RWSA BOARD OF DIRECTORS
Minutes of Special Board Meeting
Community Meeting on Preliminary Design of the Ragged Mountain Dam
June 1, 2010

A special meeting of the Rivanna Water & Sewer Authority (RWSA) Board of Directors was held on Tuesday, June 1, 2010 at 6:00 p.m. in "City Space," in the Charlottesville Community Design Center, 100 Fifth Street NE, Charlottesville, Virginia. The purpose of the meeting was to allow members of the Authority's Board of Directors to attend the Community Meeting on the Preliminary Design of the Ragged Mountain Dam.

Board Members Present: Mr. Kenneth Boyd, Mr. Michael Gaffney – Presiding, Mr. Maurice Jones, Ms. Judith Mueller, Mr. Gary O'Connell, and Mr. Robert Tucker.

Board Member Absent: Mr. Dave Norris

Authority Staff Present: Mr. Tom Frederick, Mr. Chad Johnson, Mr. Chuck Kent, Ms. Jennifer Whitaker, Mr. Robert Wichser, Mr. Lonnie Wood, and Mr. Konrad Zeller.

Also Present: Mr. Chris Webster – Charlottesville Branch Manager with Schnabel Engineering; Ms. Becky Clay Christensen – Facilitator with the Clay Christensen Group; Mr. Randall Bass – Project Manager with Schnabel Engineering; Charlottesville City and Albemarle County Government Officials; Albemarle County Service Authority, City, and County Staff; members of the public; and media representatives.

Call to Order
The special meeting of the RWSA Board of Directors was called to order by Mr. Michael Gaffney on Tuesday, June 1, 2010 at 6:00 p.m., and he noted that a quorum was present. Mr. Gaffney then stated that no Board actions would be taken tonight, but minutes of the meeting would be prepared, submitted to the Board of Directors for approval, and then posted to RWSA's website.

Mr. Gaffney next invited attendees to sign the register if they had not already done so when they entered the meeting and to also provide their e-mail address if they wanted to receive regular updates on this project.

Mr. Gaffney then noted that the meeting was being taped by Charlottesville Public Access Television and would be aired in the coming days on local government cable television. The schedule of airtimes will be available at www.rivanna.org and www.charlottesville.org.

Background
Mr. Gaffney explained that the design of the new Ragged Mountain Dam is being performed by Schnabel Engineering, which has a local office in Charlottesville and offices in Greensboro, NC and Alpharetta, GA. He explained that the firm provides geotechnical engineering, geostructural design, dam engineering, tunneling, applied geosciences design services, and construction

inspection and testing. Mr. Gaffney noted that the company was founded in Ashland, VA in 1956 and although their greatest presence is still in Virginia they reach across much of the U.S. including offices in Denver and Seattle. He reported that Schnabel was selected last summer by a panel as the most meritorious firm for the Ragged Mountain Dam design, and explained that dams are usually designed in two phases – preliminary design, which focuses on gathering significant geological, geotechnical, and geophysical data on a proposed site then defining and optimal layout with the key features of the dam – including type of construction, availability of source materials, dam location, and spillway and piping locations. Mr. Gaffney said that the second phase of final design builds upon the preliminary design layout to produced detailed plans and specifications for bidding by construction contractors. To date, he said, the RWSA has only authorized the preliminary design – which Schnabel has recently completed – and tonight's meeting will summarize their findings and recommendations from that work.

Mr. Gaffney announced that Becky Clay Christensen would be the facilitator for the meeting, adding that she has many years of experience facilitating public meetings including several previous RWSA meetings and numerous meetings for the City of Charlottesville.

Introductions of Presentation Speakers

Ms. Christensen said that there would be presentations by Schnabel, followed by questions from the audience for clarity and general comments about the project. She introduced Chris Webster, the Principal and Charlottesville Branch Manager for Schnabel where he has worked since 1986; and Randy Bass, who is serving as Project Manager for the Ragged Mountain project. She said that Mr. Bass has 32 years experience in dam engineering and was the former manager of Georgia's Safe Dam Program; he has been with Schnabel for six years.

Presentation

Mr. Webster addressed the audience, presenting a map of Virginia that highlighted Schnabel's projects – dam projects, geotechnical projects, etc. He said that the firm has had a strong presence in Virginia since the mid-1970s, and worked on the original expansion of Scott Stadium.

Mr. Bass reported that Schnabel Engineering got into dam design about 13 years ago and acquired a small firm in Georgia. He explained that a lot of the company's senior people were involved in dam design at other firms before joining Schnabel, adding that they have a big focus on water supply projects and flood control projects. Mr. Bass presented images of other Schnabel projects, including a North Carolina project that has an RCC gravity dam in part of the structure and an earth-filled dam in another part. He emphasized that you can have both components in a dam, adding that this geologic setting required this as "the most economical solution." Mr. Bass presented an image of a flood control project, noting that the Natural Resource Conservation Service owns about 10,000 flood control dams – and stating that the Georgia project he was referencing is a 65-foot high earth-filled dam. Mr. Bass noted that another project in that state included a dam that is a little over 100 feet high, with a concrete spillway and a big earth emergency spillway. He said that one in south Georgia is a water supply project, adding that there must be a reservoir regardless of rainfall totals – which are about 50 inches per year there. Mr. Bass noted that they also have large water supply projects in

Dahlonega and Macon, Georgia, emphasizing that the firm has done a lot of dams that are 100 feet or slightly more.

Mr. Bass explained that earth-filled dams are very common in the U.S., and the Corps of Engineers keeps an inventory of dams – which currently totals about 82,000 dams. He presented a breakdown on the dam heights, noting that most are small (under 25 feet) and were built for farming. Mr. Bass noted that there are 1,575 dams that are over 100 feet high, with some over 300 feet high – which are typically dams of the Tennessee Valley Authority, the Bureau of Reclamation or Army Corps of Engineers. He said of almost 1,600 dams, over half are earth or rock-filled, with the higher dams out west using concrete arches. Mr. Bass reported that in Virginia there are 23 dams that are over 100 feet in height, with one in Dickenson County reaching over 250 feet in height. He explained that the dam is rock-filled, noting that both the rock and earth dams have a center section made of clay – but with a rock dam the outer portion is made of rocks that are three to four feet in diameter; the earth-filled dams basically use sandy soils, and thus require a flatter slope in order to be stable.

