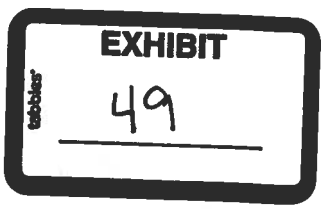
AGO Exhibit 49

2007 testimony of Clint Marshall, vol. 11, pp. 2911-70 [direct examination]



STATE OF NEW MEXICO

WATER QUALITY CONTROL COMMISSION

WQCC 03-12(A) and WQCC 03-13(A)

IN THE MATTER OF:
APPEAL OF SUPPLEMENTAL DISCHARGE
PERMIT FOR CLOSURE (DP-1341) FOR
PHELPS DODGE TYRONE, INC.

PHELPS DODGE TYRONE, INC.,

Petitioner.

TRANSCRIPT OF PROCEEDINGS

BE IT REMEMBERED that on the 6th day of September, 2007, the above-entitled matter came before the New Mexico Water Quality Control Commission, taken at the New Mexico State Capitol Building, Room 309, 490 Old Santa Fe Trail, Santa Fe, New Mexico, at the hour of 8:36 a.m.

VOLUME 11

A P P E A R A N C E S

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I N D E X

MS. PADILLA: Come back on the record, and we'll move to Mr. de Saillan with your next witness.

Just a quick reminder. It's five until 4:00. We do need to vacate the room by 5:30, so keep that in mind in terms of the presentation and your schedule.

MR. DE SAILLAN: Thank you, Madam Chair.

For our next witness, the Environment Department calls Mr. Clint Marshall.

And Mr. Kevin Myers is here, as well. He's going to be our audiovisual man for today.

CLINT MARSHALL

having been first duly sworn or affirmed, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. DE SAILLAN:

Q. Please state your name.

A. Clint Marshall.

Q. What is your current position?

A. I'm presently employed as a senior hydrogeologist with the Groundwater Quality Bureau of the New Mexico Environment Department.

Q. And how long have you held the position of hydrogeologist in the Groundwater Quality Bureau?

A. Fourteen years.

Q. Could you please describe your education and

relevant experience?

A. I have a bachelor's of science and a master's of science in geology from the University of Houston. I have also completed a summer program in groundwater hydrology at Oklahoma State University.

I was employed as an exploration geologist with Marathon Oil for four years in Midland, Texas. I also did a brief stint with the Environmental Protection Agency in Dallas in the RCRA permitting program.

Q. And what are your responsibilities as senior hydrogeologist at the New Mexico Environment Department Groundwater Quality Bureau?

A. I oversee all aspects of discharge permits under the Water Quality Act, including operations, monitoring, reclamation and closure of mine facilities. I conduct facility inspections, observe fieldwork, including site investigations. I monitor facilities for compliance. I review engineering plans and specifications. I conduct enforcement actions pursuant to discharge permits and abatement plans.

I oversee all operational and closure issues related to the Tyrone Mine. I'm also the permit lead for five operational permits and the closure permit, DP-1341, at the Tyrone Mine. I'm also the operation team leader for all mining discharge permits in the

State of New Mexico.

Q. Mr. Marshall, I'd like to direct your attention to your written testimony, which is NMED Exhibit Number 15, and I want to ask you if there are any little corrections that you want to make to that written testimony.

A. Yes, there is.

We could begin on page 3, at the top. The very first line continues from the previous page, and it says "would fill within 40 to 50 years -- 40 to 50 years." That should state "would begin to fill within 40 to 50 years." So there's a couple of words that need to be inserted there.

If we move down to the fifth line of that same page, the first two words say "five-fold." They should say "four-fold."

Moving to the next page, that would be page 4 of my written testimony, the third line down from the top, about the center of the page, it says "Precambrian Burro Mountain granite." It should say "Tertiary quartz monzonite."

Want me to repeat that?

MR. SLOANE: That would be good.

MR. MARSHALL: Tertiary quartz monzonite.

It's a type of rock. Maybe not real

important, but --

MS. GOAD: Tertiary quartz what?

MR. MARSHALL: Tertiary quartz monzonite.

MS. MALAVE: Instead of the granite?

MR. MARSHALL: Instead of the Burro Mountain granite, correct.

MS. MALAVE: Oh, all of that should be deleted.

MR. MARSHALL: Right. The "Precambrian Burro Mountain granite" should be scratched.

And moving to the page 8, third line from the bottom, the line starts off "scenario after the pits fill up." It should read "scenario after the pits begin to fill up." So again, inserting the words "begin to."

That's it.

MR. DE SAILLAN: Thank you, Mr. Marshall.

And again, the Environment Department would be willing, if the Commission would like, for us to provide some replacement pages, but --

MS. PADILLA: I don't think that's necessary.

MR. DE SAILLAN: If you don't think that's necessary, then we won't.

Q. Now, Mr. Marshall, let's move on to the hydrology and geology of the Tyrone Mine.

And before you begin, I'd like you to explain

NMED Exhibit Number 17, which I understand you're going to be referring to in this part of your testimony.

A. Yes. Madam Chair, members of the Commission, we've got -- actually, you all have copies of these exhibits in front of you. I'll be working off the -- the posters here behind me. Actually, at one point, I'll have two easels up here, but we'll start off with one.

We also are providing the slides up here on the screen just in case we need to kind of look up close at some of the exhibits, at least for my -- my exhibit anyway. We'll have them up here on the screen. They may be used in some other people's exhibits.

And I'd just like to start off talking about this presentation that -- actually, my presentation really focuses on the lower half of the Tyrone Mine. That's what's referred to as the central mining district. It's where all the stockpiles and the pits are located.

However, after a -- seeing all this discussion yesterday on just the tailings, I'm a little bit regretful that maybe I didn't include that, as well, especially after seeing what Tyrone is presenting in their case. Therefore, I will try -- I will be relying to maybe a little bit extent.

If we do want to talk about the tailings to any great extent, I'll use Mary -- Ms. Menetrey's Exhibit 13, which includes the entire mine site, including the tailings.

Also, Mr. Blandford has been very kind to provide me with all of his exhibits, as well, because Daniel B. Stephens always has the best maps at these hearings. Their exhibits are excellent. And actually, when it comes down to talking about mine boundaries, I really have to rely on their exhibits, because ours really don't have that boundary.

Working for the Groundwater Quality Bureau, we don't really deal with boundaries too much.

First of all, though, I would like to start off with Exhibit 17. And we can turn down the lights maybe a little bit to see that better, and if -- now, Exhibit 17, this is a geologic map of the lower portion of the Tyrone Mine. It's a little bit more detailed than Mr. Shomaker's map. And if you -- if you all remember that from the part one of the hearing, he provided a more general geologic map.

This is really much more focused. This map was produced by Daniel B. Stephens, which is Mr. Blandford's company. It was provided to us in one of Phelps Dodge's reports. And we're just using it here

to talk about the geology. I think it's one of the best maps we have, just to talk about the general geology in the area.

So I'd like to explain a few things on the map first. And I know the colors really don't come out so well on the -- on the screen up there, but if you'll refer to your handouts.

Again, this is the lower portion of the mine -- of the Tyrone Mine.

