SOAH DOCKET NO. 582-07-3140
TCEQ DOCKET NO. 2007-0477-UCR

APPLICATION OF SAN ANTONIO WATER SYSTEM TO AMEND ITS CERTIFICATE OF CONVENIENCE AND NECESSITY NO. 10640 IN MEDINA COUNTY, APPLICATION NO. 35484-C	§	BEFORE THE STATE OFFICE OF ADMINISTRATIVE HEARINGS

SOAH DOCKET NO. 582-07-3141
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ORAL DEPOSITION OF:

GEARY M. SCHINDEL

MARCH 13, 2008

COMPLIMENTARY

COMPRESSED COPY
WITH WORD INDEX

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****

ORAL DEPOSITION OF
GEARY M. SCHINDEL
MARCH 13, 2008

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ORAL DEPOSITION of GEARY M. SCHINDEL, produced as a witness at the instance of the Greater Edwards Aquifer Alliance, and duly sworn, was taken in the above-styled and numbered cause on the 13th day of March, 2008, from 10:02 a.m. to 12:06 p.m., before Sharon L. McDonald, CSR, RPR, in and for the State of Texas, reported by machine shorthand, at the Edwards Aquifer Authority, 1615 N. St. Mary's Street, San Antonio, Texas, pursuant to the Texas Rules of Civil Procedure and the provisions stated on the record or attached hereto.

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APPEARANCES

FOR THE GREATER EDWARDS AQUIFER ALLIANCE:
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FOR THE APPLICANT, SAN ANTONIO WATER SYSTEMS:
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FOR THE OFFICE OF PUBLIC INTEREST COUNSEL:
MR. SCOTT HUMPHREY
OFFICE OF PUBLIC INTEREST COUNSEL
TEXAS COMMISSION ON ENVIRONMENTAL QUALITY, MC-103
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Austin, Texas 78711

ALSO PRESENT:
Geary M. Schindel, the Witness
Sharon L. McDonald, CSR, RPR

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MR. ALLMON: I just want to start the deposition. This is Eric Allmon for Greater Edwards Aquifer Alliance. I'm noting the agreement this is under the Texas Rules of Civil Procedure, and all objections except for those set forth in those Rules are reserved for hearing.

MR. PRESSLEY: Okay.

GEARY M. SCHINDEL,

having been first duly sworn, testified as follows:

EXAMINATION

BY MR. ALLMON:

Q Could you please state your name?

A My name is Geary Michael Schindel.

Q Okay. And who do you work for?

A I work for the Edwards Aquifer Authority.

Q And what position do you hold?

A I am the chief technical officer with the authority.

Q What's your educational background?

A Well, that's a good question. Let's skip high school.

Q Uh-huh.

A I have an undergraduate degree, a bachelor's of science in geology from West Virginia University, which I obtained in 1981.

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I have a master's of science in geography, emphasis in physical geography, karst hydrology from Western Kentucky University, which I obtained in 1984.

And then I've taken continuing education classes, course work at various places over the last so many years. I actually teach a class for a professional organization, National Groundwater Association, in karst hydrology.

My expertise, my experience, my background, my passion is groundwater movement in these carbonated aquifers. So that's my background and educational background.

Q Okay. And what is your occupational background?

A After receiving my undergraduate degree, I worked at Mammoth Cave National Park for the park geologist there. His name was Dr. James Quinlan. Dr. Quinlan developed many of the techniques that we utilize in studying karst. I worked for him as a -- basically a research assistant for a number of years.

I also worked while in graduate school as a graduate assistant for the Center for Cave and Karst Studies, which is located at Western Kentucky University under Dr. Nick Crawford -- Nicolas Crawford, who is also a recognized expert in karst.

I then was hired to -- after finishing

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graduate school, I was hired by the Kentucky Division of Water as a supervisor of a newly formed section called the groundwater section that was reorganized into a branch and I became the branch manager. That would be about 1988.

I was branch manager for about a year, working for the Kentucky Division of Water for a total of about 3 1/2 years. While there, I basically developed the -- I was the senior staff and lead author on what's called Kentucky Groundwater Protection Strategy, which was developed by the various governmental agencies. We were basically the lead agency on it, but it was to develop a multiagency strategy to protect groundwater in the state of Kentucky per guidelines from the US EPA.

After 3 1/2 years of being in the Kentucky state system, I left, became the environmental manager for a company called A-Tech Associates, where I was involved with environmental investigations and project management.

I'm sorry. Let me back up and say the position that I held in the state of Kentucky was in Frankfurt, Kentucky.

I then moved to Nashville, Tennessee, where I was the manager of the environmental program for A-Tech Associates where we were responsible for doing

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underground storage tank evaluations and removal and groundwater investigations, quarterly monitoring for landfill work and other -- and other environmental investigations and management practices.

Also was involved in the asbestos evaluation program. So I managed that program, also, where we did asbestos evaluations in public schools for half the state of Tennessee.

After three years of working at A-Tech, I left there to go to a company called Eckenfelder, Incorporated. It was an environmental consulting firm in Nashville, Tennessee, also. There we did higher end environmental work. I was the program manager II, and also their director of karst hydrology where I managed the RI aspects for RAFS investigations related to superfund sites.

So I basically did all the investigations on a couple of superfunds or managed them, anyway. I had a number of folks who were actually doing a lot of the field work for superfund sites, both state and federal, NPL sites, national power lab sites.

I've done -- also basically did all of our coordination and environmental investigations related to karst hydrology at Eckenfelder for all of our work, basically, that we did throughout the country. So I'm

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not sure how many states I've worked in, but too many states probably.

And then at that point was hired by the Edwards Aquifer Authority as the chief technical officer and I've been here nine years.

Eckenfelder, Incorporated, was one of the oldest environmental consulting firms in the US, and during the consolidation in the environmental field, it was bought out by a company called Brown and Caldwell, which is a very large environmental and civil engineering firm, and so I actually worked for Eckenfelder for eight years, then worked for, I think, Brown and Caldwell -- it was Eckenfelder, Brown and Caldwell, and then Brown and Caldwell -- for about a year and a half basically in the same position.

And then the CTO position was opened up and I applied and was accepted, and I've been here for -- it will be nine years in April.

Q Okay.

A So next month it will be nine years.

Q What is the Greater Edwards Aquifer Authority?

A I don't know what that is. The Edwards Aquifer Authority is --

Q Yes. Excuse me. What is the Edwards Aquifer Authority?

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A It is the regulatory body that was set up by the Texas Legislature to regulate both withdrawal, water quality and quantity from the Edwards Aquifer is my understanding.

Q Okay. What is the Edwards Aquifer?

A What is the Edwards Aquifer? It is the primary source of water for the San -- greater San Antonio region. The area that we encompass includes Uvalde, Medina, Bexar County, parts of Caldwell, Atascosa, parts of Guadalupe, Medina -- I'm sorry -- Comal and Hays counties.

There's some -- I'm trying to think about the -- the jurisdictional issues, you can probably read the statute and it will probably be more important, but they extend our authority, I think, five miles above the boundaries around all of those counties with the exceptions of Caldwell and Atascosa and Guadalupe where there are just slivers of the aquifer that occur except for Bandera County, which was exempted. So it's somewhat convoluted.

What is the Edwards Aquifer? It is a karst aquifer. Probably one of the more prolific karst aquifers and probably one of the best known karst aquifers in the world. It is the water supply for approximately 1.7 million people.

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It is the water supply for 1.7 million people. It's used for both environmental --

(Brief interruption.)

A Anyway, the aquifer itself is complicated. It is, by nature, complicated because it is a karst aquifer. It has been influenced by faulting, by volcanic intrusions, by dissolution processes.

It extends basically -- this portion of what's called the Balcones Fault section of the Edwards Aquifer extends from Kinney County area, and we're investigating that boundary now, eastward through San Antonio and then northeast all the way to -- into the northern Hays County area in the area where Onion Creek occurs, and then at that point it becomes the Barton Springs segment.

Would you like more? I mean, we can start with the first year and then work our way forward?

Q Well, how about we start with some of the characteristics that generally characterize a karst aquifer. Is a karst aquifer -- is there anything about a karst aquifer that makes it particularly susceptible to contamination?

A US EPA and the federal register has recognized karst aquifers as the most vulnerable aquifer type.

Q And what are the reasons why it's one of the most vulnerable aquifer types?

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A Because I told them it was. They actually reference a document I wrote in the federal register. They basically reference that. It was a document that we prepared related to susceptibility of karst aquifers through tracer testing. It's actually source water or well protection process.

It's been well-recognized. It's not just my authority on whether or not -- I hope they wouldn't do anything like that. But to be honest with you, karst aquifers have been recognized by people who specialize in karst aquifers as probably being the most vulnerable type.

It is a subsect of all the ground works aquifer types out there. For example, there are sand and gravel aquifers, what some people would tepefy as porous equivalent aquifers. There are fractured aquifers, and then there are karst aquifers, and there are continuums among those.

The difference between a karst aquifer is that it is -- it is a process -- and the nuances may be lost here, but the -- it is a karst aquifer where the -- a karst aquifer is an aquifer that has been basically or the predominant -- well, the topography on it is the predominant geomorphic aging occurring on the surface is

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dissolution processes, so -- and then that organizes itself into networks below ground, self-organizing, but a positive feedback loop, and basically it allows these networks to form and integrate.

And so what you see are converging groundwater flow, which means we have a very, very large catchment area that extends from Uvalde County all the way to Hays County with the water discharging out of the aquifer. So you have a large catchment area, but the discharge areas for the aquifer are such that there are only a few very, very large springs.

