

CLAYTOR LAKE PROJECT NO. 739
APPLICATION FOR NEW LICENSE

UPDATED STUDY PLANS MEETING
CLAYTOR LAKE PROJECT NO. 739
November 29, 2007

DAY TWO

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The following UPDATED STUDY PLANS MEETING came on to be heard on this the 29th day of November, 2007 at the Claytor Lake State Park, Dublin, Virginia. TERESA

ROGERS: Let's go ahead and get started. My name is Teresa Rogers, I'll be heading up the Claytor relicensing. I think I know everybody who is here. They're mostly consultants this morning, but that's okay.

BILL KITTRELL: We appreciate you all coming out for just us three state guys.

TERESA ROGERS: We appreciate you guys being here. The way we do this, we pretty much stay with the agenda. Some people come in for just one particular study for what they're interested in so you'll be seeing people come in and out today.

I do want to give a brief overview. I know most of you have already heard it before so I'll go through it quickly. Just so everybody does know who all is here we'll go through the room first and introduce ourselves. We'll start up here.

[Thereupon participants introduced themselves.]

Melissa is going to be transcribing the meeting today so if there are any questions or anything make sure you state your

name first so that she can get it down for the record. That will be going in as part of our filing with the FERC.

This is a real brief update from the last meeting. We last met in May. We've had some different studies, consultation on some of these studies between then and now, but as far as our big update meeting the last one was held in May. The first year of studies have continued.

We filed our initial study report with FERC on November 13 and then this is the initial study report meeting. It is part of the ILP process. The approved studies, just so everybody is on the same page, we're going to do aquatic resources assessment, cultural resources, debris, erosion, fish entrainment and impingement, instream flow needs and reservoir elevation, native and exotic aquatic vegetation, navigational systems, recreation and angler use, sedimentation, water quality and then wetlands, riparian, woody debris, littoral and bald eagle habitat.

As I said before, this is a meeting that is required. It's part of the ILP process and it's to update stakeholders on where we are in the study, discuss any modifications that may need to be made and if there are any new studies that need to be done based on what

we've found so far.

The consultants are going to be here to discuss where we are in each one of the studies and kind of give you an idea of the data that's been collected so far and then we'll review those upcoming due dates for the ILP process.

I do have a copy of the process plan over on the table for you to take with you. It gives you all the deadline dates for filings by the participants and by us and FERC. Yesterday we did a review of the aerial mapping and bathymetry. We do have an example here if anybody is interested of what that looks like.

We did sedimentation and erosion update, instream flow needs, debris, habitat and aquatic vegetation and recreation and angler use. Today we will followup with cultural resources, water quality, aquatic resources assessment, that includes the mussel surveys that's been done to date, navigational aids, fish entrainment and impingement and I'll give an update on shoreline management.

As far as upcoming due dates, I will file a summary of this report by, of this meeting rather, by December 17 and then the participants have until January 16 to file their comments on the studies until now and any study modifications or new studies.

I guess we had some discussion yesterday because we don't have a lot of data for people to look at yet in order to make some assessments I think there was some question about what do you do in this case and John was going to followup.

John, I don't know if you had an opportunity to talk to anybody because it was kind of late yesterday when this came up.

JOHN SMITH: Well, I learned this morning that it's happened on a number of projects so it's not that unique. What the applicants have done in those cases is try to set up a separate or an additional iteration in the process plan where when the studies did come out or the draft studies were completed there was another go around of comments and a FERC study plan determination.

TERESA ROGERS: Okay.

JOHN SMITH: So, I mean you would have to agree to that and then if you did agree to doing that in the summary you could just state that that's what we've agreed to do is, you know, establish sometime in the spring when the majority of the studies would be completed.

The agencies and the other participants could comment at that time and then FERC could issue a determination.

We would still want to go through the one that's in the schedule, you know, in January. You know, this first iteration for any of those studies that people are comfortable commenting on we still want that to occur.

TERESA ROGERS: Okay. I think that's kind of what we had in mind anyway with the draft study reports and then having a comment period before finalizing the reports, so I guess the only thing different is that you guys would actually be making a determination after those comments.

JOHN SMITH: I mean, if it's necessary. If there were modifications or additional studies requested at that time then we would have to say something about it, but, you know, that would only be on an as needed basis.

TERESA ROGERS: Okay.

JOHN SMITH: The one thing I think we would like to avoid is having a determination after completion of every individual study. We would rather it be lumped together at a convenient time.

TERESA ROGERS: Okay.

JOHN SMITH: I don't know if that necessitates another meeting or if you just want to do it via email, you know, I'll kind of

leave that up to the group to think about.

TERESA ROGERS: I believe in our schedule we had planned another update meeting in May.

JOHN SMITH: That would be good then. That would be a good time to check in again on the completed study.

TERESA ROGERS: The only thing that would possibly be left out of that would be the April/May information that we didn't obtain for the recreation that we talked about yesterday, so that's something to keep in back of your mind. We may not want to wait til then. You'll see the data before April so maybe we need to keep that in mind.

JOHN SMITH: Yeah. I would definitely encourage people to comment on the studies or the information that we know about now in this first iteration that's in the process plan.

TERESA ROGERS: Okay. Sounds good.

JOHN SMITH: I have one other minor question.

TERESA ROGERS: Yes.

JOHN SMITH: On the website it looked like the two -- there were two IFIM PDF files on the instream flow study.

TERESA ROGERS: Yes.

JOHN SMITH: It looked like they were both the same file.

TERESA ROGERS: That could be.

JOHN SMITH: If you have a chance -- this was yesterday, it's not that critical but if maybe you could get the second one up on there.

TERESA ROGERS: I will. I'll put the one that has everything together so I'll get that -- also you don't have cultural resources this morning but I will be putting that on tomorrow.

JOHN SMITH: Okay.

TERESA ROGERS: I guess -- are we kind of clear on how we're going to do this then? I'll write that up in the study summary so that you can comment on that, but I think what we'll do is we'll just plan on that meeting in May to followup on anything as far as modifications because you'll have those draft reports, I think most everything by then. We will make sure.

As far as the studies go, we're finishing up that first year of studies, the draft study reports were provided to the stakeholders for review and comment. We'll also be having some workgroup meetings on those individual study reports as well so that people can

ask questions and have a little bit more time than just one of these update meetings.

We discussed yesterday that one of the activities that we were not able to complete in 2007 was the draw down. It was canceled due to the low inflow conditions and the drought forecast and this has impacted our ability to finalize some of the first year of studies, which includes cultural resources, they were going to be going out during the draw down.

The mussel study had some work to be done during the draw down, littoral habitat, navigational aids and then there were -- also talked about instream flow needs where we haven't been able to get that high flow yet because there just hasn't been enough water.

Then they reminded me this morning that fish entrainment and impingement has a component that we need some higher flows for so we'll have to coordinate getting that part as well. I'm sure they'll discuss that.

That was just a copy of the river gauge at Galax before Thanksgiving to kind of give you an idea of where we were as far as inflow based on the median daily 77 year discharge events. You can see how low they are. It was a hard decision. You never know what

to do.

You can get one really good rain and fill everything back up but again you could be five feet down and never be able to refill. We kind of basically had to base it on the drought forecast and current inflows for it.

This shows that the drought is ongoing in our area and of course this water comes from down in North Carolina so you can see it's all drought persistent and intensifying. That just shows Virginia, that Pulaski County is in a moderate drought condition right now.

These are some of the things that we need to base on our decision on. We do have a website that we keep up for Claytor relicensing, claytorhydro.com. A lot of these presentations are on there now. I will update that after this meeting to get the most up to date presentation copy on there. It will be part of our filing with the FERC.

Any questions so far? We will go ahead and go to cultural resources.

