

GROUNDWATER RESEARCH SUBCOMMITTEE MEETING RECORD

TIME AND DATE:

9:00 AM, Wednesday April 7, 2010

LOCATION:

Texas Commission on Environmental Quality Campus Building F, Room 2210, 12100 Park 35 Circle, Austin, TX 78753

PURPOSE OF MEETING:

Third quarter regular business meeting

AGENCIES/ENTITIES REPRESENTED:

Bureau of Economic Geology (BEG)
Texas AgriLife Research
Texas Commission on Environmental Quality [TCEQ]
Texas Department of Agriculture [TDA]
Texas State Soil and Water Conservation Board [TSSWCB]
Texas Water Development board [TWDB]

ATTENDEES:

Bridget Scanlon	BEG, Co-chair of the GW Research Subcommittee of the TGPC
Kevin Wagner	Texas AgriLife Research
Lauren Bilbe	TCEQ
Alan Cherepon	TCEQ
Richard Eyster	TDA
Peter George	TWDB
Peggy Hunka	TCEQ
Donna Long	TSSWCB
Joseph L. Peters	TCEQ
Scott Underwood	TCEQ
David Villarreal	TDA

MEETING SUMMARY:

Call to Order and Introductions

Dr. Scanlon called the meeting to order at about 9:04 AM. Her first order of business was to have everyone introduce themselves. Mr. Kevin Wagner, with Texas AgriLife Research, Texas Water Resources Institute (TWRI), was acting as Co-chair at this meeting, sitting in for Dr. B. L. Harris who could not be present.

Discussion of Sources of Funding and Current Calls for Proposals

The Subcommittee decided to postpone planned discussion for this meeting concerning the application for CWA 106 Groundwater Grant funding for groundwater projects as originally planned since key people were not present. Instead the Subcommittee took up recommendations for research topics that could be included in the upcoming *Report to the 82nd Legislature*, commonly called the *Legislative Report*.

Mr. Wagner informed us of the *Legislative Report* Subcommittee meeting that had taken place on March 10, 2010. He told us that there were several potential research topics or recommendations discussed at that meeting that fell in the area of interest of the Groundwater Research Subcommittee and that we could consider them for our list of recommendations for the *Legislative Report*. A handout listing these topics was handed out, a copy of which is attached to these minutes. The topics included

1. Evaluation of the Impact of Dryland Agriculture on Groundwater Resources in the Texas High Plains Aquifer
2. Study of the Impact of Irrigation on Groundwater Resources in the High Plains Aquifer
3. Evaluation of the Characteristics of Desalination Concentrate and Residuals for the Support of Streamlined Permitting
4. Acquisition and Analysis of Brackish Groundwater Data

Each of the topics was discussed. Dr. Scanlon indicated that the first topic had already been taken up in a research project and that we could drop it from our list. For the second topic, Dr. Scanlon indicated that some work had been accomplished. She mentioned the BEG was trying to link up with an agricultural demonstration project in which the TWDB was cooperating with Texas Tech University. The project is being carried out in Hale and Floyd Counties. All the funding for this project is through Texas Tech. So Dr. Scanlon suggested that we could also eliminate this topic from our list, but she then went on to ask if this could be funded through 319, like the Seymour project, looking at nitrates. Mr. Wagner responded that it could be possible to pair it up with such a project as the Seymour, but only to look at water quantity related issues. He went on to suggest that this might be a project that could best be taken on with the pursuit of a grant rather than giving it to the Legislature as a recommendation.

Discussion moved on to the fourth item concerning brackish groundwater. Mr. Wagner commented that we do need more state wide data on brackish groundwater resources. These resources will probably be used more and more in the future. Mr. George informed us that the TWDB had a specific group of people that gathered information on brackish groundwater. Two new personnel that they recently hired for this group are Mr. John Meyer and Mr. Matt Cook. Since this project has received funding through the TWDB, Mr. Wagner suggested that the recommendation for it be modified to ask the legislature for continued funding.

The third item, concerning the evaluation of characteristics of desalination concentrate and residuals for streamlined permitting, was being looked into by Mr. Cary Betz. Mr. Wagner mentioned that much of the streamlining for the obtaining of these permits has already been accomplished. Ms. Hunka informed us that Mr. Betz planned to ask the Underground Injection Control (UIC) and Public Drinking Water groups at TCEQ to see if they wanted to reword this recommendation.

