

Arizona Navigable Stream Adjudication Commission  
*In re Determination of Navigability of the Santa Cruz River*  
 (Case No. 03-002-NAV)  
 Tucson, Arizona, March 28, 2014

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Wade Noble	Chairman	Rich Burtell	Witness
Jim Henness	Vice Chair	Sean Hood	Attorney representing Freeport-McMoRan Copper and Gold, Inc.
Bill Allen	Commissioner	Joy Herr-Cardillo	Attorney for the Arizona Center for Law in the Public Interest
Jim Horton	Commissioner		
George Mehnert	Director		
Fred Breedlove	Attorney representing the Commission		

Mr. Burtell: ... down you see where this Valle de Correa is, where he said that...at that point the Native Americans dug for their water. And then he says they found a full flow of water down in San Augustin de Oiaur which is in the Tucson area. The reason I think that account is important is again we're back in 1697 where a very early period of time, were also there autumn during the harvest period, and he is describing a river that from the Tucson area up to peak, he did not see any water. You can imagine if you are an explorer at this time and your travel through this countryside with your horses and other livestock, that having a source of water is critical. So, I believe if there was water there he would have said so.

Mr. Hood: In addition to the table we just discussed, you address sort of a summary account by Bentacourt in court in the body of your report, is that right?

Mr. Burtell: Yeah, this is a key document that was entered into evidence I believe during the first round of Santa Cruz hearings. And Bentacourt does a nice summary, like me, he became a student of the historical accounts that he could for the area and tried to paint a picture of what stream flow conditions were based on those

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accounts. And on the top of page 6 of my declaration, I quote him directly and I will go ahead and read his quote regarding the occurrence of flow in the Tucson area along the Santa Cruz River. He says, "All accounts agree that the flow of the Santa Cruz first appear not far north of Tubac ..."

Mr. Hood: First disappeared.

Mr. Burtell: Right, sorry... "first disappeared not far north of Tubac near the Ford at La Canoa." The flows..." and then he jumps to the next point where he sees flows, which is in the Tucson area by the mission. "The flows from Punta De Aqua and Agua de la Mission springs disappear at San Xavier and the eastern base of Martinez Hill respectively. Permanent water reappeared about 2 miles north of Martinez Hill quitting again in less than 2 kilometers. Another brief stretch of perennial flow existed halfway to Tucson in the northern half of Section 2, Township 15 south, Range 13. The evidence that the water flow disappeared north of Tucson is less clear.

This shows a river that north of the Tubac and the Canoa area is dry and that flow resumes in the Tucson area; but even in the Tucson area it's discontinuous. It's not a long stretch of flow in that area all the way up to Picacho Peak. In fact, these accounts indicate that not far north of the Marana area is where the flow stopped and there simply wasn't flow regularly further north of there.

Mr. Hood: Is that the reason the State Land Commission suggested that the middle region end at Marana's because there was evidence that the flow ended at Marana?

Mr. Burtell: My understanding in looking at their justifications for their segmentation was just that, that the Marana was where regular flow stopped. Since I looked at the segmentation based more on channel characteristics and the fact that they were still a defined channel further north is why I extend it. I guess my beef with the State Land department is that they...and they admit too, that there is this long stretch between Tubac and San Xavier which is dry. And just the occurrence of flow shouldn't necessarily stop where the reach is. To me it is more defined by where there is a definable channel.

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Mr. Hood: Well, let's talk now about the stream flow records that you looked at and let's talk about depths.

Mr. Burtell: Sure. We are, ah...fortunate to have a couple of sets of stream flow records that can be used in my opinion, to evaluate what the both ordinary and natural conditions of flow were and their associated depths. We'll start with the gauge that is near border with Mexico, it is referred to as the Nogales Gauge, and if you look in my declaration you can see on Figure 2, there is a map that shows where that...where the Nogales Gauge is. It moved...originally it was just about a mile north of the border and then it was moved a few miles further down. Data were collected from that gauge starting in the early 1900's and it is still being monitored. I have been to that gauge, I have several photographs of how the stream channel looks over time. At that point, I focused on data that was collected very early prior to 1940 and prior to any ground water pumpage for irrigation in the area, understanding again that if I am going to look at stream flow data that is post statehood, I better try to have a good handle on how much diversions occurred above the gauge so that when we look at the gauge data it can be looked at in light of how much water we need to add back if you will, to...to look at the natural conditions.