CULTURAL RESOURCES

BILL GREEN: Good morning. I want to talk about the

cultural resources study which involves the archeology and standing structures. The only standing structure really we're going to talk about is the dam itself.

Why is this work required? Project operations has the potential to effect historic properties, which is anything that's on or eligible for inclusion in the National Register that's located in and around Claytor Lake, for example erosion, development or other project related activities.

FERC must consider the projects effect on historic properties when issuing a new license for the project. Study objectives were to determine the area of potential effects, which is any area that has the potential to be effected by the project, so that not only includes the lake itself but shoreline areas, some areas downstream, it just depends on the type of study.

Also identify previously recorded cultural resources in the Virginia Department of Historic Resources site files within the area of potential effects and develop a database on these resources. Identify the locations that have the potential to contain archeological resources, locate archeological sites in areas exhibiting effects from project operations and in areas where ground disturbing

enhancements are proposed.

Access the National Register eligibility of the project facilities and other historic resources within AEP, including those that may contribute to a historic district, evaluate the potential for effects on historic properties and archeological resources from all project operations or project related enhancements and develop a historic properties management plan specifying how these properties within AEP would be managed over the time of the new license.

Start off collecting information by reviewing previously reported information available at the Virginia Department of Historic Resources, Virginia State Library, Radford University, Radford Historical Society and several other facilities.

We consulted with the Virginia State Historic Preservation Office or SHPO, on defining areas likely to contain archeological sites. We conducted a Phase I intensive survey of areas within the AEP and have a high potential to contain archeological sites.

Phase I study survey methods involved pedestrian survey, which was used to locate things like quarries, cemeteries, chimneys, wells and other above ground features, as well as

artefacts that happen to be lying on the ground surface that were exposed from erosion.

Shovel testing was also done at 50 foot intervals across areas likely to contain archeological sites. This was defined based on consultation with the Virginia SHPO's office and the Indian tribes as areas having a slope of less than 12 percent.

We also did an above ground survey and National Register Eligibility assessment. We conducted an architectural evaluation of the Claytor Dam Complex, including the dam and powerhouse. We took interior and exterior photographs of the dam and did some historic research at the Pulaski County Library, Virginia Tech, Pulaski County Circuit Court Clerk's Office and Radford University.

The study area consists of about 101 miles of shoreline and eight islands along Claytor Lake and Peak Creek. There were 20.4 miles of shoreline and eight islands considered to have a high potential for containing archeological sites and these were intensively surveyed by excavating -- shovel tests as 50 foot intervals.

There were six miles of shoreline that were surveyed using pedestrian survey and there were 74.6 miles of shoreline that

were visually inspected from the boat. I know you can't see this very well but these were the areas investigated.

Those showing in yellow were shovel tested at 50 foot intervals, those in red were pedestrian surveyed. The remaining areas we drove by in a boat to make sure there was nothing like rock shelters that were obvious with the boat.

The results of the Phase I study. We found 17 archeological sites and two isolated finds. Isolated finds are just a single artefact or two in an area but nothing else was found. There were nine sites and two isolated finds that were recommended not eligible for the National Register.

One site, a rock shelter, was recommended for additional study because we were not allowed, because of Virginia state law you're not allowed to do any excavations inside a rock shelter, so we planned to -- we have since received a permit and once the new draw down is done we will go back and do additional studies on that rock shelter.

There were 7 sites out of the 17 that were recommended potentially eligible for the National Register. The Claytor Hydroelectric Dam, the powerhouse was recommended -- also

recommended eligible for the National Register.

The types of sites we found -- there are some of the artefacts we picked up, some of the tools. We found two early archaic sites which date from about 10,000 to 8,000 years ago. We found two late archaic sites which date from about 5,000 to 3,500 years ago. We found one early woodland site which dates at about 3,500 to 3,000 years ago.

We found seven woodland area sites, which could be anywhere from about 3,500 to 500 years ago and eight sites which are not temporally diagnostic. That is they are just flakes, the byproducts of making stone tools, so we don't really know when the site dates to.

There were not many historic sites that we found. We only found one mid 18th to 19th century site and four 19th to 20th century sites. There is just the location of the sites that we located along Claytor Lake. Sites shown in red are previously recorded sites that we revisited. I think one is here at Claytor Lake State Park. Potentially significant archeological sites is just a list, I'll be going through each one. This is to let you know the site numbering system, 44 stands for Virginia.

It's just based on alphabetic ordering from the first state to the last state, 50 states and Virginia is number 44. PU is Pulaski County and then 161 is the 161st site identified in the county, so site 44PU161. There is a picture of it and a map.

The red dots are where we found artefacts. The open circles are where we dug but did not find anything and then the dash line around it is the boundary of the site. The site is located on the north eastern shore of Claytor Lake near Dublin Hollow. It's a prehistoric lithic scatter and measures about 115 X 55 meters.

We found 54 artefacts including 4 stone tool fragments and 50 flakes made of chert, quartz and rhyolite. This site is experiencing some erosion and we recommend Phase II testing or stabilization along the shoreline.

This is site 162, it's located also on the northeastern shore of Claytor Lake near Dublin Hollow. It's also a prehistoric lithic scatter. It measures about 85 X 45 meters. We found 66 artefacts at this site including 63 flakes made of chert, quartz, crystal quartz and chalcedony and 3 pieces of glass.

The site is experiencing some erosion and we recommended Phase II testing or stabilization on the shoreline.

TERESA ROGERS: We're not sharing anything that shouldn't be public?

BILL GREEN: No. You couldn't tell from the site locations where they are.

TERESA ROGERS: I just wanted to make sure.

LAURA BULLARD: May I ask what Phase II testing is?

BILL GREEN: Phase II testing is more intensive investigation. We would go back and dig 3 X 3 foot test units to determine whether or not the site is truly eligible for the National Register. Right now the best we can say is that it's potentially eligible and Phase II testing allows us to say whether it's eligible or not to get a better idea of what's out there.

This is site PU164. It's located on a small island in Dunkard's Bottom. It's possible early woodland lithic scatter dating from about 3,200 to 2,500 years ago. It measures about 30 X 35 meters. We found 32 artefacts including 3 stone tool fragments and 29 flakes, almost all of them made out of chert.

The site is experiencing some erosion. We recommend Phase II testing or stabilization on the shoreline. This is site 165, probably one of the biggest sites we found. It's located on the south

shore of Claytor Lake near Spring Hollow. It had early archaic, late archaic, woodland and late 19th early 20th century artefacts. It measures about 155 meters by 80 meters. It had 393 artefacts including spear points and other tools, flakes and 2 pieces of prehistoric pottery.

We didn't find much pottery at all, prehistoric pottery on the survey. I was a little surprised at that but we may have found a handful over our whole survey. Historic artefacts we found included nails and glass. The site is also experiencing erosion and we recommended Phase II testing or stabilization.

This is site 167. It's located on the southeastern shore of Claytor Lake near the community of Hiwassee. It's woodland area site surrounded with lithic artefacts. Lithic is just stone tools. It measures about 105 X 45 meters. There are -- we found 45 artefacts including 3 stone tool fragments, flakes, chert, quartz and rhyolite and 70 pieces of pottery.

There were no project related effects and we recommended no additional work at the site. This is site 168. It's located here at Claytor Lake State Park. It's a middle or late woodland period surrounded by lithic scatter. It measures about 80

X 80 meters. 134 artefacts were found including 1 stone tool, 129 flakes that were made of chert quartz and crystal quartz and there were also 4 pieces of limestone tempered and sand tempered pottery.

Tempering is just the agent that people put into pottery to prevent it from cracking when it's being fired. There are no project related effects from this site and we're recommending no further work.

