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Data, Correspondence, Reports, and Exhibits for Ground Water Rights Cases (or, Challenges in Developing and Presenting Data to Support a Ground Water Rights Case)

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I. SUMMARY

Technical issues underlying contested ground water rights cases can be unique and often present a challenge to the attorney and expert in laying out the facts before the court. These cases have a number of similar characteristics. They typically involve large parcels of land and are regional in nature, covering hundreds, if not thousands of square miles. The database necessary to describe the study area is extensive and requires interpretation and extrapolation of data and the use of data assumptions. Ground water rights cases involving large study areas are highly dependent on the availability of hydrologic and geologic data in the public record. Traditional data sources include the U.S. Geological Survey and other federal agencies; State Geological Surveys, State Engineers' Offices, and other state entities; and private sources. The public database is supplemented by on-site data and limited off-site work. All these sources of data create a database that can be highly interpretative. Opinions to prove a ground water rights case are typically based on projections of impacts in time. These projections typically are the subject of much dispute because of the limited nature of the database, different interpretations of the data, and the use of computer models to project impacts to develop the principal opinions.

An issue that can make supporting a ground water rights case difficult is the cost of data collection. Typically, ground water data collection is expensive, often requiring the construction of wells and the use of special instrumentation to collect hydrologic data. This is one reason why so much emphasis is placed on the availability of data within the public record. Further, it is difficult for a private investigator to gain access onto private lands other than his client's for the purpose of collecting additional data. Landowners rarely give permission to construct new wells or to test existing wells on their property. Consequently, the investigator is usually limited to public lands to make hydrologic and geologic observations. Use of data from the public record can be extremely helpful and can provide most of the database necessary to complete an investigation. However, the

circumstances under which the data were collected may be uncertain, which, in some instances, can make the use of the data questionable. There are typically three sets of data in any study: data collected by the expert, data collected by the opposition, and data available within the public record. Problems can arise because an investigator typically does not have control of two of the three databases, simply because he was not involved in the collection and initial analysis of the data. An issue that is very characteristic of a ground water rights case, more so than other hydrologic cases, is that frequently key data values are difficult, if not impossible, to quantify and, and as a result assumptions and interpretations must be made regarding those values. It is not unusual to have two or more valid but differing assumptions and interpretations regarding the same data value.

Other issues that can make proof of a ground water rights case difficult are the legal tests or standards that must be satisfied, and tradition. In many cases, the legal standards are not well defined leaving considerable room for interpretation and opposing opinions. Instances in which the legal standards are well defined can require an expert to define an impact using a standard that exceeds the current accuracies of measuring hydrologic data. Tradition, defined as the history of technical opinions and court decisions, can often set the stage for future decisions. A court may be reluctant to render decisions based on new approaches or technical concepts that counter prior technical opinions.

II. CHARACTERISTICS OF A GROUND WATER RIGHTS CASE

Ground water rights cases can differ greatly from other hydrologic or technical cases. There are a number of features of a ground water rights case that distinguish it from other technical cases. Not all these features are present in all ground water rights cases, but many are. Because of the particular features, presenting the facts of a ground water rights case before the court can be a definite challenge to the attorney and expert.

A. Regional Nature

Ground water rights cases typically are regional in nature and study areas often include hundreds, if not thousands of square miles. Issues in a ground water rights case usually are related to drawdowns caused by a well or a group of wells on the aquifer or on the surface water system. Drawdowns created by these wells, over time, can extend miles from the pumping center. The magnitude and extent of drawdowns are influenced by a host of hydrologic features such as the nature of the aquifer material, the presence of faults or fractures, the degree of surface and ground water connection, the existence of a shallow water table that contributes to the growth of plants, existing well development affecting the aquifer and future well development potential.