He presented information on the Lake Anna Dam, noting that it is 100 feet high with the Upper North River Dam at 118 feet in height. Mr. Bass pointed out that larger dams are usually for water supply, flood control, navigation control, etc., and in other parts of the world dams can be built that approach 1,000 feet in height. He mentioned some of the larger dams with which Schnabel has been involved – including a 170-foot high water storage dam in Michigan – and said that the firm has significant experience with earth-filled, rock-filled, and concrete gravity dams. Mr. Bass presented information on the Hollis Latham Dam, indicating it would be similar to the Ragged Mountain Dam and noting that grout curtains, filters, and drainage systems are very important for an earth-filled dam. He said that Hard Labor Creek has been designed and permitted by the State of Georgia Safe Dams Program, with bidding expected next January or February, and that dam is also very similar to what is proposed for Ragged Mountain. Mr. Bass explained that there are similarities between most dams, with typical sections very common throughout the U.S.

Mr. Bass reported that Schnabel was hired to take over from the previous consultant to look at doing at least the preliminary design for a roller-compacted concrete (RCC) dam, which is "just a different method" of building a concrete gravity dam. He said that the firm started by looking at the potential of creating an on-site aggregate source, as there would be a concern by citizens with hauling in aggregate because of the impact on Reservoir Road if the aggregate were imported from off-site. Mr. Bass explained that with a concrete dam, about 200,000 tons of aggregate material would need to be moved up Reservoir Road, so the firm explored the possibility of finding rock on-site to be used as an aggregate source. He stated that they did some geophysical and geotechnical investigation, and found that the rock is not shallow – with some places as much as 80-feet deep before solid rock was reached. Mr. Bass said that Schnabel came back to the RWSA with a recommendation to consider an earth-filled dam, adding that they are typically cheaper than concrete if the earth is available on-site. He indicated that Rivanna suggested doing an alternative assessment comparing the pros and cons of an RCC-gravity dam to an earth-filled dam.

Mr. Bass explained that there is a calculation used in engineering that compares the elevation of a body of water to how much water volume can be stored in acre-feet, noting that the existing reservoir has an elevation is 641 feet with 1,625 acre-feet of capacity for a total storage of 530 million gallons of water. He said that a roller-compacted dam must be built one foot at a time, and there is a risk of water leaking through the joints – a facing system overcomes that risk but can be very expensive. Mr. Bass stated that with an earth-filled or concrete dam, there is always the goal of reducing the amount of water that can go through the rock fractures. He said that over time, water can leak through these fractures and a grout curtain serves to minimize this water loss, explaining that the grout is essentially injected into holes in the dam to fill cracks and prevent water from migrating under the dam. Mr. Bass indicated that one concern Gannett Fleming had, which is shared by Schnabel, is potential water leakage into the natural ground. He said that Gannett had considered excavating and building a very high concrete wall, at a cost of about $6-8 million. Mr. Bass added that Schnabel has proposed an extensive grouting program to minimize water losses – at a cost of about $3.5 million.

He reported that an RCC dam would be about 126,000 cubic yards of concrete, and indicated that it would be the equivalent of 15,000 Redi-Mix trucks, but instead the plan would be to put up a concrete plant on-site and make the aggregate there. Mr. Bass also mentioned that the grouting would be $3.4 million with the facing panels costing about $3 million. He stated that Schnabel estimates an RCC gravity dam with a 20% contingency would cost $50.9 million, and an earth-filled dam would require 700 yards of earth – at less than $4 per yard versus $100 per yard for concrete. Mr. Bass explained that Schnabel recommends putting in a tunnel, which adds somewhat to the cost but is a safe approach for an earth-filled dam. He said that their estimate for that dam is about $29.5 million with a 20% contingency – for a difference of about $20 million less than concrete, with essentially the same water storage capacity behind the dam. Mr. Bass commented that the earth-filled and concrete dams will both last over 100 years, perhaps 200 if they are maintained. He said that the ancillary components of the dam – such as piping, handrails, and even some of the concrete – will deteriorate over time and need replacement. Mr. Bass said that almost 95% of the dams in the U.S. are earth-filled, so there is a long history and track record of their safety and design. He emphasized that both earth-filled and concrete dams do fail – but usually due to poor maintenance or lack of maintenance.

Mr. Bass presented the pros and cons of each alternative, noting that alternative selection is not entirely based on price. He said that the RCC dams usually require a specialty contractor, as there are not that many of these structures built in the U.S., and they need to be pre-qualified and probably only three or four bidders would apply; with earth-filled dams there may be 10-15 bidders. "It's a lot more competitive, and there's a lot more contractors that can do that work locally, where the RCC ones are generally going to come from out of state." He mentioned that there would be less traffic on Reservoir Road with an earth-filled dam, as there wouldn't be traffic trucking in the aggregate material, adding that the base of a concrete dam is about 110 feet wide – with an earth-filled dam at about 700 feet. Mr. Bass said that there is less concern with the foundation for an earth-filled dam because the base is wider. He added that with an earth-filled dam, there would be no impact to Camp Holiday Trails other than some traffic – but Schnabel would have to buy about ½ acre of land from Camp Holiday Trails. Mr. Bass said that there would be an additional 13 acres of trees that would not be needed with an RCC dam but would need to be removed with an earth-filled dam, and it would also take about four months

longer to construct because soil can't be placed when it's raining. He stated that there would be an additional 360 linear feet of stream impacted because of a wider dam footprint, and the inlet/outlet controls would need to be placed in the middle of the reservoir with a bridge leading to them. Mr. Bass reported that the lake would be pulled down by about 20 feet for one year, in an effort to excavate the soil for an earthen dam; the RWSA has done a study that shows they can live with the reduction for one year.

He also explained that much of the costs for a dam are for spillways, and because this is a regulated dam for Virginia as well as a high hazard dam, because the spillway must be designed for "probable maximum precipitation" (PMP) runoff – such as that produced by a hurricane. Mr. Bass noted that the National Weather Service develops the data that engineers use to design spillways, and a two-year storm event for this site is just under four inches of rain in 24 hours; 100-year storm event is about nine inches of rain in 24 hours; the PMP is a little over 37 inches of rain in 24 hours, which hasn't occurred frequently in the U.S. but almost occurred recently in Madison County. He mentioned that in Georgia they had a "half-PMP" event that caused several dams to wash out, with 22 inches of rain in 24 hours on the west side of Atlanta. Mr. Bass emphasized that we don't want the dam to fail, so we design it for extreme events that we hope never occur. Mr. Bass indicated the location of the existing dam on a map, showing the "borrow areas" adjacent to the upper dam and on the east side of the reservoir. He explained that the design target for the borrow area is to find available 1.5 times the soil needed, and Schnabel did an extensive study to determine what kind of soil is available and how much there is – and it was established that additional trees would need to be taken in order to get enough soil. Mr. Bass pointed out the location of clay-type material, presenting a picture of a zone embankment dam construction and explaining that chimney drains and blanket drains collect the seepage going through the dam.