PU177 is located in the confluence of Peak Creek and Claytor Lake. It's a prehistoric lithic scatter and measures 95 X 85 meters. We found 70 artefacts including 3 stone tool fragments and 67 flakes. The site is experiencing some erosion. We recommended Phase II testing or stabilization.

As to Claytor hydroelectric dam and powerhouse. The project was completed in August 1939 by Appalachian Power Company. It was named in honor of the company Vice President W. Graham Claytor. The overall project consisting of the dam and powerhouse are eligible for the National Register as a single entity.

The project is recommended eligible for the National Register for two reasons in particular. One is the New River case was decided by the US Supreme Court in 1940 and was based on

the Claytor project. The decision expanded the ability of the Federal Power Commission, which is the predecessor to FERC, to regulate the use of the nation's rivers.

The dam and powerhouse were also good examples of hydroelectric project design and have retained good integrity through the years.

Any questions about any of the sites we found?

LAURA BULLARD: When do you anticipate doing further testing or do you? Will you?

TERESA ROGERS: I guess our next step is that we send the draft report to SHPO to see what they say. Based on other experience if we have any sites that are being impacted by erosion that are potentially eligible then that's when we will go on with the next Phase II to determine whether or not they are actually eligible.

The timing on that I don't know. We consult with the state. The report itself won't be made public because it's information that we can't make public, but we consult directly with them and FERC is involved in that as well.

In fact, when I put this on the website I'll probably strip out that site specific information just so that people don't study it too

well and find out where they are.

BILL GREEN: Like Teresa said, the next step is to submit the draft report to the state preservation office and other consulting parties, such as the Indian tribes, for their review. We will probably do this late November or early December and then once we review we submit the final report.

It's unclear whether -- I'm not sure whether we're going to include the results of the draw down survey in that.

TERESA ROGERS: We'll probably go ahead with what we have now.

BILL GREEN: We're also going to prepare a historic properties management plan. FERC then prepares an agreement and then we implement the terms and conditions of the HPMP and PA including how to resolve those adverse effects that are occurring to the sites.

Any questions?

BOB MUNSON: The State Park's office building over here, is that already protected?

BILL GREEN: There's no project related effects on it so it's really probably outside the area of potential effects because

there's really nothing that Appalachian Power --

BOB MUNSON: And that's because the shoreline is armored?

BILL GREEN: Yeah, the shoreline is armored and the house is in no danger. It doesn't experience any effects from the project itself. That's my guess but I would ask Bruce that.

LAURA BULLARD: Did you test on the AEP properties or up to 1850 or were you on some private lands and if so do you check with landowners about further testing? How do you handle that?

BILL GREEN: We did up to the 1850 and then as we found a site we continued, we asked the landowners whether we could continue on their property to fully evaluate the boundaries of the site. Most people were cooperative. There was only one landowner that asked us to leave. It was a church.

BOB MUNSON: You were digging up bones.

BILL GREEN: It wasn't a cemetery.

TERESA ROGERS: John, do you have any questions?

JOHN SMITH: No, I don't.

TERESA ROGERS: Is Kristin doing the SHPO for this

project?

JOHN SMITH: Yeah. Kristin is on cultural but unfortunately she couldn't attend the meeting this morning.

TERESA ROGERS: I'll make sure she gets a copy of the draft report. I couldn't remember if it was her or John. I know there will probably be some additional people coming in from water quality so we've got half hour.

[Recess.]

Let's go ahead and get back on schedule with water quality.

WATER QUALITY STUDY UPDATE

MARK HUTCHINS: Well, I can't believe that there isn't a bigger crowd. This is water quality. This is water quality, this is something contrary to what Teresa said I have data, I've got tons of data.

BILL KITTRELL: It is the middle of deer season right now.

MARK HUTCHINS: The purpose of this presentation is first I want to review the study plans as finalized after the May stakeholders meeting because they've changed somewhat.

I want to present the major results of each sampling component. We only finished collecting data about the first of the month so we haven't had a chance to review everything or study everything so I won't be presenting everything but I want to discuss some of the technical aspects of what we're seeing and then draw some preliminary conclusions.

With respect to the study plan there were a number of components, the continuous temperature monitoring upstream of Claytor Lake at a site to be designated by DGIF. That site was designated, I guess it was in April and we established monitoring stations near the, I think it's the New River Trail State Park. We're monitoring in triplicate up there and will be collecting data for a year.

The in lake water quality sampling to do DO temperature, PH conductivity, chlorophyll a. and chlorophyll a. by one meter profile on a weekly basis. We were doing selective chlorophyll a. samples for laboratory analysis on each of those events. We established stations in the center of the lake channel essentially from Allisonia to Claytor Lake Dam. This was a modification of the original study plan.

We had one station immediately above the dam at the

power line which was a four station transect. We were collecting data. We were to collect data weekly starting June 15. We modified the recommended modification of the sampling program based on review of historic data. It was originally intended to stop September 15 but we didn't feel like we captured the extent of low DO problems potentially depending on the year and recommended that we extend the study until the DO levels from tail water got above state standards.

That's what we did. We actually sampled them until October 24 was the last sampling date. In the tail water we were to establish continuous monitoring which would reflect DO temperature, PH conductivity and this data would be collected concurrent with the sampling program.

We had down river sampling stations below Claytor Lake where we also did DO temperature gauge for conductivity. These were all shallow stations so we were sampling about a foot below the surface. We did quarter points across the channel in fairly wide areas. They were well mixed top to bottom

There were three stations established, the Route 11 bridge, upstream confluence of Plum Creek and down in the

Pembroke area. This data was also to be collected concurrent with the in water sampling program. You probably can't see this but these are the sampling stations that were established.

Actually these are not the sampling stations that were established. These are some of the historic sampling stations. The update to this slide we can't download it. Since you can't read it anyway it really doesn't matter. The next set of slides I'm going to be showing are DO temperature profiles for the lake. We've got them color coded green, yellow and white.

The green is optimum temperature for striped bass less than 20 degrees C and a DO of greater than four milligrams per liter.

The yellow is acceptable conditions, temperature less than 24 degrees C and DO greater than 2. The white is unacceptable conditions or temperatures greater than 24 degrees or -- it should be or a DO less than two.

Just to set up the slide so everyone is onboard this is Allisonia here, shallowest, progresses down the lake to Claytor Lake Dam. Deepest depth is on the Y axis. We list both temperature and DO for each sampling location. Boy that doesn't look yellow it looks green.

Anyway, the darker color is the area that is green on my screen and is the optimal conditions for striped bass. The lighter color is the acceptable and the white is the unacceptable. From the time we started sampling, this was June 19, the surface waters were already too warm for striped bass and some of the deeper waters were without DO or DO was declining. There was a pocket of optimal water near the dam and upstream for several miles and the rest of the lake was in the acceptable range. The red lines here, this is the intake, the depth of the intake structure at the dam. This is between 6 and 7 meters and between 20 and 21 meters. So this area is approximately the intake area.

Why this is here we don't really know because we didn't start sampling early enough to be able to see the pattern set up but my guess is that it's leftover from earlier in the year when probably the entire lake was in optimal conditions and it is gradually being reduced by various, for various reasons.

The next week all optimal and acceptable conditions had been considerably reduced, at least in terms of size relative to the whole lake. The optimal condition was somewhat reduced and the acceptable conditions were substantially reduced.

This is the first week in July. You can see that the optimal conditions are getting smaller and the acceptable conditions are also getting smaller. The white would be considered unacceptable for survival of striped bass at least. Things continue to decline in terms of water quality by July 10. We've just got a little pocket of water that would be considered suitable for striped bass.

Conditions continue to decline relative to striped bass habitat. By July 18 there's not a lot of water left. By the 26th there's no optimal water left. There's some small probably acceptable. We had a little runoff event.

