SPDSS Groundwater Technical Peer Review Committee Meeting 5, December 18, 2008

Meeting Minutes

Meeting Attendees (according to sign in sheet)**:**

Last Name	First Name	Organization
Ahrens	Brian	Colorado Division of Water Resources
Ahrens	Brian	Colorado Division of Water Resources
Aldred	Angela	Deere & Ault Consultants
Banta	Ned	US Geological Survey
Bau	Domenico	Colorado State University
Bennett	Ray	Colorado Division of Water Resources
Chase	Patrick	Colorado Division of Water Resources
Cuthbertson	Scott	Colorado Division of Water Resources
Decker	Jim	Farmer - Well/groundwater user
Eisel	Leo	Brown and Caldwell
Fleharty	Rick	Lower South Platte Water Conservancy District (attending for Joe Frank)
Flory	Val	Clear Water Solutions, Inc.
Ford	Jon	Leonard Rice
Gullapalli	Lavanya	Brown and Caldwell
Halepaska	John	Halepaska
Hein	Michael	Colorado Division of Water Resources
Hemenway	Courtney	Hemenway Groundwater Engineers
Kammerzell	Gene	Farmer - Well/groundwater user
Kammerzell	Jan	Farmer - Well/groundwater user
Longenbaugh	Bob	Retired Engineer

Last Name	First Name	Organization
Martindale	Dee	Farmer - Well/groundwater user
Martindale	John	Farmer - Well/groundwater user
McCluskey	Mark	CDM
McCurry	Gordon	CDM
McLoud	Rick	Centennial WSD
Miller	Calvin	MGE
Moore	Andy	Colorado Water Conservation Board
Musleh	Shaden	AMEC
Palumbo	Mark	HRS Water Consultants
Sanchez	Chris	Bishop-Brogden
Shawcross	Luke	Northern Colorado Water Conservancy District
Simpson	Hal	H.D. Simpson Consulting/CDM
Strickland	Hayden	Lytle Water Solutions
Topper	Ralf	Colorado Geological Survey
Wilson	Erin	Leonard Rice Engineers
Yu	Chunming	Colorado Division of Water Resources

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The following table summarizes the questions asked and responses provided during the meeting, as well as some additional responses from the SPDSS team providing more information or resources. An acronyms list is provided on the last page. The presentations are available on the CDSS website at http://cdss.state.co.us/

ID	Comment or Question, Answer, and Additional Response	
1	**Q**	There are limited groundwater pumping records.
	A	Need one-to-one ratio of acreage to pumping records to determine what is actually being used.
2	**Q**	Regarding total annual surface diversions - how much is agriculture use vs. city use?
	A	Water commissioners code the water, and this data is all irrigation.
3	**Q**	How did you reach the 60/80% efficiency values?
	A	Actual calculated efficiency is usually lower than 60%, 60/80 are used only as a maximum cap. These numbers are commonly used in South Platte change cases depending on irrigation type (60 for flood, 80 for sprinkler).
4	**Q**	What is the significance of blue groundwater line on first part of graph?
	A	Pre late 1960s, hadn't put in sprinklers, therefore the efficiency represents only flood irrigation.
5	**Q**	Are units in gallon or acre-feet?
	A	Units are converted to acre-feet so all units are consistent.
6	**Q**	Clarify the term "structure" on slide, and what is the availability of the presentations?
	A	Slide 14 of the consumptive use presentation shows irrigated acreage by water source, and lists the number of "Structures with Surface Water Only = 218, Structures with Surface and Ground Water = 112, Ground Water Only Groups = 83". "Structures" include individual ditches, wells, or groups of wells. Presentations will be available on CDSS website.
7	**Q**	Was size of recharge structure used to determine whether to include in the model?
	A	It was noted that the volume of recharge was not a new model input, but that the recharge was changed, from being distributed evenly over the lands associated with a structure to being focused at recharge ponds.
8	**Q**	When does the model show pumping?
	A	Model will never show pumping if there was no irrigated acreage assigned to a well.
9	**Q**	Were consumptive use calculations limited by well capacity?
	A	Use maximum decreed rate for individual wells.
10	**Q**	How are actual pumping data used?
	A	As pumping records are collected, they will be incorporating in future model updates.
11	**Q**	If vegetables have changed to wheat, how are changes accounted for?
	A	Last snapshot was 2005, and there will be another one in 5 years. SPDSS keeps growing so additional data will be captured in next irrigated acreage assessment.
12	**Q**	Commented that he (farmer) doesn't run well/surface water 24/7 to irrigate crops.
	A	Pumping is only estimated to meet what crops can use and then further limited by pump capacity; pumping is only estimated for lands that have wells.