B. Use of Public Data

Virtually all ground water rights cases are highly dependent on the availability of data within the public record. Without public data, it would be extremely difficult and in some cases virtually impossible to adequately present the facts for a ground water rights case. Traditional sources of geologic and hydrologic data include the U.S. Geological Survey, the U.S. Soil Conservation Service, the U.S. Forest Service, and other federal agencies. These agencies, among other duties, collect, analyze, and report hydrologic and geologic data. Perhaps the most prolific of these entities is the U.S. Geological Survey. This federal agency can provide an investigator with information on surface and subsurface geology, streamflows, water levels, the results of aquifer tests, and the results of interpretative investigations, such as ground water computer modeling studies.

State agencies such as the State Geological Surveys, Departments of Water Resources and others also are sources of geologic and hydrologic data. These agencies, like the federal agencies, collect, analyze and report basic data. An expert usually visits these agencies or libraries that contain their reports to initiate the investigation.

C. Extensive Database

Because many ground water rights cases are regional in nature, covering hundreds, if not thousands, of square miles, the database necessary to adequately describe the ground water system often is very large. To prove a ground water rights case it is important to describe the hydrologic characteristics of a ground water system in as much detail as possible. To adequately describe a ground water system often requires data such as depth to the top and bottom of an aquifer, thickness of an aquifer, hydraulic conductivity (a measure of an aquifer's ability to transmit water), storage (the amount of water that is released from the aquifer to a pumping well), sand and shale percentages in the aquifer, geologic structure, water use, locations of recharge and discharge, the degree of surface and ground water connection, and the rate at which ground water moves vertically between multiple aquifer systems throughout the study area. If a ground water rights case involves several thousand square miles and a computer model is used, it is easy to see that the database required to adequately describe the hydrologic and geologic features of the study area can approach hundreds of thousands of individual pieces of datum.

D. Highly Interpretative Nature of Data

By their very nature, ground water rights cases require large amounts of data and interpretation and extrapolation from areas of known data to parts of the study area with few data. In many cases the aquifer being studied lies tens or hundreds or maybe thousands of feet beneath the land surface. The ground water being studied cannot be seen, nor can its rate of movement be measured accurately. As a result, basic hydrologic and geologic data are collected, analyzed, and interpreted. Once an investigator is satisfied with an interpretation of a set of data, for example hydraulic conductivities, those data are transferred to a map and a contour map describing the aerial distribution of hydraulic conductivity for an aquifer is drawn. Needless to say, there are a number of ways in which hydraulic conductivity values can be calculated and there are a number of ways in which a contour map of hydraulic conductivity values can be drawn. The result is plenty of room for opposing opinions.

Application of geologic principles in developing contour maps that describe hydraulic conductivities, aquifer thickness, water levels, and other data sets is required. Knowledge of the geologic setting of a particular aquifer assists an expert in interpreting the relationships between individual data points. An aquifer's structural setting can greatly affect its hydrologic characteristics. Knowledge of the geologic structure in which the aquifer occurs can be very helpful in interpreting the data. An awareness of faulting and fracturing which can affect the basic geologic and hydrologic data can explain anomalies within the database.

Because the database is highly interpretative, differing conclusions and opinions may be derived, i.e., there is a very large gray area between absolute white and black.

Unfortunately, because of the absence of data, and in some cases the inability of the expert to actually test and calculate a data value, it can be difficult to prove or disprove certain conclusions or challenge certain assumptions.

E. The Time Factor

Ground water rights cases are always characterized by projections of well impacts in time. Ground water movement can be extremely slow relative to surface water movement, and velocities typically are expressed in terms of feet per year. By comparison, surface water flows are expressed in terms of feet per second. Ground water movement is slow because ground water must move through the pore spaces of rocks. Therefore, it can take long periods of time for drawdowns to spread throughout a ground water system. In the case of a nontributary test it is necessary to quantify the impact of a pumping well on a stream system after 100 years of continuous pumping. Clearly, the impacts cannot be measured or demonstrated by a test. Instead, they must be projected using standard techniques and equations. Even a case of predicting the impacts of one well on another well requires projections of drawdowns using time periods of months and possibly years.

