tasks 35, 36, and 37 during Phase 2, update the analyses and mapping of these data from Phase 1, and to provide these data to enhance HydroBase. The results of this task will help satisfy the SB 96-74 recommendations regarding analysis of aquifer property data from the Denver Basin Region bedrock aquifers.

Approach:

Task 43.1 Analyze and Map Aquifer Property Data This task is a continuation of Phase 1 effort, that allows the additional data collected during Phase 2 to be included. As included in Exhibit D, Task Compensation, the Consultant will review all data and include data that the Consultant determines to be beneficial for the SPDSS. These data will be converted to an electronic format appropriate for incorporation into HydroBase. Data collected under Tasks 35, 36, 37, 39 and 40 during Phase 2 also will be converted to an electronic format appropriate for incorporation into HydroBase.

- The database developed under Phase 1 will be updated with Phase 2 data. The updated database will be summarized for descriptive purposes, including the database fields, number of entries in each field by aquifer, and sources of data.

- Digital contour or point plot maps developed under Phase 1 will be updated with Phase 2 data. These include, for each aquifer, maps of (a) hydraulic conductivity and/or transmissivity, and (b) specific yield and/or storage coefficient, including the location of data used in the contouring. Contour maps will be prepared for those datasets with sufficient data to reliably develop contours, while sparse or highly variable data will be presented on point plot maps. The maps will include the location of Phase 2 data used in the contouring.

- The maps will be evaluated and revised based on the presence of outliers, comparison to existing contour maps, consultation with SEO and CWCB staff familiar with the data, and Consultant's professional judgment.

Deliverables:

Task 43.2 Phase 2 Denver Basin Region Aquifer Property Technical Memorandum

- The Consultant will develop a submittal of up to 10 pages (with additional pages for maps and appendices), consisting of a description of the Phase 2 aquifer property database and its analysis, as described in Task 43.1. This Technical Memorandum will focus on information collected during Phase 2 and will be an update to the Task 43.2 Phase 1 Technical Memorandum.

- The Technical Memorandum will include the following:

    - a discussion of the Phase 2 data sources, analysis methods, and results

    - a summary of the HydroBase-compatible database fields, structure and contents

    - an electronic HydroBase-compatible version of the aquifer property database

    - aquifer property maps as described in Section 43.1 for the alluvial aquifer and for each bedrock aquifer, presented in 11x17 inch hardcopy format

- The Consultant will provide six hard copies and one digital copy (in MSWord and Adobe Acrobat PDF format) of the Draft Technical Memorandum for the State's review. The

Consultant will incorporate the State's comments and recommendations and provide a Final Technical Memorandum. Six hard copies and one digital copy in MSWord and Adobe Acrobat PDF format of the Final Technical Memorandum will be provided.

Task 43.3 Phase 2 Lower South Platte Region Aquifer Property Technical Memorandum

- The Consultant will develop a submittal of up to 10 pages (with additional pages for maps and appendices), consisting of a description of the Phase 2 aquifer property database and its analysis, as described in Task 43.1. This Technical Memorandum will focus on information collected during Phase 2 and will be an update to the Task 43.3 Phase 1 Technical Memorandum.
- The Technical Memorandum will include the following:
    - a discussion of the Phase 2 data sources, analysis methods, and results
    - a summary of the HydroBase-compatible database fields, structure and contents
    - an electronic HydroBase-compatible version of the aquifer property database
    - aquifer property maps as described in Section 43.1 for the alluvial aquifer, presented in 11x17 inch hardcopy format
- The Consultant will provide six hard copies and one digital copy (in MSWord and Adobe Acrobat PDF format) of the Draft Technical Memorandum for the State's review. The Consultant will incorporate the State's comments and recommendations and provide a Final Technical Memorandum. Six hard copies and one digital copy in MSWord and Adobe Acrobat PDF format of the Final Technical Memorandum will be provided.

Task 44: Analysis and Mapping of Water Level Data

Objective:

The objective of this task is to evaluate the aquifer water level data collected during Phase 2, to add to the Phase 1 analyses and mapping, and to provide these data to enhance HydroBase. The results of this task will help satisfy the SB 96-74 recommendations by expanding the groundwater level measurement database for the Denver Basin Region bedrock aquifers

Approach:

Task 44.1 Analyze and Map Aquifer Water Level Data

- This task is a continuation of Phase 1 effort, that allows the additional data collected during Phase 2 to be included. As included in Exhibit D, Task Compensation, the Consultant will

review all data and include data that the Consultant determines to be beneficial for the SPDSS. These data will be converted to an electronic format appropriate for incorporation into HydroBase. Data collected under Tasks 35, 36, 37, 39 and 40 during Phase 2 also will be converted to an electronic format appropriate for incorporation into HydroBase.