Mr. Hood: And indeed, if you are looking at stream gauge data that is even before statehood, you still need to account for any diversions.

Mr. Burtell: Absolutely. You know, regardless of this copy, the ability to quantify diversions upstream of a gauge...um, I think it is important and a critical point that we have to look and as you know, Arizona was diverting water long before statehood. And so, I was cognizant of that and because of that, I looked at the stream flow data in that light. And what I did in Table 3 of my report is I... I'm sorry, Table 4, is I compiled the stream flow data from this Nogales gauge from 1913 to 1922 and from 1930 to 1939. Monthly data, these are median stream flows and as I mentioned, and ah...I discussed at length, it is critical that we have a handle on what are...if any diversions could have affected these data. Based on the U.S. geological survey's description of the gauge site, there was only in their reports a couple hundred acres that were being irrigated upstream of gauge. They also note that there was a stream...that there was an irrigation canal ditch in the United

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States upstream of the gauge site. We are fortunate that USGS actually measured the amount of water diverted into that canal. It ranged from less...or about a 10<sup>th</sup> of the CFS up to a 1.6 CFS. So less than 2 CFS. I bore you with these details because it is these amounts of diversions that we need to be cognizant of when we look at these stream flow data. So when you look at that amount of diversion into this irrigation canal and the irrigated acreage upstream of the gauge in my opinion, there would only be about 5 CFS that might have been diverted from this stream; 5 cubic feet per second upstream of this gauge that you would affectively need to add back to these numbers. Again, with our task being to look at natural and ordinary conditions and in this case, naturally what was the water without any diversions. If you add that 5 CFS back to these numbers, what does it do? Well, it does not make the numbers that much bigger, um...and what I did was try to evaluate what that affect that would have on the stream depths, um...similar to the Lochiel gauge, if you go to my Figure 4, and this again is following the approach that is similar to what Fuller did for the San Pedro, I plotted a series of discharge measurements that the USGS collected at the gauge site from 1975 through 2011. So we are talking over 30 years of field measurements, over 200 measurements I think almost 250 measurements of how stream discharge varies with the average depth and these are not as Mr. Hjalmarson does...did hypothetical descriptions of the channel being a nice smooth parabola. This is physically what is out in the field of what USGS actually saw.

Mr. Hjalmarson took great issue with this...this figure from my report and if you look at his report towards I think it is the end of the appendices, he really lets me have it regarding this. I was surprised by his criticisms I guess first of all, in that he was very critical of this analysis even though the same analysis of using multiple field measurements of discharge and depth was used by the State's expert, Fuller, in the San Pedro. So, I do not understand why he thought what I was doing was so inappropriate in that regard. He was also very taken by the fact that I plotted discharge on the Y-axis versus the X-axis. I think he thought that by doing that I was presuming some causation between variables, that the Y is the independent variable and the X is the dependent or vice versa. In no way was I doing that. I was simply plotting the data to show that there was a relationship between the two factors,

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average depth in discharge. So I certainly was not concerned with the causation. And I would also point that, in the very report for the Santa Cruz River that Fuller put together on behalf of the State Land Department, they plot in the same way as me. They plot discharge on the Y-axis like I do and stage or depth of the stream on the X-axis. So the very thing that Mr. Hjalmarson, the Center's expert criticized me for doing which he thought was very inappropriate, um...the State's expert, Fuller, does that for the Santa Cruz River.

Mr. Hood: Can you identify the page in this specific document, please?

Mr. Burtell: Yes, this is the 2004 navigability report, ah...study that Fuller put together. It is um...I think Exhibit 19 and starting on Page 76 through 79 they have a series of rating curves where again, they fought discharge of the Y-axis, which is what I do and stage or depth on the X-axis, which is what I do, so...

The other thing ah, Mr. Hjalmarson the Center's expert took great issue with me and I was very confused by this was my analysis of or use of average stream depth to evaluate navigability. You might recall the from the San Pedro hearings and Mr. Hjalmarson, who unfortunately is not here to speak for himself, but based on my reading of his report, he assumes for purposes of evaluating navigability and stream depth the stream is a smooth parabola. But what's most importantly is that, his analysis, his findings are all based on the maximum depth of such an artificial channel, that is, at its deepest point, and that is what his analysis is based on. So, all of his conclusions are based on that maximum depth. And when you he then compares that maximum depth to boating standards, it is all based on the maximum depth, not the average depth.