Traditional ground water equations are used to make these predictions. Although there are a few standard set of equations that are used to predict drawdowns, the predicted drawdowns can vary significantly because of different interpretations of data that are used by the equations. Different interpretations of data can provide different values of surface and ground water relationships, hydraulic conductivities, aquifer continuity, and the natural use of water by plants, all which can affect the predicted outcomes using these standard equations. When the time factor is added to these different data interpretations, significant differences in predicted drawdowns and, therefore impacts, caused by a well or group of wells result.

F. Use of Computer Models

A contested ground water rights case involving a large study area almost always involves the application of computer models. Computer models have been used for years in court to prove cause and effect relationships. Computers are important for a number of reasons, including their ability to store and handle large amounts of basic geologic and hydrologic data. Computers also permit an expert to analyze an extensive database quickly and efficiently and to predict cause and effect relationships over time.

There are many different computer models, ranging from simple analytical models to the more complex, yet more flexible, finite-difference models. Differences in opinions are not usually caused by differences in application of different computer models. Instead, most differences in opinions can be attributed to different interpretations of the basic geologic and hydrologic data that go into the model.

III. ISSUES THAT CONTRIBUTE TO THE CHALLENGE IN SUPPORTING A GROUND WATER RIGHTS CASE

The very characteristics that distinguish a ground water rights case from other technical cases also make it challenging to support a ground water rights case in court. There are issues other than the technical issues that can create problems in supporting this type of case. Some of these technical issues are discussed below.

A. Cost of Data Collection and Access onto Private Lands

Collecting ground water data is expensive. Because the ground water resource in most cases cannot be seen and its rate of movement cannot be directly measured, test holes and test wells are drilled and constructed to collect data. Large amounts of information can be collected from a single test hole or test well, but, in most cases, the collected data are directly valid only at the well site. To apply these collected data to other parts of the study area requires interpretation and extrapolation of the data. Drilling and constructing test wells can cost from $50 to $100 per foot or more depending on the depth to the aquifer below the land surface. While all the data collected from the well can be helpful, the most useful data from a well are aquifer thickness, water level, water quality, and hydraulic conductivities. In a situation in which an aquifer is the subject of a ground water rights investigation and lies 1,000 feet or more beneath the land surface, a test well can cost $100,000 or more, and only four key data points are collected from a test. Because of this, not many test wells are constructed during a ground water study to supplement the existing database. The high cost of data collection places much emphasis on the availability of data in the public record. It also requires the development of data assumptions, and the need to interpret extrapolate data from known data points.

Even in a ground water rights case where the aquifer in question may be shallow, and the total cost of test well drilling construction is lower, the total cost of a project can be high enough to be unaffordable. Further, in a regional ground water rights case, the property owned by the client can comprise a very small part of the total study area. As a result, the collection and use of on-site geologic and hydrologic data contribute very little to the total understanding of the hydrologic picture. Once the client understands this concept, he is reluctant to authorize extensive data collection, particularly when he understands that only four useable data values are collected per well, at a cost of perhaps, $25,000 per data value.

In many cases, data in the public record are the only data available for aquifer characteristics off-site of the client's property. An expert representing a landowner who desires to develop a ground water source can rarely gain permission for access onto private lands to make hydrologic observations, to construct test holes or test wells, or to test existing wells. By the very nature of a water rights case, a landowner is immediately suspicious of a private individual entering onto his land and asking questions about his water rights and water supply. It is not uncommon for private investigators to be denied access onto private lands and in some cases, to be escorted from the property under "extreme conditions."

As a result, hydrologic and geologic observations off a client's property are usually completed only at places of public access or on public lands. These observations are usually limited to visual inspection of geologic units, the occurrence or absence of surface water flow and perhaps others. It frequently is difficult to obtain permission from public entities to construct test holes or wells. Aerial photographs or satellite images are helpful and often provide insight to certain issues, but on-site observations are necessary to collect certain types of data.