- The database developed under Phase 1 will be updated with Phase 2 field data. The updated database will be summarized for descriptive purposes, including the database fields, number of entries in each field by aquifer, and sources of data.

- Digital contour or point plot maps developed under Phase 1 will be updated with Phase 2 data. This includes maps of (a) water level elevations for the current year and (b) hydrographs. The water level elevation maps will include the location of Phase 2 data used in the contouring. Contour maps will be prepared for those data elements with sufficient data to reliably develop contours, while sparse or highly variable data will be presented on point plot maps.

- The maps will be evaluated and revised based on the presence of outliers, comparison to existing contour maps, and Consultant's professional judgment.

Deliverables:

Task 44.2 Phase 2 Denver Basin Region Aquifer Water Level Technical Memorandum

- The Consultant will develop a submittal of up to 10 pages (with additional pages for maps and appendices), consisting of the historic data on aquifer water levels and their analysis, as described in Task 44.1. This Technical Memorandum will focus on information collected during Phase 2 and will be an update to the Task 44.2 Phase 1 Technical Memorandum.

- The Technical Memorandum will include the following:

    - a discussion of the Phase 2 data sources, analysis methods, and results

    - a summary of the HydroBase-compatible database fields, structure and contents

    - an electronic HydroBase-compatible version of the aquifer water level database

    - aquifer water level maps that are representative of non-pumping conditions for the calendar year for the alluvial aquifer and for each bedrock aquifer, presented in 11x17 inch hardcopy format

    - hydrographs developed for the 40 wells that were presented in the Phase 1 Task 44.2 Technical Memorandum will be updated with Phase 2 data, presented in 8.5x11 inch hardcopy format

- The Consultant will provide six hard copies and one digital copy (in MSWord and Adobe Acrobat PDF format) of the Draft Technical Memorandum for the State's review. The Consultant will incorporate the State's comments and recommendations and provide a Final Technical Memorandum. Six hard copies and one digital copy in MSWord and Adobe Acrobat PDF format of the Final Technical Memorandum will be provided.

Task 44.3 Phase 2 Lower South Platte Region Aquifer Water Level Technical Memorandum

- The Consultant will develop a submittal of up to 10 pages (with additional pages for maps and appendices), consisting of the historic data on aquifer water levels and their analysis, as described in Task 44.1. This Technical Memorandum will focus on information collected during Phase 2 and will be an update to the Task 44.3 Phase 1 Technical Memorandum. The Technical Memorandum will include the following:
    - a discussion of the Phase 2 data sources, analysis methods, and results
    - a summary of the HydroBase-compatible database fields, structure and contents
    - an electronic HydroBase-compatible version of the aquifer water level database
    - aquifer water level maps that are representative of non-pumping conditions for the calendar year for the alluvial aquifer, presented in 11x17 inch hardcopy format
    - hydrographs developed for the 15 wells that were presented in the Phase 1 Task 44.3 Technical Memorandum will be updated with Phase 2 data, presented in 8.5x11 inch hardcopy format
- The Consultant will provide six hard copies and one digital copy (in MSWord and Adobe Acrobat PDF format) of the Draft Technical Memorandum for the State's review. The Consultant will incorporate the State's comments and recommendations and provide a Final Technical Memorandum. Six hard copies and one digital copy in MSWord and Adobe Acrobat PDF format of the Final Technical Memorandum will be provided.

Task 50 Development of a Data Centered Approach for the SPDSS Groundwater Component

Objective:

The objective of this task is to design a data centered approach to facilitate the evaluation and development of groundwater data for use in MODFLOW, the USGS ground water model, and a process used with the surface water model. This process will consider existing approaches and tools, and requirements from users of the models. The data centered design will adopt and improve current "best practices" used by the State and others for ground water modeling for implementing MODFLOW in the South Platte. This process is anticipated to provide a general framework with applicability not only to the SPDSS, but also to other groundwater modeling activities conducted by the State or other members of the groundwater community.