Mr. Webster noted that the current dam was built in 1908, and in 1934 an earthen buttress was added to provide additional stability. He said that to control the seepage that goes through the dam or beneath it, a grout curtain is used. Mr. Webster explained that the clay soils present on-site provide a relatively thin core, and there are transition zones with silty soils and sands. He mentioned that during the final phase of design, additional geotechnical work would be done to better define the amount of core material – and the cost does include the potential for bringing in some of that material. Mr. Webster reported that there is seepage of about 118 gallons per minute, the brunt of which goes through the foundation and is then addressed by the grout curtain; the minimum flow past the dam criteria established by the DEQ is the equivalent of 17 gallons per minute, and 118 gallons is actually typical.

Mr. Bass reported that there would be a 60-foot high concrete tower for inlet/outlet controls with multiple elevations so water can be drawn from various elevations of the lake; it would be situated about 115 feet from the shoreline. He said that the spillway inlet structure will handle a storm up to the 500-year storm event level, and it will go into the tower, through the tunnel, and then into a plunge pool at the base of the dam. Mr. Bass added that if the storm is greater than a 500-year event, water would go into a 125-foot wide emergency spillway cut into the rock, with a 1,000-year flood having water run through a channel down the hillside and back into the creek. He said that there will need to be a 36-inch water line under pressure, and this raises concern if the pipe were embedded in the new dam as a burst could wash out the dam. To remediate such

risk, the water line can either be encased with a massive amount of concrete or put into a carrier conduit – which in this case is a tunnel. Mr. Bass stated that the tunnel would be drilled and blasted, with the 36-inch pipe placed inside placed on a pedestal. He added that the 500-year storm level would flow along the floor of the tunnel and then into the plunge pool below the dam; there is no conduit in the dam itself. Mr. Bass emphasized that most of the time when there is a dam failure it's because pipe penetrates through an earth-filled dam, so if the pipe is instead in a tunnel outside of the dam it removes the potential for possible failure due to the pipe. He added that dam security has become increasingly important, and the Department of Homeland Security is very serious about securing dams. Mr. Bass added that if a pipe is not located inside the dam, it eliminates the opportunity for someone to use the pipe to cause the dam to fail.

He explained that as a plan is developed, so are different cost estimates – and the slides he presented showed information garnered from their study and reviewed by a technical review team. Mr. Bass said that some costs have gone up, and some have gone down – with the final preliminary design showing construction costs of $20 to $27 million. He said that currently heavy civil construction work "is going dirt cheap," as there are a lot of bidders, adding that "it could be cheaper than what we think" when based on other large projects that have recently been bid. Mr. Bass emphasized that other costs – such as fuel and steel – could increase. He said that Schnabel has only been authorized to do a preliminary design, and the cost to do a final design and construction phase engineering services would be $3.7 - $4 million.

Mr. Webster reported that a total cost of $28.8 - $36.6 million would also include work on the I-64 embankment and tree replacement for 200 acres at Buck Mountain Creek, adding that there would be approximately 9,000 fewer truck trips on Reservoir Road. He said that the project would replace the currently inadequate spillway, and would yield 4.5 times the existing water supply available. Mr. Webster added that unemployment in Virginia is about 7% while the national average is 10% – but unemployment in the construction industry is 25% in Virginia, with 9,700 jobs lost over the past few years. He presented a rendering of the dam developed for Charlottesville Tomorrow.

Public Questions for Clarity

Ms. Christensen asked attendees to offer any questions for clarity, requesting that comments be held until after all questions had been asked.

Question from Rebecca Quinn, City resident: "You said you usually would like to see 1½ times of your zone one core materials on-site, but your numbers showed you need 79,000 and you maybe have between 80,000 and 90,000. And then you said that your price does include bringing in some clay. So could you clarify what the clay situation is?"

Response from Mr. Webster: "Regarding the question of bringing in soils, well two things. First off, the final study, as Randy has pointed out, we would do more geotechnical investigations, with test borings to better define the available clay on-site. So this is just based on the preliminary findings at this time that we have; it's about 80,000 cubic yards of material. So it's very possible that we could find more once the final study is underway. Having said that, the contingency that Randy has pointed out does include costs from contractors – as part of developing the contingencies were surveyed several contractors in Virginia and North Carolina

to find costs for earthwork, which would include either on-site cut and fill operations – or the potential for bringing in off-site materials. And we took that into account in the contingency costs."

Question from Betty Mooney, City resident: "The geographical data that you presented so far shows there's very little clay on-site. So how much more money will it cost us to find out if there is enough clay on-site. How much more do you need to be paid, and how much more testing? That's one question."

Response from Mr. Webster: "This would be part of a final engineering study. The proposal that we put to Rivanna referenced both preliminary and final study components. We up to this point have been involved in the preliminary study, and during the final study is when we would better define the soils specific to the clays – which would include test borings, additional salt laboratory testing, and help us better define what we have on-site. Still, we have a sufficient amount of soils on-site, but it's very possible that with the test borings we'll find additional soils on the site. But the cost, as Randy has pointed out – which includes a contingency – does take into account the potential for some soils to be trucked and on-site.

Follow-up question from Ms. Mooney: "But it is correct then to say that we would have to give you an additional $3.7 to $4 million to really tell us if there is enough clay on-site to reduce the cost of the dam. Would that be a correct statement?"

Response from Mr. Webster: "No, let me clarify that. The $3.7 to $4 million, that includes both the design phase and the construction phase services. So we're not contractors; we don't build the dams. But part of a successful project is to have good quality control, which includes being out at the site with the contractor during the entire process when it's built to confirm that the contractor is doing a good job, following specifications, following the documents. And this is the type of service that we have provided on several occasions in the past – here in town, including work in the rest of Virginia. So, the $3.7 to $4 million includes the design phase and construction phase."

Follow-up question from Ms. Mooney: "So could you break it down then, how much money is it going to cost to find out if in fact the dam could be cheaper by you finding enough clay on-site. Of that amount, of the $4 million, how much of that money do we need to turn over to you to figure that out, is my question."

Response from Mr. Webster: "It's about one quarter of that."

Follow-up question from Ms. Mooney: "So about a million?"

Response from Mr. Bass: "The final design – which would include any additional fill-work – is about $800,000….that's not just to find out; that's to do the final design, that's doing all the structural calculations. To do additional field work, which is test borings and all that…it may be $40,000 or $50,000."

Follow-up question from Ms. Mooney: "So once you do that, and you found out there wasn't really any additional clay on-site and the dam couldn't really be cheaper, would you then give us a better cost estimate? Would you come back and say, as Gannett Fleming did – they gave us a cost estimate of $37 million for a lot more than the dam. That included a lot more. Then they found the fractured rock in the second phase. The preliminary phase was the $37 million. So if you found that, would you then give us a new cost estimate?"