And you'll see a gray line actually that kind of wiggles down through the -- through the different colors on the map. And you'll recognize it looks actually fairly similar to the MMD boundary. And it may be. I actually can't vouch for that at this point, because I didn't make the map. But it's -- it seems to be very close to the MMD boundary. And the MMD boundary does kind of -- it has moved around a little bit in the past, especially down in the southwest corner, where they've added some property.

But that kind of gives you an idea of the location of the mine itself since the mine disturbances aren't on here.

Now, we've got a -- again, just to orientate yourself, we've -- up to the southeast, on the southeast flank of the mountain, we have the Little Burro

Mountains, that run in a northwest/southeast direction. And then down to the southwest of the mine -- and I'm pointing to the lower left-hand corner of Exhibit 17 -- the Big Burro Mountains are located on the southwest flank of this map.

Now, we've got three different colors -- or actually four different colors of rocks in this area.

The pink color represents the quartz monzonite, Tertiary quartz monzonite. This is an intrusive body, and this rock primarily holds the copper deposits, the intrusive rocks that Tyrone is presently mining for copper.

The green is the Burro Mountain granite. It's Precambrian in age, and especially the country rock. I believe this is also the rock that makes up most of the Big Burro Mountains, which is located southwest of the site. But it does exist within the mine area itself.

This dark yellow, kind of orange color is what's referred to as the Gila Conglomerate. We've heard a lot of discussion about that. This is a Tertiary or maybe a Quaternary deposit, also, that actually overlays the igneous rocks, the quartz monzonite, the -- the Cambrian granite, as well as some volcanics in the area. It's a valley fill. It kind of filled the low spots that occurred after faulting in

this area.

Now, the light yellow -- the light yellow is alluvium, and it follows the major stream drainages in the area. And I'll talk about those more in a minute. But this map here actually shows probably, for the most part, where the locations of a lot of those alluvium channels are. And we'll talk about the alluvium a lot more later in my talk.

But this probably gives the most detailed picture of where a lot of those channels -- although not all of them, by any means, lie.

Now, you see a bunch of black lines running through the map. These are the faults in the area. Some are smaller than others. But you can see an obvious grain that kind of orients itself kind of in a north -- in a southwest/northeast direction through the mine area. A lot of this faulting is perhaps associated with the igneous intrusion which brought in the copper deposits which Tyrone Mines. So the area is heavily faulted.

I'd like to talk about some of those faults now, some of the major faults anyway, because this is what affects groundwater levels in the area, and I think it's important to kind of get a good grasp on that.

We've heard a lot of talk about the Mangas

Fault, and that's the black line that runs in a northwest/southeast direction on the northeast flank of this area on this map. It's a regional fault. I think the throw on this fault -- when I talk about throw, I'm talking about displacement between the two blocks of rock on each side of the fault.

I know you can't record that on your -- but there -- and if you'll notice on your -- your handouts, also, there's a U and a D associated with some of these faults. That tells you that one block is downthrown with respect to the other.

The Mangas Fault is a large regional fault in the area as part of the -- based on the tectonic regime that occurred across this area. It's got a throw on it of at least, what I've been told, 1,300 to 1,500 feet. So it's -- it's quite a large fault in the area, and quite extensive, too.

Other major faults in the area include the Sprouse-Copeland Fault. It's mostly buried under Gila Conglomerate, sits on the east side of the mine here. But it's a very important fault, and I'll be talking more about that in a minute. It's oriented in a north/south direction. And it is downthrown to the east. So the west block towards the mine itself is the upthrown block.

Another major fault in the area is the Burro Chief Fault. You can see it kind of angling in from the southwest, kind of curving northward up through the mine, and actually, I think, goes into the pit in places, or close to the pit, actually, just west of the pit. It is downthrown to the east, as well. So the upthrown block is higher than the -- the upthrown block on the west side is higher than the block on the east side.

Another major fault in the area that we will hear about -- we've talked about already, actually -- is the Southern Star Fault. It's located up on the north side. Again, it's mostly a buried fault. It's buried under Gila Conglomerate. It's downthrown to the north, so the southern block is actually higher.

And those are kind of the major faults that bound the area. We also have a couple of others.

You see the Virginia-Racket Fault. Actually, there's no throw on it, and I don't really know what the throw is on that particular fault. But we do have some fairly large faults in the area, although we don't really deal with them from a regulatory standpoint because they're really deep within the mine, and not very accessible, so we can't really talk about -- I can't really give a whole lot of detail there regarding

those faults.

Q. Mr. Marshall, next could you describe the surface water hydrology around the Tyrone Mine site, and if you could do so with reference to NMED Exhibit Number 18?

A. Now, is that 18? Is that 18, or is that 19?

MR. BUTZIER: It's 14, isn't it?

MR. MARSHALL: There we go.

According to my poster here, this is Exhibit 18. Okay.

This is perhaps not the best map to show the drainages, so I'm going to refer back to Exhibit 17 here in just a minute, because I actually think that, in a lot of ways, shows the major drainages a little bit more, but this actually does show some of the drainages on the -- on the map -- around the Tyrone Mine itself. I'll explain a lot more of these features in a minute.

But primarily the major features that we want to talk about at the moment -- again, you see the -- the mine itself, you see some light blue -- actually, they appear to be almost green lines, in and around the mine site. And these basically kind of outline where the various discharge permits are within the mine.

Here within the Environment Department -- or within the Groundwater Quality Bureau, when we talk

about discharge permits, we don't really talk about boundaries that much, but nevertheless, it's also -- it's helpful to at least show the locations, and we do that with lines, and we will do that throughout our presentation here.

The black dashed line that runs from the southwest to the northeast through the center of the mine is the Continental Divide.

And what I want to talk about as far as surface water drainages, they actually appear as light blue lines, and they don't really show up well on this particular map, so -- but I'll go ahead and point out their general location and refer back to Exhibit 17.

Now, since we have the Continental Divide running right through the center of the mine, we're dealing with two river basins. We've got the Gila-San Francisco River basin to the northwest, and we've got the Mimbres River basin to the southeast. These are the same -- these also correspond to the groundwater basins, and I'll talk more about those in a minute.

But all the surface water basically northwest of the mine kind of flows towards the Gila River, and all the drainages southeast of the Continental Divide flow eventually toward the San Vicente Arroyo and the Mimbres River.

The major drainage, probably the largest drainage in the area, is the Mangas Wash. And we've heard about that one. It starts at the Continental Divide on the northeast side of the mine and flows northwestward, down a large valley, and eventually joins with the Gila River.

Over here on the west side of the mine, you'll see a word over there called Deadman Canyon. That refers to a drainage that runs -- actually flows in a northerly direction from the Continental Divide, along the west flank of the central mining area, comes up around the tailings and eventually joins with Mangas Wash. And I'm talking about this particular drainage right up here.

So those are the two major drainages on the Gila-San Francisco side.

On the Mimbres side, which is down here on the southeast side, we've got Brick Kiln Gulch. Brick Kiln Gulch actually starts exactly where Mangas Wash does, but it flows in a southeasterly direction off the Continental Divide. It eventually joins with the major drainage that comes along the southern part of the mine, Oak Grove Draw, and they join together about a mile east of the -- of the main central mining unit.