Task 50.1 Review of Existing Approaches

Approach:

- The Consultant will meet with the State's Colorado River DSS and Rio Grande DSS development teams to define the current data centered modeling processes and tools that have been implemented for both surface and ground water modeling. The sources of data and methodology currently utilized by these teams will be summarized in workflow diagrams. Available programs and documentation will be inventoried and reviewed for consideration in the data centered ground water design. Analysts from the State and other SPDSS consultants will be interviewed to identify deficiencies in current approaches and suggested areas for improvement. Two four-hour working meetings with the CRDSS and RGDSS teams are planned. Each of these meetings will include a demonstration by the State's team of the process involved in moving data through process definition and model configuration to model output.

- Other data centered approaches will be identified and at least two of these will be selected for more detailed evaluation to identify features that may be beneficial for incorporation into the SPDSS system. Candidate systems will include both integrated commercial software systems, such as Groundwater Vistas, Visual Modflow, MIKE-SHE, USGS/Argus, and generalized approaches such as implemented by the City of Aurora for their alluvial well field model, or the Wyoming Groundwater Modeler system. The selected approaches will be summarized and workflow diagrams developed. Attributes of these systems that appear to be beneficial to the SPDSS will be identified.

- A review meeting will be held with the State to discuss preliminary findings.

Deliverables:

- Draft and Final Technical Memoranda (TM) up to 10 pages in length will be prepared that will summarize the results of this task. This TM will summarize the existing data centered approaches that were evaluated, including workflow and tools that are utilized. Each deliverable (draft and final) will include 6 paper copies, plus source files in Microsoft Word and Adobe Acrobat format. The final TM will incorporate the State's comments and recommendations.

Task 50.2 Definition of Requirements for SPDSS Data Centered Approach

Approach:

- Based on the results of Task 50.1, a 4 hour meeting will be held with the State to define data sources, processes and tools to facilitate the data centered approach to ground water modeling. Prior to the meeting, approximately 3 representatives of the user community will be queried by phone to identify those features that are most important to them to consider for

incorporation into the system design. User interface issues will also be addressed through this process.

- A detailed summary of proposed data centered approach to ground water modeling will be developed that includes the data management component, process management component and model management component. These processes will include both conceptual and numerical modeling components. Ideally, data and process definitions will flow to a framework- independent conceptual model. This conceptual model and associated data then can be cast onto a numerical model framework for simulations and analysis of alternatives. Elements in these components that are suitable for automation and will result in improved quality, reliability and usability will be defined. A peer review group including the Consultant, the State and approximately two other parties will meet two times for approximately 4 hours to review and refine this evaluation.

- The suitability of existing computer tools that have been developed for other DSS processes will be assessed. These tools may be included in the design and necessary enhancements will be defined during the process. Linkage or user interface requirements will be defined.

- A requirements summary will be developed and elements prioritized to determine which of these elements will be included in the implementation scope of work. The prioritization will be done cooperatively with the State. This requirements analysis will address the use of and integrated system versus multi-step processes.

Deliverables:

- Draft and Final Technical Memoranda (TM) up to 10 pages in length will be prepared that will summarize the results of this task that include:

  - a summary of the interviews,

  - a summary of the proposed data centered approach to ground water modeling,

  - the suitability of existing computer tools that have been developed for other DSS processes, and

  - a requirement summary.

- The final TM will incorporate the State's comments and recommendations. The results of the final TM will serve as the basis for Task 50.3, implementation scope of work.

Task 50.3 Implementation Scope of Work

Approach:

- A draft implementation scope of work will be developed, based on Tasks 50.1 and 50.2. The specific tasks will be described, along with the schedule and cost for implementing. Opportunities for phasing implementation will also be identified in this document.

- A process workflow for the recommended design will be included in the scope, along with linkages between sources of data and models. Programs that facilitate each of the steps will be defined in sufficient detail to estimate costs and schedule. Existing programs that will be enhanced will be identified. The design will be flexible to allow prototyping during development that will result in a more useable system to meet the State's objectives. This process workflow will identify reports and visualization tools that will be included that will address both source data and model output. User interface requirements will also be defined.

Deliverables:

- A Draft and Final Scope of Work up to 10 pages in length including a detailed approach for implementation, cost estimates and schedule will be provided. Each deliverable (draft and final) will include 6 paper copies, plus source files in Microsoft Word and Adobe Acrobat format. The final Scope of Work will incorporate the State's comments and recommendations.