Mr. Hood: He's using the maximum depth or the standard is using maximum depth, that's an important distinction.

Mr. Burtell: He is using the maximum depth and what I found unusual, he takes great...he is quite concerned with the fact that I am using averages and said that is inappropriate, that you need to use the maximum depth. That surprised me and it surprised me in a couple of ways because I will start with the Utah case. The Supreme court case related to the navigability of streams in Utah.

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They looked at the Green River, the Grand River and the Colorado River and a Special Master in that case and I have his report here. He does exactly what I did. He looks at mean stream...mean or average stream flow depth in his evaluation of the navigability of those streams. Nowhere in the Special Master's report for the Utah case, does he look at the maximum depth for these streams. He looks at the mean or average stream depth, which is what I did. I would also point out that Fuller, in his study of the San Pedro which we have already gone through, but I looked back at it again, and when Fuller evaluates – and again this is Exhibit 16 from the San Pedro evidence – Fuller did the same thing. He looked at average stream flow depths in his evaluation of the navigability of those rivers.

Mr. Hood: That makes perfect sense if your navi...if you are attempting to navigate a stream and your relying upon the maximum depth, then unless you know right where that maximum depth is that does not matter much.

Mr. Burtell: Yeah he draw the...he draws the example of the Mississippi River where they...they go down, they dredge channels through the Mississippi River which, ah...my understanding is barges will follow those dredge channels. That is a very different thing than an Arizona stream which after a storm event, ah, could have changed its channel quite a bit. And when I checked last, there are not many barges that I have seen on the Santa Cruz River dredging the channel. Its just...it just does not make a lot of sense.

As a further example of the use average or mean stream flow depth to evaluating navigability, we have the State of Washington, which has developed criteria that they are using to evaluate navigability of their streams. One of their criteria: mean depth of the stream. There is nothing about maximum depth, which is what Mr. Hjalmarson uses. But I thought what got me most about Mr. Hjalmarson's criticism is the very method that he uses to evaluate boating criteria, that is, the depth is required for recreational boats, um...is based on average or mean depths, not maximum depths and I draw...we'll submit these into evidence I believe

Chairman Noble: We hope.

Mr. Burtell: Excuse me?

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Chairman Noble: We hope.

Mr. Burtell: This is...if you look at Mr. Hjalmarson's report, he...he takes his modeling analysis and looks at it in light of these boating criteria. Okay, this is the methods of assessing in-stream flows for recreation. This is his main tool to evaluate whether his stream flow results...his model results indicate that the stream is navigable or not.

Mr. Hood: And these are...we discussed this as some length on the San Pedro proceedings, these are the recreational...modern recreational boating standards that indicate that a modern canoe needs a foot to navigate.

Mr. Burtell: That is correct. He used these not only in San Pedro, but he is also using these in the Santa Cruz. He presents these...he references these, we are talking about the same thing. And when you take a look at these methods and you go to page...when he talks about his methodology as he is using what is called the single cross section method, I won't bore the Commission with the details. But I would draw the Commission to the fact that in this...in these criteria, it talks about using a computer program, the IFG Model to calculate what parameters you need to use for the single cross section method, okay. So this IFG Model is referenced in the methodology that has these boating standards. Well, what I did then is I went to the very document that was published about the same year by the same group, this is Hydraulic simulation of in stream flow studies, is the same group U.S. Fish & Wild Life and they have further detail about this model, the so-called IFG Model, which they say that you use to figure out what your depths are for boating criteria. So then when you go to that report, which we'll also submitted into evidence, they talked about this model IFG and what is the output from the model? Not maximum stream flow depths. The output is average depth.

And just this one final indication that I wasn't just imaging things, I spent a few minutes online and found a study where Wyoming Game & Fish used that same model, the IFG model, which again, is what references to the method you can use to calculate the depth to figure out your boating criteria for recreational purposes. And what is the output from the IFG model that the Wyoming...that the state of Wyoming presents? Average depth. So, I apologize if I

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beat the drum a little bit loud here, but Mr. Hjalmarson took great pains to attack my report for looking at average stream flow depths, when it appears from these records average stream flow depths is, in fact, what people use, including the only methodology he uses to evaluate boating criteria.

Mr. Hood: So even in the context of modern recreational boating criteria which I think we have addressed at length why that is not applicable here. Even in that context you want to look average depth, not maximum depth?