Q. (BY MR. DE SAILLAN) Can I interrupt you there

just a second --

A. Yes.

Q. -- Mr. Marshall?

Oak Grove Draw, is that also sometimes known as Oak Grove Creek?

A. It's called several things. They all have Oak Grove in them, creek, draw, wash. It's more -- most commonly referred to as Oak Grove Draw. In this particular -- yeah. They put creek on here. I didn't make this map, so -- but yeah. Oak Grove.

So again, these two drainages join just about a mile east of the site and then flow southeasterly from there.

We have some other drainages farther up in Mangas Valley, but I don't think it's really important at this point to talk about those. They're tributaries primarily to Mangas -- Mangas Wash.

Q. Okay.

Could you next describe the groundwater hydrology around the Tyrone Mine, and again with reference to NMED Exhibit Number 18?

A. In talking about groundwater hydrology of the mine site, I kind of want to divide this up.

First of all, I want to talk about the basins. We have two groundwater basins. They coincide roughly

with the surface water basins in the area. Again, we've got the Continental Divide, that runs through the middle of the mine, and the Gila-San Francisco groundwater basin is the basin on the northwest side of the mine.

On the southeast side of the -- on the southeast side of the mine, we have the Mimbres groundwater basin. So all groundwater -- basically in these two general areas, we have groundwater flow that moves into these two basins from the Continental Divide itself.

Now, Tyrone Mine -- they're mining the area, and they've created several pits in the area. So the pits themselves act as kind of miniature groundwater basins. So groundwater in the vicinity of the pits themselves actually flows into the base of the pits.

We've got the Main Pit, which is by far the largest pit in the area, we've got the Gettysburg Pit, which is located in the southwest corner -- or southeast corner of the mine, and we also have the Copper Mountain Pit.

Now, these two smaller pits do gather water. The Gettysburg Pit gathers a little bit of water, does intercept groundwater, Copper Mountain to a lesser extent. But the Main Pit intercepts -- is the deepest well and intercepts most of the groundwater on the site.

Now, on top of this second -- you know, aside from the groundwater basins themselves, we also have an aquifer system, and a rather complex aquifer system here. We've actually got two aquifers. We've got the regional aquifer, which we've heard a lot of discussion about, and we've got an alluvial aquifer. And the alluvial aquifer primarily coincides with a lot of the major drainages in the area. They both exist on each side of the groundwater divide.

I'd, first of all, like to talk about the regional groundwater. It's a primary source of domestic -- domestic water or domestic use in both basins, including the Silver City -- Silver City itself, its well fields, basically. This is the big aquifer that they tap. It resides in different rock bodies depending on which part of the -- you know, wherever you're talking about at the -- in various areas. And here that plays an important role.

I'd like to start off on the north side of the mine itself. And when I say north side, I mean north side of the central mining area.

Up here we -- on the regional aquifer is the Gila Conglomerate. And the water is approximately 40 to 90 feet below ground surface in this area. It's fairly accessible. It's been -- it's got a lot of historical

use associated with it.

On the east side of the mine -- and again, I'm talking down here on the -- on the east flank -- and south of the Mangas Fault, it also -- we have regional aquifer. The regional aquifer down here is also the Gila Conglomerate. The difference here is, though, the depth of water is 500 to 600 feet below groundwater. So that's an important distinction, and I'll talk a little bit more about that in a moment.

So the regional aquifer on the east side, on the north side, Gila Conglomerate. Within the mine itself, it resides in igneous rocks, the Precambrian granite, the Tertiary quartz monzonite. This is where we've heard a lot of talk about fractures. In the Gila Conglomerate, you're talking about an intergranular porosity. The water resides between the grains of sand and gravel that make up the Gila Conglomerate.

Within the igneous rock, it resides within fractures. And that's a much more complex situation. It's a very high -- variable hydraulic conductivity. The permeability of the rock itself, you can have a good well if it hits fractures, and you can have a not so good well if it misses the fractures.

Now, again, I'll talk about the main pits in the area. They are embedded -- the base of these pits

basically are in -- in the igneous rock. Okay. They're down in the Tertiary quartz monzonite, the granite, I don't know which. They've actually gone through the Gila Conglomerate, most of these, at least the Main Pit. And they collect regional groundwater at the base of these.

The Main Pit itself pumps -- what I've been told recently is about 1,300 to 1,400 gallons per minute.

Now, the faulting that I talked about in the area -- and I'll move back to Exhibit -- Exhibit 17 again. This is a geology map. We've talked about all these faults. The faults actually affect the groundwater levels in the area.

Some of the major faults that affect groundwater level are, of course, the Mangas Fault, the big fault that I talked about, runs over here -- it's over here on the northeast side of the mine. Groundwater in this area generally drops as you move from north to south across that fault. It's at a shallower level on the north side of the fault, it's deeper as you cross that fault.

Sprouse-Copeland Fault, again, we see a drop of groundwater as you move from west to east across that fault. It drops from about 200 feet below ground

surface to about 500 to 600 feet below ground surface. So substantially affects the level in that area.

Burro Chief Fault, we also see a drop here of about 200 to 300 feet as you move from west to east across the Burro Mountain. Again, the groundwater level drops.

And the same thing with the Southern Star Fault on the north side. As you move north across the fault, the groundwater drops by about 200 feet.

And those are my estimates. I mean, they may vary as you move along the fault, but I'm giving you general numbers here, but -- I think you get the point.

I keep talking to this side. I'm sorry. I'm ignoring everybody over here. I'll try to do better.

MS. PADILLA: We're listening anyway.

MR. MARSHALL: So the -- what's important about this drop in level -- and you've heard this in previous testimony already -- it gives a sense -- or basically what it's doing is -- what we see is these faults kind of act as a dam, they tend to restrict horizontal flow as water moves up against these faults, basically, and that's essentially what causes this drop.

Dr. Shomaker, though, also talked a lot a bit -- a little bit about the significance of faults putting one type of rock against another, and that's

also important. And that's, again, what kind of affects the water levels in these areas. You've got a highly conductive material such as Gila Conglomerate against maybe a tighter rock such as Burro Mountain granite, so -- and that's -- that's very true at this point.

The thing that's kind of significant about these faults, though, it does significantly affect Tyrone's ability to -- to exercise its pit capture zone that we keep talking about, in other words, control the water levels in the regional aquifer through pumping of the pits. And we see that on the groundwater -- on the groundwater level maps. And I'll talk a little bit more about that in a minute.

Now, the other aquifer that we're talking about in this area is the alluvial aquifer. And that's not as extensive as the regional aquifer. It's located in these alluvial channels. And that's those little yellow channels that you see strung out all over the place up here.

Q. (BY MR. DE SAILLAN) Mr. Marshall, could I interrupt you just a second?

These alluvial channels that you're referring to, do these roughly correspond with the surface water streams that you were talking about a minute ago on the other map?

A. Yes, they do. And they're actually -- on Exhibit 17, they're delineated in this kind of light yellow, which designates the presence of alluvium on the geologic map. This is the -- this is the location -- or approximate location, for the most part, of the alluvial aquifers that we talked about in the area.

Now, the alluvial aquifers are where the present day drainages have actually eroded into the rock. And it may be igneous rock. Most of it in this area is Gila Conglomerate.