You can see here we had some water that's only 20 degrees entering the lake but down by the dam and for the vast majority of the lake conditions are getting dire. That cool water formed an underflow, went into the lake at depth and enhanced conditions substantially at least for the end of July, at least bringing conditions into the acceptable range.

Down by the dam the acceptable water is almost gone. By the 8th of August it was gone. There was still some acceptable water back up the lake but this was a couple of miles or more from the dam.

We began noticing fish kills at this time. Large striped bass on the surface. They were not dead. I suspect what happened is that they were forced out of their refuge down by the dam and had to come up into warm water and the warm water killed them.

By the middle of August what little remaining water that entered during the summer that was accessible was also being rapidly depleted. By the end of August there was none left in the lake that would be considered acceptable for striped bass. Obviously there's been probably small areas that would hold bass. I don't think we had a complete fish kill here.

We only saw large striped bass in the ten pound range maybe that were effected, but certainly some of the small tributaries would probably be creating condition --

BILL KITTRELL: Yeah, I can confirm that. During August we were picking up ten, on the average ten pound striped bass and they were primarily all on the lower end of the lake when that habitat depleted there and then washed up on the shoreline. So one morning I was just riding around and picked up 15 that were, you know, eight to 12 pounds.

MARK HUTCHINS: So this condition this was getting to

the tail end of August. The same thing August 28, the same thing the first part of September. By the middle of September inflows started cooling so we were beginning to get some cooler water into the lake.

I think that some of this created an underflow but I think that some of this over here is the result of things beginning to cool on the surface and deepening the epilimneon so that some of this is becoming a little bit cooler and introducing some higher DO levels at depth, which creates more acceptable conditions.

By the end of September a considerable portion of the lake, at least at depth, was becoming acceptable. Still down by the dam low DO conditions all the way up to 12 or 13 meters. By the first part of October the bulk of the surface water and down to a depth of 17 or 18 meters had recovered in terms of acceptability for striped bass.

We still had a pocket of low DO water down near the dam. That was creating low DO conditions in the tail water which we will get to later. We thought we were getting out of that but then we had a warm spell in the middle of October and river flow continued to decline.

So conditions deteriorated a little bit at depth and we

made the decision to continue sampling. By the 16th of October we had cooler water coming in, even cooler water coming in for inflow that was plunging in the lake following the lake contours down.

In this case all of the water in the intake zone was in the acceptable range and Teresa decided that we should continue for one more week to make sure that that situation did not change and it didn't change for all practical purposes.

We did get a little blip of low DO water down near the dam here which may have resulted from under flows, those cool water under flows forcing a little bit of water but it didn't have a significant effect downstream so we terminated the studies.

I want to back up and just talk briefly about what I think is actually happening here. As I said previously, I don't really know the extent of what the optimal water was because we didn't sample it early enough to find it, but essentially we've got a pocket of good quality water at depth down near the dam.

It's been referred to by some of previous work as a metal limneon oxygen maximer and it really isn't that. It's my understanding that a metal limnetic oxygen maximer is created by algal growth at depth usually in clear lakes where algae can continue

to grow as it falls through the water column.

When it hits the metal limneon the density difference is of such that it slows down falling through the metal limneon and therefore produces relatively more oxygen in the metal limnetic area than in the hypolimneon.

In this case we've got a secchi depth of a meter or less.

There's no light down there and algae aren't producing that. I think it's just a remnant, something leftover from earlier conditions. It's being pounded from the top by decaying, dying and decaying algal cells. It's been pounded from the bottom by sediment oxygen demand.

The two combining forces are just going to shrink everything, which they did.

The second thing or the other thing that may be happening -- let me back up. We do have a little bit of this water in the intake zone, so the intake to the hydro facility is likely stripping out some of this, but by the tail end of June that water is outside of the intake zone. The intake zone may be down at around 21 degrees.

We played around with looking at some of the conditions

in the tail water and trying to match it with conditions in the lake. We haven't finalized that but it looks like the intake zone is probably something on the order of 6 meters to 21, maybe 22 meters.

So at least early in the year the facility may be removing some of the good quality water but as the season progresses the good quality water is below the intake zone. So operations of the dam itself, I don't believe, are having an impact on the remaining good quality water.

I think it's simply the productivity of the lake that is creating the oxygen demand at depth that eventually just strips, eliminates the available oxygen. I think that's why this zone continues to shrink even though it is -- this zone of good quality water even though it's outside of the intake zone for the hydro facility.

You can see, if you look at the data carefully, you can see the DO levels. Like here I mean it's essentially zero all the way to 50, 60 meters. Down here it's zero but it hasn't quite reached the upper layers, but with time I think because of the oxygen demand from above and below it simply over powers the ability of the lake to retain oxygen.

So I think that's kind of what's happening. I think that

looking at what happened mid summer I think that occasional runoff events could be extremely important in maintaining suitable conditions in the lake. If you don't have them then you arrive at a situation similar to what we had at the end of the summer this year and throughout September, essentially no -- the vast majority of the lake not suitable for striped bass.

Now we'll go on to some of the other parameters.

BILL KITTRELL: One question. Bill Kittrell. You said that you did try to match up discharge to the water quality downstream that was being discharged with what was in the lake so were you seeing the same thing that the discharged water quality was matching up with, that water quality that was in that discharge zone.

MARK HUTCHINS: We haven't finished the analysis because we haven't had the data long enough to really play around with it. We need to also overlay the hydro operations, which I just got from Teresa maybe a week ago, to get a better sense of what's going on. But basically we've been looking at temperature and trying to match temperature as well as DO. DO is a little trickier.

DO is slightly higher downstream than what we're seeing upstream. There is probably some minor reiteration that's

occurring but it's a matter of tenths of a milligram per liter. We've got PH conductivity we can look at too. We haven't done that yet.

But the temperature, based on a temperature with a couple of weeks or a couple of events that we've looked at it looks like maybe 6 meters to 22 adequately describes the draw down zone or the zone of influence from the dam, then temperatures seem to match up really well.

BILL KITTRELL: Would you agree that discharge during that July and August period tends to exacerbate an already stressful period on striped bass at that elevation, at that depth I mean?

MARK HUTCHINS: Perhaps during the early part of the year during June because the intake depth is so low but later in the season I think the intake isn't having any influence on the remaining good quality water. I think it's sediment oxygen demand combined with algal die off and decay at depth which is eliminating the rest of the oxygen.

BILL KITTRELL: And instream flow study, I guess when we measure intake velocities and currents and so forth that should be able to compliment some of this information?

MARK HUTCHINS: Right. And I think the --

BILL KITTRELL: Where exactly that intake is occurring?

MARK HUTCHINS: I think the DTA component --

SCOTT FLETCHER: W2 model.

MARK HUTCHINS: With the W2 model will also give us a better sense of where that intake zone is.

BILL KITTRELL: Are you seeing any kind of evidence of a density current in these cool water runoff events, storm events density current occurring throughout the reservoir to the discharge point.

MARK HUTCHINS: It didn't -- what we had during the summer didn't quite make it to the -- I mean here's one that came in the first part of -- I guess it's the tail end of July -- we've got a little bit of a problem here with our month.

But we had something that came in the tail end of July and we had a density underflow that essentially made it throughout the whole lake, almost, but it appears that before it got to the dam mixing from the surface combined with DO demand with algal cells falling through this column of water it just disappeared and didn't quite make it.

If the flow event had been a little bigger and one of the things we need to do is quantify the actual flow event versus the volume in the lake and get a better sense for how much water

actually entered --

BILL KITTRELL: So on a normal water year, you know we're in drought conditions, a normal water year you may see more of a continuous --

MARK HUTCHINS: I suspect you would.