Mr. Burtell: That is correct. And I will just point out again, that all of Mr. Hjalmarson's findings are based on maximum depth, not average depth.

Mr. Hood: Okay. Just in brief summary because you touched upon it in your table, what kind of depths did we have during the stretch...at this stretch, the middle, in ordinary natural conditions?

Mr. Burtell: If you take a look at my table, I outlined...and there is well over...I think it is almost 150 different months and you an even probably see it from a distance; these are median stream flows for all these years and...

Mr. Hood: And, again, we are back to Table 4 now?

Mr. Burtell: We are at Table 4 and I highlighted in bold red those months where based on the median stream flows and that stage relationship that rating grade might have between average depth and discharge. There is only four months in over 150 months where the average depth was greater than a foot. Those average depths were greater than a foot during a winter storm in January and February and also during August during the monsoon floods.

The point to take home here and I go on longwinded is that, for a period of time when there was no ground water pumpage, when there was very minor diversions using actual data from the stream. This is not a simulation, this is not a hypothetical of what a channel looks like, this is the actual channel conditions. You only have a couple of months out of over 150 months where the flow was greater than a foot. Obviously ... even I think Mr. Hjalmarson

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would admit that flow less than a foot would not be conducive as a highway of commerce.

Mr. Hood: He did admit that on the San Pedro.

Mr. Burtell: And in the San Pedro I do believe he did admit that.

Mr. Hood: Okay. Um, let's...now I just want to be clear, have you accounted for those minor diversions in the canal system?

Mr. Burtell: Yes, and I...I encouraged the Commission to go back to my Figure 4. And again, Mr. Hjalmarson took it issue with the fact...well I should point this out. He took issue with the fact that I plotted multiple years of field measurements on the same plot, understanding that this is a sand channel that changes its grade over time. Well, when I read his criticism I was very surprised because that's exactly what I was trying to do with this graft is to show the variability. I did not want the Commission to get locked in with one rating curve which represents the channel that could change over time. I have over 30 years of field measurements that show how that channel changes over time and how the width of, or I should say, the depth of the channel changes with its discharge. And I did not use the equation on this graft. I just used...I put these...the line in the equation, I simply showed there was a relationship.

Getting back to Mr. Hood's comment: if you take the actual median flows that were measured at that gauge and add back in the 5 CFS, and quite frankly add 10 CFS, it really doesn't matter, and you then take that flow 50, 60, 70, 100 CFS, and you walk across and see what the associated depths are with over 30 years of field measurements, they are all still less than a foot. So, my point is Mr. Hjalmarson was very critical that I was using multiple data points...that is exactly what I wanted to show. I wanted to show the full range of possible variability of stream discharge with depth. Even when you look at that full range you still get less than a foot of flow.

Mr. Hood: Adding 200 CFS, you are still talking about a stream that pales in comparison to the San Juan which was deemed non-navigable, is that right?

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- Mr. Burtell: In fact if you put in 200 CFS in my figure 4 and you walk across and look all the field measurements that the USGS took when there was 200 CFS is fairly more than 1.2, 1.3 average depth in a stream. So, it just simply...it just simply would not be conducive to be a highway of commerce, even if you put the diversions back in.
- Mr. Hood: In terms of depth...a depth comparison, the San Juan was over 2-1/2 feet in terms of average depth and here we are talking about a stream on the middle that is clearly under foot.
- Mr. Burtell: When you look at the Special Master's findings in the Utah case, he actually compiled the number of days that the average depth of the San Juan River was in different categories. And as I recall, I believe over 150 days out of the year, it was greater than 2 feet.
- Mr. Hood: And the typical CFS was 1000 or greater, is that right?
- Mr. Burtell: Yes. A couple of 1000 as I recall. And again, we are talking a stream here where you've got 10's of CFS versus a stream with 1000's of CFS's, and the San Juan is deemed nonnavigable. So, we are talking a stream of orders of magnitude difference of flow.
- Mr. Hood: Let's talk...um...let's move now to history and navigation. You have already said that there is none. Okay, I think there is a couple of examples of people paddling around behind a manmade lake and people floating in effluent. But during this period of time you talked about Father Kino's explorations, we know the 49ers came through, we had military encampments, including Fort Buchanan. We had mine operations, silver mines in the Patagonia mountain area: what explains the fact that there was no history of navigation. We obviously had a need...and we had people here who would have used it.
- Mr. Burtell: You know, I think what...one thing I took out of the Utah case that I think is critical that subsequent reports in and Commissions have acknowledged and had to take into account was just because there was not boating in an area, you can't necessarily assume that the stream was not navigable just due to lack of boating. However, the court was clear in that is...that might be explained because there was a lack of need, that there wasn't any settlement to the area. The area was largely unsettled and the reason there was not a lot of boating was there simply was no one there.