Response from Mr. Bass: "The final design will have its own cost estimate….and as we mentioned, in addition we've got about a 20% contingency – which is about $4 million – and then there's another line item called unlisted items, which is about $1 million. And those are for items, during a preliminary design you don't think about every nut or bolt, so we say about $1 million will cover those items. So there's basically about $5 million in contingency. If you had to import, say, 20,000 yards of clay material, we're talking about maybe $1/2 million, but well within the limits of the contingency. Right now we're saying we don't have 1½ times the available clay – at least right now, we don't know that – is that in the worst case if we had to import 20,000 cubic yards, it could be done under $1/2 million."

Follow-up question from Ms. Mooney: "So in the Gannett Fleming's estimate of the $37 million, which was their preliminary estimate, and also in their $72 million estimate, they included mitigation costs. Now we're talking about flooding more land – have you added in additional mitigation costs? They also had money for land replacement to be paid for the City of Charlottesville to replace land that the City would lose. They also had money for trail replacement – is all that money in your cost that you just showed us?"

Response from Mr. Bass: "I'll let Rivanna speak about the mitigation; that's not really part of ours. But the $72 million from Gannett did not include trail replacement…the last [estimate] was strictly the dam and the reservoir clearing and stuff like that, but not even mitigation work. But the last number for the dam – comparable to ours – is $72 million and some change."

Follow-up question from Ms. Mooney: "So your cost doesn't include any of the things that I listed."

Response from Mr. Webster: "Just to clarify here, this cost here – the $28.5 million to $36.6 million – that includes mitigation costs as well as the work for I-64."

Follow-up question from Ms. Mooney: "And the trail replacement and the land replacement?"

Response from Mr. Webster: "If it's part of the mitigation costs…"

Comment from Ms. Mooney: "No, it's not. It was a separate cost, so we'll have to go over that."

Question from Sam Freilich, County resident: "Is the dam that you're proposing earthen dam, is it solely earth or will it be a combination of earth and rock?"

Response from Mr. Webster: "It's an earth dam."

Follow-up question from Mr. Freilich: "A purely earth dam, there won't be any rock?"

Response from Mr. Webster: "The rock is represented by the rock cut, of a rock spillway, but the dam itself is constructed – the center's clay and silt, and then sandier soil."

Follow-up question from Mr. Freilich: "And since we found out that the original dam is over-cracked and potentially unstable rock based on taking it so much higher, were there borings done in the area you are projecting to put the dam, this earthen dam. To show that that rock underneath it is stable?"

Response from Mr. Webster: "Yes, that's right. We have several test borings. We have ten borings in several geophysical lines in the dam footprint, and then again during the final stage, the final design phase, we would do additional test borings…"

Follow-up question from Mr. Freilich: "Could you say then at this time that there is no unstable rock underneath it, or would that require some additional study?"

Response from Mr. Webster: "Well, I would encourage you to take a look at the rock core samples that we brought tonight; the rock, the upper portion, does have some fracturing…and then the rock that's at a greater depth – more than 20 feet – does also have some fracturing. But, it is based on the Schnabel's evaluation as well as info from the panel of experts, the independent review panel that the more fractured rock can be effectively grouted."

Follow-up question from Mr. Freilich: "Effectively grouted. You're talking about the 20-foot deep rock, is that what you're saying?"

Response from Mr. Webster: "I'm saying the rock that's greater than 20 feet…it would be grouted, there's a grout curtain. There's a drawing over there that shows the grout curtain – it actually is a series of holes and a minimum of two rows of grouting, and that represents a low-permeability barrier that would dramatically reduce the seepage that would go through the more fractured zones. And again we have the rock, which I'd encourage people to take a look at those to get a sense of the quality of rock. The rock quality is actually quite good at the site, especially below 20 feet. It does have some fracturing but it's typical to the Piedmont area. This is a rock, it is metamorphous granite…typical for this area, and it's a good foundation to build a dam on."

Follow-up question from Mr. Freilich: "So you're reasonably certain there won't be any movement or potential structural failure on this dam."

Response from Mr. Webster: "That's correct. Again, the thing to keep in mind is the seepage is not a stability problem, it's not a matter of safety, but a matter of you want to reduce seepage because that is a cost that's reflected in pumping – so we want to minimize the amount of seepage that goes through but we don't want to throw a lot of money at it either. In other words, about 95% of the seepage can be effectively addressed with the grouting program, for which we have $3.5 million in our budget…and so you don't want to chase a lot more money after it to try to bring that up to like 99%..."

Question from Rebecca Quinn, City resident: "I think you said in passing and I'd like to clarify what is proposed for the existing dams, and I believe you said they would remain, so doesn't that isolate a certain volume that would not be available under extreme conditions?"

Response from Mr. Bass: "With the RCC option, you're basically going to remove a portion of the lower dam, and you've got to reach the upper dam for the water – right now the water is reaching the upper dam through a broken pipe. So you can't ever guarantee that that broken pipe won't eventually just cave in. On the earth-filled dam, because the inlet/outlet pressure is not near the old dam….we're not going to touch the old dam. What will happen is that if the water got down below the level there's going to be a little pool of water in between the old dam and the new dam. We're talking a small amount that's going to be sitting there. We're going to actually breach the upper dam. If you notice the borrow area up by the upper dam, we're going to basically recycle any good soils out of the upper dam and use them in the new dam. So that dam will be almost completely removed, and then the water will flow freely from that lake into the other lake. So the upper dam basically is going to be mostly removed; the other one's not going to be touched."

Question from Jim Hill, County resident: "What is the Corps of Engineers involvement in your design during construction?"

Response from Mr. Bass: "None. None at all. It's regulated by the state…"

Follow-up response from Mr. Webster: "…with the exception of the stream mitigation by the DEQ and the Corps. But Randy's correct on the dam design itself. It's a DCR [project]."

Question from Mr. Hill: "Would use of reinforced earth help reduce some of your earth-fill quantities?"

Response from Mr. Bass: "You know we looked at several…going back to a rock-filled dam, there is some rock like for the emergency spillway, we thought about maybe making part of the downstream toe out of rock fill. We'd make it steeper and use less material. And those types of things during the final design will be revisited a little closer – you know, is it cheaper to make part of the dam rock fill and most of it earth fill? Because we do have a retaining wall downstream to reduce the impact to the stream, but the reinforced earth, it's possible to use it, you know I wouldn't make a hundred-foot high reinforced earth wall in a high hazard dam; but potentially it might could be used as a toe. But I think right now when we build that emergency spillway, there's like 30,000 yards of rock that comes out of there. We can use that rock for rip rap for the upstream slopes instead of buying it, and we might could use it as part of the downstream toe. But those are things that would be looked in the final design."

Question from Mr. Hill: "You've talked a lot about the what and the how much – what about the when? What is the potential timeframe for construction?"