BILL KITTRELL: Currents sinking throughout the reservoir and discharging --

MARK HUTCHINS: That would be my expectation. You would probably have periodic pulses of good quality water going through the lake that would sustain reasonable conditions.

Let's move onto some other in lake parameters. My primary purpose for showing these is to show you that we collected them. There's not a lot you can conclude from them. I wish I didn't have this going so slowly now because I can't speed it up. I probably could if I knew what I was doing, I don't.

It's the same format for chlorophyll conductivity and PH profiles that were also taken in the same locations. Here we have three different plots on the same graph, chlorophyll the first one, conductivity the middle one, PH the second one. I guess the only reason to show this is to show the patterns that we're seeing.

Obviously high chlorophyll a. in the surface water that's

where the algae is, that's where it's growing. Conductivity low in the surface water, higher in the deeper waters where that water is essentially isolated from the rest of the water column and conductivity, because of the lack of dissolved oxygen, continues to increase.

It may also result in part from occasional under flows of denser water that may be higher conductivity. We do have some -- I think Peak Creek, which I'm not showing here, I think Peak Creek conductivity is high relative to the rest of the lake, which may explain some of the higher conductivity levels we see at depth. PH is highest at the surface, in fact it exceeds nine on a number of occasions. I think it's entirely related to algal growth with algae modifying the PH environment.

We have essentially the same identical trends at least for all of the weeks sampled. Conductivity continues to increase with depth, which is expected. The longer that water is isolated the more things can dissolve in it, especially with zero DO at depth. I'm not sure -- we get some high chlorophyll values down near the bottom on occasion, not sure why that is.

Certainly algal cells are piling up down bottom but they should be dead but maybe not, I don't know. We've never really

investigated chlorophyll a. at depth. So essentially same type of trend every week with conductivity tending to increase at depth. It also begins too at the tail end of the summer we begin to see it rising in the surface waters.

It's up to 125 micro-ohms per liter by the end of August, micro-ohms per milliliter. I'm not sure what the units are right now. But as the flow continues to decrease conductivity tends to rise. It's up into the 120's in the surface waters by the first of September. It's up in the 150's or 60's down at depth, but there's not really, in my judgment, there's not really that much to say about it.

There's nothing surprising here. There are no high moments in looking at it. It is what one would expect it to be. PH tends to decline at the tail end of the summer because of reduced algal growth and chlorophyll also tends to decline. I guess I should have pointed out that the darker colors are higher values and the lighter ones are lower ones.

Now turning to the tail water. We had continuous monitoring there for the entire period of our in lake work, in fact we left it in for a week afterwards just to make sure that we had captured everything that we intended to capture. The blue line is the blue dots for temperature, red dots are dissolved oxygen.

These are daily averages for the period of record. We have four milligrams per liter shown here for dissolved oxygen, five here. I believe the state standards are a minimum instantaneous is four and the daily average is five.

In the tail waters you can see the average daily dissolved oxygen fell below five by probably the third week of June and it stayed below five until the middle of October. It dropped below four essentially completely by the first week in July and remained below four until the first of October. It was in the two's for a substantial period of the summer.

We did not see a daily average of less than two milligrams per liter but it is reflective of the low dissolved oxygen levels in the lake and the intake zone. Comparing the tail water temperature to the upriver continuous monitoring station that we had established, we're not actually missing data, for some reason it wasn't in the database, it is now but I don't have the new slide that shows that.

But essentially it's consistent with information that has been presented previously. You can't see the colors here but the values up top are the upriver stations. There are three of them. They're all essentially the same. The bottom line is the tail water and

as we've seen in previous data the tail water is colder than inflow during the spring and for half the summer. Here's our cold water inflow event which shows the flow is actually less than the tail water for a period of time but quickly spiked back up. By the end of the summer tail water becomes warmer than inflow and remained so through our study.

Again it's consistent with the DGIF data we've seen in the past. Claytor Lake acts as a thermal body that modifies downstream temperatures as compared to upstream temperatures so that when upstream is warming downstream is less warm because of the influence of the lake. When upstream is cooling downstream is warmer, again because of the thermal mass of the lake. So nothing surprising there. Then down river these plots are the four parameters that we were measuring.

All of these measurements were done in the pre dawn hours so that dissolved oxygen was as low as what you would expect it to be.

Here the color pattern is the same as what we had before with dark being higher values and lighter being -- that's not entirely true for temperature, in fact the temperature is similar to our DO temperature plots where the white is actually the warmest, but for

the rest of them the lighter colors are lower values the darker colors are higher values.

These are the sampling dates so you can see how things might have progressed with time, you can see how things progressed down river with N1 being Route 11 -- NR1 being Route 11, NR3 being down in Pembroke, so things progressed from upstream to downstream across the three levels.

Basically you can see that with water temperature we get warming from upstream to downstream, makes total sense. With temperature we have some temperatures that exceed 24 degrees but most of the time, at least up near the dam or down to Plum Creek, temperature is less than 24.

With respect to dissolved oxygen even though we had very low levels in the tail water by the time we get to the Route 11 bridge we only had three events that early morning dissolved oxygen levels were less than five milligrams per liter. We never had an event where it was less than four.

Above the confluence of Plum Creek we only had one event where dissolved oxygen was less than five. So dissolved oxygen recovers very quickly downstream from Claytor. Conductivity and PH nothing extraordinary. Both tend to increase as the summer

progresses.

I shouldn't say that, both increased downstream -- upstream to downstream, doesn't seem to be much change as summer progresses. Nothing that is extraordinary or of any great significance. Chances are down in the Pembroke area we have other influences to water quality, wastewater discharges, maybe tributaries that increase the conductivity levels but really nothing astounding. I think the most important thing is the recovery DO downstream.

Conclusions, I mean basically what we are finding is that the data is largely consistent with historical data, especially with a low flow year, which I think we had in I think it was 2002. We saw similar data from some of the previous studies. Claytor Lake is a eutrophic body of water that develops DO problems at depth and those DO problems can last for long periods of time.

It appears that the water quality, poor water quality is exacerbated by river flow though we haven't really done that analysis yet. At times DO and temperature conditions are not suitable for striped bass for the entire lake or the vast majority of the lake.

Even though the dam intake itself appears to influence the amount of high quality DO and temperature water at depth during

the early part of the year as the summer progresses the loss of DO at depth I think is entirely related to the eutrophic state of the lake and the conditions associated with that.

I think it's water column SOD, because of algal cells, and sediment SOD also because of algal cells. We do see low DO conditions in the tail water that result from low DO conditions in the lake, in the intake zone. We saw dissolved oxygen levels consistently less than five for more than three months, consecutive months, and less than four for at least two months during the summer and fall of 2007.

We didn't see any dissolved oxygen, daily average dissolved oxygen levels less than two milligrams per liter. I haven't had the chance to go through the data on a 15 minute basis to determine if we saw levels below two occasionally. Probably we did, I don't know because we were pretty low. We were down near a two milligram per liter level at one point.

Tail water was as much as five degrees warmer than inflow upriver temperatures at times, or lower at times in the early part of the summer and similarly as much as five degrees higher during the fall. DO quickly recovers down river from the dam.

Only three sampled days did we see DO less than five at

the Route 11 bridge and only one day at Plum Creek, none at Pembroke. That's about it. I did have a couple of other slides that I couldn't bring up on the screen that we looked at and will look at some of the patterns, DO temperature patterns, that we see in the tail water that may relate to hydro operations. I got a plot of it's hourly values for a week and there are distinct diurnal changes in temperature by perhaps a half a degree. It's not substantial and DO appears to parallel that, at least in part, which suggests that we are seeing some effects of the daily change in temperature and oxygen related to the surface waters and the daily heating and algal growth that is occurring during the day.