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That argument cannot be made for the Santa Cruz River, it just cannot be made. At the time when there was...even Apache unrest, a fellow named Malory, who the Center's expert spends a lot of time talking about, he has...I believe it was a silver mine up in the Patagonia mountains. There are records. He has written about having to transport supplies from the Port at Guaymas by wagon train up to that mine site. Supplies were also being brought in to Yuma at that time. Supplies from Yuma and Guaymas were all brought either to Tucson or to the Tubac area by wagon train. There was a military base...we all know about the Tucson Presidio, it was here in Tucson. There was also a military base in the Tubac area. There was a U.S. military base, Fort Buchanan, up Sonoita the creek and it was operating before the civil war. They got its supplies from Guaymas; there was...by wagon train. There were people in the area. There was a need for a highway for commerce. If there was ever a need to bring in supplies, either equipment for the mines, supplies for the troops, there was a need. That need was talked about. But the river was not used to meet that need, at any time of the year. Even if one could make the argument, which I do not believe the Center and their expert have that for some way irrigation dried up the river in the times of year when there was not irrigation going on, during the harvest and in the winter time, and in years when the Apache unrest had largely caused the area to be abandoned, they still didn't use the river. So you have to start to ask yourself the question, you had a need for supplies being brought in, you had a need for a highway for commerce, but the river was not used. I think that is strong evidence to say that the river was not suitable as a means for navigation. Except...

Mr. Hood: Please proceed.

Mr. Burtell: The Center in their brief, talks about more recent use of the river. They talk about boating on two lakes that were in the Tucson area; Silver Lake and Warner Lake. When one looked at those lakes it does not take very long for one to figure out that those are artificial lakes. They were formed by dams being placed across the Santa Cruz River. I think the best evidence...and I thought about it last night of why it is unreasonable to consider those lakes from a navigability prospective. If there was any ponding of water, why didn't any of the historic accounts before that time mention those

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lakes? Nobody did. That is because the lakes were not there, they were formed by dams. Those dams that I think the proponents of navigability are very quick to point out the effects of diversions having an effect on navigability. Well in this case, they can't have it both ways. You cannot put an artificial structure across a stream that dams off water that causes a pond to form, that thus is used by boats and all of a sudden it is navigable. That's just unreasonable.

Mr. Hood: It is not ordinary and natural.

Mr. Burtell: It is not natural. So, their artificial lakes and in my opinion, any boating accounts described to the Commission as evidence of navigation on Warner and Silver Lakes, those are not natural water bodies and they shouldn't be considered. They have taken more recent...they present more recent evidence of boating, um, and that is during summer monsoons and they present...and I have in my declaration, some newspaper articles that describe folks that have boated along the Santa Cruz River during storm events in wintertime and monsoonal floods in the summer and also along effluent reaches.

And I would like to point out to the Commission, I do not think this has been entered into evidence up to this point, but when I was with the Department of Water Resources I had an opportunity to work on the Arizona water atlas, among other duties, and in the tables to water atlas we at that time, actually tabulated the amount of water discharged from the treatment plants along the Santa Cruz River. And the Nogales International Waste Water Treatment Plant, which is down by the Rio Rico area, it discharges some 16,000 acre feet a year, which when you convert it into CFS's about 22 CFS. So, folks that talk about boating the Santa Cruz River in the Nogales area, they are floating on the effluent, the 20 or so CFS of effluent. At least when they're there not during a storm event. Then you move up to the Tucson area where we are at now and the Roger Road Treatment Plan, the records we have indicated it was discharging about 32,000 acre feet a year in discharge and you convert that into CFS and that is almost 50 CFS. So, the Center has discussions of some people that live here that float down the Santa Cruz River in a rubber raft. In 50 CFS you can float down...you can float down the Santa Cruz River on that effluent dominated reach. And during flood events if you have got

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the will you could do the same thing. Neither one of those – effluent reaches or flood events – in my opinion, or I don't think anyone's opinion, would be a natural stream flow condition as defined by the Arizona Court of Appeals.