Response from Mr. Bass: "As I mentioned, the final design has to be done first, and I'm going to say that's probably about a seven-month process. So if we had authorization, say if we started final design now, construction could start next spring."

Follow-up question from Mr. Hill: "How long would that take you?"

Response from Mr. Bass: "About 18 months."

Question from John Martin, a Board Member of the Albemarle County Service Authority: "Thank you very much for your excellent presentation. I saw your presentation at Rivanna and then here…there's one term that you used at Rivanna and then here, calling the dam a 'high hazard dam,' and I wonder if you could clarify precisely what that term means?"

Response from Mr. Bass: "Good point. Calling a dam a high hazard dam does not reflect on the integrity of the dam, it doesn't mean the dam is unsafe or anything. It basically means but means that if that dam were to fail, it has the potential to kill people. So when somebody says 'that dam's high hazard,' that doesn't mean the dam is unsafe – It just means that the consequences of that dam failing would actually impact people's lives."

Follow-up response from Mr. Webster: "It's a classification by dam safety."

Question from Chad Freckmann, City resident: "Could you clarify a little bit regarding Interstate 64 on the map here in your presentation, it doesn't look like the new reservoir goes underneath 64, and you made a couple of comments in mitigation doing something with the embankments. So could you please clarify that?"

Response from Mr. Webster: "With the expanded reservoir, there is – those of you who are familiar with that site – I-64 has an embankment that is about 145 feet high that goes along one edge of the reservoir now; and there's actually an existing culvert that goes beneath that. There is an unnamed tributary where the water comes in from the other side, and empties into the reservoir at the present time. With the 45-foot height increase at a proposed elevation of 686, water would raise up onto each side of the earth embankment that supports I-64 by about 30 feet. The evaluation of that embankment Schnabel is involved in – we're involved in the geotechnical components – but as a sub-consultant to another firm, who I understand will be giving another presentation with their findings in the not-too-distant future. There is, with the expanded reservoir, a portion of this fill embankment, again it was filled in the 1960's, that will be inundated with the raised reservoir.

Question from Dr. Liz Palmer, County resident: "I have a question about the construction itself. You were talking about how the prices of construction are good right now, and it would be obviously helpful for us to take advantage of that if possible. Is this a year-round project? You said you would start in the spring and obviously that's associated with how long it would take somebody to do the final design. But if you for instance started in August, would it go all winter long or is there a season that you can do this construction?"

Response from Mr. Webster: "That's a good question. The construction process for an earth dam is a little different from the roller-compacted concrete dam. The concrete dam is typically done in several shifts, and work is done during the day and the night; and it's advantageous to do concrete work like that in the winter months, in the cooler months. Whereas with an earth dam, it's a little different. You use conventional earthwork construction methodologies and we anticipate that Rivanna would limit the construction to the daylight working hours – sunup to sundown so to speak, and probably Monday through Saturday. And as Randy pointed out earlier, the construction schedule would probably be about 16–18 months, so it's about four months longer than you would have with a concrete dam."

Additional comment from Mr. Webster: "During the winter months, if it's cold and wet, you probably won't be placing earth. You'll have to wait for the drier months. But during the winter months, they can be actually building a tunnel and pouring concrete. So they might not be placing earth during the winter, but they can work on the other portions of the project."

Question from Dede Smith, City resident: "With any project as large and complex as this, I think we all understand there's a number of design phases, and when Gannett Fleming was fired – actually at the point they found the fractured rock – they were 25% into their final design, and so I'm wondering at what point in the final design, and is there anything you know you don't know that might be your 'fractured rock.'"

Response from Mr. Bass: "When you look at the design, some portions like a hydrology study and the hydrology of the spillway, that's … 95%, and then you might find some that might be at 20% - so it varies depending on the components. So at preliminary design, I'd probably say is at 35%, so if you average all the parts together. Right now we chose a tunnel option, and we've got limited borings and we've got some geophysical surveys along that alignment that show where we think the rock is. Now generally, tunnels are cheaper to build in solid rock than in poor rock, so one of the things to confirm the tunnel alignment would be more borings to make sure we've got good rock where the tunnel's going to go…in the report, we mentioned the tunnel would cost us about $400,000 from another alternative – and that's putting the pipe beneath the dam. It would be sitting on rock encased in concrete, it's done all the time…but the water authority said hey, for only $400,000 more let's put it in the tunnel and make it that much better. So my 'fractured rock' would be the rock where that tunnel is. Is that tunnel still only $400,000, because that's based on limited engineering."

Question from Ms. Mooney: "Would you say you know how far along you are in the embankment design and cost of that? At what point would you put that in terms of design phase?"

Response from Mr. Bass: [Editor's Note: Mr. Bass' response described his work on the preliminary design of an embankment that is part of the earthen dam, not the I-64 embankment.] "We went through, we did some limited soil laboratory tests – because what you had to do is get the strength properties of the soil to see how strong it is and how impermeable it is. So we did some limited testing and Gannett did some earlier, but we actually do some more. We don't think we're going to find anything different because all our soil borings show that the soil is really all the same – it's either clay or sand. But you don't want to base your stability analysis

on the dam, say, on four samples...but we did a limited stability analysis to confirm the slopes. So you have to look at earthquakes and all these things, and we did a limited seepage study, again based on permeability – but we want to do more just to make sure we've got the extremes. Because you always want to test at the lowest strength…"

Question from Ms. Mooney: "Does your cost include a hazmat for the worst possible toxic spill we could have? Does your cost for securing the embankment include that, and also does it include a thousand-year flood event for that embankment?"

Response from Mr. Bass: "The PMP, a lot of people refer to as 10,000 year flood – well that's the highest – that's the one you design for. Now Virginia law, and it's been in the news, they used to have a full PMP, now that's been changed because some people thought that was extreme, but a lot of states and all the federal agencies require the full PMP, which is 10,000."

Follow-up question from Ms. Mooney: "So your costs would include that at this point? I'm not talking about the dam, I'm talking about the embankment reinforcement. The highway – I mean for the toxic hazmat, the highest level of protection, and also the highest level of flood event."

Response from Mr. Webster: "You're using a lot of extreme words here…"

Follow-up question from Ms. Mooney: "Well that's what you said about the spillway and terrorism. I mean, you brought this up, that we need to do this because of terrorism, so I'm talking about terrorism."

Response from Mr. Webster: "The $28.5 – $36.6 million does include the cost associated with the I-64 embankment, and again we're working as a sub-consultant on that project, but it does include spill containment; the extent of it, I can't answer – I know it does include spill containment, and that's work that we're doing with other firm…the spill containment is part of technology…Volkert will be giving that as part of their presentation."