I also looked at 15 minute data for a day to look at how the hydro operations might be affecting it and there are some -- when they're cycling, when they are on auto cycle there are some distinctive little patterns that you see with both temperature and DO.

Again very, very minor but does suggest that perhaps -- I'm not sure what it suggests because when they're operating -- when they're generating power they're discharging water, when they're not generating power they're not generating water. So what we see when they're not generating is the ambient conditions or the conditions in the tail water as unaffected by any water release

because there isn't any. So whether that means anything or not I don't know. Again, we haven't had a chance to look at the data carefully but irrespective of the patterns that we see the impacts are really very small. It's two or three tenths of a degree perhaps and perhaps the same for DO levels.

That about it. There's a lot of data. There's more that we haven't shown. We also did a sunup to sundown hourly sampling event down near the dam just to see what kind of changes we were getting in DO and temperature at all depths to help better explain what we're seeing in the tail water but I haven't looked at that data in any detail so I didn't present it.

TERESA ROGERS: This presentation will be part of that meeting summary so you'll have a chance to look at that data that he presented a little closer and kind of digest it a little bit when we file that report. This is prior of course to the study report going out.

That will give you a chance to really look through that data a little bit closer because I know some of it was kind of hard to see on the screen.

MARK HUTCHINS: It is and for some reason that doesn't present the way it does on the screen. It's quite different and not as clear.

TERESA ROGERS: What you see in the report will be more like what's on the screen.

LAURA BULLARD: Laura Bullard. Please excuse me because I've not been involved in any of the water quality and I came in a little bit late to your presentation, but I just wondered, I heard you talk about the water quality as it relates to striped bass but is there any correlation of how it relates to people and their health or e-coli or any of those, you know, how the water quality impacts recreational use of the water by swimming or by eating fish or any of that? Is that part of the study?

MARK HUTCHINS: That is not.

TERESA ROGERS: No.

LAURA BULLARD: That was not considered --

TERESA ROGERS: No. I guess what we're trying to get a feel for, especially like downstream is, you know, how our operations can effect temperature and DO. We also need to figure out what's happening on the lake in terms of temperature and DO to kind of draw some conclusions, although we didn't look at --

LAURA BULLARD: How it relates to aquatic life and not to human life or use?

TERESA ROGERS: No.

MARK HUTCHINS: Well, the two -- I mean the influences -- the water quality parameters that might influence human health are largely if not entirely unrelated to hydro operations and therefore they haven't been included.

It doesn't mean that they are not something that needs to be looked at and DEQ has looked at those types of parameters in the lake up river and down river but with respect to the hydro operation the link between the two is not there so it's not -- I would assume that is the reason why it wasn't part of the study plan.

BILL KITTRELL: If I'm not mistaken also the -- I mean obviously DEQ does sampling in the lake in the river for contaminants in fish and so forth but I'm thinking we had discussions about additional contaminant sampling as being part of a study plan, but it is not recommended to go further than that. I think it was FERC if I'm not mistaken.

TERESA ROGERS: I think that we were looking at existing data that was out there --

MARK HUTCHINS: Which we did.

TERESA ROGERS: For things like PCB's and I think that's all part of that initial report that went out kind of assessing existing quality -- existing water quality data compilation,

presentation, evaluation of accuracy, that was the report that was sent out I guess in May and it's part of this so if you want to kind of look to see what was included in that and that went out to the workgroup and it is part of the initial study report as well so it kind of gives you an idea of what existing data is out there.

MARK HUTCHINS: And that data also includes some of the secchi depth phosphorus data that Friends of Claytor Lake have been collecting which provide some of the more aesthetic parameters for some of the parameters that are more directly related to recreation and they also do fecal coliform, which may be directly related to human health.

BILL KITTRELL: I think from other sampling events, you know, thinking about striped bass habitat one more time from other work that's been done on the reservoir and other reservoirs in this latitude I think we will see striped bass habitat being pretty much lake wide in the spring and then it shrinks down and shrinks down and then when you picked up your sampling schedule there you know it's already shrunk down to a small component in the lower reservoir.

However, this being the driest, warmest summer probably one of them on record, this was one of the worst case scenarios and I'm just wondering how much discharge, even though discharge is

reduced to match inflows, how much, you know, additional stress it's putting on that habitat component, you know, to generate that fish kill. That's something to think about.

MARK HUTCHINS: And I think once we do a little closer look at inflow versus reservoir -- volume versus discharge then I think we will have a better sense of whether the hydro operations are actually -- I mean obviously they're matching inflow to outflow to the extent that they can but the volume of the lake is such that at those low generation rates, I'm not sure that the discharge itself is having any great effect on the interior part of the lake.

I mean my suspicion is that it's simply the richness of the lake that is creating the low DO conditions and that the hydro operation itself, when it's this lower flow, may not be really playing any significant role, with the exception of maybe right down by the dam.

Again, we haven't looked at that data to assess the volume in the intake zone and how much the withdrawal from that zone is actually affecting it.

BILL KITTRELL: Again, the entrainment and impingement study may be tied into that with a little more information.

MARK HUTCHINS: Uh-huh.

SCOTT FLETCHER: Just a little note. On the W2 model it's going to pull out a lot of these data we just talked about, especially on the stripers. One thing we noticed down on Duke Energy's project at Lake Norman and Lake James a lot of that cold water reservoir that was remaining in the summer was based on the weather conditions.

For instance, if you have high flow springs and a low summer those high flows were essentially pushing that cold water reserve out of that lake faster than it would a normal flow or a low flow spring.

So a spring flow has got a lot to do with how much reservoir, cold water reservoir was remaining in that lake. In this case it was stripers and waleyes down in North Carolina. I know Jim is going to talk about that today, about how different years, how that cold water reservoir conforms to different weather patterns.

The other thing I noticed that was kind of interesting was that on stripers that that summer squeeze all that chlorophyll a., indicator of algae phytoplankton was in the upper profile, the fish were being squeezed down to the lower levels.

Forced fish are going to be up where the food is, the phytoplankton is, so they are basically getting squeezed down, low

DO, they've got an optimal temperature or at least they're trying to find it but there's no food, there's no forage fish there to feed on that plankton.

We found that in the case down at Lake Norman to be the same. In certain years when you had the squeeze forage fish, you know, alewives and the herring and the shad are up here, stripers were down here where the temperature and DO is where they can take it but there is no food there. So they're all popping up to the surface in August thin as rails, you know.

BILL KITTRELL: They're emaciated from basically not feeding. But it's interesting that the small striped bass are more like hybrid striped bass and they don't have that same sensitivity to the temperature and the DO. So, you know, the small year class, the first couple of year classes are still in the reservoir. So it mainly effects those that are over, you know, by eight pounds and up.

TERESA ROGERS: All right. We're a little bit ahead of schedule. I would like to make a proposal that we go ahead and do fish entrainment and impingement and then after lunch we'll go into aquatic resources and then I'll bump up mine because I don't think it's going to take me as long and then what I can do is I can hang around later if someone comes in just for navigational aids or

shoreline management because I know some people want to get on the road.

Are you prepared.

TERRY EUSTON: I'm ready. Give me a five minute pause.

TERESA ROGERS: All right. Take a quick break.

[Recess.]

TERESA ROGERS: Let's get back together for the fish entrainment and impingement.

FISH ENTRAINMENT AND IMPINGEMENT

TERRY EUSTON: Okay. We're going to talk about the entrainment and impingement study that we are conducting. It's a literature based study with a field component. The field component, as you may have guessed, is on hold from what Teresa said. That's the measurement of intake velocities at I believe it's two different generation levels and without proper inflows you really can't do that.

So that has been postponed until sometime in 2008. Teresa said it might be organized whenever they can get the high flows for the instream flow aspect. So these were these -- the overall objectives of our study was to evaluate the likelihood based on available literature of entrainment impingement and turban mortality

for this list of species. It's a fairly lengthy list.