An example of the cost of collecting data and the difficulty in gaining access to test a well on private land occurred in a recent ground water rights case. An expert wanted to gain access onto private lands to test a particular well. The landowner denied permission but the expert, through his client's attorney, received a court order allowing him to test the well, but he had to post a $10,000 bond. The test that was to be completed on the well was a simple pumping test in which water level measurements were taken in a pumping well using the landowner's pump. The test was completed and was considered successful, but nevertheless, consumed a large amount of time and tied up a large sum of money.

In another example, an applicant in the Denver area constructed two deep wells on a 3,500-acre parcel of land, and his expert relied on the on-site data from those two wells and data from a number of off-site wells that were close to the property to develop opinions regarding water availability. Based on this effort, the client filed an application in water court to adjudicate rights to the ground water resource. During negotiations with opposing parties, issues of inadequate data were raised and a trial was threatened if additional data were not collected. In an effort to avoid this confrontation and to secure absolute water availability numbers, the client constructed two additional wells at a cost in excess of $350,000. These two new wells supplied additional data which changed the projections of ground water availability approximately 5%. In this case, the opposing parties clearly could have accepted the estimates because of the extensive nature of the database. Further, opposing experts could have noted probable differences in amounts of water availability and could have examined the probable impacts of these differences on their client's water rights. Had this entire issue been examined in reasonable detail, opposing parties may have accepted the initial conclusions and opinions.

The cost of data collection and the inability of an expert to gain access onto private lands increases greatly the importance of data available in the public record. Without these data, very little would be known about regional ground water systems.

B. Use of Public Data

Even though data available in the public record is important and must be used in a ground water rights case, there can be problems with the data. An expert who does not collect the data has no control over the program or the quality of data being collected. Often he may suspect the data are not valid and prefer not to use the data in his investigation and analysis. These types of data can include testing of private landowner's wells, measurements of water levels in wells, geologic mapping, records of water use, and other tests made by public agencies such as U.S. Geological Survey, State Engineer's offices, and other entities. An expert who suspects the data faces the same problems in attempting to collect data from private lands in that he cannot gain access onto the lands to duplicate the tests or finds landowners unwilling to answer questions regarding the past work. An expert is then faced with the difficult task of defending his decision not to use select data available in the public record.

There typically are three types of data in any investigation: public data, data collected by the expert conducting the investigation, and data collected by the opposing expert. An expert does not have control over two of the three data sets. Yet, because the data are available, they must be considered in an investigation unless independent studies can prove that the data or parts of the data should not be used. The expert again is faced with the problem of not being able to confirm or deny certain data in the two data sets he has available. Even so, an expert should make an attempt to utilize data from all three sources and, where possible, confirm data from all sources. Unfortunately, confirmation of data is not always possible.

Sometimes, even when site specific data from the public record are used, it can be difficult to overcome more general public data used by the opposition. For example, in a recent Denver Basin ground water rights case, an expert was able to show with site specific water level data that certain streams were not in connection with the Denver Basin ground water system. As a result of this analysis, delivery of replacement water to those streams was not necessary to protect existing water users. The opposing expert simply raised questions regarding the accuracy of water level measurements in the public record; no site specific investigation regarding stream connection was completed, instead the expert had merely relied upon geologic mapping by the U.S. Geological Survey as a basis for hydrologic connection. The court decided that connection was a possibility. In this instance, the opposing expert was able to use the fact that the U.S. Geological Survey mapped certain features on a regional basis to overcome site-specific data.

C. Assumptions

Every ground water rights case requires an expert to make and employ assumptions because certain data values cannot be collected or measured. Assumptions used in a ground water rights case are usually the target of extensive review and ultimately crossexamination. Some assumptions can be supported by basic hydrologic or geologic principles such as the development of contour maps using the concept that the data are related to each other and lines of equal data values can be drawn between two known data points creating a contour map that shows the lateral distribution of data across the study area. Other assumptions, on the other hand, may not be supported by basic hydrologic or geologic principle, but instead may be based on interpretations of other, related data and the experience of the investigator.