They dug these large channels, it's filled up with this very porous, sandy material, alluvium, and water resides at that permeability barrier, at the base of the alluvium, where it rests either on top of bedrock or it rests on the -- when I say bedrock, the igneous rock -- or it rests on the Gila Conglomerate itself.

Now, the groundwater -- depth to groundwater in these -- in this -- in these particular aquifers varies significantly, but generally it's on the order of about 10 to 50 feet below ground surface.

The important thing to realize about this aquifer, it's not affected at all by the pumping of the pits. I mean, you can pump the pits as much as you want, but this stuff remains perched or suspended within the alluvium itself in these channels.

So that's kind of a brief synopsis of the groundwater conditions in this area. I think we'll have a little bit more discussion later on as questions come up.

Now, the groundwater flow in the area is a -- is the other aspect that I want to talk about, and that's actually the movement of groundwater within the mine -- Tyrone Mine itself and around the Tyrone Mine.

Again, I've got Exhibit 18, I'll put back up.

Now, I've explained some of these features already. We've got the Continental Divide. We've got the surface water drainages. This is basically kind of a rough topo map. The yellow -- the dots on the map I'll talk a little bit more about in a minute.

I've actually got another map, Exhibit -- what's this one -- I think Exhibit 19 is the same map just without the blue arrows on it or the Continental Divide. It kind of clears up the map a little bit so I can talk about the water quality, which I'll do in a minute.

But first of all, I'd like to talk about the -- the groundwater flow itself.

First of all, groundwater flow is recharge from the southwest in the Big Burro Mountain. That's basically where a lot of the recharge occurs.

Obviously, recharge occurs to some extent at the mine itself, wherever rainfall falls. But basically what we see in general is regional groundwater flows onto the mine site from the southwest roughly parallel to the Continental Divide.

So as it moves onto the mine site itself, we see a divergence, basically, depending on which side of the Continental Divide that the groundwater is on. But groundwater generally moves in a northeast and in kind of a more -- or northerly direction in the Gila-San Francisco Basin, which is the area located on the northwest side of the divide.

And on the southeast side of the divide, as groundwater moves into the mine site, we see a divergence more to the east and then down -- kind of down Oak Grove Draw, basically, in that direction.

Now, obviously, with the pits and the pumping of the pits at the Tyrone Mine itself, a lot of the water that moves onto the mine site eventually moves into the pits, primarily the Main Pit, but to a lesser extent some of the other pits, as well.

Now, the pits at Tyrone -- the evaporation from the pits does not exceed the amount of groundwater moving into the pits. Okay? And that's in -- that's kind of an important note to make.

I mean, the -- basically, the reason the pits are drying out is due to pumping; however, if the pumps would be turned off, and the groundwater allowed to fill the pits, it would eventually fill up and spill over into each groundwater basin, both the Mimbres groundwater basin and the Gila-San Francisco groundwater basin.

So the only reason it's not at this point is because the pumps are being pit -- or the pits are being pumped. That's kind of hard to say. The pits are being pumped at this point. But this is not a natural hydrologic sink out here. It's a -- it's a situation where -- and actually, Tyrone actually had their own consultants do a study of the groundwater filling in this area.

And what it showed, basically, is that if the pumps were turned off, okay, the -- within 40 to 50 years, the pits would fill to the point where we'd start seeing water from the mine site, a lot of it being contaminated, that would actually be moving into both these groundwater basins, not just one, but two, because we're sitting on the Continental Divide.

So we've got clean water coming off the Big Burro Mountains. This is good stuff. This is good stuff. I'll give you some numbers in a minute. But it

moves -- it moves in parallel to the -- into the mine site here. And if it -- and like I said, with the absence of pumping, it would become contaminated and basically move off into two groundwater basins on each side.

Now, right now that's being contained by pumping of the pits and a lot of -- a lot of wells and trenches and stuff that we'll talk about a little bit more in a minute that's -- that's helping to contain that to a certain extent. Not totally, but somewhat.

So just to kind of recap here, this is a very complex hydrogeologic system, and I hope we can get the Commission to kind of understand some of this. I know some members understand it more than others given their background.

But we've got two basins, two groundwater basins, we've got two aquifers, we've got numerous faults, and we've got several open pits, all that act to kind of disturb this groundwater flow and influence the groundwater flow in the area.

The mine straddles the Continental Divide where we have these two groundwater basins. We've got these two aquifers that behave independently of each other. And we've got these numerous fractures and faults that basically control groundwater in

unpredictable ways.

The mining activities themselves also act to artificially influence the groundwater flow in this area. So it's just a -- it's a very complicated picture.

Q. Thank you, Mr. Marshall.

Now, let's move on to groundwater quality, and I'd like you to begin with a description of the groundwater quality prior to the discharge.

And here we can refer to NMED Exhibit Number 19.

A. Premining groundwater quality in the area. Actually, we heard Mr. Blandford talk about this a little bit, but actually there's not a whole lot of data that goes all the way back before mining ever existed in this area.

And I concur with that information; however, there are some numbers in the area, some of which Tyrone collected -- most of that data which Tyrone collected, but there's also some -- been some existing wells in the area.

But in general, regional groundwater around 1981 is water coming off the Big Burro Mountains. In 1981, it had a TDS in the -- on the order of 200 to 300 milligrams per liter and a sulfate concentration on

the order of 20 to 100 milligrams per liter. That groundwater quality still stands today. It's still pretty good stuff.

The alluvial aquifer, again, we're talking about a TDS -- a background concentration -- not a background, but basically what would be considered a premining water quality with a TDS concentration on the order of 210 to 380 milligrams per liter, sulfate concentrations on the order of 30 to 100 milligrams per liter.

Q. Okay.

Now, could you talk about current groundwater quality and -- now you probably should get to NMED Exhibit Number 19.

A. Now I'm going to get to it. Okay. Like I said.

This is Exhibit 19. It's the same thing as Exhibit 18, only I've taken some arrows off of it to make it less cluttered, so I can talk about the little dots, different colored dots that you see on the map.

These represent -- these, by far, don't represent all the monitoring wells at the site. We're talking about roughly 700 -- 750 monitor wells and pump-back wells out here. But these show the locations of a lot of the major wells. There are significant

wells on the site.

The different colors represent different water quality.

The green dots that you see, those indicate wells where groundwater standards are not exceeded in either the regional aquifer or the alluvial aquifer. Okay. So that's important. That green color stands for both aquifers.

The red dots indicate wells where we have exceedances of groundwater standards in the regional aquifer.

The orange dots represent exceedances in the alluvial aquifer.

And the purple dots -- and there's just a couple of them, and we've heard testimony about this already, but these are wells where we have exceedances just for manganese and fluoride.

And we see manganese and fluoride kind of pop up in some of these wells, they exceed standards, but there's really no source around to indicate that it's due to mining activities. So I think it's kind of important to distinguish those to some extent.

Now, groundwater at the mine site is, obviously, heavily impacted by mining activities. A lot of this is due to the discharge of leachate solutions by

Tyrone Mine to leach metals. That's what they're in the business for. Some of it's also due to acid -- what's referred to as acid rock drainage.