This aquifer is noted for having some of the largest springs in the country. They are peripheral or magnety springs, Comal and San Marcos Springs, but there are some other smaller springs, Waco Springs, San Antonio, San Pedro Springs, Leona Gravel, Leona Springs.

There are other -- there are other springs noted in other portions of the Balcones Fault subsection of the Edwards Aquifer, Barton Springs, San Felipe Springs, Las Moras Springs, Goodenough Springs, et cetera, et cetera.

So these are all indicative of integrated flow paths, rapid groundwater velocities. Little, if any, filtration that may occur in these, they're noted

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for the ability to transport contaminants long distances very, very quickly in concentrated fashion. That's the reason why they're considered the most vulnerable aquifer type.

Q Why is there little filtration in this type of aquifer?

A Well, the -- the water basically will enter the aquifer either in the recharge zone directly through infiltration in the beds of streams or it will enter it in the -- in the areas between stream beds where there are -- where the limestones are exposed, and there may very well be also cross-formational contributions from other aquifer types or other sources such as the Lower Glen Rose or Upper Glen Rose Trinity Aquifer Systems.

So, in essence, what happens is we have water that falls out of the sky, and as part of the hydrologic cycle, it will absorb carbon dioxide from the air. It will absorb carbon dioxide from decaying vegetation, and it forms a weak acid called carbonic acid.

Given sufficient amounts of time, the carbonic acid will dissolve out the limestone, which is soluble in these materials. And when it dissolves that out, it creates a void and some of these voids are very small, the size of my finger. And that is a continuum

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that extends up to -- large enough to have a commercial cave and being able to take tours in it, or people who are caving or cave enthusiasts actually mapping those caves.

If the cave -- and there are a number of caves that we can enter that we can actually go see the water table, the actual Edwards Aquifer in the recharge zone. If it doesn't filter out me as a caver, it's not going to filter out any bacteria.

The flip side of that is we have the deep artesian zone. That process is probably not driven as much by carbonic acid as it might be driven by hydrogen sulfite processes from deep-seated sources in the artesian zone related to bacteria feeding on sulfates at depth and outgassing the hydrogen sulfite, which then makes sulphuric acid, which then dissolves these things out at depth, and so that's probably why we see the artesian portions of the aquifer having such high -- such high transitivity or, in essence, ability to pump out large quantities of water.

You can, in essence, install a well anywhere in the Edwards -- almost anywhere in the Edwards and you will get -- in the artesian zone, and you will get very high well yield.

The recharge zone itself probably at one

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time was part of the artesian zone, and so you're seeing the recharge zone transition from what are called hypogeum processes, which are formed at depth from the Edwards in the artesian zone, to what are called epigenic processes, which are the shallow processes where carbonic acids are being formed.

So the recharge zone itself is in transition and evolving from having been formed by hypogeum processes by high transitivity up there and then being integrated into the epigenic processes.

These are relatively new theories. Let me back up and say the -- the genesis of the Edwards Aquifer has been looked at. The hypogeum process, which is a relatively new process, understanding of that process appears to be extremely important in having us understand all of the properties of the Edwards.

Q What is a tracer test?

A A tracer test is a surrogate for a contaminant. It will allow us to -- and is, in essence, a contaminant itself if you look at it that way.

We -- we have come down here -- I came down here having utilized tracer testing a great deal in other areas to try and understand a couple of things about aquifers. It is -- what it tells you is the relationship between an injection point where you put the tracer in

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and a recovery point. It will tell you -- it will give you a generalized idea or an apparent flow path from Point A to Point B. It will give you an idea of the groundwater velocities and it will give you an idea of -- to some extent, the ability to dilute or to -- as some people call, filter out a contaminant.

So we've been very active. Before we got -- before we came down here, very little tracer testing has been done in the -- in the San Antonio segment of the Balcones Fault subsection. That probably goes back to the reason that very few people who are working down here are specialists in karst. Very few universities have programs that deal with karst. Very few people have training specifically dealing with karst. So, therefore, if you don't know about the karst tools, you don't apply them. And so -- or do not apply them well.

So we were told when we came down here that tracer testing had been applied and it doesn't work. Having a little more experience and expertise in that -- actually, I have a lot more experience and expertise than most of these people who have done that work -- we managed to get it to work and work quite well, and it's telling us some very interesting things about the aquifer.

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Q So what have you been able to learn from the tracer tests you've performed?

A Well, you know, it'd best be shown with figures, but the fact is that the conventional wisdom -- I will give you an example of some tracer testing that we did in northern Bexar County.

In northern Bexar County, we injected -- we looked at all of the geologic information related to the presence of faults, the outcrop zones of the Edwards Aquifer, and the conventional wisdom from previous reports was that these faults may actually act as barriers and that the faults would prevent water from flowing directly from northern Bexar County into central Bexar County in the artesian zone where the water will be withdrawn for use and that it would cause the water to move to the west and to where -- into Medina County where some of these faults tend to play out around that end and then back underneath southern Bexar County.

So the flow path itself would be much, much longer and much more elongated. And at that point there would be sufficient time -- some suspect that there would be sufficient time to be able to allow for dilution and/or treatment and/or degradation of contaminants.

We have also run our computer model related to particle tracking. There's a process where you can

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actually use the computer models that we developed. It indicated that groundwater flow would be to the east towards Comal Springs. The tracer test, however, is empirical data. It's real data. It can be tested. It can be reproduced. We went in and we have injected a series of dyes in northern Bexar County which allowed us to look at flow paths and groundwater velocities.

The groundwater model had predicted groundwater velocities of about a mile per year. The conventional wisdom among scientists was that there was no estimate on groundwater velocities, but the groundwater flow direction would be off to the west, southwest.

The tracer testing data indicated that groundwater velocities are as high as more than 10,000 feet per day in some places, that we see groundwater flow paths that we've traced so far of five miles. We have seen that groundwater has come out of the Upper Glen Rose portion of the Trinity Aquifer, which has tested the ability for -- tested the assumptions that there is also no communication between -- or limited communication between the Glen Rose limestone and the Trinity Aquifer and the Edwards. We found that to not be the case.

They moved through convergent flow processes, basically through conduit flow, and converged

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upon a sink hole -- one sink hole point, let's see, three, four, five, six, seven, eight -- seven of the tests did. One test went to another well which is not that surprising.

They reduced out opposite of the model and opposite of conventional wisdom. So you saw very, very rapid groundwater flows. We picked up the dyes. We reproduced the process -- the test. We got the same basic empirical data from those.

The -- to quote my former employee(sic) who -- Jim Quinlan, who is a luminary, and that is, you know, there's no true filtration through -- you know, the dye doesn't lie. It is what it is, and we need to look at more conventional wisdom in our thinking.

That is that, you know, a -- one tracer test properly constructed and interpreted is worth 100 expert opinions or 1,000 groundwater models. And sometimes we would argue about whether it's really 1,000 expert opinions and 100 groundwater models.

But, basically, the dye tracing data is very solid. We've gone to extremes to do quality control and feel very comfortable with it. And it also shows you that, you know, the dyes or surrogates can be used for surrogates for contaminants, so it gives you an idea of how rapidly the water out of the recharge zone can

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infiltrate into the Edwards and move into the deep artesian system -- a shallow artesian system -- I'm sorry -- and probably into the deep artesian system and potentially contaminate the aquifer.

Q Okay.

A And the other thing that dye tracing does is it should give you -- and should be incorporated into any of your response plans and management plans related to how you deal with spills and how you deal with releases of both point and nonpoint sources in karst aquifers.

It's an extremely powerful tool. There may be, when I first started doing this, a handful of people in the US who probably do it well. There's probably a few dozen now.

And again, you know, if you were trained as a traditional hydrogeologist where the emphasis in teaching -- and teaching there is sand and gravel aquifers because they fit convenient formulas and that's the experience that most people have, and you do not get exposed to karst hydrology, then you're not aware of or can incorporate into your conceptual framework or understanding, you know, these processes that are occurring in karst that are completely alien and separate from what you would normally see in a sand and gravel aquifer. However, that doesn't keep people from applying

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any of those tools. You know, the analogy is when all you've got is a hammer, everything becomes a nail. Well, we brought some new hammers called dye tracing and a few other tests that we can do in the aquifer to try to understand it better.

So basically the tracer testing is shifting the paradigm for those who are willing to progress with the data to look at. Not everyone is.

Q You said in your prior work you had done some superfund investigations?

A Yes.

Q Were any of those over karst aquifers?

A Some of the state NPL sites were, yeah. As a matter of fact, a number of them were, and also a number of TOSCA sites. So I've dealt with PCBs, heavy metals, VOCs, and a number of other contaminants in karst aquifers, so I probably have as much experience as anybody in the country tracing and chasing these things.

Q And what did you observe in those superfund investigations over karst aquifers with regard to contaminant movement and infiltration?

A Very consistent with what we see here in the Edwards, in the epigenic karst systems. So looking at the karst areas I've worked at in Kentucky and Tennessee, Alabama, West Virginia, Pennsylvania, God knows where

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else, the movement of a lot of these materials themselves are very rapid. There may or may not be any dilution. They can be extremely concentrated. They pose a health threat.

I've also dealt with -- actually my thesis title was working on biologic contaminants, pathogens, enteric contamination in an urban karstified carbonate aquifer. And so that actually was my early area kind of interest and specialization.

So not only have I dealt with the aspects related to some of the contaminants that people are concerned with, in particular, VOCs, PCE, GCE, PCBs, herbicides, pesticides and that, I've also dealt with pathogens and chloroform, and fecal and chloroform bacteria transport in karst, and those are also a concern.