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13	**Q**	The Blaney-Criddle coefficients produce estimates of maximum consumptive use. Many farmers however are not attempting to maximize crop yields. Therefore, is use of the Blaney-Criddle coefficients overestimating consumptive use?
	A	We looked at pumping records for specific lands - sensitivity analysis - doing as much as possible now and working with Central to get more data over time. We believe that use of the Blaney-Criddle coefficients results in reasonable estimates of potential consumptive use that are applicable for the temperature and precipitation conditions at specific locations in the South Platte Basin. Again, we must emphasize that the South Platte DSS is intended for planning purposes and has never been designed, nor intended, to replicate the precise groundwater responses occurring on individual farms throughout the South Platte basin.
14	**Q**	Concern with 60% on farm efficiency is not accurate, especially for my farm.
	A	We struggle with this on a basin-wide level – we are not doing a consumptive use analysis on a specific farm; at this level we think that 60 and 80 are appropriate.
15	**Q**	Commented that 60% on farm efficiency is the maximum level, so it is not always reached.
	A	Will be hit more frequently if water short, and less if water long.
16	**Q**	Number efficiency is dynamic - spring needs versus later is very different
	A	Again, basin-wide level of effort, some of these nuances don't get captured.
17	**Q**	Concerned that finite model will be developed and limit wells.
	A	This model is for use by CWCB, Roundtables, Metro, etc for planning purposes. The model is able to look at regional scale only and not at the level of farms or individual wells.
18	**Q**	Concerned that even with basin wide model, not using good data.
	A	If results of tools don't match historic data, then we will have to re-evaluate, but if they do, then tool should be considered useful for the regional-scale applications. The model will also help identify data gaps that can focus future field data collection efforts.
19	**Q**	Concerned that if $4.5 million spent on this program, what is likelihood of spending more money or improvement.
	A	Maintenance costs are considered when the feasibility studies are done - so we will be able to improve the tools over time.
20	**Q**	If you can't identify maximum efficiency on a ditch or more local level, how are efficiencies calculated in the model?
	A	The engineering estimates used in the current model can be updated or replaced using actual data at a later time should these data become available. Part of the modeling process is to identify where there are data gaps so we can go back and fill those in.
21	**Q**	What is the consumptive use for phreatophytes ? 477,000 acre-ft/yr?
	A	Phreatophyte use is approximately 255,000 acre-ft/yr from groundwater; the 450,000 acre-ft/yr consumptive use value includes CU from precipitation. The estimates were developed by an expert on this subject. The results are included in a technical memo on Evapotranspiration in the South Platte Basin. This is a difficult part of the water balance to quantify, so the PRC is being asked to review the memo, and provide comments. Currently the model is using the numbers from that memo.
22	**Q**	Requested a specific ET meeting - perhaps there are misconceptions with Groenveld - has some concerns about methodology.
	A	Please review memo and provide comment - then can review specific comments.
23	**Q**	Is it scoped to perform applications using the SPDSS Alluvial Groundwater Model?
	A	Yes, the current contract includes a task to apply the model once it is calibrated, but there is some flexibility as to what the specific applications will be.