Task 51: Phase 2 Project Management and Meetings

Objective:

The objective of this task is to track work accomplished, maintain budget and schedule, and report the status of work activities. An additional objective is to promote communications between the Consultant and the State, and between the Consultant and other SPDSS Consultants.

Approach and Deliverables:

Task 51.1 Progress Reports

- Consultant will provide up to 12 monthly progress reports. These will include work activity descriptions, task summaries, and a project summary.

- The Work Activity Description will describe work accomplished the previous month for each Task presented in Table 1 of this Phase 2 Scope of Work. The Task Summary will describe the budget, costs to date, percent spent, percent complete, and estimated cost to complete. The Project Summary will describe any technical, budget and schedule concerns and proposed corrective actions for the Project.

Task 51.2 Invoicing

- Consultant will prepare monthly invoices that correspond to the activities described in the progress reports. The invoices will include billing by person with their rate and hours, by Task. The other direct costs and a summary of retainage (retainage this period and total retainage to date) will also be included.

Task 51.3 SPDSS Coordination Meetings

- Consultant will prepare for and attend 12 monthly SPDSS Coordination Meetings with the State. Each meeting is expected to consist of a three-hour meeting held at the Consultant's office in Denver and include discussion of progress, budget, schedule and activities expected to occur in the next month.

Task 51.4 Phase 3 Scope of Work

- Consultant will develop a Draft Phase 3 Scope of Work based on the feasibility study and based on the information and experience obtained during the execution of the Phase 1 and Phase 2 scopes. State comments on the Draft will be incorporated into a Final Phase 3 Scope of Work.

EXHIBIT B

Rate Schedule – Phase 2
South Platte Decision Support System Groundwater Component
October 30, 2003

Camp Dresser & McKee Inc.

	Hourly Rate
PRINCIPAL, TECHNICAL ADVISOR	
John Rehring, Associate and Officer in Charge	$ 160
Michael Smith, Vice President and Senior Technical Advisor	$ 160
SENIOR ENGINEER/SCIENTIST	
Gordon McCurry, Project Manager	$ 135
STAFF ENGINEERS/SCIENTIST II	
Gary Shaughnessy	$ 100
STAFF ENGINEERS/SCIENTIST I	
Leah Smerud	$ 86
Andy Horn	$ 86
Mark McCluskey	$ 86
JUNIOR ENGINEERS/SCIENTIST	
Becky Albrecht	$ 65
Donovan Paschall	$ 65
CLERICAL/ADMIN	
Connie Epson	$ 50

All staff will be billed according to their labor categories at the time charges are incurred, at the rates shown in Exhibit B-2, attached.

EXHIBIT B-2

CAMP DRESSER & MCKEE INC.
SPDSS PHASE 1 HOURLY LABOR RATES

EFFECTIVE 10/30/2003

LABOR CATEGORIES	LEVEL	HOURLY BILLING RATE
ENGINEERS/SCIENTISTS/PLANNERS:		
JUNIOR ENGINEER/SCIENTIST	1-2	65.00
STAFF ENGINEER/SCIENTIST I	3-4	86.00
STAFF ENGINEER/SCIENTIST II	5-6	100.00
SENIOR ENGINEER/SCIENTIST	7-8	135.00
PRINCIPAL, TECHNICAL ADVISOR	9-10	160.00
SUPPORT SERVICES:		
DRAFTER/TECHNICIAN		65.00
CLERICAL/ADMIN		50.00
WORD PROCESSOR/ADMIN		50.00
OTHER DIRECT COSTS:		
AUTO MILEAGE	PER MILE	0.36
PHOTOCOPY	PER COPY	0.10
COLOR COPIES	PER COPY	1.00
TELEPHONE	PER MINUTE	AT COST
FAX/TELECOPY	PER SHEET	1.00
CADD COMPUTER	PER HOUR	5.00

1) COSTS FOR THIRD PARTY INVOICES SUCH AS SUPPLIES, TRAVEL, RENTALS AND SPECIALIZED EQUIPMENT WILL BE COSTED ON AN AS NEEDED BASIS AND BILLED AT COST
2) A 5% HANDLING FEE WILL BE ADDED TO SUBCONTRACTOR CHARGES.
3) COMPANY OWNED EQUIPMENT WILL BE BILLED AT OUR CUSTOMARY RATES