Q Does the Edwards Aquifer Authority have regulations governing private water wells within the contributing or the recharge zones of the Edwards Aquifer?

A There are a number of different regulations related to wells, well construction, both public and private wells. And if the well is drilled through the Edwards limestone, then they require a permit from us and we do impose well construction standards on them.

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Existing wells, however, may be exempt from those standards in the event that they're not creating a contamination problem.

That area is dealing with our regulatory programs, and I would probably recommend that you talk to one of our regulatory folks to get the more specifics on this program, so I don't misinterpret anything. I helped write the regs. I helped -- I had input into the regs. I didn't write the regs. I had input into the regs for those. I did help write, basically, the regulations for a water well drilling program in Kentucky.

Q Okay.

A So I'm familiar with well -- I've installed hundreds of wells. I'm very, very familiar with well installation processes especially in karst.

Q But you do have knowledge of whether or not private wells that would be drilled in the future over the contributing or recharge zone are subject to those regulations?

A I do. If the well is drilled in the contributing zone and does not intersect the Edwards, then my understanding is that we do not have direct regulatory control over that well. We do not have well construction standards for those wells.

Q Okay. Are there other aquifers in the

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contributing zone above the Edwards that someone may drill a well into?

A Well, there are technically stratigraphically -- that means in the layers of the rock, the rock layers themselves, there are aquifers above and below the Edwards. Below the Edwards would be what a lot of people call the Trinity, and depending -- the Trinity Aquifer, and depending on how you define that may include a number of different units and subaquifers. That stratigraphically is located below the Edwards, but that is what makes up the contributing zone predominantly.

Q Okay.

A There are some aquifers above the Edwards, also. Those are usually found above the artesian zone.

Q Okay. Have you reviewed the San Antonio Water Systems applications for CCNs?

A No, I have not.

Q Let me show you first one map. Okay. Let me show you what is SAWS Exhibit SAWS-MN7, which is a map of some of the SAWS CCN areas. Do you see the area marked application number 35445-C?

A Uh-huh.

Q Is that over the -- are you able to judge whether that's over the Edwards Aquifer contributing or recharge zones?

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A It appears that it's -- parts of it are over both.

Q Okay.

A Both the contributing zone and recharge zone and possibly a little of the -- probably not the artesian zone, but maybe. You know, again, I'd have to get out our maps and compare it.

Q Do you have those maps easily available?

A No. They're over -- I do not office in this building. I office in another building. I'd have to take -- it would probably take 10 to 20 minutes to get them.

Q Okay. And the area marked application 35484-C, do you see that area?

A Yes, sir.

Q Is that over the Edwards Aquifer recharge or contributing zone?

A It looks like part of it may -- just a very small part of the southern tip of it may be. But again, I would have to look -- the fault basically runs like this. The recharge zone runs from east to west passing basically through this area, parts of Medina County, Medina Lake, south of Medina Lake, through the southern part of Camp Bullis, so there may be some locations up in here where it does, but I would have to look very

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closely.

As a matter of fact, this may be the recharge zone. I assume this is mapped correctly. If that's the case, then the answer is yes.

Q Yes, with regard --

A Both.

Q -- to 35484-C?

A Both. Yes.

Q And with regard to 35445-C?

A Right. And in looking at this, also, then I can imply that -- yes, both of them -- that you have -- part in the contributing zone and part in the recharge zone.

Q Is there any portion of either of those that's outside of either the contributing or the recharge zones?

A There may be a little part of the southern portion down here that would appear that it is outside of -- south of the recharge zone. There may very well be either over what's called the transition zone and/or the artesian zone.

Q And you're referring to the southern part of 35445-C?

A Correct. And also 11671.

Q Okay. Do you have any opinion as to the impact of granting a water service CCN in these areas on the environment?

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A And this is basically to run a water line or a sewer line or --

Q Run water lines to provide water service.

A I have my own personal opinions, yes, based on my professional judgment.

Q What are those opinions?

A They may not be -- they may not be consistent with or reflect the Edwards Aquifer Authority's opinion.

Q Okay. Just in your own professional opinion, what opinions would you have?

A It goes back to potential impacts to the system from development that the contributing zone and the recharge zone contribute water to the Edwards Aquifer itself. By installing water lines into the area, you increase the potential density of development in an area, and that increases the north point source runoff and can also bring development which may create source points.

And so higher density development in these areas is generally not recommended.

Q What are the particular --

A If you're interested in water quality.

Q What are the particular impacts of high density development?

A You end up with basically storm water runoff that may be occurring related to impervious cover, and

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with other -- impervious cover associated with mostly motor vehicle traffic. You end up with changing of land patterns from, let's say, low density rural agricultural land to higher density urban development. Along with that comes the uses of herbicides and pesticides associated with land use.

Normally most people associate agricultural production with high -- high usages of fertilizers, herbicides or pesticides. The urban environment can also be a very important source for those contaminants. Then you also have with higher density development a greater potential for pathogen -- well, pathogen creation and transport, and the pathogen transport is probably the most serious of all the issues.

Q So going back to -- you referred to storm water runoff. What are the -- and you've listed some of them, but what are the potential contaminants contained in storm water runoff?

A A number of metal contamination associated with lead and some of the other trace and heavy metals. Oils and greases, which when mixed -- when entering the water system and the -- can create issues. Organic compounds themselves, you may get a higher loading associated with organic sources. What I mean by that is it would be organic debris, like, let's say, grass, decaying

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vegetation, et cetera, that you may get because of increased runoff that degrade to form organic carbon, and then that creates issues with managing what are called disinfection byproducts associated with chlorination of water supply systems.

You will also get herbicides and pesticide treatments from lawn applications with urbanization. You will also get -- depending again on how sewage is -- the septic sewage -- or sewage is basically handled. You may have the installation of septic tanks through aerobic digesters, I guess, or the anaerobic systems, and those need to be maintained and so you may end up getting impacts associated with that process, also.

Of course, there are issues related to sort of the industry or -- that you may have associated with these related to emergency response issues. For example, while our regulations ban the installation of underground storage tanks in the recharge zone, I understand that they do allow the installation of underground storage tank systems in the contributing zone, the contributing zone itself.

And so you have transport of fuels across the recharge zone to service those, so you run into the potential for having an accident and a release from a transport system. You also have potentials associated

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with handling of other hazardous materials. For example, dry cleaning operations which are not -- which are still, I think, allowed or were allowed and are still happening on the recharge zone and in the contributing zone. And we have seen the effects of some of those on water quality in the Edwards.

Q So what, in particular, are the negative impacts that movement of these contaminants in the Edwards aquifer could have?

A Well, there's health risks associated with the presence of these contaminants and they range from exceeding the -- what's called the maximum contaminate limit, the MCL, for a particular contaminate, for example, dry cleaning fluid or gasoline. And, again, you may have an urban nonpoint source for those materials.

People use paint thinners and they use solvents and then they flush them into their sewage system, their septic tank, and/or anaerobic systems which are not really designed to treat those solvents or paint wastes or whatever, and then they basically enter the system.

The emerging area also is pharmaceutical and personal care products. We have plans to do some analysis of those yet, but we have not -- we have not actually collected any samples, but that's an emerging

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contaminant area that's of concern.

And then -- let's see. The other thing that you have is the installation of construction of retail outfits that basically sell hazardous materials. For example, some of your large retail home improvement and/or garden shops will carry large quantities of fertilizers, herbicides, pesticides, paints, construction debris or construction materials. In the event that there's a fire, the decision would need to be made as to whether you try and put the fire out, which means you spray large quantities of water on it, which means you basically are bleaching whatever is on fire or has ruptured and burned in that building into the runoff that comes from the fire which may very well infiltrate into the aquifer, and we have seen that with the Helotes fire that occurred last year.

And so the installation of those kinds of facilities that usually track development in a given area, I'm sure they would follow and they create a potential hazard.

Q If we put aside the impacts of septic tank systems, do you still think there would be negative impact?

A There's certainly a higher risk of that because of the potential development that would follow and then

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we would also see increased loading of the contaminants of herbicides and pesticides and fertilizers from urbanization.

Q Okay.

A That's been pretty well documented in the literature across the US, and there's no reason to think that the Edwards would in any way, shape or form filter that material out before it reaches the aquifer.

Q And if sewer lines were installed in this area to serve these areas, could installation of those sewer lines have negative impacts on the Edwards Aquifer?

A They could. And sewer lines themselves are commonly run down drainages because they are -- usually gravity -- people, when you design them, you try and use gravity flow system down the stream ways, stream courses. And when you are -- and that is the area where we receive infiltration. The reason those streams are dry is because the water is seeping into the Edwards. So you run sewer lines down those drainages and those sewer lines are susceptible to either leaks and/or catastrophic failure, and we've seen examples of catastrophic failure issue.

The general leak issue is unless the leak is bubbling to the surface, it must be functioning correctly. That's the way that septic tanks that have

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sewer lines are basically installed. And the philosophy that many people have, in reality those facilities may very well be directly entering the ground and, therefore, entering the aquifer and may be moving away from the site rather than bubbling to the surface, and so people assume that they're working correctly and they may very well not be. There's some very good examples in the literature of all that.

Q Okay.

A Probably the most noticeable one was the leak that occurred -- loss of 120,000 gallons of sewage at 1604 just west of 281 that occurred a couple of years ago.

Q And could you describe what happened there?