You've got three black bass species, two moronids, actually three if you include the hybrid, waleye, two phorid species, alewife and gizzard shad, a couple of panfish species, black crappie and bluegill. Quite a diverse array of fish and habitats that they occupy.

We used this overall pathway or model if you will. The top half represents the entrainment portion of it. We used the site characteristics that we can determine that are available. We blend into that the life history information for the list of the target species and fortunately in Claytor Lake there is a fairly extensive amount of information available about life history, fish movements, things like that.

The bottom half of this is the mortality portion of it. We used survival observed at other sites that's reported in the literature. We also can use a model to use various inputs to predict the likelihood of mortality. In this instance it's largely by blade strike.

So we get an assessment of passage survival and of overall entrainment assessment along with impingement likelihood and you come up with an overall assessment of what the effects are likely to be for the target species.

Here are some of the factors that we will look at and are looking at now, the size and depth of the intakes. Mark referenced the location of the intake zone. I actually have that a little bit shallower than six meters but that may not be.

There were a couple of other inconsistencies, but at any rate, where the intakes are located and the depth is important. The water velocity of the intake entrance that's part of the field component that has not been undertaken yet.

There are some old calculations of intake velocity at and through the intake that we can probably compare this to. The other important factor or an important factor is the intake location relative to fish habitat. Most of the fish that are susceptible of entrainment typically live in shallower waters. The intakes in this instance are at moderate depth.

We look at the characteristics of these fish populations, the relative abundance of them and fish behavior. There aren't many migratory fish here however there are a number of species that move quite a bit through the reservoir up into the headwaters for spawning for example.

We look at where this occurs, also what some of the preferred habitats are of the target species. We also look at

characteristics of the turban units, the turban type, size, number of blades, the spacing of the blades, turban speed and the extent of hydraulic pressures that have penstock, turban and tail water.

In this instance Claytor is considered a high head site. It's a head in excess of 100 feet, so that's something that we would look at as opposed to a low head site. Reservoir water levels are also something that is taken into consideration. If there is an extensive draw down some reservoirs where there is a lot of flood storage, these could be extensive in instances. Claytor is not the case here. There are these brief draw downs for shoreline maintenance but that's about it. So these were the five primary tasks that we were handed to do this literature review of swim speeds and behavior for the juvenile and adult stages of those 11 target species. We also were to review the existing data for evidence of impingement or entrainment problems associated with current operations. We consult the literature to look for entrainment and impingement problems reported elsewhere for projects of a similar nature to Claytor.

Number four is the field study, intake velocity fields during maximum hydraulic capacities and I believe also for a lower

capacity was also built into that, then compare them against the swim speed data obtained in objective number one or task number one and then we blend it all together in the final analysis for the overall assessment.

As I mentioned the swim speeds, there's quite a bit of data on the swimming speed of fishes. A lot of it was done 30, 40 years ago and there's been some more recent investigations for some species in riverine situations that are likely to use fishways.

So there's been an update, particularly for fish such as waleye and small mouth bass where they're trying to find out what the conditions are in a fishway, whether they will use it or not, so they've got some more data for those species.

For the evidence of impingement we really consulted the folks at AEP and whatever information was available in the literature.

Some of the studies that Virginia Tech has done over the recent years have tried to get after this aspect of it to see if they can define some of the things for entrainment of striped bass in particular. So we tried to gather as much information about that as we could.

Now when we took a look at the burst swim speeds, these are the fastest speeds that fish can obtain but over a very short time frame and these are the ones that they would be likely to use if

they got into a flow field that they weren't comfortable in, can they get out of it.

When we took a look at what these were your fastest swimmers, as far as adults, striped bass and alewife. Interestingly enough striped bass I believe were able to enter and get through water velocities 14 feet per second or more and alewife similarly.

They being anadromous -- I think those swim speeds were developed for anadromous alewife and their ability to get through fishways is pretty amazing. So they are the fastest swimmers from what we found in our review. Medium or moderate swimming capacity, waleye, gizzard shad, small mouth bass and white bass.

Your slower fishes and body morphology probably can tell you this as well as anything, black crappie, bluegill, large mouth bass. They are your slower adults. We could not find any data on spotted bass or hybrid striped bass so we had to sort of interpolate between congeners in this case to kind of estimate what their swim speeds or swimming ability might be.

Now for juvenile fishes they as a rule don't swim as well as adults and their swimming ability increases as they mature during their first year. Their greatest vulnerability to flow fields is in the early stages of their first year and

in some cases they almost approach adult swimming ability by the end of their first year.

But as a rule we found that juvenile fishes swim within 1.2 to five feet per second. For striped bass for example, I believe at their smallest size, which probably corresponds to about the size that they're stocked in Claytor Lake, it's maybe about two feet per second, but within a fairly short time by the time they obtain five inches. Maybe late in the summer they are able to swim at five feet per second.

We wanted to get some information on entrainment by looking at studies of projects with similar design. We consulted primarily with EPRI and FERC compilations to look for data that has been summarized for a number of studies that occurred in the 1990's and are available to compare to Claytor Lake.

Again we reviewed information on the different project characteristics in the fish spawn and then we integrate this with respect to the target species. This is the project or a component of the project that has been delayed due to drought. We planned a field study of intake velocities with acoustic dopplar profiler gear.

We're going to look at velocities at the bar racks, comparing that to an engineering analysis. Jon Magalski, it was

discussed I think with Matt about looking at some engineering some kind of -- I have an email about that somewhere but I don't know where that's gone to be honest.

The overall objective is to compare the literature information on swim speeds with the empirical determination of the approach velocity in the field immediately in front of the project intakes. So that will occur sometime in 2008 most likely.

In the last component, the final integration is the final assessment. We will develop representative entrainment rates for the target species and the bulk of these come from the EPRI database developed in the late '90's and then we will take a look at that in view of estimates of turban mortality for the units at Claytor.

Like I said, we're going to use information in the literature, some empirical studies on some of the target species we've obtained and the use of the predictive model. I'm going to go through some of that stuff shortly.

The EPRI database. It was developed for 43 sites that they screened for basically data quality. Most of the sites were smaller than Claytor in terms of hydraulic capacity, which Claytor is about 10,000 cfs and many of these were considerably smaller than this. So we're a few larger but most of the site and it really has to do

with logistics, most of the sites were easier to do empirical studies at because of their size.

We were able to find representative entrainment rates for most of the target species. Where we could not we used surrogate species. For example, there are no available entrainment rates for striped bass but there were some for white bass, which are fairly close and also happened to be one of the target species.

So we plugged that in and then we would make a few comments about how relevant that was since we don't have the striped bass data. The entrainment rates were available for 3 fish size groups, that's how EPRI presented it for fish 8 inches or less, 8 to 15 inches and your larger fish 15 inches and up.

The one thing that was clear when we went through this is 90 percent of the fish that were entrained more than 90 percent were small fish less than 8 inches long. Out of the same database they developed representative mortality rates for the specific turban types that comprised the studies.

These overall -- the 43 sites had both propeller type turbans and Francis units. Francis units are what we have here at Claytor. So they looked at the mortality by turban type, whether it was a high speed or a low speed turban and in this case for fish size

groups they split the fish less than eight inches into four inches or less and between four and eight inches.

These are some of the station characteristics. Claytor has four Francis units. They are considered low speed units, 138 rpm's, in most instances rpm's less than 250 are considered low speed. It's a high head station 116 feet. Stations less than 100 feet are considered low head, has a fairly larger runner diameter.

There's two actually -- I think there are two manufacturers which is why there's a different runner diameter but they are essentially 11 feet in diameter. That's probably at the widest portion of the configuration.