EXHIBIT C

Certification
South Platte Decision Support System - Groundwater Component
October 30, 2003

I hereby certify:

a. That I am an Associate and duly authorized representative of the firm of Camp Dresser & McKee Inc.; and

b. That the wage rates and other factual unit costs supporting the compensation to be paid by the State for these professional services are accurate, complete, and current; and

c. That I understand the original contract price and any additions shall be adjusted to exclude any significant sums by which the State determines the contract price had been increased due to inaccurate, incomplete, or non-current wage rates and other factual unit costs; and

d. That all such contract adjustments shall be made within one year following the end of this contract.

_____
Signature

EXHIBIT D

Task Compensation

SPDSS Groundwater Component - Phase 2

October 30, 2003

Task	Description	Total Cost
33	**Workplan Revision and Update**	**$9,000**
	33.1 Design	$5,000
	33.2 Workplan	$4,000
35	**Construction and Testing of Alluvial Wells**	**$283,800**
	35.1 Drilling/Data Collection	$267,300
	35.2 Denver Basin Tech Memo	$9,500
	35.3 Lower South Platte Tech Memo	$7,000
36	**Construction and Testing of Bedrock Wells**	**$124,700**
	36.1 Drilling/Data Collection	$119,700
	36.2 Denver Basin Tech Memo	$5,000
37	**Aquifer Pumping Tests**	**$246,600**
	37.1 Phase 2 Data Collection	$99,300
	37.2 Aquifer Testing and Analysis	$137,500
	37.3 Denver Basin Tech Memo	$9,800
39	**Collection of Water Level Data**	**$24,000**
	39.1 Data Collection	$16,600
	39.2 Denver Basin Tech Memo	$3,700
	39.3 Lower South Platte Tech Memo	$3,700
40	**Evaluate Abandoned Wells for Conversion**	**$8,000**
	40.1 Evaluation	$5,000
	40.2 Denver Basin Tech Memo	$3,000
42	**Aquifer Configuration Data Analysis**	**$17,000**
	42.1 Analyze and Map Data	$8,000
	42.2 Denver Basin Tech Memo	$5,000
	42.3 Lower South Platte Tech Memo	$4,000
43	**Aquifer Property Data Analysis**	**$30,000**
	43.1 Analyze and Map Data	$21,000
	43.2 Denver Basin Tech Memo	$5,000
	43.3 Lower South Platte Tech Memo	$4,000
44	**Aquifer Water Level Data Analysis**	**$20,000**
	44.1 Analyze and Map Data	$11,000
	44.2 Denver Basin Tech Memo	$5,000
	44.3 Lower South Platte Tech Memo	$4,000
50	**Development of Data Centered Approach**	**$ 33,600**
	50.1 Review Existing Approaches	$ 12,600
	50.2 Definition of Requirements	$ 13,000
	50.3 Implementation Scope of Work	$ 8,000
51	**Phase 2 Management**	**$37,833**
	51.1 Progress Reports	$7,833

51.2 Invoicing	$6,000
51.3 Meetings	$17,000
51.4 Phase 3 SOW	$7,000
Phase 2 Total Cost	**$833,933**

EXHIBIT E

Task Schedule
SPDSS Groundwater Component - Phase 2
October 30, 2003

Task Description	Task Start[1]	Task End
33 Workplan Revision and Update	01/03/04	5/03/04
35 Construction and Testing of Alluvial Wells[2]	3/01/04	11/15/04
36 Construction and Testing of Bedrock Wells[2]	3/01/04	11/15/04
37 Aquifer Pumping Tests	01/03/04	12/28/04
39 Collection of Water Level Measurements	01/03/04	12/28/04
40 Evaluate Abandoned Wells for Conversion	01/03/04	2/28/05
42 Aquifer Configuration Data Analysis	01/03/04	2/28/05
43 Aquifer Property Data Analysis	01/03/04	2/28/05
44 Aquifer Water Level Data Analysis	01/03/04	2/28/05
50 Development of Data Centered Approach	01/15/04	7/30/04
51 Phase 2 Management	01/03/04	2/28/05

Notes: (1) Starting dates for all Tasks assume Phase 2 contract execution by 01/03/04.
(2) Ending dates for Tasks 35 and 36 are dependent on field and weather conditions and assume site access can be obtained within 30 days.