Ms. Hunka went on to present a printout of an email of Dr. Scanlon's that had a list of research recommendations. Ms. Hunka asked Dr. Scanlon if there was anything from this list that she might have an interest in adding to the Legislative Recommendations List. The list is attached.

Mr. Wagner suggested that if anything from the list is added it should be something that had statewide implications, something that would be a priority research need for the state. There was some discussion about the CO₂ storage recommendation. It was pointed out that this one was already included in the last *Legislative Report*. Mr. Wagner asked if there were any current permitted CO₂ injection facilities. Mr. Eyster stated that the Railroad Commission may have permitted some tertiary recovery involving CO₂ injection, but otherwise, except for maybe a pilot project or two, there were no CO₂ sequestration facilities.

Ms. Hunka reiterated that the Groundwater Research Subcommittee put together a list of their legislative recommendations that can be presented at the next Legislative Report Subcommittee meeting. Therefore, we want to be ready to present the full list of recommendations to the TGPC in July, for approval.

Dr. Scanlon suggested that the concern that Dr. Harris had expressed at the last couple of meetings -- that there needs to be a means of meeting the needs of certain rural populations on water wells that may have water quality problems -- needs to be formulated into a recommendation. Everyone agreed that this should be one of the subcommittee's recommendations. Mr. Eyster stated that he was also planning on giving this recommendation to the Commissioner of Agriculture. Ms. Hunka suggested this recommendation, once it is formulated, be sent to her to add to the list she was compiling.

Dr. Scanlon turned the discussion to groundwater/surface water interactions and in-stream flows. Mr. Wagner suggested that more work needs to be done in this area. Mr. George stated that the USGS was working on a couple of projects concerning this subject. They had received some funding from the Corp of Engineers through the TWDB. The projects are on the Guadalupe near San Antonio and on the Upper Brazos. These two projects are in progress. Mr. Darwin J. Ockerman of the USGS in the San Antonio office is in charge of these projects.

Dr. Scanlon suggested that Mr. Wagner and she work on wording the needs-of-certain-rural-populations recommendation while Mr. Cary Betz should work on the groundwater/surface water interaction recommendation as well as follow through on the CO₂ sequestration one as well as on-going support for desalination project.

Mr. Eyster recalled that the Rail Road Commission had recently had an opening for a temporary position (two-year) to start developing a CO₂ sequestration program for them. Mr. Eyster did not know if the position had been filled.

Mr. George reminded Dr. Scanlon that Ms. Janie Hopkins of the TWDB was proposing to the TWDB a project to look at the effects of water quality on water quantity, by both anthropogenic and natural constituents.

Mr. Wagner mentioned that there were considerable funds available for climate change studies, and he was wondering if anyone had looked at the effects of climate change on groundwater supplies, etc. Mr. George responded that there had recently been a presentation at the University

of Texas by a graduate student concerning this topic. Dr. Scanlon added that she had just written a proposal for the High Plains, to look at the impacts of climate change on sustainable water resources. Any increase in temperature would have a tendency to increase the Potential Evapotranspiration (PET), but also an increase in CO₂ would increase the efficiency of plant photosynthesis which would decrease the plants use of water. Dr. Scanlon said that she had found a number of early papers describing this effect of increased CO₂ countering the effects of increased temperature. Ms. Long mentioned that they had been doing CO₂ work at Blackland in Temple for a number of years. But Dr. Scanlon responded that none of the work done there had directly addressed the possible offsetting effect of increased CO₂ concentrations on what would otherwise be an increase in PET due to higher temperatures. Ms. Long suggested that Blackland probably has all the data collected from all the work they had done and that perhaps the data could be analyzed with the view of determining the possible effects of increased CO₂ on water usage.

Dr. Scanlon said that the main problem with climate changes is the increased incidence of droughts, and the increase in extreme temperatures. The TWDB was created because of the 50s drought. Increased extreme temperatures will have an effect on such thing as livestock mortality. The agricultural production of the entire High Plains is around twenty billion dollars, which is about 10% of the entire US production. It's about the same production as the California Central Valley. Increased droughts would increase the reliance on irrigation. Only 10% of the Ogallala has been depleted, but this depletion is concentrated in certain areas, with the biggest declines in Texas and Kansas. Dr. Scanlon asked what was being targeted by the TWRI with respect to climate change impacts. Mr. Wagner responded that they were looking at plant breeding for drought tolerance and salt tolerance. Mr. Cherepon asked what the effect was on the growing areas during the fifties drought. Mr. Eyster responded that dryland farming diminished considerably.