Mr. Hood: I want to back up a little bit the stream flow data. I jumped ahead to the history of boating, the absence thereof. Where there some other data that you looked at on the middle reach?

Mr. Burtell: We are...again I feel fortunate that we have some measurements that were taken by the Tucson City Engineer between 1880 I believe and 1883. Tucson was starting to grow quite a bit at this time, and he was very concerned, understandably, with a growing population and a limited water supply. So what the Tucson City Engineer did, I believe his last name is Culver, is he went out and looked at the main areas where stream flow starts in the Tucson area. And if you take a look, it is one of my tables, I tabulated his findings. And it is Table 5, entitled Early 1880 Santa Cruz River Discharge Measurements in the San Xavier, Tucson area. And what you find is that it is a very modest quantity of flow that he measured, and he these above where the diversions occurred. The springs that fed the agricultural lands of the San Xavier Mission area, he looked at the springs above the mission. There was as I mentioned, Warner Lake, Silver Lake. Those lakes were formed downstream of mills along the Santa Cruz River. He actually looked at the flow of the water either going in or leaving these mills along the mill \_\_\_\_\_. I encourage the Commission in Table 5 to once again look at the quantities of flow we are talking about here. When he added these up because he did not want to do...he did not want a double count, he came up with on the order of 25 CFS, um...and depending on...he was being conservative, so he originally said it could be up to 35 CFS. But so 25-35CFS of flow in the Tucson area along the Santa Cruz River, I will just ask the Commission again, to consider: we are talking about streams like the San Juan with several thousand of CFS being deemed unnavigable, and we are talking here about streams with less than 50 CFS on the order of 20 or 30 CFS its...we are talking orders of magnitude difference of flow, um, it just does not seem reasonable to me based on these very minor amounts of flow that the Santa Cruz River could have been used for a highway for commerce, it is just hard for me to imagine.

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- Mr. Hood: And by comparison it is not restricted to the San Juan. The Commission can take a look at the submission that Mr. McGinnis made that SRP has prepared and used over the course of time that shows a number of other streams that have been deemed navigable, non-navigable. And, again we are talking about thousands of CFS, in comparison to the stream here where we are talking about 10s.
- Mr. Burtell: Yeah...it's just a...again it's the orders of magnitude that we are talking about. Um...and I would draw the Commission's attention even to the Colorado River, which I do not think any folks argue at least the lower portion along our border was historically navigated. Once again, we are talking 6, 7, 8, 10,000...10,000 CFS not 10 to 20 or 30 CFS.
- Mr. Hood: Have we covered the general basis for your opinion regarding the middle of reach at this point?
- Mr. Burtell: I think the last point that I really would draw the Commission's attention to is that, I agree that there were portions of the middle Santa Cruz River from the Mexican border down Santa Cruz Flats that had regular flow. I believe, and hopefully the evidence I have presented indicate that that flow was very shallow. But the Commission cannot...I do not think can ignore the fact that, that whole stretch, unlike what Mr. Hjalmarson concludes, based on the historic accounts, the whole stretch didn't regularly have flow. North of Tubac, based on the evidence I looked at, it appears that the stream went intermittent. But north of Canoa it was ephemeral all the way up until you got to the commiss...ur...up, up to San Xavier. From a boating perspective, what we are saying is...and I am largely agreeing with the um...with the State Land Department. That's one segment. Within that one segment you would not have over a 20 mile portage from the Canoa area all the way up until you hit San Xavier. You would have to have portage of the river. There was no water regardless of whether there was enough water that you could float a boat in.
- Mr. Hood: And indeed it was intermittent up to...between north of Tubac to Canoa, so even during that stretch you would often times have to portage.
- Mr. Burtell: And again, that is assuming there was enough depth which I do not believe there was. And there would be one other account I want to

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draw to...the Commission's attention to before I leave the middle. Continuing along with this idea of portages though; so now you are in San Xavier and you encounter these springs. Well, it is not a steady flow from those springs all the way down to Marana, as described by Bentacourt, as described by these historic accounts. The flow occurred and then it just disappeared. Well, every time it disappears you need another portage. So within the segment from the...from the Mexican border all the way down to Marana or in my case, all the way down to Santa Cruz flats, it is not a steady flow all the way along there. You'd have to portage, and that portage would in those areas defeat the navigation.