A Sure. To the best of my knowledge, there was a sewer line that ran out of the Stone Oak area, ran down -- I think it's called Lawrence Creek to a lift station. The City of Hollywood Park, which is actually on septic tanks and on-site sewage treatment systems, had -- my understanding is had not granted permission for San Antonio to run a sewer line down that creek, and so it put in a lift station which pumped sewage under pressure up to 1604, over the 281, and then the sewer line by gravity came down 281.

My understanding is there was some

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defective piping, PVC piping in that force pressure main and that ruptured, and my understanding is -- is that approximately 120,000 gallons of water -- of sewage -- I'm sorry -- basically flowed down Lawrence Creek for a number of days before it was reported and the response to clean up occurred.

The actual response to that cleanup, my understanding was a berm was put up in the creek, that there were a number of vacuum trucks that were brought out to the site to try and remove the sewage, that there was attempts to try and put a -- basically a powder chlorine, sodium hydrochlorate probably, on that and then the idea was to try and dilute or flush the material, which resulted in the authorities -- basically the people who were responsible for that, San Antonio Water Systems, and the people who were -- who were directing at TCEQ recommended that three fire hydrants be opened up and allow the flow of about 400 gallons per minute for about 24 hours, which basically flushed the material down the creek.

I do not think that the vacuum trucks -- I haven't seen any data that shows the vacuum trucks removed that volume of material out of the system, so we can infer very quickly that it probably -- a lot of that infiltrated into the ground.

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When we do our dye tracing -- dye tracing, we actually use about 10,000 gallons, 5,000 to 10,000 gallons of water to help flush our dyes down through the conduit system into the aquifer where -- where we -- where we're able to detect it. So, in essence, you know, what occurred was a very, very large dye trace using sewage.

And luckily I think the city of San Antonio dodged a bullet. I'm surprised, but it did not go to the nearest wells. It went into the aquifer system probably to the east, and though we ran a very extensive testing program to try and detect it, we did not see that sewage.

We did propose a dye trace be run while -- at the same time because part of the problem with these sewage systems is that when you try and test for bacterial contamination, you need to go through an incubation process, so you have a 24-hour incubation time. You collect the sample. You take it to a lab. The lab processes the sample, then they basically put it in an incubator for 24 hours and then they can read the plate.

And the problem with that is the dye tracing that we did occurred right in this area in the drainage just to the west where we saw dye tracing coming out of bullets and over in this area out of the Stone Oak

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area.

Q And when you say "this area," can you describe it by words?

A I'm sorry. Yes.

Q So we're able to understand it.

A Yes. We injected dyes. We did a series of tracer tests up here where we injected dyes on the golf course in Shavano -- I'm sorry -- the Sonterra golf course and Dinoid Cave adjacent to 1604, and three sink holes on -- two sink holes on Camp Bullis and one sink hole up here off of Blanco Road.

Those dye traces showed that the dye and groundwater, therefore, moves directly south to be recovered in wells by Panther Creek, a monitoring well at Panther Creek, and that data indicates to me that we have very rapid groundwater velocities there, measures in the orders of 5,000 to 10,000 feet per day.

The spill occurred just to the west or just to the east of the area where we did our dye tracing in the next drainage basin over. There's no geologic reason for me to think the groundwater flow paths would be any different there. They were probably very rapid and probably concentrated.

And I think we're very lucky that the wells that feed that system are -- up here are operated by

Bexar Met right off of Bitters Road were not impacted. I was surprised that they were not and we're very fortunate they weren't because I suspect it would have resulted in very, very serious illness in some people.

Q And if you look in the areas covered by -- going back to these applications -- by application 35484-C and 35445-C, what direction does your previous experience indicate the water in the Edwards Aquifer beneath those areas would flow, what direction?

A We have not done any dye tracing in that area, but I have no reason to doubt that the water would flow directly into karst features in the ground, that it would probably move rapidly to the south, that it's unclear what the role, if any, that some of the large faults in that area would play. Our dye tracing data shows they play very little role.

The general assumption from the dye tracing that we did in northern Bexar County was that these faults, again, act as barriers and push water to the west. Our model showed that the water should flow to the east. Our dye tracing data showed it flowed directly across six faults at a speed of 5,000 to 10,000 feet per day -- directly across those faults and right into the -- into the northern part of the artesian system, artesian zone.

Q And so would that be similar to the speed you would expect water --

A I have no reason to doubt that there would be any difference there.

Q And what is that speed again?

A Well, the groundwater velocities that we have measured in the northern Bexar County area range from actually a low of 80 feet per day for one trace to -- but most of the traces were in the thousands of feet per day with the highest, I believe, being over 10,000 feet per day.

Q Okay.

A So very, very rapid groundwater velocities. Generally most people assume groundwater velocities move in the order of, you know, feet per day and feet per year. So again, these numbers are not untypical for karst aquifers. As a matter of fact, they are basically in the norm. They are consistent with the dye tracing data that the folks in the Barton Springs District have also been doing where they've seen groundwater flow more than 15 miles in a matter of a week or so. So these are not all that surprising numbers for the recharge zone.

In addition, our data shows that we injected the dyes into the bottom of some very deep caves up in Camp Bullis, and those injections actually occurred

in the -- in the upper member of the Upper Glen Rose limestone, which is part of the Trinity Aquifer, and it also flowed to what's called the 608 well down by Blanco Creek. And again with very, very rapid groundwater velocity.

So there's no reason to think that just because the geology in the upper part of the Glen Rose is -- it's called a different geo -- a different stratigraphic unit by people who match stratigraphy. The water really doesn't care what you call it. It is going to do whatever it's going to do, and -- but we can do a lot of arm waving and, again, try and do a lot of speculation related on what we think our interpretations are of what's occurring out there when we've done that. The tracer testing has shown we're wrong.

Q If someone had a private water well within either of these CCNs completed into the Edwards Aquifer, what impacts on that well do you think could occur as a result of increased density of development in the area?

A Again, depending on where the well is drilled and what unit it's completed in. We have seen where we have injected our dyes into certain karst features, and those dyes have appeared extremely quickly in the order of days to both private water supply wells and public water supply wells.

So the potential for, you know, having a well intersect one of these conduits or caves or basically drain in a particular area, the contributing zone and/or the recharge zone, if you have a well that intersected one of those, then you would be drinking basically unfiltered water.

Q Okay. And if we were to assume that Gallagher Utility is seeking number 12990, do you see where that is located on the map?

A Yes, I do.

Q If we were to assume that they derived their groundwater from the Edwards Aquifer, could development in these areas impact that groundwater?

A Yes.

Q And how would that be?

A It would be the same manner. Again, these karst systems generally have three different sources. The rock itself, the actual Edwards limestone unit itself, these karst systems are considered basically what are called permeability or porosity units.

So you have the water that is retained in the rock matrix itself, which has very, very low permeabilities, the primary porosity and permeability of rocks very well. You have fracture systems that basically run through the matrix, and then you have these

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conduits that basically intersect fractures and integrate with other conduits as well as being surrounded by the matrix.

And so depending on whether your well is in the matrix, in the fracture or in the conduit, and what the fracture or the conduit itself is connected to and drains to, it would not be surprising to see a well -- and we have seen this where -- in my studies that we have wells that are -- seem to respond very, very quickly to small events, and then we see wells within 20 feet of or 30 feet of the well that responds not respond at all. A lot of it depends on whether it's in that -- what I'll call slow flow system -- slow flow system of the matrix, or whether it happens to have intersected an integrated conduit.

If it's intersected an integrated conduit, then you would expect to see, you know, large fluctuations in water levels, changes in water chemistry in the well. You would expect to see the well to be susceptible to contamination. We've seen that where we have dye traced in the wells and we have been able to detect those dyes very rapidly after injection. In essence, there's very little infiltration occurring or pollution occurring in those wells.

Q And you see those impacts occur often shortly

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after a storm?

A We have a series of probes that we have to put into wells that measure -- continuously measure or measure every 15 seconds the water levels in a well, and we also have a -- the probe commonly is associated with a conductivity probe, so we're collecting two different sets of data.

Conductivity indicates the presence of dissolved solids in the well, the total dissolved solids. They're a surrogate for that. The total dissolved solids are indicative of the contact that the -- how long the water has been in contact with the rocks. And so when we see storm events, what we see is -- in some wells, and not in others -- again, depending on whether that well is connected to the matrix or not, what we see is water levels sometimes rising quite rapidly in a matter of a few days, sometimes more than 100 feet.

We have seen conductivity spikes go down, which is indicative of very rapid infiltration of fresh water. We can walk up to the surface and see sink holes all over the recharge zone when it rains, so we know water is going in, and we see that signature as that falls comes through. So that conductivity signature also implies that those wells are directly connected to and probably would be susceptible to contamination.

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Q Can increase in pervious cover and development lead to higher runoff of solids and developed solids?

A Well, I believe that it can -- it will increase the total amount of suspended solids -- I'm sorry -- total amount of suspended solids and sediment. The impervious cover, depending again on what it is, may or may not increase the total amount of -- it may actually cause the total dissolved solids to go down because it's more fresh water rainfall. It doesn't have a lot of dissolved minerals in it. So when it strikes the ground, it's relatively aggressive and is trying to pick up these dissolved minerals like calcium and bicarbonate and other things.

And what will happen is that once the water has been in contact with the ground longer, we see that the conductivity starts to return as the water comes into equilibrium with the medium or the rock itself.

So we see these signatures of fresh water directly impacting the Edwards. If you see those kinds of responses very rapidly related to storm events, then there's no reason to think that contaminants couldn't enter the same process.

Q At what level is -- at what level is the Edwards Aquifer generally at in the area of San Antonio as far as elevation?