Dr. Scanlon commented that if the effect of climate change would be an increase in rainfall in the High Plains, there would be an increase in recharge, especially around the playas. 2004 was the second wettest year on record in the High Plains, and as a result there was an increase in groundwater levels around the playas.

Dr. Scanlon brought up the subject of water footprints. For instance, it's claimed that it takes 15,000 liters of water to produce one kilogram of meat. However, there is a lot of variability depending on circumstances. For example, in the Panhandle, much of the feed for the feedlots is sorghum imported from outside the Panhandle area and sorghum is mostly be produced by dryland farming. An Australian study found that beef produced totally on pasture only took about 300 liters per kilogram. Mr. Wagner commented that what is fed at the feedlots depends on the cost. For instance, when the price of corn was so high, there was a considerable shift to the feeding of sorghum. Dr. Scanlon went on to mention that the price of 100% pasture grown beef from Nebraska was advertized at about twice the price of ordinary beef. Mr. Eyster explained that since available grazing lands are pretty much fully utilized, feedlots become necessary to increase beef production to meet the demand. Dr. Scanlon also mentioned that globally over the last century 90% of water use was for irrigation and with climate change irrigation demands will be increasing. Dr. Scanlon opined that it would be good to have information on water footprints for various products.

There ensued a discussion on how economics drives agricultural inputs, such as the prices of diesel, fertilizer, pesticides, etc. Dr. Scanlon asked about the degree to which no-till farming was being implemented. Mr. Eyster responded that it depends on locality and the crops being raised.

Dr. Scanlon brought up the interesting fact that in Northern China they double crop, planting corn in the summer and wheat in the winter, harvesting about 500 Kg per Hectare from each. The winters there are dry so the wheat is irrigated. This compares to single cropped corn in the High Plains where they harvest about 1000 Kg per Hectare. There was some discussion as to why double cropping isn't done very often in Texas or the High Plains. The feasibility of double cropping depends on economics and logistics.

Dr. Scanlon returned to the climate change topic, summarizing that there were a couple of National science Foundation (NSF) projects and one United States Department of Agriculture (USDA) project. The TWRI is leading on the USDA project. Mr. Wagner outlined the different regions into which the TWRI study was to be divided. For the High Plains Texas would partner with Kansas and Nebraska. For the Southwest the partnership would cover West Texas, New Mexico and Arizona. To the East Texas would partner with the southeast states. They will be looking into effects on plant populations, livestock, and water resources. Dr. Harris is leading the water resources study.

As an information exchange item, Mr. Wagner mentioned that he had put together a presentation for the EPA Region VI Groundwater Meeting, giving an overview of groundwater research at Texas A&M University. He said that either he or Dr. Harris could give the presentation to our Subcommittee.

The meeting adjourned at 9:50 AM.

Minutes prepared by Joseph L. Peters, April 19, 2010

Action Items:

- I. Follow through on the following Legislative Recommendations
 1. Evaluation of the Characteristics of Desalination Concentrate and Residuals for the Support of Streamlined Permitting. [Mr. Betz is to ask the UIC and Drinking Water Groups at TCEQ whether this one needs to be rewritten.]
 2. Acquisition and Analysis of Brackish Groundwater Data. [This existing recommendation needs to be modified to ask for continued support from the Legislature.]
 3. A recommendation expressing Dr. Harris's suggestion that some way be found to for rural communities on individual wells to be considered as water systems for the purpose of providing aid for individual household treatment systems. [Will be composed by Mr. Wagner.]

4. Groundwater/Surface water Interaction recommendation. [Will be composed by Mr. Betz.]
 5. CO₂ Sequestration Recommendation should continue in *Legislative Report*
- II. Presentation at next meeting by Mr. Wagner or Dr. Harris giving an overview of groundwater research at Texas A&M University

HANDOUTS:

1. **Support Groundwater Research**
2. **Project Ideas for Future TCEQ Research**

These two handouts are included as Appendices to these minutes, starting on the next page.