Two key values usually are always assumed in a ground water rights case: the degree of the stream-aquifer connection (stream conductance), and the degree at which ground water can move vertically between two geologic units (vertical conductance). In many cases, it is difficult to measure or calculate these two values. Therefore, an expert, using his knowledge of the geology and hydrology of the area and his experience, assumes these values. Clearly, two investigators can assume different values and therein lies the problem. These two factors strongly affect the spread of drawdown and the amount of surface water that is intercepted by the drawdown created by a well or group of wells. If one investigator assumes values that are of a certain magnitude, he will reach conclusions and opinions that can differ vastly from an investigator who assumes values of a different magnitude. Unfortunately, even when these factors can be calculated, it can be difficult to overcome traditional and conservative assumptions.

D. The Time Factor

All ground water rights cases require projection of impacts in time. Because ground water movement is so slow, it is difficult and not always possible to establish a procedure to test or measure the impacts from a ground water project. Because of this, equations and computer models are used to project impacts in time. In many cases, the projections of ground water impacts are sometimes tens and even hundreds of years into the future. Thus, disputes in ground water rights cases take place over events that will not develop within a lifetime. Differences in the database and interpretation of the database by opposing experts are magnified by projecting well impacts in time, making it extremely difficult to satisfy opposing parties and to convince the court on certain conclusions and opinions.

E. Legal Tests

In some instances, the legal standards which must be proven in a ground water rights case are more stringent than the current ability to measure the occurrence and movement of water. In a tributary/nontributary ground water rights case in Colorado, ground water pumped from a well is considered nontributary if the stream depletions resulting from the pumping of that well do not exceed 0.1 percent of the amount of water pumped from that well within 100 years. For example, if a well produces 1,000 acre-feet of water per year, stream depletions cannot exceed 1.0 acre-foot of water per year for that well to be considered nontributary. This legal test is more exact or precise than the ability to measure the discharge of water from that well, because flow measurements for a well typically are accurate only to 3 to 5 percent of the well discharge. In this case, the discharge of the well cannot be measured to within 30 to 50 acre-feet per year, yet stream depletions must be predicted to a level of 1.0 acre-feet per year.

The amount of water within a stream basin probably cannot be determined to within plus or minus 30 percent, and perhaps more depending on hydrologic features of that basin. Inabilities to accurately measure precipitation; streamflow; aquifer characteristics; surface and ground water use by plants; water uses by municipalities, industries and agriculture; and other factors all contribute to this uncertainty. Include with this measurement uncertainty the inability to measure certain data values and the use of assumptions, and the overall uncertainty increases. However, with equations and the use of computer models the impacts of a pumping well can be predicted to a precision greater than 0.1 percent.

A recent example may illustrate some of the frustrations the courts may have in ground water rights cases. In a tributary/nontributary case in the Denver Basin, water measurement accuracy and well impact projections in time were at issue. Testimony revealed that surface water flows in the basin could not be measured to within ±25,000 acre-feet of water per year and that large, key water right structures could not be adjusted to administer minor streamflow changes. After 100 years of pumping, stream depletions in that basin were projected to be approximately 27.2 acre-feet of water per year. The court expressed interest in the expert's projections of stream depletions to the nearest tenth of an acre-foot at the end of 100 years of pumping, and questioned the ability of the expert to accurately represent what was occurring within the stream basin. In that same case, the year at which maximum stream depletions would occur also was an issue, and testimony showed that maximum stream depletions would be 75.3 acre-feet of water per year, 395 years after pumping stopped. The court was interested in which court had jurisdiction for this part of the United States 395 years ago, and probably is still chuckling over those opinions. Yet, conclusions and opinions like those had to be presented because computers will provide the numbers and that was the legal standard that had to be met.

F. TRADITION

Tradition may be defined as the history of technical approaches and opinions and court decisions that define the pattern of water development within a stream basin. The pattern in part guides future decisions. The court may be reluctant to initially accept conclusions and opinions based on new thinking, approaches or analyses in the technical arena that differ significantly from prior, more "traditional" efforts. An expert may be able to explain adequately a cause and effect relationship with a new understanding and a different approach to data analysis, but when challenged by an opposing expert with the more traditional analysis, he may not convince the court with his opinions.