Follow-up question from Ms. Mooney: "The earthen dam with the chimney design seems unusual. Can you give an example of where this has employed in a similar situation, and can you also give an example of where you yourselves have constructed an earthen dam in the mountains, which also seems rather unusual?

Response from Mr. Bass: "Well chimney drains are very common in engineered dams, a lot of farm ponds don't have them…but there's different types of them. A chimney drain can be vertical, it can be on an incline. But they're very common in a zone embankment."

Follow-up question from Ms. Mooney: "So you have designed one of these, in a dam this size in the mountains?"

Response from Mr. Bass: "Those pictures I showed earlier have chimney drains. It's a common design feature."

Follow-up question from Ms. Mooney: "And those were in the mountains?"

Response from Mr. Bass: "Well in the Appalachians…"

Response from Mr. Webster: "Some were in the Piedmont. It's the same geology."

Response from Mr. Bass: "Also, you've got the chimney drains and you've got what's referred to as the blanket drain. Underneath the downstream shelves, that whole valley is covered with sand and gravel, so if any water comes to a rock fracture that wasn't grouted, it's picked up in the drain. There's also called a trench drain or a toe drain, and that runs around the perimeter – so there are all sort of what we call internal drain features to make sure the dam stays dry."

Follow-up question from Ms. Mooney: "So the reason Gannett Fleming got fired was they wouldn't assume the risk of the seepage of this dam; they wouldn't assume that risk. They said they could build a cheaper dam – they had told Rivanna that, and Rivanna was going to go with them. So will you assume the risk? Are you going to take the risk of this dam? Are you going to assure the cost, will you guarantee the cost of the final design, and will you also assume the risk – and not ask Rivanna to assume the risk – of the dam and any failure, or any over-cost, overruns, any seepage?"

Response from Mr. Bass: "Every day as engineers, our job is assuming risk on every project. Well I've got a professional license."

Follow-up comment from Ms. Mooney: "Gannett Fleming wouldn't, and they're very well-known engineers too."

Response from Mr. Bass: "Well, I'm not sure about Gannett Fleming…but an earth-filled dam that size is very safely designed and constructed."

Follow-up question from Ms. Mooney: "So all we want to know is if you'll take the risk, and you're telling us right now [that] any risk, you're going to sign off on."

Response from Mr. Webster: "Well our professional engineering licenses, we stand behind."

Follow-up comment from Ms. Mooney: "Well, Gannett Fleming had that too, but when they had to sign the contract they wouldn't so…"

Comments from the Public

Ms. Christensen asked for public comments on the dam project presented.

Comment from Sam Freilich, County resident: "I reside in Ednam Forest in the County, and as you may know, Ednam Forest is the closest residential subdivision to the subject expansion, and many of us in Ednam Forest are rather concerned. The existing dam we have now seems to be quite sufficient for the population that we have now – which is roughly 150,000 people. When we had the major drought in 2002 which lasted over six months, there was still over 50% water capacity in the dam. So clearly we're starting from a good point. If we look at what has

been proposed, and that is increase over 50 years from our existing population – 150,000 – to 250,000, that's a 67% increase. What's being described here tonight is a 440% increase in the volume of water. [Editor's Note: Mr. Freilich is assuming there is a linear relationship between the volume of storage and the yield of a reservoir to water supply, but the relationship is not linear. Complex safe yield computer modeling is required to correlate storage to yield.] Now that can only mean to me that Rivanna Water and Sewer Authority is planning to either allow certain reservoirs to silt in and become impotent, or they're just going to close down other dams. It's worrisome to me to have all our eggs in one basket. I don't think it's a good idea. I'm especially concerned about 64 crossing a portion of the dam, which still will be the case. And even though you say it's failsafe, we're looking at an incredible tragedy with BP. Anything can happen, and if that's going to be our only major water source – or 95% of our major water source – we're asking ourself for a potential tragedy in the future, besides the environmental and ecological damage. We're talking about clear-cutting tens of thousands of mature trees that act as a carbon sink; you're talking about killing and displacing hundreds of animals that live in those areas – 200 acres now, plus or minus, are going to be clear-cut and will stay as stumps for 7-12 years, until there's enough water to be able to allow the pipeline to be built, and so far we have no information on a pipeline that has to pump tons of water well over nine miles, because the Western Bypass no longer exists. That's the basis of this originally, uphill and downhill. What's going to be the cost of the power plant or plants to run that to make it work? They are overwhelming questions. The dam needs to be replaced, and I'm glad these guys are doing it, and I think their approach to an earthen dam is excellent. It's the size of the dam that I think is irrelevant and important [important]."

Comment from Rebecca Quinn, City resident: "To answer the specific questions, my response to the preliminary findings – the design – is I think y'all have done a great job. If there is a dam, it looks like this would be a good one. It looks like y'all have been very thorough in your analysis, and I know a little bit about what y'all are talking about, so I'm pretty comfortable with that. What do I like about this project? I don't like anything about this project, for the reasons previously stated. If we don't have a problem, then I don't care how low the cost is on this dam – it's more expensive than doing nothing. Where are my concerns, where do I have concerns? I think we've already expressed those. They're not about the dam design or this design; they're about the justification for whether a dam is needed. Thank you."

Question from Susan Ward, County resident: "I want to know that if this dam is built, what type of oversight and what level of involvement Schnabel will have in following quality control issues, and making sure that the dam is built properly. Many times there are quality control issues that are not watched after, and you don't get the product that you are looking to get. How does that get managed?"

Response from Mr. Bass: "A design is only as good as what is constructed, and on a dam like this there is full-time staff out there to run like compaction tests to make sure the filters are put in right and everything's built to the right size. And it is a critical component of a dam like this to make sure that you get it right. So there are a lot of engineers that take initiative with a construction project to make sure that it's done right."

Follow-up question from Susan Ward: "So when you put your name on it and stamp on it, you're going to make sure that it's done right?"

Response from Mr. Bass: "Right. And the other part of that is, on any dam, there's a lot of instruments that will be installed in the dam and beneath the dam. So as the lake's being filled up, the instruments are being monitored to make sure the pressures are what you thought they should be. So that initial filling of any dam is the most critical time, because everything that's put under it is stressed for the first time. So that first time that dam is being filled, it's being closely monitored by Rivanna's engineers, and if they hire a consultant to help them. But the QC and the quality assurance is critical…"

Additional response from Mr. Webster: "…in addition to my work at Schnabel I also teach part-time at U.Va. as an adjunct in the engineering department, and one thing that I tell my students – the three major components for a successful project are 'communication, communication, and communication.' And so it's important not only for Schnabel doing the quality control work, having good communication with the owner's representatives, contractors, suppliers – but just as importantly with all the other stakeholders, which includes folks like Camp Holiday Trails, Ednam Forest, all the folks along Reservoir Road, to get their input. And again, to have a successful project we need to know what those concerns are and make sure that the contractor follows through.