Mr. Hood: So, even if there were sufficient depth, which your analysis suggest there is not, demonstrates there is not, um...the spatial discontinuity of the river during the middle reach also defeats navigability.

Mr. Burtell: That is correct. In one historic quote that I really would also like to remind the Commission of was one that was made at a time of year where again, arguably there was little or no diversion...this was made way back in 1857 by a fellow named Reed and he made this in the Calabasas area. Calabasas is where the Sonoita River joins the Santa Cruz River. And he talks about his observations, ah, again in February of 1857. And this is what he says: he says if you will portray in your imagination, a bottom covered with tall golden colored grass, hedged by mountain who sand wither like metal, divided by a meandering stream, Santa Cruz River, a dozen yards wide – so 36 feet wide – and is made many inches deep...

Mr. Hood: Twelve inches deep?

Mr. Burtell: Twelve inches deep. This shaded by Cotton Woods, Willows and Mesquites. And a few hundred yards higher up another stream Samoa Creek, a creek with less volume pouring in from the right. And in the fork an elevated rolling surface you will have a view of Calabasas.

A dozen yards wide and as many inches deep. So he was saying in February of 1857, he was seeing 12 inches of water, a foot of water at Calabasas. Well, that's not that far away from my analysis of how much stream flow was in the river based on the gauge data. I draw the comparison to Mr. Hjalmarson's report where he says

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that the Santa Cruz River from the international border all the way down to Picacho Peak in his opinion, over 75% of the time had greater than 2 feet of water. It just does not...it is just not supported by the historic evidence. And again, I think that's partially due to the fact of how he did his model.

Mr. Hood: Okay. Well, maybe talk a little bit about that at the end. Let's move on now...I think you made your opinion clear as it relates to the navigability or non-navigability of the middle reach. The lower reach we could probably go through a little bit quicker.

Mr. Burtell: Sure.

Mr. Hood: Because I do not think we have anybody contending that the lower reach is navigable. Is that your understanding?

Mr. Burtell: Um, when I looked at the Center's September 2012 brief, they urged the Commission to consider portions of the middle reach as navigable. They did mention either the upper or the lower being navigable. In fact, I believe the Commission...and I included the quote in my report, they even talk about it. They say, this is their words not mine, the Center states, "the lower Santa Cruz River in Pinal County, never support perennial flows. It is only during flood times that the river flows continuously to the Gila River. There are no reported instances of boating at any times on the lower Santa Cruz. Although during one high flood event Tucsonan Sam Hughes opined that the river was big enough to float a steamboat all the way to the sea." I don't believe based on that, that the Center is making much of an argument that the lower Santa Cruz River was navigable. Their expert did not address it.

I would say the best evidence is when you look at the historic accounts. I mentioned and I draw the Commission's attention to Figure 5...6 of my Declaration. And this is a map that was put together based on all Kino's travels up and down...up along the Santa Cruz River. You will notice that just north of Picacho Peak, Kino and his associate left of the river. They left the river. Now, this was a stretch that was very difficult to go...you know, there was no water. So, obviously these folks wanted to stay where there was water. If there was water at Santa Cruz flats and in Santa Cruz wash, you would imagine that Kino would have stayed on that course where there was water. Notice there is no missions

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that were established in that stretch. He left the river at the point where he called Santa Catalina and then followed a kind of a northwesterly direction up the Gila River which was the closest source of water. He needed water as he is...with all of his troops as he...or his associates as they are working their way up, he was accompanied by military people. I think this is the best evidence we have that there wasn't water in this stretch, or there would be any reason why Kino would not follow a river that has water, either to establish missions or to have water for his horses as he moves his way up and down the river. This course that Kino took was then followed by all the subsequent folks all the way through the 49ers, and in fact, pretty much all I think where I-10 goes. This is the path that subsequent explorers, including Captain Anza who went up through the area in 1775, he followed the same course. Captain Anza talked about how difficult this passing was because there wasn't any water. Certainly if the Santa Cruz flats and the Santa Cruz wash area have water. They wouldn't have the river they \_\_\_\_\_.

There is no historic accounts of boating obviously in this area. The talk about taking a steamboat up there in the flood time, I think that speaks for itself.

Mr. Hood: Not an ordinary time.

Mr. Burtell: Certainly a flood event is not ordinary and when that water hits Santa Cruz flats it spreads out. It is very dispersed in that area. It is not a single, defined channel. So, Mr. Hjalmarson's idea of a nice uniform channel, I think he would even agree that, that area...that breaks down.