Tradition may also encompass conservatism. Even though the court may be interested in a new approach to or analysis of an old question, decisions may be based in part on a need to be conservative, to protect existing water users against correct but untried or untested analyses and explanations.

IV. DISCOVERY AND AN EXPERT'S FILES

In a contested case, formal discovery almost always occurs. In a ground water rights case involving large amounts of data, it is important for an expert to keep the data in an organized manner, well referenced for easy access. This usually means that the data are presented to the opposing parties in a similar manner during discovery. The extensive nature of the database creates special problems in data handling and presentation. It is extremely important to be organized and more so if the database is measured in hundreds of thousands of data values. Traditionally, data were stored and delivered during discovery in hard copies, in the forms of tables, maps, graphs, etc. The results or the interpreted values of a ground water investigation also were stored and displayed in similar formats. Recently, however, there is a trend to store most, if not all, of the data in electronic form. Nothing will delay an opposing expert more than when, during the discovery process, a tape containing 1,000 gigabytes of data is turned over with no table of contents or references. Much time is spent searching the tape trying to figure out what has been delivered and what another expert has done.

There are a couple of issues that an expert should keep in mind while preparing a database for discovery. First, if drafts of work products are kept as a matter of office policy, it is important to provide explanations of prior drafts of databases, reports, etc. It is not uncommon that during the early stages of an investigation preliminary conclusions and opinions are developed based on limited data. However, as the investigation proceeds and more data become available or further consideration is given to the data, preliminary conclusions and opinions can change. If these preliminary conclusions and opinions are in written form and they differ significantly from the current conclusions and opinions, it can be difficult to explain the differences. As a matter of course, an expert's general policy should be to discard all drafts, simply for ease in maintaining files and minimizing storage space within the office.

Prior to discovery, it is important that the client's attorney examine the expert's files. An expert must assume that everything he touches is producible. There may be, however, documents in his files that are subject to protection based upon attorney-client privilege or attorney-work product and should not be turned over during discovery. This is extremely important, as in some cases, key documents outlining case strategy could be accidentally produced if the files are not examined.

For example, in a recent case involving surface and ground water issues, the attorney did not closely examine the expert's files. Included in the expert's files were correspondence between the attorney and the client, and from the attorney to the expert laying out some issues in the case. Also in the files was correspondence from the expert to the attorney responding to a request for a possible course of action and strategy. Unfortunately, within the expert's correspondence were statements such as, "the opposing counsel is blowing smoke again" and other interesting quotes. In that same letter, the expert laid out parts of the overall case strategy that ultimately were pursued. Unfortunately, the attorney conducting discovery was able to get a glimpse of the opposition's strategy. At the same time, comments regarding "blowing smoke" and others only served to increase the division between the parties.

V. GOLDEN RULES OF GROUND WATER RIGHTS CASES

There are a number of rules that are applicable to many technical and virtually every ground water rights case. Every expert who attempts to develop a database to support an application should be aware of these rules.

The Rule - He who has the burden of proof in a ground water rights case often loses.

White's Rule - If there are more than two data points in a database, at least 50% will be in error.

An Expert's Lament - On a day to day basis, legal standards are of little use; only after the trial are they applied with certainty.

Reynold's Law - The uncertainty of an expert's conclusions and opinions increases in direct proportion with the amount of data available.

Padlock's Paradox - Never argue with a fool, the court might not know who is the fool.

Whiner's First Law of Experts - There are no real answers, only opposing opinions.
Whiner's Second Law of Experts - No real problem has a solution.

First Rule of Opposing Counsel - For every investigation, there is an equal and opposite study.

Robert's Axiom - Only errors exist, and one man's error is another man's data.

First Rule of Expert Testimony - Whatever happens, look as if you intended it to happen.

The Attorney's First Law of Debate - Anything is possible if you don't know what you're talking about. **The Attorney's Second Law of Debate** - Nothing is ever accomplished by a reasonable expert.

Lead Counsel's Lament - The best strategy for a case is developed midway through the trial.