Comment from Dr. Liz. Palmer, County resident: "I just want to say that after about, I guess 14 years now, of being involved with Rivanna Water and Sewer Authority – I got involved in the beginning because of the deteriorating aging infrastructure in the Ragged Mountain/Sugar Hollow system – so for me this is long overdue. And I'm very, very pleased with what you've done, and I'm very anxious to see it get started. My big concern is that we will continue to do additional studies on other parts of the water supply plan and we'll miss our opportunity to take advantage of construction prices as they are today. Thank you."

Comment from Ms. Smith: "One of my concerns should this go forward is that with the mining of earth and the lowering of the dam, and then the clearing of the forest, how will we prevent massive erosion over the period of time, particularly given that after the dam is built it will be a good – unless something's changed – a good decade before it's filled. So how do you time the clearing of forest without getting major erosion during storm events?"

Comment from Richard Lloyd, County resident: "You were talking about the instrumentation of the dam, the filling of the dam, and generally when you build a dam you have certain guarantees that are given that it's going to fill and that it's going to work. My question is, as this dam is built, we know that it's not going to be filled for 10 to 15 years. [Editor's Note: Computer modeling performed for RWSA shows the new reservoir can be filled using the existing Sugar Hollow pipeline within three years.] Does the guarantee exist that will transcend those 15 years; will Schnabel stay on the job for those 15 years to make sure that all of the work you've done is proper and that it's working out as designed, and that the instrumentation is properly monitored?"

Comment from Bob Gilchrist, County resident: "I just came to observe and learn about this project, and I like it. What I am concerned about the most though is seeing all the enemies of this project line up with their written statements, and there isn't just a single source of our water system. There's the Sugar Hollow Reservoir; there's the Ragged Mountain Reservoir; there's South Fork – and all of those will still be holding water and be available to the system. And these people tend to say how worried they are about the environment and so forth, [but] they're willing to give up the Moormans River, which is one of only two scenic rivers in the state of Virginia, to keep that thing empty by putting more and more water out of Sugar Hollow and into another reservoir. And that infrastructure is shot, and I'm just amazed - these people have put on two years of additional time and studies and $500,000 worth of additional studies, and we need to get on with this dam thing and get our water system working."

Comment from Ms. Mooney: "I'm sure that Schnabel is a very good firm, and what they've done is good work, but our community is finding I think that we don't need this dam, and because the construction environment is so good dredging is looking more and more like the best alternative. And certainly no one in this community wants to starve the Moormans River of water, and I don't think that's what our ultimate plan should be – I think it should be an integrated plan that looks at all elements of our environment and our community. And I think costs have to be a factor, and I think the dam even though it is still under investigation is extremely costly. And it needs a pipeline that we know is probably $60-100 million, and that's not even with operating costs. And the environmental costs really haven't been talked about very much. I know the Moormans River is certainly one we want to consider, but there are many others that need to be considered. So I think that on the whole, we're going to end up saving at least $100 million I think…that's because our City Council has been brave enough to go forward with this dredging study. And I think I have to disagree with Mr. Gilchrist that we will end up with three viable reservoirs. The water plan as it now stands will allow the South Fork Reservoir to be lost to siltation in the 50-year plan; the pipe to Sugar Hollow will be cut off – that will not be a direct source of water – and we will end up essentially with one reservoir, no redundancy in this plan as it ends in 50 years. So I think it's extremely important to look at dredging, because that now looks like, once we get the cost information, it's environmentally the best solution. It will cost the least of any of these plans, and it will take care of all the water we need. This plan was based on faulty information, and I think we have a dam design we don't need. I appreciate Schnabel's good work. It's not their fault, they were hired. But I think it's a waste of the community's money that we went forward with yet another dam design after we fired Gannett Fleming, without first getting the dredging information to see if that was a much less costly and more environmental solution. And I hope that now that will finally come forward, and we'll get the right information on the water we need and the correct dredging information that we've never had."

Comment from Ms. Christensen: "We are going to have another meeting later in the month about the dredging, and we'll take comment then about that. But let's focus, let's just dredge you for all the good stuff you have to say about this proposal – what you like, and what you don't like. And I understand how the issues are inter-twined in some ways, we just wanted to have some really crisp, clear feedback regarding these preliminary findings this evening."

Comment from Richard Lloyd, County resident: "The last information we have on the current Ragged Mountain Dam said it needed a new spillway, which I think everyone agrees to. Additionally, there's a space on back of the dam where if we had an earthquake, the earth would bounce and it would go down, slip down the embankment. And both of those could be filled at the time for roughly $3.5 million, and the comment that was given in the quotation was that that would stabilize the dam 'for at least another 100 years.' And yet now we find in this very room, Charlottesville Tomorrow put on a presentation and they said 'here's the dam at Ragged Mountain,' and they showed the picture of the 1908 dam – in fact, they showed this picture that's in the presentation today. Ms. Palmer keeps saying it's a very frail dam that's ready to go, and yet we don't have any evidence to that. Nobody has looked….last Christmas at Christmas parties, Schnabel's employees were out saying 'this dam is no good.' Of course if this dam is no good, then we have to build 'that' dam. So I'm just kind of concerned because I can't find this dam. When I go out there, it looks like an earthen dam with a cyclopean face – not what is pictured over and over and over in the community. And I just wish we'd get that squared away as to whether the dam we have now is serviceable, given that it needs a new spillway and it needs some additional work done to it."

Question from Dr. Palmer [to Schnabel]: Do you think that you could say something about the condition of the old dam, before we leave tonight?

Response from Mr. Bass: "Gannett Fleming did a very limited investigation – they drilled two holes through it – and got some data…they did a stability analysis based on that data. And you look at the type of construction, and that was fairly common back then – where you built a gravity dam out of large boulders and you kind of put cement mortar to kind of hold it all together. So it's a gravity dam; there were no joint treatments; there was no what we call 'transverse joints' that you see in concrete dams – that was fairly common back then. The problem with them – there's numerous problems with just that type of design – is particularly in today's thing, where earthquake load is a critical component, you know we look at conventional concrete structures and we want 4,000 PSI concrete. We don't want an average of 4,000 – we don't want 2,000 and 6,000 and the average is 4,000 – and that's what you have with this type of construction. You've got poor quality concrete here, good quality here."

Comment from Mr. Lloyd: "But it's an earthen dam."