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1. Support Groundwater Research

- *Evaluate Impact of Dryland Agriculture on Groundwater Resources in the Texas High Plains Aquifer—Provide funding for field studies to broadly assess the impacts of dryland agriculture on groundwater recharge.*
 - Continue to support this Recommendation and discuss at the next Groundwater Research Subcommittee meeting.
- *Study the Impact of Irrigation on Groundwater Resources in the High Plains Aquifer—Provide funding for studies in the High Plains region to determine whether irrigation return flow has reached the aquifer or if it is still within the unsaturated zone.*
 - Continue to support this Recommendation and discuss at the next Groundwater Research Subcommittee meeting.
- *Evaluate Characteristics of Concentrate and Residuals and Support Streamlined Permitting—Provide funding of \$100,000 to compile existing data on the chemical composition of desalination concentrate in FY (fiscal year) 2010, which could support the general permitting process and \$150,000 to complement and match federal funds currently being used by universities to develop advanced desalination technologies. Priority areas for study would be based on identified need in the State Water Plan*
 - Cary Betz will look into this to see if it will continue to be supported.
- **Acquire and Analyze Brackish Groundwater Data—Provide funding to the TWDB for 2.5 full time employees and \$500,000 in appropriations to acquire and analyze brackish groundwater data and assess groundwater modeling techniques to predict brackish aquifer performance.**
 - Janie Hopkins and Kirk Holland will discuss this to see if the Committee should continue to support the Recommendation.

Project Ideas for Future TCEQ Research

Bridget Scanlon, Bill Harris, Kevin Wagner, and Steve Walden

Texas Bureau of Economic Geology and Texas Water Resources Institute

January 2010

1. **Fate of land applied materials: It is critical to assess the impacts of land applied materials, such as sewage sludges, biosolids, and manure related to sewage plants, CAFOs, and AFOs, on underlying aquifers.** Transport rates of nutrients, including nitrogen and phosphorus, trace elements, and possibly pathogens may vary depending on application rates, precipitation amount and timing, vegetation type, and soil type. Field studies should be conducted to quantify the penetration depth of different elements, such as nitrogen, phosphorus, trace metals, and pathogens. The relative importance of piston versus preferential flow should be evaluated to determine if contaminants are bypassing the unsaturated zone. Assessing potential linkages between land application processes and surface water and groundwater quality is critical for understanding the vulnerability of water resources to potential contamination from such sources. Best management practices to reduce impacts of land applications on the environment should include field investigations, modeling analyses, and risk assessment. The assimilative capacity of different aquifers can also be addressed in these studies. The results of such studies will provide valuable information for performance of these systems in different parts of the state over major and minor aquifers under different climate conditions, crops, and soil types.
2. **Groundwater perchlorate contamination: High levels of groundwater perchlorate have been found in the High Plains aquifer, with concentrations up to 200 ug/L.** Proposed concentrations for MCLs are 24.5 ug/L based on the most recent NRC report. While previous studies have characterized the regional distribution of perchlorate concentrations in groundwater and have conducted limited studies on unsaturated zone reservoirs of perchlorate, it is important to conduct more detailed studies that link land use, unsaturated zone reservoirs, and potential future groundwater levels. Additional drilling and sampling should be conducted to evaluate impacts of agricultural management on development and mobilization of perchlorate reservoirs and potential build up of perchlorate in crops that would provide another pathway for perchlorate to humans.
3. **This study will link agricultural management with groundwater nitrate contamination to reduce future contamination because nitrate is the most widely distributed contaminant in Texas aquifers.** Preliminary studies indicate that some of the nitrate in the unsaturated zone is natural in origin. These studies have linked land use with unsaturated zone reservoirs and potential future groundwater concentrations with mobilization of these reservoirs. We have conducted detailed studies in the southern High Plains, Seymour, and Gulf Coast aquifers. Examples of activities that could be conducted to reduce future groundwater nitrate contamination include timing of fertilizer application (fall versus spring), growing winter cover crops to sequester nitrogen, and promoting denitrification.