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A The elevation. We record that elevation -- well, we record that elevation in a lot of wells. The well that most people are familiar with is what's called J-17, which is over by Fort Sam Houston, and that is the water well that's actually reported on the news.

That water level may range from the lows around -- let's say -- during the most extreme drought, I believe the lows were actually below 620 -- 620 feet above mean sea level to a high of about 703 feet above mean sea level.

The aquifer levels elsewhere may be higher or lower depending again on where you're at.

Q And how does increased -- how does the increased drawing of water from the aquifer affect those levels?

A The -- I'm sorry.

Q How does increasing the amount of water being drawn from the aquifer affect those levels?

A They would cause a lot of water levels to drop.

Q Okay. And what impact does the dropping of water levels have on the aquifer?

A Well, it causes the water levels to go down. The water levels at J-17 have been directly correlated -- a very high correlation rate to discharge at Comal Springs. Comal Springs is a location where there are a number of listed federally protected endangered species.

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Q And what is the level of the aquifer -- do you know whether there is a level of the aquifer at which flow at Comal Springs ceases?

A There is a level. I don't have that stored in my --

Q In your memory.

A Well, if I gave you a number, it would probably be wrong. That's one I'd prefer to look up. But, yes, Comal Springs in 1956 did stop flowing for a number of months.

Q And if Comal Springs was to stop flowing, what impact would it have on those species in the springs?

A Well, that's a good question. I don't know that. I would assume that most of the species are aquatic, so that less flow is probably not good for them. But to be honest with you, I'd recommend you talk to a biologist who would probably tell you the same thing.

Q Uh-huh.

A And no flow is real bad. If you don't have any water and you're an aquatic species, you don't last too long.

THE WITNESS: Can we go off the record for a minute?

MR. ALLMON: Yes.

(Recess taken, 11:04 to 11:07.)

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Q (BY MR. ALLMON) Mr. Schindel, you had said there were some matters you wanted to clarify.

A Well, or expand on because I don't think I covered all the issues.

Q Okay.

A You talked about pathogens, and we talked a little bit about pathogens and septic tank sources and other sources of pathogens. To emphasize the vulnerability of these to -- of the Edwards Aquifer, we can point to other karst aquifers as -- also as models.

One of the best examples is a case in Walkerton, Ontario, Canada, where there was a karst aquifer there being utilized by Walkerton. And a couple of years ago, their public water supply wells, the fellows -- my understanding is the fellows who operated those wells had turned off their chlorinators. They were not functioning and they had not gotten them repaired or they were not being maintained or something.

There was a large rainstorm, and the rainstorm flushed bacterial contamination into the aquifer where it was pulled out of the wells. A number of people got sick who went to the doctor. The doctor said, It looks like you have food poisoning, is my understanding, and that he recommended that people go home and drink more water and stay hydrated.

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Out of the town population of roughly 5,000 people, 2,000 people got sick. Seven people died from it, and there are, I understand, more than 100 people waiting on the transplant list for new kidneys from it.

The contaminant was what's called E. coli 0157:H7, which is commonly associated with cattle manure. Again, this was not a high density feeble operation. The actual source of contaminant -- suspected contaminant was basically spreading manure out on the ground.

We've seen other cases where septic tanks have been implicated in the occurrence of hepatitis in a spring in Kentucky that had been tied through tracer testing back to a doctor's septic tank -- office where I think about 70 people came down with hepatitis from that.

And then in Braun Station, the first outbreak of cryptosporidium in the United States occurred in San Antonio in 1984 where 200 people became stiff from drinking water contaminated with cryptosporidium. This is -- I understand that this was the first documentation of health effects of cryptosporidium in humans, that it had been identified in cattle in other places. But this is, I believe, the same material that caused the outbreak in Milwaukee where as many as a 100,000 people became ill from it. It's a very serious illness.

So we know pathogens can travel through

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these karst systems. We know that they can go through public water supply systems that even have advanced filtration systems. And the Milwaukee case is a good example. That's a surface water system using one of the great lakes, and that cryptosporidia passed through their filtration -- I believe that's what they were using -- and survived their chlorination process.

The problem with part of the Edwards is that we have really no filtration process in our public water supply systems. Basically water comes out of the ground. It is then chlorinated per the recommendation or specifications of the TCEQ, and then goes into the distribution system so there's no filtration to speak of at the point of withdrawal.

Many groundwater systems do not require that if they can be shown that they're isolated. The deep artesian portions of the aquifer probably are and may not be a major concern. At least that's what we suspect.

The systems -- the water supply systems that are located closer to the -- to the recharge zone, even if they are in the upper, what I'll call the shallower artesian system, may very well be susceptible to that. And we do have cases of both private water supply wells and public water supply wells that have been

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known to pump sediment as well as leaves and twigs and things out. So if you know that leaves and twigs can get through a system, probably bacteria and viruses won't have a problem.

The resonance times of these things in the aquifer is debatable. My understanding is that it's a difficult area to study, but we think that some of the viruses, for example, may survive for months or years in the aquifer before they biodegrade.

Q And you mentioned Kentucky. Does Kentucky have any karst aquifers that have been significantly contaminated?

A The public water -- well, approximately half of the state of Kentucky is recognized as a karst aquifer or containing karst aquifers. Probably the best known example of that was a sewage treatment system that was discharging sewage into a sink hole and that they -- the water supply -- the sewage system was accepting industrial waste. The sewage system was not capable of treating that industrial waste. It caused the degradation of the digesters. They were injecting sewage into a sink hole under the city of Horse Cave, Kentucky.

There is a very large commercial cave there called Hidden River Cave, and that commercial operation had to be closed down for many, many years because the

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smell of sewage was overpowering and would actually basically blow out of the cave, you know, barometric pressure, and you could smell it around the entire downtown area.

This was traced through the presence of metals, heavy metals, to -- many miles away to the series of springs along the Green River in Kentucky and found by Dr. Quinlan. It's a very well-known piece of work.

And only in the last about ten years has the -- this regional sewage -- there was a development of a regional sewage system which basically was designed to collect that wastewater, do a better job of treating it, and then discharging all the way to -- running pipeline all the way over to the river where it would discharge there and they also had a discharge from that.

So these things can be cleaned up, they can be prevented, but that's probably one of the better examples. There's a number of other cases where contamination -- we've done dye tracing to springs and/or water wells that are being used in karst areas as water supplies.

Q Okay. Are you familiar with any situation -- with any instance where the board of the San Antonio Water System has overturned a decision by the staff to extend water service to an area?

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A I'm not aware of it. I do not follow the inner workings of San Antonio Water Systems, so I'm not aware of that.

Q All right. What impact would the withdrawal of an additional 3 1/2 million gallons of water from the Edwards Aquifer have on the aquifer?

A That's a -- that's a good question. We regulate the aquifer on a total per minute amount.

Q Uh-huh.

A And the -- whoever would want to withdraw that volume of water would be required to meet our per minute requirements. Those per minute requirements are capped by statute.

Q Okay.

A So it would be -- you know, there would be a lot of -- if you wanted to get into specifics of -- I would have to ask you, Okay. How much water would you want to withdraw, where would you want to withdraw it, and how would you like to space it? You know, would you want to withdraw it all in one day or would you want to withdraw over a 12-month period of time?

Then we would have to sit down and put in a model and see what our model was telling us, and then use that to sort of give us the ability to maybe make an informed decision on whether that would be a good idea or

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not.

Q Okay.

A In essence, though, you can look at it as a water balance issue, and that is what water is coming out of the aquifer, what you pump out of the aquifer either is not helping support high water levels in the aquifer, and also decreases spring flow.

Now, those relationships -- you know, percentages would be dependent upon where you withdrew it and which spring it would impact.

Q Are there any wildlife that depend on the Edwards Aquifer?

A Well, the endangered species that live in the springs, and then there's one species that actually occurs in the aquifer, but it is over by San Marcos Springs. It's called the Texas Blind Salamander. I understand it was the first species that was listed on the Endangered Species Act. That -- we assume that that species, as water levels go up or go down can migrate into the aquifer habitat-wise where it needs to.

The other species -- and again, the aquifer has -- while the springs have gone, the springs have stopped flowing, Comal Springs have stopped flowing, that did not mean the aquifer did not have water in it. It just no longer reached the level, elevation necessary for

it to discharge at the spring.

Q And can water quality impact on the aquifer, impact those species?

A I wouldn't see any reason why it wouldn't. There are certainly a number of cases where that has occurred in the past in other aquifers. There's no reason to think it wouldn't occur here.

MR. ALLMON: Okay. That is all of my questions.

MR. PRESSLEY: Do you want to take it, Scott?

MR. HUMPHREY: No, I don't.

MR. PRESSLEY: All right. Go off the record for a second, please.

(Recess taken, 11:18 to 11:22.)

EXAMINATION

BY MR. PRESSLEY:

Q Good morning, sir. My name is Robert Pressley. I'm an attorney with the firm Matthews and Freeland. We represent the applicant in this matter, SAWS, and I'm going to be asking you a few questions based primarily on your testimony earlier this morning.

I'd like to start out with a couple of questions about your qualifications.

A Sure.

Q Tell me again what -- what educational training you have in looking at the possible effects that urbanization might have on a karst aquifer.

A Well, I -- again, I worked on a nonpoint urban -- urban storm water runoff program under my professor at Western Kentucky University for the city of Bowling Green where we collected extensive samples related to storm water runoff in karst and included surface water samples and groundwater samples and that.

I've reviewed those reports. I've reviewed other urban storm water runoff reports, both dealing with karst and with surface water systems.