Response from Mr. Bass: No, I'll get to that. Because the original picture was built as a cyclopean concrete dam, and there's a picture in your hand out of it. So the problem with cyclopean concrete is that its strength properties are very erratic – you've got six-foot boulders, one-foot boulders, cement mortars – so the problem with those is if you get an earthquake, they're not going to withstand; it they're going to crack. It doesn't mean they're necessarily going to fail, it might, but it's going to crack to where you have water squirting out and potential failure. That's one big problem with cyclopean concrete and construction; you don't see it built anymore, because there's a reason for that. It's built like that picture shows as a gravity dam, and in the 1930s there were some letters written raising some concerns about the stability of it; and in the 30s there was this earth buttress placed against the back of the dam – there's no design or documentation exactly why it was done – so based on those letters that were written there was

concern about the stability of the dam. Richard, as you mentioned, it won't just slide downstream."

Comment from Mr. Lloyd: "Referring to earthquakes, there's a section that Gannett Fleming just a few years ago identified, but not back in 1933. Those design parameters have never been found – we found the 1908 but we never found the 1933 design."

Response from Mr. Bass: "You're absolutely right. No, that's right. It's fairly conjecture on my part I guess, that there were concerns about stability and they put this buttress – which is common to buttress something. That's a way to fix an instability problem – you either add concrete, or in this case you add dirt and rock I guess it probably is, as a buttress to keep it from sliding. So that's not uncommon of a way to rehabilitate a gravity dam that has stability issues."

Additional response from Mr. Webster: "To give you a sense of a history, the original dam was built in 1908, and some of you are familiar with these letters – in the1912-1913 timeframe – where letters came forth, three letters to our knowledge. One by the contractor, another by a designer, and a third by an independent consultant. All three of these letters were found in the personal collection of John Newcomb, the second President of the University of Virginia, and was also head of the Civil Engineering Department. It's the opinion of the University of Virginia Special Collections Library that the independent consultant was John Newcomb."

Comment from Mr. Lloyd: "He didn't sign his work? The head of the Civil Engineering and he wouldn't sign his work?"

Response from Mr. Webster: "I'm just saying what was stated by the University of Virginia."

Question from Mr. Fenwick: "So are you saying that dam is unsafe in any way?"

Response from Mr. Bass: "That dam is unsafe in many ways. One is the spillway is inadequate. It was built inadequate. I'm kind of surprised that the design engineer built it so inadequate, but it is."

Question from Mr. Fenwick: "So would you consider it a conflict of interest since you're trying to get the work to design the new dam to sort of put in the public perception that that dam is really not safe?"

Response from Mr. Bass: "No and I'm glad you brought that up because it's been brought up before. I'm a professional engineer, a licensed professional engineer. Ethics and public safety [are] at the top of the list of what I do as a dam designer. When we did this alternative study, I could have told Tom here – 'yeah, let's design an RCC dam because that's higher fees for Schnabel; it's going to cost more, take more manpower.' No, I went to Tom and said 'Tom, an earth-filled dam is best suited for this project for a variety of reasons,' and I didn't tell Tom we were going to make less money, but we will. So the accusation that I'm going to choose something so that I can make more funds from my job, it's a slanderous statement."

Follow-up question from Mr. Fenwick: "OK, so just to make it clear then, what you said tonight just now in no way says that that dam, the existing dam, is unsafe."

Response from Mr. Bass: "Well I just said the spillway is vastly inadequate…now the stability of it is not known completely because the data that Gannett took is very limited; it was a good result but it's not enough to say the stability of the dam is safe or unsafe. I can't go that far. But we know the spillway is vastly inadequate; we know back in 1912-1913 some issues were raised and in the 30s somebody put a buttress there for some good reason."

Follow-up comment from Mr. Fenwick: "Which has lasted 80 years, so you're sort of minimizing what was done as well."

Comment from unidentified speaker: "The Corps of Engineers in their Phase I inspection report said that dam was unsafe. And state dam safety says today that dam is unsafe."

Response from Mr. Bass: "I will call it unsafe because I know the spillway is; I don't know for a fact personally that it has stability issues – I would assume it might, but I can't tell you for certain."

Comment from Mr. Lloyd: "In 1933, some qualified engineers put a buttress against that dam, knowing that the dam leaked. It's a cyclopean dam and it has no expansion joints; it has no freeze-thaw capabilities. They knew that thing was going to leak. Now the buttress is a buttress that stabilizes it; Ms. Palmer has said that this thing is improperly moored…it's not going to move against the buttress. But the buttress was also designed as a dam. It holds back the water. The water comes through the cyclopean dam as it always does because they don't have expansion joints. So somebody had to engineer this to keep the water table below the surface of the soil, which has done very well for the last 80 years. I don't know that we've had any leakage problems of any note, of any significance."

Comment from Ms. Smith: "I'm sorry that this has gotten so contentious over the years, but I think all are commonly concerned about the environmental impacts, including the Moormans River, and one of my concerns is that because there is not enough natural inflow, and very little natural inflow, and it does need to be filled from someplace else, that in the interim between building this dam and potentially building the new South Fork Pipeline – it's going to be filled from the Moormans. And in fact Ridge Schuyler from the Nature Conservancy, at a Dredging Task Force Meeting – and it's on podcast – said 'it will be filled by the Moormans River.' And my parallel concern here is that as our demand is going down, and we take on the debt of building this dam in the 10 or 12 or 15 years before the pipeline is scheduled to be built, it will be so obvious that we do not need this water, that that pipeline will never be built. And it will continue to draw from the Moormans River because won't even be able to afford the debt service on the dam we've built."

Comment from Ms. Christensen: "What a wonderful airing of, mining for more questions, really intelligent questions that inform the conversation for all of us, but also then the diversity of opinion. It's obvious that you don't all see things the same way – which is part of the richness of the conversation. Because we have to at least listen to the other opinions, and expose where

there's some deep concerns that continue to be a part of this dialogue. What I'd like to do is close this session and ask Mike to come up for next steps. And thank you sincerely for your contributions of questions or comments, because it's going to make the project ultimately better. Thank you.

Closing comments from Mr. Gaffney: I'd like to first start out by thanking all of the elected officials that were here this evening, as well as Board members and staff from Rivanna. And the public for attending, and definitely participating. The Rivanna staff will review the public comments and consider all appropriate selections and clarifications, and Rivanna will continue to offer opportunities for civic/community organizations to learn more about Rivanna. All you need to do is call and talk to Mary Knowles to set up a speaker to come out and speak to your organization. Please complete the meeting evaluation if you haven't done so. They're at the back table, if you didn't pick one up on the way in. Also, please sign in and if you leave your email you'll be on the email list, which will continue give updates on the community water supply plan. Rivanna will be holding another public meeting later this month – June 30th – here in this room, 6:00, and that is a Wednesday. I hope to see all of you here again, and bring you friends. That will be on the Phase Two of the dredging feasibility study by HDR….Thank you all for coming. The Rivanna Water and Sewer Authority meeting is adjourned.

Respectfully submitted,

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Mr. Robert W. Tucker, Jr.
Secretary-Treasurer