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24	**Q**	Regarding ET one of model stresses - is model going to be capable of calculating groundwater ET?
	A	Yes, groundwater ET is defined as the consumptive use of water drawn directly from aquifer system, which is just a portion of total consumptive use.
25	**Q**	Will model be able to compute ET from groundwater based upon water level and ET-depth relationships?
	A	Yes, the model will do this using the ET-depth relationships developed and presented in Evapotranspiration technical memo.
26	**Q**	Do you have a feel for how many recharge ponds there are?
	A	Yes, there are 683 recharge structures in basin.
27	**Q**	Is there a scale/model cell limit for whether pond would be included?
	A	If a recharge pond had a decree then it will be included in the model and assigned to the model cell or cells that correspond to the pond's location. Previously the recharge from individual ponds was assigned on ditch-wide basis.
28	**Q**	Where does the recharge pond data come from?
	A	Information is obtained through HydroBase and StateCU model.
29	**Q**	Will model treat phreatophytes as same over time?
	A	Will treat land use (except for irrigated acreage) as constant over time because that is a reasonable place to start; would like to work with you about information from those studies.
30	**Q**	How do you define subirrigation? How do you field check it so you know its there?
	A	ET memo states expected phreatophyte consumptive use; there is phreatophyte coverage, and then there is subirrigation - might occur on alfalfa and irrigated meadows if CU demands are not met by irrigation water - each one has a function of GW ET versus GW depth
31	**Q**	What is impact of lined gravel pits?
	A	The anticipated impacts are associated with localized groundwater flow near the lined pits and also for localized effects on recharge and groundwater ET; we are moving forward with the model calibration without representing lined pits because lining is a relatively recent occurrence, and few lined pits existed during the historic period on which this model is being calibrated.
32	**Q**	Are all the wells shown on Slide #21 titled "Updated Pumping" active?
	A	This is a map of wells that potentially pump during the 55 year period - the model is run on a monthly time step for each year, and various wells turning on and off each month as the records and crop demands indicate.
33	**Q**	On the stresses, curious about status of USGS work on Denver Basin Model computed bedrock flow (interaction with Bedrock aquifer).
	A	USGS has developed and calibrated a model - CDM has been given the bedrock/alluvium flux inputs on a cell by cell basis, but the modeling report is still under internal review. Ned Banta (USGS) noted that he didn't know the timeframe on completion of the report.
34	**Q**	Is there going to be a peer review on Denver Basin model?
	A	We will see what we can coordinate.
35	**Q**	How are you including bedrock aquifer flux from outside Denver Basin?
	A	Not incorporating bedrock aquifer flux other than from Denver Basin; for areas out of the Denver basin footprint, we are assuming minimal interaction and any bedrock flux from these areas is not included.
36	**Q**	Asked if will have another PRC on Denver Basin?
	A	We will work with USGS on this; may be next year. We'll get together with the USGS modeling team and will discuss this.

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37	**Q**	Asked if there are any plans for a water availability analysis for South Platte?
	A	Not at this time; still have to develop the surface water model before this type of assessment can be undertaken.
38	**Q**	Are you taking advantage of the existing MODFLOW models that have been developed for the South Platte basin?
	A	Yes, to the extent that the models and their data that are publicly available - if they are, we are using publicly available models (using data that goes into the models); some models are tied up in court and therefore not available (e.g. Tamarack model); another example is Rick Arnold's (USGS) work in several locations in the study area - we are tracking that so can use those data and applicable model results when they are complete.
39	**Q**	What are the sources of data for the groundwater model?
	A	Data comes out of HydroBase, identified publicly available studies, StateCU model and collected data under the SPDSS that will be available through the CWCB.
40	**Q**	Are you confident that wells were installed in that year by doing thorough decree record review?
	A	The protocol used is that once the decree was in place the well was also constructed and assumed to be operating; we didn't check the installation dates of wells, but if no irrigated acreage associated with well, then that well would not pump in model.
41	**Q**	Regarding hydraulic conductivity and distributions - Are you changing them cell by cell? Do you specify ranges of variation?
	A	Distributions of hydraulic conductivity will be based on the high-confidence field data analyzed and reported on in previous SPDSS tasks. The model will used these data to set up pilot points (a statistical method) and control the distribution of values.
42	**Q**	Regarding hydraulic conductivity and distributions - Will it be adjusted during calibration?
	A	Yes, hydraulic conductivity will be varied during model calibration.
43	**Q**	Were field tests completed to determine conductance?
	A	Yes, there was some field testing completed to guide ranges of conductance used.
	Additional Response	See SPDSS Task 37 and 43 Tech Memos.
44	**Q**	Question regarding streambed conductance and boundary of streambed testing.
	A	We have done testing in field - see Tech Memo 34.3 - Streambed Conductance Testing; we used the same methodology as COHYST (falling head test).
45	**Q**	What was source of pumping data?
	A	See Tech Memo 48.1 (forthcoming) for details. For ag wells, pumping was determined based on demand and as limited by a well's decree. For M&I wells, the demand was determined based on decrees, reported pumping rates or population based estimates.
46	**Q**	Regarding Tech Memo 48.2, Figure 3-8 - there are a significant number of new wells, where do these new wells come from when there are supposedly no new wells without augmentation plans?
	A	The number of wells was derived from State Engineers records. The numbers in that figure are not used to estimate pumping for the model; the figure was developed to identify potential calibration periods when there were relatively minor changes in the number of wells coming online.
	Additional Response	The data used to develop the figure is correct. However, it should be noted that an explanation for the "unexpected" increase in decrees is partly due to Augmentation well development.
47	**Q**	Regarding Tech Memo 48.2, Figure 3-8 - concerned that observed four years with high numbers of new decreed periods.
	A	Noted using figure to show pumping over time not to estimate well pumping. Well pumping in the model will be presented in a forthcoming stress inputs tech memo.