My thesis itself was related to storm water runoff associated with bacterial contamination of karst aquifers in Bowling Green, Kentucky.

I have worked on contaminate transport issues commonly associated with storm water runoff, related to a number of a different contaminants. Probably the one that would be most related would be PCB runoffs. PCBs tend to adhere to sediment. Sediments are commonly transported and actually make excellent tracers other than they're extremely toxic, but they're very detectable and they do transport quite well through conduits.

Q And I believe earlier you testified that you have not conducted any studies relevant to the two areas for which applications are on file; is that correct?

A Well, we have -- we have conducted through a -- through some of the research through -- research we funded through the US geological survey, some work in the Medina County area, and I believe some of that data is actually up in here.

We've looked at groundwater data. We've collected -- probably collected some water quality samples maybe in that area. I'd have to go out and look to be sure. We have not done any tracer testing data. We have not done any tracer testing in that area. We are actually looking at doing some.

Q If you haven't done tracer data there, what -- specifically what type of data has been collected? I believe you mentioned Medina County.

A In Medina County? We have an extensive water quality testing program that collects water samples across the aquifer. We've collected water samples in Medina County and Bexar County. I would have to look and see what samples exactly we've collected in that area, but I suspect we've collected samples if not in the area, nearby.

Q Okay.

A Now, those are water quality samples.

Q Right.

A And again, we're talking water quality versus tracer testing. I want to make sure you understand we haven't done any tracer testing.

Q And go ahead and tell me how that should be distinguished.

A Well, the water quality samples are basically samples that are collected from either public or private water supply wells and/or through monitoring wells, and we pull samples out of the wells and we analyze them for a wide range of constituents including bacteria, general chemistry, cations, anions, BFCs, herbicides, pesticides, et cetera.

We have -- and our testing system has evolved since I got here in '99 when we basically were collecting only water quality samples. Generally what I will call general water -- general chemistry, cations, anions, some nutrient data and the metals.

Generally most of those samples were collected along the saline water/fresh water interface which is much farther south. Since then we've been able to modify our programs to include a wider range of parameters and a wider location. So over the last eight years, we've been modifying our database.

Q Would it be accurate to characterize the type of

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data that you collected as being the information you used to establish background levels of contamination rather than any type of cause and effect relationship?

A The technical term I think would be ambient water quality characteristics, so that may imply that they either have been impacted or not impacted, but they are current water quality contaminants that we have seen, yes, or water quality characteristics.

Q And again, you have not conducted any dye tracing tests in that area?

A We have not, no, sir.

Q Let's go ahead and take a look at some of the EAA's rules. I believe you said that there are some water quality rules that EAA has promulgated; is that correct?

A Yes.

Q And could you describe for me generally what the nature of those rules are? What is regulated?

A We regulate well construction practices associated with new well construction. And we also regulate the installation or -- and also I guess maintenance of underground storage tanks. We currently ban the installation of new underground storage tanks in the recharge zone for water quality.

Q Right. And earlier you said that today you

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would be giving in your testimony your opinion, and I just want to make sure that I understand. What you're testifying to today is your opinion. It's not that of EAA, correct?

A Correct. I'm acting -- you know, I'm basically giving my opinion based on my education and experience as a karst hydrogeologist.

Q And do you know whether the TCEQ has any water quality rules that pertain to the Edwards Aquifer region?

A They do.

Q And could you explain to me what your understanding is of what those rules regulate?

A They put certain restrictions on density of development related to development over the recharge zone, and to a lesser extent, the contributing zone.

Q And, in your opinion, are those rules sufficient to protect water quality concerns?

A They are currently regulating through the development issues total suspended solids and do not test for a wide range of other potential parameters, so the answer is: I don't know that.

They do offer a -- they do offer a degree of protection, though. I will -- I will say that from -- just from my understanding of being able to remove some of the suspended solids.

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Q Sure.

A There is a -- certainly a degree of protection. They are -- some people consider them relatively stringent in relation to source water protection regulations.

Q That's where I was heading. Are you familiar with any other -- whether it be another aquifer authority or any other state that has similar levels of protection, perhaps in Kentucky or elsewhere?

A The -- in some areas there are some folks that may have more stringent and in other areas they're probably much less stringent, so it would be difficult to give you a comparison, side-by-side comparison, especially since I haven't worked in those programs in a number of years since moving down here. That would require some research.

Q And, I believe, earlier in response to one of Mr. Allmon's questions you said that prior to today you had not seen SAWS CCN application; is that correct?

A I have not looked at it. Now, my understanding is someone sent me a -- mailed -- let me back up and say someone sent me a --

THE WITNESS: I believe it may have been from your office, but to be honest with you, I have not opened -- I have not had time to open it up or look at

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it. So I'm not very -- I think that you-all have submitted an application. I have not evaluated it in any real shape or form.

Q (BY MR. PRESSLEY) So would it be fair to say, then, that -- well, have you developed an opinion as to whether SAWS's application should be granted or denied?

A No.

Q Please tell me your understanding of what authority is granted when an entity receives a CCN or an extension to an existing CCN.

A I don't know. That's outside my area of expertise.

Q Do you know what criteria should be considered by the TCEQ when determining whether to grant a CCN application?

A Am I familiar with that? No, sir, I am not. Again, that would require some research.

Q I believe earlier in your testimony you discussed some potential problems to water quality that could be associated with private wells.

A Well, it would be actually any well. It's not specifically limited to a private well, but --

Q I follow you. Could tell me, then -- I'd like to revisit that issue. And what I'm wondering is might there be instances where after a storm event, runoff

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could enter recharge zone, contributing zone through an existing well because it's not cased properly --

A Absolutely.

Q -- or some other --

A Yes.

Q Could you explain in your own words how that might happen?

A Sure. There's a number of different potential sources for contamination. Some of those are poor well construction standards or non-existent well construction standards, poor well construction or poor well maintenance.

And what that amounts to is that wells are commonly constructed in the area. Depending on the age of the well and the purpose of the well, it may be drilled for stock use and then converted to domestic use. It may be installed for -- specifically for domestic use.

So in the event that you have a well installed, the water quality standards -- previous water quality standards have a minimal amount of casing that was required at the surface. In the event that that casing was either not correctly installed and/or has failed through degradation, surface water contamination could run down a well and enter the aquifer resulting in contamination of the well and of the aquifer.

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Q And does EAA have a program where inspectors go look at these existing wells to determine whether there might be concerns?

A We have a program to inspect new well installations, and when we have complaints related to existing wells, my understanding is we have inspectors that go out. If the well has been technically considered abandoned, then we also have a program to identify those, and I know that we encourage people to properly seal those wells if they are considered abandoned.

Q And could you tell me, the EAA, does it require a permit be issued for the production of any amount of groundwater?

A It requires a permit for municipal, industrial or an agricultural use. For domestic use, if it falls within a certain category, then it does not require a permit, but it does require that you register your well.

Q And do you happen to know what that daily amount is?

A I believe it's -- well, my understanding is that domestic wells and stock wells are allowed to remove up the 25,000 gallons per day. There are some other criteria that may require you to have a permit based, again, on when you installed your well. Within a subdivision requiring platting, and some of the other

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criteria, I do not -- I'm not involved with that program enough to tell you the nuances of when you're required to have a well permit. Or I'm sorry. When you're required to have a withdrawal permit. You're required to have a well permit if you install the well since our regulations.

Q Are you familiar with -- currently for these two areas covered by these two applications whether there are any residents out there relying on existing wells?

A I am not specifically aware of any, but I would certainly assume there are some. If there are households out there that are not using wells, then -- if there are households out there and they're not connected to a public water supply system, they either have a cistern system or they're probably using a well system, well source.

Q All right. Let's shift gears. I believe earlier you testified that there could be water quality concerns associated with the use of septic tank systems?

A Uh-huh.

Q And could you please just generally tell me what those concerns are, again?

A Generally, the effluent coming out of the septic tank may not be sterile. There's certainly a number of studies associated with the fact that some of these

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septic system treatment processes where effluent from the septic tank enters the septic lines, septic system lines, and discharge into the soils or the gravels around those lines, the thought was that the bacteria that would grow and feed on those would actually help to neutralize pathogens. In reality, they sometimes do not function correctly and allow for a very rapid injection of effluent into the ground.

Currently the regulations are designed to determine whether the criteria that's commonly used to determine whether a septic system is functioning or not is whether waste basically emerges on the surface. If the material is short-circuiting the septic lines and going directly into the groundwater, there's really no good method to determine whether they are -- they are functioning or not. So out of sight, out of mind.

Q So do you know -- well, assume for this next question, assume that certain residences are on septic tank systems in these two areas covered by the applications.

A Right.

Q Is it fair to assume, then, that those types of concerns would be present?

A Yes, sir. Sure. Now, you know, the flip side of that discussion is that the septic tank offers some

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level of protection or some level of treatment by retaining, for some limited time, waste in the tank itself, which does offer some treatment.

Most systems right now that are going in are not septic tanks partially because there's usually insufficient soils in these areas to be able to have them work effectively.

Previously I understand that septic tanks were commonly installed by actually trenching into the rock and installing the lines around them. Currently the process most -- most on-site septic systems are using anaerobic processes, which are probably a higher level of treatment, and then spray irrigation out on to a field or on to a landscape. So those are basically point of discharge treatment systems.

Q Would you anticipate that there would be more or less environmental concerns if an area was served by septic systems or centralized treatment and not the -- not having a treatment plant here, but just the wastewater lines?