And I'd like to refresh the Commission's memory a little bit about how that works. Acid rock drainage occurs when you have sulfide minerals, minerals like pyrite, which come in contact with water, oxygen and these little bugs, these little bacteria. I forget the name of them. I had it -- well.

In any case, those three things combined create sulfuric acid, and the sulfuric acid, in turn, leaches metals out of the rock itself, and it's this -- this liquid, this -- this fluid that eventually -- or is responsible for contaminating groundwater if it makes contact with groundwater.

Now, we've got two aquifers, they've both been contaminated, and on both sides of the Continental Divide.

I want to kind of start out and give you a brief tour. I went into much more detail on this at the last hearing. I'll spare the Commission this time around. But I'm going to be a little bit more brief, but feel free to ask questions.

The regional aquifer on the north side of the mine -- and I'm talking just north of the Number 3 on

Exhibit 19. Maybe it's easier for me to just use the screen up here so it's -- I think everybody can see it.

But in this particular area, you see a cluster of red dots. That's the -- that's DP-286. The Number 3 Stockpile as it used to be referred to, it's now referred to as the Number 3A Stockpile. That's the leaching portion. The 3B portion is a waste rock pile that sits right behind it on the edge of the pit. So that's why it's a 3A and 3B now. Just a nomenclature change by Tyrone.

This stockpile contamination was discovered here back in 1990, rather extensive contamination that showed up rather quickly, both in the alluvial aquifers, and these are the alluvial channels coming out from underneath the stockpile, and shortly outside the toe of the stockpile they merge with the regional aquifer which exists actually in the alluvium and the Gila Conglomerate in this area.

So you've got the alluvial aquifer merging with the regional aquifer, and we've got contamination both within the alluvial aquifer and the regional aquifer, because we have seepage going straight down through the stockpile and into the regional and out, as well.

The contamination was, obviously, significant

in this area, because -- I believe the well number now is around 400 wells, both monitoring wells and pump-back wells. We have pump-back trenches, we have surface collection trenches. We've got a vast network -- I say we. Actually Tyrone does.

Tyrone has a vast network of collection systems out here and monitoring lines going farther out into the valley to not only collect the renegade PLS that has moved offsite, but to monitor and make sure that those capture systems are actually working.

That's the north side of the mine.

If we move down to the west flank of the mine, we've got Oak Grove -- I mean not Oak Grove Draw -- this is Deadman Canyon. It's a pretty little canyon, wanders down the -- it flows from the south to the north. Right along the flank, up on the top edge of the canyon, you can you see the stockpiles. We have the 2A Stockpile and as well as portions of the Number 2 Stockpile that border that canyon.

The USNR leach system, which is a historic operation that Tyrone has acquired the property of now, they were also in this canyon. And some of the contamination that's in this canyon is due to their operations as well as seepage that occurs from the 2A Stockpile itself.

Another stockpile just to the south of the 2A, which is called actually the 2B Waste Rock Pile, that's actually where a lot of the seepage is coming from.

The major seepages in this area are the 5E Seep and another seep called the DC2- -- DC2-1, I think. We've got ARD coming off the waste rock pile that moves into this canyon that's contaminated both the alluvial aquifer, which has a relatively thin veneer of, again, alluvium, this time sitting on hard rock. It's on -- it's on igneous rock in this area.

The fractured regional aquifer in this area has also been contaminated by seepage from the stockpiles on this side of the mine.

Now, moving around to the south side of the mine, this is where Oak Grove Draw is. It starts over here. Again, the Continental Divide is in this direction. Again, it trends, you know, southwest to the northeast. It starts up at the Continental Divide, moves around along the south edge of the mine and then offsite.

Down here on this side, we have portions of the Number 2 Leach system, on the southwest corner, but we've got -- primarily what borders this drainage is DP-396. It's a waste rock pile and extends -- actually, the boundaries of this permitted facility have extended

over time, but it extends on a major portion of Oak Grove Draw, along the southern perimeter.

Now, this stockpile has never been leached. So we're not talking about leachate in this stockpile. We're talking about ARD in this stockpile. This is the acid rock drainage. This is leachate that's occurred from rainfall basically falling on the pile, becoming contaminated and coming out the toe of the stockpile. It's contaminated both the regional aquifer extensively in this area, as well as the alluvial aquifer in this area.

This is a stockpile that actually I started reg -- I came on board with the Tyrone -- or regulating facilities here at Tyrone back in -- about 1994, started with the Groundwater Quality Bureau in 1993. And this is one of the first facilities that Tyrone actually approached me with as a regulator. They wanted to actually leach this stockpile, and they approached us back in 1995 or something to that extent.

It was at that time that we issued a letter, I think in May of 1996, that stated that groundwater had already been contaminated at this facility and that they cannot -- they cannot leach it, but they still needed a discharge permit, because now they had a discharge of ARD coming out the bottom. Therefore, they needed a

permit for that discharge.

So they conceded, basically, applied for a discharge permit for 396, and that's how that particular stockpile has gotten its -- its discharge permit. But it is a little bit different from most of the other facilities within the central mining area that -- because those are all leaching facilities.

Now, over here on the east side of the mine, this is -- this has kind of got a long history. We've got three leach -- we've got three leaching facilities in this immediate area. We got the 1A Stock -- 1A Leach Stockpile, which is located right here on the east side. Just north of it is the 1B Leach Stockpile. And we've got the Number 1 Leach Stockpile that sits out here on the other side of Highway 90, which runs north/south right along the east flank of the mine.

This is, again, one of the first facilities I regulated when I first came on board with the Groundwater Quality Bureau. I renewed this permit in 1995. I required that they drill a new regional monitor well right up as close to the toe as they could get on the east flank of the mine.

When they started drilling that well in 1996, they discovered PLS at 20 feet below ground surface. Okay. And that's -- some of the Commissioners have

heard this before, but I'll just reiterate. But basically, that's -- that kicked off a rather massive corrective action plan to discover where the leachate was coming from and if there were other sources in the area.

Daniel B. Stephens was the lead project on this. I think they opened up an office in Silver City after this occurred. But primarily it led to a large -- a large number of wells being drilled.

As contamination was discovered coming out of the 1C, the 1A, the 1B Stockpiles and the Number 1 Stockpile, all coming out through these alluvial channels, in the alluvial aquifer, into the major drainages, and the plume extended three-and-a-half miles offsite, that's when they -- that's when they -- that's where it was by the time they discovered it, about a half mile from their own Mimbres production wells, which are located down in Oak Grove Draw.

We've heard some talk about that from Dr. Shomaker.

So we've got extensive contamination in all of these. They put in a series of transects, pump-back systems all the way down to capture this, this -- these fluids basically, and contain them. That -- those pump-back systems are still in effect.

They have dried up certain portions of the alluvial aquifer, mainly the section of Oak Grove Draw, right where it leaves the east side of the mine, and merges with Brick Kiln Gulch. That section is primarily dry now due to a rather large collection system that they put in in Oak Grove Draw, right here at the -- along the east side of the -- of the -- of the mine itself.

However, there's other sections, especially the section of Brick Kiln Gulch between the Number 1 Stockpile down at Transect 7, where we still have fluid in the alluvial aquifer, and they continue to pump it out and pump it back up to the mine and process it for copper.