Mr. Hood: Let's talk now...I want to be as brief as we can, just to talk...make a few more observations regarding Mr. Hjalmarson's analysis.

Mr. Burtell: Sure.

Mr. Hood: You have touched on a lot of it as we've gone...but just in general strokes, did his analysis of the Santa Cruz compare to what he did on the San Pedro?

Mr. Burtell: It did. And he took three general steps in my understanding... and again, I got a week to look at his report, but in the time that I did

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have and also preparing for this. It seemed like there was a similar approach followed in the...as he used for the San Pedro and that is this: his first step is to try and figure out what the predevelopment stream flow was. That is, stream flow absent any diversions. In this case, unlike the San Pedro, I looked at his predevelopment stream flows and they do not seem that unreasonable to me. I did not have a lot time to study them, but the quantities of average predevelopment flow that he looks at along the stream – now that is average, not median flow, so his averages incorporated include those big flood events – range from I believe from 20 cubic feet per second all the way up to like 60 CFS, 60 CFS being in the Tucson area. Maybe absent the ones in the Tucson area, those do not seem that unusual to me, again that is average flow. And again, we are talking less than 100 CFS in water, um...where I then take great issue with what Mr. Hjalmarson did is the next thing he did similar to the Santa Cruz River, is that he then has to relate those average stream flows to the frequency of flow and he talked about the flow duration curve, which again, is just a fancy way of saying is how often as a percentage is the flow in the river equal to or greater than a certain amount. And the 50% flow in a flow duration curve is its median flow. Half the flows are less than, half the flows are higher. Where I take great issue with Mr. Hjalmarson is Mr. Hjalmarson used the flow duration curve for the Nogales gauge, the very gauge that he attacked how I used the data from it. He used that flow duration curve to represent the occurrence and the frequency of flow at all the other stations along the Santa Cruz River. So, let me bring an example to mind. He is saying the frequency of flow at the Nogales gauge where flow is much more regular down there, I would admit that, is the same as frequency of flow in the Continental area, which is the area between the San Xavier Mission and the Tubac area. Now, those historic accounts that I talked about all were in agreement that there was no flow in that area. It was ephemeral. Mr. Hjalmarson takes a reach, which is a femoral and superimposes on it a flow duration curve from an area which was perennial or maybe intermittent, which was the Nogales gauge. And when you do that you end up with these very unusual findings which Mr. Hjalmarson has in his report. And...I do not know what the...Commissioners...if you do not have a copy of this in front of you, but Mr. Hjalmarson's flow duration curves have what he concludes based on this, and...he referenced the page of his

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report...this is Page 23...actually I may need to get back a few pages. This is Page 15 of Mr. Hjalmarson's report and the figure I am referring to is titled *Flow Duration Relationship for the Middle Santa Cruz River*. In the Continental area, which is right in the middle where if you look at my historic accounts, these travelers realized they were going through a dry stretch, and they all say it, this is a dry stretch. If you believe Mr. Hjalmarson's report, 50% of the time in that area in Continental, you would have 20 CFS. Mr. Hjalmarson in fact says that the river only goes dry 10% of the time at that Continental reach, 10% of the time. So he is saying 90% of the year there is flow in that Continental reach, which is between San Xavier and Tubac and Canoa.

Mr. Hood: In all of the empirical evidence demonstrates that that stretch is not perennial, it is not intermittent, it's ephemeral.

Mr. Burtell: It's ephemeral. I will just again, encourage the Commissioners to go back in my historic accounts that were made in the winter time, that were made during the harvest period, no one says that there is water in that stretch. Mr. Hjalmarson on the other hand with his flow duration curve. He says there

[recording ends]

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I, Carolyn Turner, declare:

1. I work in the word processing department at Fennemore Craig, P.C.
2. At the request of Sean Hood, I reviewed and transcribed tape 2 of 4 of the March 28, 2014 hearing held in Tucson, Arizona in *In re In re Determination of Navigability of the Santa Cruz River* (Case No. 03-002-NAV). Mr. Hood provided assistance to identify certain speakers, words, and spellings that I was unsure about.
3. The foregoing transcription of tape 2 of 4 accurate to the best of my ability to hear and discern the questions, testimony, and other statements captured on the tape.

Executed on this 21<sup>st</sup> day of April, 2014

  
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Carolyn Turner

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