A Right. My grave concern actually would be for the sewer line systems, and the reason is the septic tank systems and the anaerobic -- the aerobic or the anaerobic systems, whichever is being used, are at least providing some modicum of treatment; whereas, just a general

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collection system does not. And so what you have is instead of having low dosages applied over a large area, if you have the failure of a sanitary line, a collection line, then you have no treatment concentrated in a small area. So -- you know, the potential to inject very large quantities of untreated sewage directly into the ground with a sewer system is much greater.

Q Would you anticipate -- back on the water quality issue again, but this time looking at private wells versus a centralized water delivery system.

A Uh-huh.

Q Would you think that there would be more or less environmental concerns associated with the use of a private well versus a centralized distribution system?

A I'm not quite sure I understand your question.

Q Earlier we talked about the possibility of either a private or a public well.

A Sure.

Q The infiltration.

A Right.

Q Well, let's say rather than having these private wells, if an area was served by a centralized water delivery system.

A Yes.

Q Would you think there would be more or less

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environmental concerns associated with the central system or the private wells?

A I think there would be different environmental concerns. You know, the private water supply wells do not have a requirement related to treatment and monitoring, so central distribution systems associated with public water supply do have requirements that they be tested for various contaminants on certain intervals.

And so some private water supply -- some folks who have private wells will do that. Many others do not, nor do they have the financial means to probably be able to treat for a -- test for a wide range of parameters.

Having said that, though, if you have a contamination problem associated with a private water supply well, you will impact maybe that person on the well.

If you have a contamination problem associated with a centralized system, you could have that problem with every well -- everyone. The example of that would be the Walkerton, Ontario, Canada, where if that well had been contaminated and it was a private water supply well, then those people who were basically using that well would have gotten sick, and probably no one would have even ever known or suspected the source;

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whereas, with the centralized distribution system, 2,000 people got sick.

So the problem you have there is a question of there are advantages and disadvantages to both systems. Does that make sense?

Q Yes.

A Okay.

Q And let's assume that the centralized transportation system is not transporting contaminated water.

A Uh-huh.

Q I can understand that was an example you used. But putting that example aside.

A Uh-huh.

Q Would you expect it to be greater or lesser environmental concerns by using that type of a system versus private wells?

A Okay. To the private water supply -- for the private use of the water supply itself, the -- I would think that the domestic water supply, the private water supply system, again, doesn't have the monitoring capability that, let's say, a public water supply system has.

The flip side of that also is that the degree of development or density of development there,

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especially in the contributing zone where water supplies are not nearly as prolific as the deep artesian, you don't get as much development because the ability to actually produce water out of the Upper or Lower Glen Rose limestone in the Cow Creek formation are much less, and so you see a lot of people who do not -- their well yields are much, much smaller, and so you see a lower -- to some extent, a lower density of development there.

If you run a centralized system and then you remove one of those impediments from development, so you would end up having more dense development and, therefore, would have a greater propensity for urban nonpoint runoff.

So it's -- there's no easy answer to your question. Whatever decision would be made will have both public -- will both have positive and negative impacts is what I'm saying.

Q Do you know if there are other regulatory bodies other than TCEQ that have regulations in effect that would impact water quality with respect to any development that occurs?

A The Medina County Groundwater District in Medina County may very well regulate water quality -- well, actually does regulate the installation and/or withdrawal of water in Medina County.

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In addition, the parts of northern Bexar County may very well be regulated by the groundwater conservation district -- the Trinity Glen Rose Groundwater Conversation District in northern Bexar County. So there would be some other groups that would -- would have some regulations there.

Q All right. Do you know whether the city of San Antonio or any county government has land use regulations that could affect water quality?

A I would assume that they do through their zoning processes.

Q But that's not your area of expertise?

A No, sir. No. The specific questions regarding that would probably be best asked to people that deal with zoning issues. I'm just a lowly hydrogeologist.

MR. PRESSLEY: Let's go off the record for a second, please.

(Recess taken, 11:47 to 11:48.)

Q (BY MR. PRESSLEY) As you sit here today, is it your opinion that there should be no additional growth in the two areas covered by these applications?

A I really haven't formulated an opinion on those particular areas. I have opinions about growth, but those have to do with a larger issue.

Q So if these applications were granted and SAWS

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CCN was expanded to cover those areas, you would not oppose granting the CCN application because of concerns you have about additional growth?

A I do not have an opinion on those particular applications at this time. I certainly would have reserved the right to develop one if I was asked by our authority and would do so.

Q Can you point out on this map where you live?

A Yes, sir. Maybe. If my glasses are good enough. Let's see here. I believe I live right about there (indicating).

Q And could you just verbally explain what it's close to?

A I live within the -- I live near the intersection of Wurzbach Road and Vance Jackson, north of 410.

Q And is that in -- according to this map, is that in the recharge zone? The artesian zone?

A It is not in the recharge zone, nor artesian zone.

Q Okay. Let me go back to my notes. I believe earlier you testified that -- and this might happen more with private wells because they would be relatively shallow -- that there could be water quality concerns there because of certain contaminants that might be in a

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relatively shallow level rather than the deep artesian zone?

A I can clarify that. Domestic wells -- I believe domestic wells are -- or wells are being used for domestic purposes throughout the region, both in the artesian end and the recharge area, and then what we call the transition zone, which is the area between the recharge zone and the artesian area.

So the concern would be that I believe the closer your well is to, but certainly not restricted to the recharge zone and/or the artesian zone, then I believe that there is a higher potential for susceptibility and contamination, but that doesn't mean the contamination problems would not be expected in the deep artesian zone for various reasons.

We know we've had those related to well construction issues at Kelly Air Force Base which is in the deep artesian zone. So those contamination problems can -- depending upon the mechanism -- really occur anywhere in the aquifer.

Q And do you have any knowledge of whether in the areas covered by the application there are those types of relatively shallow wells being used?

A I am not aware of any specific wells, but I would assume that there are probably shallow wells that

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use -- well, actually, I would suspect that there probably -- looking at the map -- may be a few wells that are intersecting the Edwards, but actually most of those would probably be into the Glen Rose because in the area that you're looking at, the Edwards limestone is relatively thin in some of those places. So what happens is people will drill wells through the Edwards limestone into the Upper or Lower Glen Rose formation.

Q But you don't know that to be the case, just hypothetically if --

A Well, that is consistent with what we're seeing in other areas where I do know wells and there's no reason for me to be believe that would be different here.

Q Right. But if somebody was using a relatively shallow well, then the concerns you addressed earlier would be --

A Sure. Yeah. Absolutely.

Q Would be relevant to --

A And even -- even with a deep well, it would go back to, again, questions related to well construction practices. You know, if you've got a very, very deep well and you only have ten feet of casing and it's rusted in half, well it probably wouldn't make any difference. You're still going to have surface water -- surface contamination entering the aquifer.

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Q If these -- if SAWS's applications are granted, do you know whether SAWS will have to apply and receive additional authorization to produce groundwater and able to provide those areas with water?

A I do not know that. I know they hold a withdrawal permit from us. I do not know how much of that permit is being utilized, whether they would have to acquire additional water rights or whether they have sufficient water rights in reserve.

Q So you have no opinion as to whether if the CCN applications are granted, providing the water would lead to any type of reduced artesian flow from Comal Springs or San Marcos Springs?

A Well, again, it would depend on whether they are pumping the water or not. If they -- or where they are acquiring the water from. And so again, you know, if they're buying -- if SAWS was going to purchase additional water from other users that currently aren't using their permit, then the answer would be yes, it probably would to some degree. I don't know what that is yet.

If they are using that water to meet that demand and they are supplementing their total water demand by other sources, such as source waters out of other aquifers to the south which SAWS is starting to

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utilize, then it may very well have no effect on their permit because they basically are substituting, you know, water from one permit for another permit, so there wouldn't be any increased volume of water withdrawn.

Q I didn't object to that response because I'm assuming that we're going to get to where we need to be, how you respond to this next one.

A Yeah.

Q Let me know if I'm mischaracterizing what you said, but I think you were --

A I'll try and clarify it.

Q Sure. Sure. That's fine. I think you were using a little bit of conjecture and speculation there --

A Yeah.

Q -- as to there might be. And my question was -- and perhaps I should have phrased it better, but my question is: Do you know whether if these applications are granted that will have an adverse effect on the amount of water that's available for discharge at Comal or San Marcos Springs?

A If you withdraw that water from the Edwards and it's additional water that's not being pumped now, then the answer is yes.

Q But you do not know whether it would be additional water?

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A No, because there's a lot of -- a lot of management options that SAWS has, and has -- that has been implemented to great -- to their great benefit and the benefit of the region. They have started to look at other sources outside the Edwards.

Q Okay.

A So, yes. So a lot -- a lot of that is really a management decision on how they handle their water supply, and it's based on lots of factors associated with everything from, I'm sure, economics of pumping to, you know, integration or networking that, and I don't -- I really don't know much about that.

Q If these applications are granted, do you know of any direct adverse water quality effects that would result from SAWS providing water to those areas?

And again, not -- I don't want you to speculate here. I'm asking do you know of any direct adverse effects on the water quality that would occur if SAWS provided water to this area?

A Again, I probably don't have enough information to be able to respond to that because again, I haven't looked at the applications at all, so I really don't know whether that would be the case or not.

Q So you have no reason -- well, let me rephrase that.

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You have no reason to suggest or to recommend, rather, that these applications be denied for water quality purposes?

A Well, I would -- with these particular applications, these particular areas, the answer is I really don't have an opinion on those.

Q Okay.

A In general, I would say that --

Q Well, that's fine. You've answered.

A Well, I may have answered your question. I need to make sure I answer it for me.