But it's -- it's been very persistent. They have not been able to eliminate that -- that particular contamination at this point. And we largely suspect a lot of that has to do with the Number 1 Stockpile itself. And they're in the process of moving towards closure on that, so hopefully we'll see some remedy in that particular area.

Also on the east side, though, we've got the regional aquifer. And if you'll remember me telling you, it's in the Gila Conglomerate, and it's at 500 to 600 feet below ground surface. Okay.

For a long time -- and this is in the record. I mean, there's statements that they didn't -- they really didn't think groundwater existed out here because it was so deep. But it does. And they've got several regional monitor wells out here now.

Now, the spooky thing about the regional contamination out here is it doesn't show up in a continuous wave like coming off the mine. It doesn't do that. It shows up in -- in just certain wells at various locations around the mine site.

And you can see those -- it's kind of hard to distinguish the oranges dots from the red dots on your map, but we've got several up here. MB-27 is that red dot right up against DP-363. That's the one that we required them to -- that I required them to drill upon renewal in -- 1995 renewal. That has been exceeding in sulfate and TDS ever since they drilled it, and it continues to -- continues to exceed standards.

But if you step just off that -- we move just off that -- away from the boundary of the mine just a little bit to MB-41, it's clean. That's that green dot right next to the red dot. So you'll notice that we've got clean wells next to contaminated wells in this area.

But that's the thing that kind of concerns us here. Again, as you go out near Oak Grove Creek, just

below where it says Oak Grove Creek, we've got another red dot. That's MB-29. That's recently been replaced by another well. They're both contaminated, and they both -- again, we have increasing concentrations in these wells. It's not like they're getting better. They're getting worse. That's another well that's been contaminated.

If we go up to the northwest of there, near DP-383, you'll see another red dot. That's MB-36. We required that one upon renewal, I believe. That one is contaminated, also. And I think it's recently been plugged, but I'm not entirely sure.

They were going to plug this well and drill a replacement well, because they're doing some reclamation out there, but I actually saw a recent hydrologic report that still shows water levels and water quality numbers coming in from that. So I have to double-check on that.

Again you'll see a couple of dots up near the Number 1 Leach Stockpile. Let me point to those. Right up here near DP-896. Those are some wells that are actually just southeast of the Number 1 Stockpile itself. They're contaminated.

Actually, the interesting thing here -- and this is again just recent information. We've always considered these regional wells. Now Daniel B. Stephens

is actually saying they may be perched wells. I haven't had a chance to talk with Neil yet about that. We'll have some more discussions about that.

Since the hearing in 2003, though, we've got a new contaminated well. That's MB-33. It sits right down here. It's in Brick Kiln Gulch. It's that red dot that's just above where it says Brick Kiln Gulch on the map. In 2003, they had not exceeded standards. It's now exceeding standards. So this well has become contaminated, too.

So we've got this kind of spotty contamination showing up in the regional aquifer hundreds of feet below ground surface, and really the next question is -- is how did it get there. And we really don't know yet. There's speculation, there's postulation about that, but we can tie a few things together about some of these wells.

They're all near the alluvial channels that are above them, near the surface. Those are contaminated. So it's -- these wells are kind of located near the contaminated alluvial aquifers at the surface. MB-27 is near the Sprouse-Copeland Fault. MB-33 sits right next to -- or fairly close to the Mangas Fault.

So again, when it comes to how the

contamination reached there, you know, we can only speculate on various contaminant pathways that occurred.

One is that it moved, you know, directly from regional contamination within the mine, in an eastwardly direction offsite.

Another possibility is it moved straight downward from the contaminated alluvial -- alluvial aquifer at the surface, straight down, or it moved down the fault systems, the Sprouse-Copeland Fault, perhaps the Mangas Fault, which some of these wells are actually located near.

In other words, the faults themselves acting as conduits for contamination -- from contamination at the surface or with -- or where it's adjacent to the mine and moving down into the regional aquifer in that area.

We're not quite certain yet.

And we've heard -- you've heard talk about the Stage 1 abatement plan that's currently in progress at the Tyrone Mine. That's continuing. And we're -- we're still in discussions with -- primarily with Daniel B. Stephens regarding those contaminant pathways at this point.

It's a big concern.

Q. Okay.

Mr. Marshall, next, could you describe the past and current use of groundwater in the vicinity of the Tyrone Mine?

And for this -- for this question, I'd like you to refer to NMED Exhibits 21 through 24.

A. Excuse me for a second. I'm going to go get another easel.

Okay.

Q. Go ahead.

A. All right. This is Exhibit 21. This represents an inventory of wells graphically by Frederick Trauger back in 1972. He did a tremendous, thorough inventory of all kinds of wells within Grant County. We've actually provided his report and his table as Exhibit 20, in case anyone wants to reference that.

I want to talk about that map for a second, this particular map. These aren't as great as the Daniel B. Stephens maps, because they have all the air photos, but -- actually, we had an opportunity to use an air photo here, but it didn't show up as well, so we went back to the USGS topo map, and that's what the base map is here. So this is dated information. Okay.

The disturbances that are shown in the Tyrone Mine area, those are dated. It's not what exists today.

It's slightly altered in places, and I can talk about that a little bit. For instance, the southeast corner here has been chopped off. They moved that stockpile. But for the most part, the locations of the mine disturbances that you see here are pretty much in the same location where they exist today, but there are some changes.

Now, the blue triangles on the map represent wells inventoried by Trauger. Again, the category of wells -- we tried to group wells to represent those that primarily represent domestic and agricultural use. And that's what -- we feel we've done a pretty good job here regarding these blue triangles on the map.

But this basically is a snapshot of what existed in 1972 based on Trauger's inventory. I'm sure it's not complete. And as a matter of fact, I think I found some wells referred to by Tyrone in and around the mine that perhaps don't exist here at this particular point. They -- so I don't know if Trauger actually got to all of them.

The purple triangles on the map -- they primarily exist within the yellow circles -- those are public supply wells. And the yellow circles themselves represent the Silver City's well fields in 1972. So there's two of them here.

Now, for -- there's -- there was a lot of -- there are also some wells logged by Trauger referred to as mining wells, and we've removed those from the map as I don't want to get into talking about exploration holes and monitoring wells here. We're focusing basically on domestic and agricultural wells.

The green line that you see in the center of the map, again, this is for illustrative purposes. This is not the MMD boundary, by any means. This was just to kind of highlight -- since it didn't show up on this map, I had the State Engineer's Office kind of draw a line about around what he saw basically on the topo map. So it's just to make the mine itself kind of stand out a little bit.

Now, you'll see this red line. This is the -- this is a line that we drew at an approximate four-mile boundary around the perimeter of the mine itself. We did this just to get a well count of basically the wells in the vicinity of the mine itself for comparison purposes with another map I'm going to show you in a second.

They used a four-mile radius primarily for a couple reasons.

It's kind of a CERCLA thing. I think CERCLA uses this primarily. We found some documentation. They

use a four-mile radius a lot of times when looking at groundwater contamination around a certain site.

But I think more importantly, especially for me, is this -- we've had -- we've had a couple of fairly large episodes of contamination at the site. We've had a three-and-a-half-mile plume that's extended off the southeast side of the mine. And we've also had a major dam break, Tailing Dam Number 3, that occurred back in the early '80s that went down Mangas Wash for several miles, as well.