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48	**Q**	Only using data to determine steady-state calibration period, then don't use that data again - is that right?
	A	Yes - the figures shown in this part of the Task 48.2 memo were used as general guidelines for identifying the various calibration periods. In some cases more refined datasets are used as model input for the respective calibration periods. This is an important distinction.
49	**Q**	The period used to do the steady-state calibration was questioned.
	A	See Technical Memo 48.2 for the justification for the period of years used for the steady state calibration.
50	**Q**	Starting water levels in 1950 - where did those come from?
	A	Don't have a lot of data from 1950 - more from latter 1950s. See USGS Water Supply Papers 1357 and 1358, and SPDSS Tech Memos 44.3 and 44.4 for a discussion of the water level data.
51	**Q**	Concern with crop types and assumptions about crop using groundwater
	A	Crops can only use groundwater directly (subirrigation) if 1) their consumptive demand was not met from irrigation supplies and 2) if the model shows the ground water table is high enough for the crop roots to benefit.
52	**Q**	Concern with amount of precipitation consumed by phreatophytes.
	A	Model doesn't apply annual precipitation and apply to growing season - only use precipitation during growing season.
53	**Q**	Was CU from phreatophytes from snow estimated?
	A	No, the Groenveld work only considered consumptive use during the growing season.
54	**Q**	Lost Creek - north end of this has high water tables so this would be area that would need manual adjustment, but bottom part the depth to water is >40ft.
	A	This is the process that we're going through - this calibration process tells us whether the model is representing reality - e.g., the flooded cells tell us that we probably don't have high enough conductivity or enough connectivity.
55	**Q**	How much will the hydraulic conductivities be varied to achieve model calibration?
	A	Plus or minus approximately 50%.
56	**Q**	Is there a slide of calibration "pilot points" available?
	A	Not going into pilot point calibration yet. We have not started this activity yet.
57	**Q**	Where are irrigation return flows accounted for?
	A	Irrigation return flows are applied as water potentially available for recharge and the amounts are calculated in StateCU - could route to the SFR as SW runoff direct.
58	**Q**	Asked about what USGS is looking into regarding lined gravel pits?
	A	There is more effect on transient model - we see this as potential future enhancement.
59	**Q**	How much are you going to vary hydraulic conductivity or transmissivity?
	A	Quite a bit of heterogeneity - haven't set a percentage to vary, but probably not more than +/- 50%
60	**Q**	Questions concerning the applicability of the groundwater model and data to farms with gravelly/coarse soils? Concerning the ability of the models and data to estimate CU for farms with coarse or gravelly soils?
	A	This is a planning model using 23-acre grid cells and average soil conditions. We believe that the model and the data sets will provide good indication of the groundwater responses for the sub-basins and the South Platte basin, but the model and the data sets have never been designed, nor intended, to model the groundwater responses for individual farms.

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61	**Q**	Asked about well pumping figure ("Updated Pumping", slide 21).
	A	Shows all wells that are pumped (1950-2006).
62	**Q**	How are wells determined (primarily ag wells)?
	A	Well is based on when it was decreed; did not confirm when well was installed; uses correlation with lands. HydroBase has a adjudication date and appropriation date. The appropriation date = construction date.
63	**Q**	How do you calibrate these overdraft basins?
	A	Noted the additional recharge used for overdraft basins in the steady-state will not be used in the transient model.
64	**Q**	Do you have a figure showing subirrigation between Denver and Greeley?
	A	There is a small amount of water/land in subirrigation.
	Additional Response	Subirrigation areas are available in the project GIS coverages.
65	**Q**	Asked if considered another period for study-state?
	A	We used the best data vailable to identify a steady-state period (water levels, well pumping, climate data and streamflows). The PRC can find further documentation in the Task 48.2 Tech Memo.

Acronyms List	
AFY	acre-feet per year
Ag	Agricultural
Central	Central Colorado Water Conservation District
CU	Consumptive use
CWCB	Colorado Water Conservation Board
DWR	Division of Water Resources
ET	Evapotranspiration
GIS	Geographic Information Systems
GW	Ground water
LRE	Leonard Rice Engineers
MAF	million acre-feet
NNT	Not nontributary
NT	Nontributary
PRC	Peer Review Committee
QAL	Alluvial deposits
SPDSS	South Platte Decision Support System
SW	Surface water