MR. PRESSLEY: Well, then I'm going to have to object as this response being nonresponsive to my question.

A Well, that's okay. You can do that, but I do need to finish it because I took an oath and will do so.

The concern I have is that the aquifer basically is recharged from water that flows off the contributing zone into the recharge zone. Any activity in those areas has the potential for degrading water quality. As more of that development occurs, then we should see changes in water quality and we've seen those with the releases of certain hazardous materials.

So my concern is not for these specific areas. I don't rate them any more or any less than any

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other development in the recharge zone, but the fact is that development in the recharge zone over the aquifer does have water quality impacts. We do see that.

Q (BY MR. PRESSLEY) Speaking generally.

A Yes.

Q Not speaking with any specifics associated with these applications.

A There's no reason for me to think that those areas that are being singled out in themselves are any way less or more vulnerable or create a vulnerability of the aquifer that may be greater or less than other areas that have already been developed.

Q But you have not reviewed the applications?

A No, sir. I haven't.

Q You do not know what those applications would grant by way of authority?

A As far as -- as far as that's concerned, no, sir. I would assume that it would be consistent with other development I've seen in the recharge zone.

Q You --

A They may or may not be. I do not know.

Q And you do not know what criteria TCEQ should consider in determining whether to grant the applications?

A Well, I'm aware of the TCEQ's requirements

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related to how they develop those areas, and that's -- and I would assume that there would not be any special regulations for these areas.

Q And perhaps --

A So they would apply those regulations consistently.

Q Perhaps, again, I wasn't clear. I'm not talking about the Chapter 213 development regs.

A Okay.

Q These are -- you don't know what criteria the TCEQ will consider to determine whether to grant the CCN applications?

A Right. I think that that's actually regulated in a different area, but I'm not positive, and it has to do with -- you know, I guess demands and needs and that. To be honest with you, I'm not as familiar with those requirements as I would be, let's say, with TCEQ 213. So I don't know that.

MR. PRESSLEY: Pass the witness.

MR. ALLMON: Do you have any questions?

MR. HUMPHREY: I have nothing.

MR. ALLMON: I'll just ask a few more questions.

THE WITNESS: Sure.

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EXAMINATION

BY MR. ALLMON:

Q We discussed that you had not actually performed tracer tests in these two areas of the applications?

A No, we have not.

Q But you still have an opinion as to the direction and speed of the groundwater flow?

A Well, we know that there are karst features up in that area, and karst features are indicative, again, of preferential flow paths and probably rapid groundwater velocities. There's no reason to think that contaminants in that particular area would behave any differently than other areas where we've done that tracing.

Water gets into the aquifer. It obviously recharges the aquifer. We see that through the presence of dry streams, springs, caves, et cetera. So there's nothing unique about the geology there that I would be aware of that might create a reason why it may be either more vulnerable or less vulnerable.

Q So what is the direction and the speed of groundwater flow again that you've --

A In that area?

Q -- stated in your opinion --

A That area I do not know because we have not tested it. I don't see any reason why it would be

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sufficiently different than other areas we have tested, so I'm not aware of any -- anything geologically that would rely -- that would indicate that it would be any different.

Q And specifically as a matter of a compass direction, what direction generally would you think water would flow from those areas?

A There has been a lot of speculation related to groundwater flow in that area. The general consensus is that -- well, let me back up and say the general consensus is that the groundwater flow may be impeded by a series of large faults that occur in the Medina Lake area, south of Medina Lake.

Some of those large faults extend north up into Bexar County where we have tested them with our tracer testing. We have found that the general consensus in that area in Bexar County is wrong. I would certainly think that testing those hypotheses that these faults may act as large barriers and push water to the -- to the west may also be wrong.

I have looked at data in the area where we've got potentiometric surface maps. I do not see where those faults really are resulting in what I would call impeding water there and some of the other characteristics that you would expect of a fault to

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create in a potentiometric surface map to necessarily lead me to believe that that's what those faults are doing. The -- you know, it would need to be tested.

Normally, I would probably say that, you know, I think that water flows vertical, you know, down the potentiometric surface, and that probably is north -- generally north to south, and there may be some differences in north to southwest, north to southeast, but it would generally flow from the contributing zone through the recharge zone into the artesian zone.

Q Okay.

A The only way to know that for sure would be to go out and do a series of tracer tests.

Q And would you able to indicate generally on here where the contributing zone, recharge zone, and artesian zones are --

A Well, they're --

Q -- close to this area?

A I would assume -- again, I haven't checked your map, but I would assume that these areas are properly mapped on here, that these coverages are available to most people -- to folks working in the area, so they're properly mapped on this map. I'm going to make that assumption. So I haven't compared this map to our maps.

But basically the area seen as outlined in

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blue here appear to be the upper limit of the recharge zone here, which would be -- that upper portion of the recharge zone would include -- would go through parts of the application there, what is it, 35445, parts of application 35484. And I assume this is another application and part of that you are contesting? I don't know.

Q We're not concerned with that one right there.

A All right. This -- part of this area is within the contributing zone, the northern part of it is. The southern part of it appears to be in the recharge zone at least for 35445. It looks like a very, very small edge of the contributing zone -- I mean, the recharge zone is included in 35484.

That doesn't mean that there isn't groundwater flow coming out of the contributing zone and directly recharging the Edwards through transformational flow. It certainly does occur in areas just to the east of there where we've done extensive dye tracing and the Department of Defense has done extensive dye tracing. I wouldn't expect there to be really -- you know, that would need to be tested, but I wouldn't expect to see a lot of difference in that over there.

Q What's the hydrologic significance of the contributing zone?

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A It basically is the area that collects and contributes water to the recharge zone for recharge. So you can think of it as the large collection area, the water shed above the area that collects the water and places it into the aquifer -- surface water.

Groundwater systems seem to have lower -- well, the groundwater systems may also -- in the Trinity and Upper Glen Rose may have cross-formational flow into the Edwards. We've shown that through our tracer tests.

Q Okay.

MR. ALLMON: That's all my questions.

MR. PRESSLEY: Nothing further.

MR. HUMPHREY: Nothing from me either.

(Deposition concluded at 12:06 p.m.)

CHANGES AND SIGNATURE
WITNESS NAME: GEARY M. SCHINDEL DATE: MARCH 13, 2008

PAGE	LINE	CHANGE	REASON

I, GEARY M. SCHINDEL, have read the foregoing deposition and hereby affix my signature that same is true and correct, except as noted above.

_____
GEARY M. SCHINDEL

THE STATE OF _____)
COUNTY OF _____)

Before me, _____, on this day personally appeared GEARY M. SCHINDEL, known to me (or proved to me under oath or through _____) (description of identity card or other document) to be the person whose name is subscribed to the foregoing instrument and acknowledged to me that they executed the same for the purposes and consideration therein expressed.

Given under my hand and seal of office this

_____ day of _____, 2008.

_____
Notary Public in and for the
State of _____

SOAH DOCKET NO. 582-07-3140
TCEQ DOCKET NO. 2007-0477-UCR

APPLICATION OF SAN ANTONIO WATER SYSTEM TO AMEND ITS CERTIFICATE OF CONVENIENCE AND NECESSITY NO. 10640 IN MEDINA COUNTY, APPLICATION NO. 35484-C) BEFORE THE STATE OFFICE OF ADMINISTRATIVE HEARINGS

SOAH DOCKET NO. 582-07-3141
TCEQ DOCKET NO. 2007-0719-UCR

APPLICATION OF SAN ANTONIO WATER SYSTEM TO AMEND ITS CERTIFICATE OF CONVENIENCE AND NECESSITY NO. 10640 IN MEDINA COUNTY, APPLICATION NO. 35445) BEFORE THE STATE OFFICE OF ADMINISTRATIVE HEARINGS

REPORTER'S CERTIFICATION

ORAL DEPOSITION OF GEARY M. SCHINDEL

MARCH 13, 2008

I, SHARON L. MCDONALD, Certified Shorthand Reporter in and for the State of Texas, hereby certify to the following:

That the witness, GEARY M. SCHINDEL, was duly sworn by the officer and that the transcript of the Oral Deposition is a true record of the testimony given by the witness;

That the deposition transcript was submitted on _____ to the witness or to the attorney for the witness for examination, signature, and return to me by _____;

That the amount of time used by each party at the deposition is as follows:

MR. ERIC ALLMON - Time Used
MR. ROBERT PRESSLEY - Time Used
MR. SCOTT HUMPHREY - 00:00

That pursuant to information given to the deposition officer at the time said testimony was taken, the following includes counsel for all parties of record:
MR. ERIC ALLMON, Counsel for Greater Edwards Aquifer Alliance;
MR. ROBERT PRESSLEY, Counsel for San Antonio Water System;
MR. SCOTT HUMPHREY, Counsel for Office of Public Interest Counsel, Texas Commission on Environmental Quality.

I further certify that I am neither counsel for, related to, nor employed by any of the parties or attorneys in the action in which this proceeding was taken, and further that I am not financially or otherwise interested in the outcome of the action.

Further certification requirements pursuant to Rule 203 of TRCP will be certified to after they have occurred.

Certified to by me this day of , 2008.

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The original deposition was/was not returned to the deposition officer on ;

If returned, the attached Changes and Signature page contains any changes and the reasons therefor;

If returned, the original deposition was delivered to MR. ERIC ALLMON, Custodial Attorney;

That $ is the deposition officer's charges to the Greater Edwards Aquifer Alliance for preparing the original deposition transcript and any copies of exhibits;

That the deposition was delivered in accordance with Rule 203.3, and that a copy of this certificate was served on all parties shown herein.

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