So we felt, okay, four miles. We'll just use that number. But it is somewhat arbitrary, other than that -- that was the justification behind it.

The well count that we came up with within this four-mile boundary is 84 wells, domestic, agricultural, as best we could assess, based on Trauger's inventory.

Now, I want to show you another map.

Again, I'm sorry for ignoring this side of the room. Howard's getting all the attention.

MS. PADILLA: And that's perfectly fine.

It's just that when you do point to the maps, could you point on the screen, though, please?

MR. MARSHALL: Okay. I'd be glad to.

MS. PADILLA: Thank you.

MR. MARSHALL: Maybe it was too much to do all this, but -- okay.

This is Exhibit 22. Again it's the same area. Again the -- oh, and there was one other line I actually forgot to mention. That was a black line that wanders down through the map here, on both maps, actually, Exhibit 21 and Exhibit 22. That's the Continental Divide. So that shows you the division between the two groundwater basins in the area, as well. They're both declared basins by the State Engineer's Office.

Now, on Exhibit 22, to get a more updated inventory of wells as they exist, you know, fairly recently -- and this is 2006, not 2007 -- we went to the State Engineer's Office and asked them if they could produce us a map basically reflecting what they've found in the WATERS Database.

WATERS, that's in capital letters. I think everybody has heard somewhat about this database, the online database provided by the State Engineer's Office.

It's not perfect. We know it's not perfect. As a matter of fact, when we went to look at the wells that actually came out on this map, we noticed -- and then I went online to check what was online, there's not nearly as many wells online right now.

And that's due to some actions by the district

office down in Deming. They took a lot of the wells off the database online because they felt it needed to be cleaned up a little bit more.

Now, there's some arguments there maybe between the Deming office and the Santa Fe office to what's clean and what's not. I don't want to get into it at this point.

I do want to recognize at this point this is not a perfect database. I think Dr. Shomaker mentioned a 20 percent give or take error here. I won't argue with that. As a matter of fact, I'll talk a little bit more about it in a minute.

But basically -- and again I'll point back to the screen. But I do want to compare -- you know, the reason I use the easels is I do want to compare these two maps side-by-side and ask you to -- the Commission to take a look at this, also. But this is just to kind of give an idea of what's occurred in the last 35 years. Okay.

Again, the features on Exhibit 22. Again, the black line is the Continental Divide. The green line shows the prime -- the primary mine disturbances around Tyrone Mine.

The blue circles are again primarily domestic and agricultural wells as we could group them according

to the various designations that the WATERS Database uses. And it uses a lot of different designations for different wells, so we had to go in and kind of pick and choose basically what we thought were domestic and agricultural and turn them all one color.

If you remember in Dr. Shomaker's map, he had about 15 different colors. Well, we tried to get things a little bit more consistent here for comparison purposes.

So the blue dots represent agricultural and domestic use primarily.

Q. And, Mr. Marshall, if I could --

A. Um-hum.

Q. -- interrupt you just a second.

In doing this exercise, you -- did you work with the State Engineer's Office in identifying these wells?

A. Yes, I did.

Q. Thank you.

Go ahead.

A. We have some purple dots. Again, these are public supply wells. You'll see most of those exist within the yellow circles, which are Silver City's well fields. We now, in 2006, obviously, have four of them instead of two. So they've expanded somewhat.

There's also some wells on here that are brown. Again, those are undefined use. So I wanted to point that out, also, over here on the -- those are undefined. So we couldn't identify the use of those. We went ahead and posted them on the map. We feel a lot of them are probably domestic use, as well, since they're in the populated areas.

Some green dots on this map are irrigation wells. There's not many of them.

So primarily what we created is two maps side-by-side to kind of give an idea of what's happened 35 years apart from each other regarding well use in the area.

Again we have the red line, four-mile radius around the Tyrone Mine site. We did a well count within this -- within this boundary. Again the blue wells which we signify as consumption wells.

Municipal wells, irrigation wells and undefined wells combined together is 350 wells, versus the 84. So we see about a fourfold increase in the number of wells close to the mine site.

Now, we'll move to Exhibit 23, and move a little bit closer into the -- so Exhibit 23, what I did was I moved in close to the mine itself, because, again, part of my talk here today is to talk about past and

present use of groundwater close to the -- close to the mine itself.

So what I did here was -- is I focused a little bit closer to the mine itself to take a look at some of the wells in this area. I -- on this particular map, I have posted both Trauger wells from 1972 as well as the WATERS Database wells.

And again we use the same symbology. The triangles are Trauger wells that were reported in 1972, the round dots were what's reported in the WATERS Database.

Again the green line shows the mine disturbances. This is a little bit different than they used on the others, but again we're just trying to kind of highlight the mine disturbed -- disturbances in the mine area, so it kind of stands out on the map a little bit.

The black line is the Continental Divide again, with the two groundwater basins on each side.

So starting in close, we've heard a lot of talk about the Fortuna wells. Those are actually located right up here, on the northeast flank of the mine, near the mill site. There's a couple of them. And they are in the WATERS Database, by the way. They do exist.

This was actually -- this particular area is actually the location of an old -- the old Tyrone Townsite, basically is what it was. It was a town that existed at one time. The old City Hall actually still exists on the mine property. They've kept that building. But it had a little thriving community at one time.

They had several wells that supplied water to the site. One of those is shown on here. I think there was actually three, but it's -- it's unclear from Trauger. We definitely have the location for this one, at least, that I could find, and -- but either one or the three wells that exist, it supplied on the order of about 25 million gallons a month to the mine.

So historically there's been some significant water produced in this area. And obviously, there's significant water -- or water produced now for the mine site, because the Fortuna wells are the potable water source for the mine.

Another interesting thing that we found in the Trauger database was this little red triangle that's located up here to the northwest of the Fortuna wells. It says Silver City Test Hole. That was a test hole that city -- the Town of Silver City actually drilled back in 1944, looking for water. It produced about 40

gallons per minute. It, obviously, was never turned into a production well. They actually moved farther north, where they have their well fields now.

Down here on the southeast corner of the site, we have well O, which actually was a domestic well, provided water for the Oak Grove Ranch located just off the southeast corner of the mine. Potable water for that ranch is now supplied by the mine itself. That well was closed out, but it did supply potable water at that time.

Trauger also reported a well associated with the USNR Mine or leach facility located in Deadman Canyon, over here on the southwest corner of the mine. It was also reported as a very good producer, actually.

You'll see a couple of domestic wells in there. Actually, one of the -- the southernmost domestic is actually, I think -- we feel it's associated with a spring that's actually in Deadman Canyon. I don't know why we've got a domestic, but I think it's -- the spring was actually declared along with a dot that appeared right on top of McCain Springs, up northward from the mine itself.

And these, we feel, were probably declared once the basin was declared, because they're reliable spring sources, maybe used for stock purposes. I don't

know why we've got a domestic designation on that.

But these domestic wells right here on the east flank of the mine, for the most part, do exist. One, we believe, was associated with a trailer. There was actually a guy living in a trailer right down in Deadman Canyon, right next to the mine, until Tyrone came in and bought him out in 1999, I guess closed in the well. But he had a well right there in Deadman Canyon.