4. **CO₂ storage: what could be the impact on the water quality of Texas aquifers if several large projects start injecting CO₂?** Brackish water pushed up-dip? Metal mobilization if leakage occurs?. This is an emerging topic of interest around the world in which BEG is a leader. This project will crystallize the underlying issues for Texas and apply BEG researcher's knowledge to assess potential impacts of CO₂ injection on fresh groundwater quality, including mobilization of trace metals and upward flow of brine mixing with fresh water. The Gulf Coast aquifer is targeted for injection because so much CO₂ is produced in the Gulf Coast. It will be very important to understand potential impacts of CO₂ on the quality of fresh water aquifers in the Gulf Coast.
5. **Characterize groundwater surface water interactions in the state with respect to water quantity and quality.** It is important to better understand how groundwater and surface water systems interact in the state to avoid double accounting of water with respect to assigning water rights and to assess impacts of groundwater discharge on surface water quality in different regions. Fundamental studies on stream hydrograph separation and evaluation of linkages between water quality in streams and adjacent aquifers are essential first steps in this process.
6. **While the Texas Water Development Board has several studies ongoing related to desalinization, it is important for TCEQ to work on specific aspects of these studies, such as disposal of desalination concentrate and drinking water treatment residuals.** Generation of brine from desalination of saline and brackish water to produce drinking water creates concentrated brine. Treatment of drinking water sources to meet the states drinking water standards also produces a residual that must be managed. Information on the chemical composition and concentration levels is an essential prerequisite to determining appropriate disposal strategies. This study should build on the original reconnaissance study of brackish and saline water conducted by LBG Guyton for the TWDB and characterize the chemistry of brackish and saline water. In addition, residuals from operating desalination plants can be sampled and analyzed to determine the distribution of chemical parameters and concentration levels.
7. **Develop a database on chemical characteristics of soil water to quantify reservoir of contaminants in the unsaturated zone derived from atmospheric and land surface processes:** Much of the contamination in aquifers is derived from atmospheric deposition, land surface processes (irrigation, fertilization) or geologic sources in the unsaturated zone (arsenic). Although the state has an active groundwater sampling program, our understanding of reservoirs of potential contaminants in the vadose zone and impacts on underlying aquifers is limited. This study would develop a database on chemical characteristics of soils from all the previous drilling and conduct additional drilling to assess whether aquifer contamination is derived from atmosphere or vadose zone processes. Understanding the reservoir of salts (chloride, sulfate, nitrate etc) in the unsaturated zone derived from natural and agricultural practices and transport rates can be used to predict potential impacts on underlying aquifers. This study can also help distinguish whether solutes in the unsaturated zone are derived from natural or anthropogenic processes, which is important for remediation purposes.
8. **Set the standards for Texas for water/aquifer compatibility and emphasize the technical hurdles to establishing Aquifer Storage and Recovery Programs in Texas.** ASR systems are an efficient technique to span seasonal dry periods. However, very few ASR locations exist in Texas compared to other states such as Florida. The State through TWDB has shown interest in developing the technology. This project will address

standards for Texas of water/aquifer compatibility and assess technical issues that need to be overcome to establish ASR projects in different aquifers.

9. **Quantify vulnerability of dynamic aquifer systems, such as karst and alluvial aquifers, to contamination, focusing particularly on pathogens:** Karst and alluvial aquifers are extremely vulnerable to contamination because recharge rates and water fluxes through these systems are extremely high. Contamination from microbes and viruses is of particular concern in these systems. The Edwards and Brazos River Alluvium aquifers could be used as case studies for this analysis. Age dating of water would provide valuable information on flux distribution in the system. Evaluating different processes for attenuating contaminants in these systems, i.e. dilution versus adsorption on clays, would be important for understanding the assimilative capacity of these aquifers. Fate and transport of emerging contaminants, such as caffeine etc should be characterized in these systems also.
10. **Quantify impacts of irrigation on water quality and status of irrigation return flow:** Recent studies in the High Plains have focused on reducing water applications in irrigated areas to conserve water resources. However, irrigation water from groundwater in the southern High Plains has high total dissolved solids and limited applications means that salts in the vadose zone are not being flushed through the system. Deficit irrigation is resulting in soil salinization. Potential impacts of mobilizing these salts into the underlying aquifer need to be addressed. In addition, decreasing aquifer thickness reduces the assimilative capacity of the aquifer and further increases salt and nutrient concentrations. Stratification of groundwater quality needs to be examined because declining groundwater levels may also be associated with increasing groundwater salinity.
11. **Evaluate Groundwater Treatment Methodologies for effectiveness and economics in relationship to removal of contaminants.** Many of our groundwaters in Texas currently being used for drinking water for rural private residences contain unacceptable and unhealthy levels of contaminants such as arsenic and nitrates. Studies are needed to determine most effective and economically viable systems for detecting and treating the water to safe levels.