Now, this is the WATERS Database we're talking about, so I decided to do a little exercise here with the WATERS Database, since I wanted to see if, you know, these wells actually existed, basically.

So I contacted the Deming office and actually asked them to verify and gave them the numbers of a lot of these wells fairly close to the mine itself here, and asked them if they could basically verify their existence and give me their locations, which they did, actually.

And I think actually Dr. Shomaker was about right, came out about 20 percent actually. I've got to hand it to him. That's a -- but the wells were actually mislocated. Some of those were actually mislocated but still within the -- the four-mile radius. So it doesn't really affect the count. Some of them -- a couple of

them, I think, are way off base.

But they're mostly stock wells located on the north side of the mine. About six of them came up with different locations other than what this plotted out on this map.

So I just want to bring that to the Commission's attention. I know we're working with a faulty database here. I didn't have time in preparation for this hearing to go over the entire map, obviously, at this point, so -- but again, when we compare the two maps together, 2006 and 1972, we're trying to get a general picture of how groundwater -- pressure on groundwater supplies in this area has increased around the Tyrone Mine.

I'd like to talk a little bit about the alluvial aquifer, too, the alluvial aquifer which I talked about these kind of shoestring aquifers that exist below a lot of the major drainages in the area.

Trauger actually has a very interesting historical report. He reports a lot of these -- these alluvial aquifers. One in particular is located over here on the west side of the mine. Again it's got a little block associated with it. It's called Former Ohio Mine Supply Well. This was actually dug in California Gulch, in the alluvium down there, and this

he reports supplied the domestic water for entire mining camp at one time.

So the alluvial aquifer is capable of supplying fairly substantial water supplies for domestic purposes. And Trauger reports a number of other alluvial wells, most of which were actually used for stock wells.

And they have seasonal fluctuations. They do -- sometimes in the dry periods they go dry. A lot of the wells, though, just kind of get lower in the -- in the fall, basically, and then they get recharged in the spring. But they do exist.

A lot of those stock wells are in the township just south of here. He reports as many as 20 alluvial wells in that particular area.

Now, we have some public supply systems in the area. I just want to briefly mention those. Exhibit 24 that we provided, NMED Exhibit 24, gives a list of all the public supply systems, I think, in Grant County. I just want to talk about a couple of them around here.

First of all, we, obviously, have the one that provides the Tyrone Mine with -- with water, referred to as the Phelps Dodge Tyrone, LLC, system. And it's designated as serving 450 users.

We have the Burro Mountain Homestead, located

about two-and-a-half miles -- I don't think it's on this map, I think it's just off this map -- two-and-a-half miles southwest, up in the Big Burro Mountains. The road to it actually runs right across the southern part of the mine. This is designated as having 79 users.

In the Tyrone -- Tyrone Townsite itself now -- that now exists just on Highway 90 north of the mine. It's about three-and-a-half miles northeast of the mine. It's designated as having about 795 users. That town still exists.

MS. PADILLA: I'm sorry. Where was that? Can you point?

MR. MARSHALL: It's -- you know, it's hard. I want to say it's right up here, in this area, but I'm not entirely sure. It's kind of hard working off this map.

MS. PADILLA: Thank you.

MR. MARSHALL: Actually, it may be a little farther north. It's right on Highway 90.

So again, I think we -- this gives a fairly good indication that groundwater in this area has been used in the past, is still presently used, it's good water quality.

People, I think, are interested in drilling wells in this area, and that was most indicative -- or

most came to mind from me back in April of 2007, of this year, when I got a phone call from Mr. Gonzalez, who came here to speak with you gentlemen -- with the Commission regarding this.

He actually contacted me in April and asked to meet with me, said he was concerned about groundwater quality in the area. He had some property in the area.

I didn't know where that was, but I was on my way down the next week to meet with Tyrone personnel at the mine, so I told him I'd meet with him.

I did. He showed me a map of the location. We figured out where it was with respect -- it's actually located about a few hundred feet off the main gate. Actually, the main road to the Tyrone itself actually runs right through the middle of his property, those eight acres. It splits it -- maybe not splits it directly in half, but it runs right through the middle of it. So Tyrone does have an easement through his property.

Mr. Schiff actually verified that that was granted by his father, I think, who actually owned the property at that time.

But regardless, Mr. Gonzalez did approach me about wanting to maybe develop the property. He talked about approaching Tyrone about purchasing the property.

They weren't interested. So he was interested in developing the property, possibly a small mobile home park. But he was interested in drilling a well there, and he was concerned that the water below the site was contaminated.

I told him I didn't know whether the groundwater was contaminated below the site because there's, obviously, no well there. I did inform him that it was not likely that groundwater was contaminated below the site because he's basically right on top of the Continental Divide.

So if that straightens out any of the conversations you heard from him, I'll lay the record straight there.

But nevertheless, I mean, this was -- this kind of highlights our concern about people moving into the area and interested in drilling a well, and in this in case within the mine boundary itself that Tyrone proposes, or has talked about, so --

MR. DE SAILLAN: Okay, Mr. Marshall.

Q. Now I'd like to ask you, is it your opinion that the Tyrone Mine site is a place of withdrawal of water for present or reasonably foreseeable future use?

A. Yes, it is.

Q. And why is that?

A. Past as well as present use of groundwater within and adjacent to the Tyrone Mine demonstrates the importance of the resource in this area. In my opinion as a hydrogeologist and as a regulator, the Tyrone Mine is a place of withdrawal of groundwater for present or reasonably foreseeable future use and always has been.

The Tyrone Mine -- the Tyrone Main Pit serves, in effect, as a large well, effectively the second largest well in New Mexico. Tyrone presently extracts water from the Main Pit to use for industrial purposes. After the mine closes, and for at least the next 100 years after that, Tyrone is required to continue to extract water from the Main Pit and treat it to remove contaminants.

Putting aside for a moment the Department's skepticism that this pump and treat requirement can or will be maintained for the next 100 years, the treated water from the pit can then be used as a water supply for domestic or agricultural use in the region.

Moreover, the use of groundwater in the vicinity of the Tyrone Mine has increased substantially in the past few decades. After Tyrone ceases operations and closes the mine, potential users of groundwater will encroach ever closer to the mine and perhaps within the mine itself.

There are locations around and within the mine and on both sides of the divide that individuals or developers might install a well for domestic or agricultural purposes.

In addition, there are hundreds of wells on the Tyrone Mine that are currently used for monitoring and remediation which could foreseeably be converted to agricultural or domestic use in the future.

Q. Thank you, Mr. Marshall.

I'd now like to move for the admission of NMED Exhibits Numbers 15 through Number 24.

MS. PADILLA: Is there any objections? Are there any objections?

MR. MOELLENBERG: I'd have to object to Exhibit 23 based on Mr. Marshall's testimony about errors in the database. And I'd make the same objection to Exhibit 22.

I think Mr. Marshall's testified that there are exhibits -- or there are errors in the -- either in the 2006 database or in the plotting of these wells such that it doesn't appear to me that these maps are entirely reliable as showing the locations or the nature of the wells.

MR. DE SAILLAN: Madam Chair, I would respond by, first of all, saying that Mr. Marshall qualified the