The runners have 15 buckets which is pretty much standard for a Francis unit. Some makes are as low as 12 buckets or blades and some have as high as 17, I think I've even seen some as 19. So that's sort of right in the middle, that's pretty much a standard configuration.

Some of the findings from the literature that we've been able to draw out, the survival for fish less than eight inches for Francis units is generally higher than 90 percent based on the EPRI database. There's a little difference between fish less than 4 and between 4 and 8 inches in the vicinity of about 92 percent.

Lower survival, as you might expect for medium and large fish it's really related to the size of the fish relative to the available passage spaces and --

BILL KITTRELL: What is considered medium or large fish --

TERRY EUSTON: Yeah, 8 to 15 inches is your medium size, that's what they grouped as medium sized fish. Fifteen inches and larger would be your larger fish. They would have lower survival. Medium fish I believe was in the mid 80's and larger fish would be possibly in the 70's.

It really relates to the size of the fish and the available passage space. Most of these units have -- it's contact with structural elements that does the damage. It could be the wicket gates.

Most of these have 20 wicket gates and support structures, 15 blades. Contrast these with caplin runners or propeller runners they might have anywhere from four to seven blades, so you've got narrower spaces for these fish to pass through. The larger the fish the lower their survival.

BILL KITTRELL: And those wicket gates can be positioned to allow maximum efficiency per unit.

TERRY EUSTON: Right. That's what they typically go -- I think even though the design capacity of an individual unit is 2,500 cfs they typically run at about 2,000, which is their most efficient position. I think they call it MEP flow and that's where you get the most output for the given amount of water, so that's what your setting would be.

There's been a number of studies, on the west coast in particular, where they tried to look at survival versus efficient operation and in some cases that seems to be the case, your most efficient operation is also where you get your highest survival. You would expect less survival if you had a turban stop down quite a bit because you've got narrower passage spaces.

Generally what a lot of the literature studies have shown is that these rates are applicable across species. It's not a factor of what species you're dealing with it's a factor of size. The predictive models were developed about ten years ago when the Department of Energy sponsored a lot of research on fish friendly turbans.

Gary Franke up at Voist developed or I guess refined a model that had been out there for some time using a lot of input parameters to predict models. It relates to a probability of blade strike and in this case we're going to be doing that for these Francis

turbans and the survival will probably be calculated for six different fish lengths, probably a narrower range than what the literature based data has.

You can actually specify what fish lengths you want quite a bit so I think we typically would use six different lengths, maybe zero to two inches, two to four and up. Some of the parameters that get inputted into this model, again it measures the probability of strike. You look at the number of runner blades, fish length, which you can vary as I said, maximum turban runner diameter, which is probably in the vicinity of 11 feet.

They look at where the fish enters the turban in relation to the blades and there's another dimension the turban runner radius. But I don't know a whole lot about the model itself other than what some of the inputs are and what some of the outputs look like. It's a pretty impressive formula if you look at it your eyes glaze over so I don't deal with that too often.

Then once you get this probability you subtract it from one and that becomes an overall survival estimate. So in the report you'll see the survival probability as the number that will be made available and then that can be compared to what the empirical estimates have shown or what the literature based estimates have

shown.

Now we did find some empirical data that we can use, these were determined from field studies that we did at Francis sites.

They were all determined with balloon tag technology which allows you to retrieve the fish after passage through a turban unit. I focused on the target species that were available, small mouth bass, bluegills or sunfish, alosid data for the alewife and gizzard shad that would be representative and what we call fusiforms, which is the body shape which is representative of waleye and striped bass, sort of conical fish.

In many cases the studies were conducted on suckers raised in a hatchery because they were largely available. It's difficult to get waleye at many times of the year for testing so you use something that would be similar in body shape and then you can get the size range that you want to test.

So those were some of the parameters for the test that we looked at. Here are some of the results that we got from the empirical studies. For small mouth bass the survival ranged from 71 to 95 percent. Now as you might expect the 71 percent was for the larger fish.

I believe that was a small mouth bass of 11 inches that

were tested in that instance, but some of the other fish may be not quite as big but, you know, in the 8 inch range was as high as 95 percent through a Francis unit.

Bluegill, sunfish, the tests that we included here had a range of survival 95 to 100 percent. For the alosids, the range of studies with survival was 84 to 95 percent. These are fairly fragile fish and it's sort of surprising to some people when they find a survival rate as high as 95 percent, but that's actually the case.

The fusiforms, again 93 to 100 percent. Quite high survival for these. So there's -- the thing that you notice here is that the survival is quite good for all of them. What these studies show too is that they're a size related component, the size of the fish. The smaller the fish the better the survival, the larger the fish generally the survival is not as good.

BILL KITTRELL: These empirical studies were they done on these Francis units that you used, have the same head -- what were the pressure changes?

TERRY EUSTON: I don't believe any were as high as you have here at Claytor.

BILL KITTRELL: Probably we'll have a lot of pressure change just through hydraulic pressure coming through --

TERRY EUSTON: There's some here, yeah.

BILL KITTRELL: And so forth coming out of those turbans, that's a pretty significant pressure change.

TERRY EUSTON: It's a fairly rapid change and that's the key. There's two things there, there's the speed of which it occurs, the other thing is the pressure at which they're acclimated. The studies have shown that if you have fish that are acclimated to atmospheric pressure, normal atmospheric pressure in the upper part of the lake, upper lake strata, rapid passage through a zone of pressure change does not have much of an effect.

The issue really comes if you have fish that are acclimated to deep water and all of a sudden they go through and they end up in the tail waste of atmospheric pressure, they get decompression trauma.

There was an instance in Pennsylvania where a lot of Alewives migrated to the deep part of the lake in winter seeking warmer water and they ended up getting sucked into the intakes and they invariably died because of decompression trauma, but they had been acclimated to depths of 50 to 60 feet and when they would come out into the tail race a lot of them had burst blood vessels and ruptured eyes and things that were characteristic of decompression

trauma.

What can happen with some of these is it can be a problem at some of the sites where you get predators that follow these fish. In this instance the Pennsylvania waleye were in the same vicinity eating meals of alewife, but it was all decompression trauma.

BILL KITTRELL: That's why so many tailraces are good fisheries because you've got injured fish coming out and the predators are in there and the birds are working over those tailraces.

TERRY EUSTON: You tend to see, particularly with alewife and gizzard shad, you tend to see that more in the wintertime, that's when they're prone to be in the deeper areas of the reservoir, that's the warmest water they can find at that point and that's when you typically have something like this occur.

Yeah, there's a number of instances where, you know, the birds are working very actively in the wintertime, late fall and winter. Both gizzard shad and alewife both have temperature tolerance issues when you get down into the 38, 39 degree fahrenheit range.

That comprises their swimming ability, they're trying to find warmer water and that's when you can get entrainment of these

species and occasionally the predators that follow them.

Did I see a hand go up?

BOB MUNSON: I probably ought to wait until your questions at the end. I'll do that. I'll wait til your questions at the end.

TERRY EUSTON: I'm almost there. So this is the status of the tasks I outlined. We have completed the swim speed fish behavior review, we've looked around and completed the analysis of any entrainment impingement problems that have turned up historically, we've looked at similar projects to see how Claytor compares to some of them.

The operating regimes that's ongoing, that's going to be part of the overall assessment. Like I said, the empirical study of the intake velocity that's on hold depending on available flows. We're still developing the model predictions of blade strike and turban survival.

So we're pretty far along but we still have a fair amount to accomplish. I believe that's it. Now.

BOB MUNSON: A lot of your analysis is looking at what happens to fish if they get entrained, I wonder what your research shows in terms of rather than a fish entrapment a fish detrapment,

are there pools or methodologies being used to scare fish away from the intakes, something like mounting a bald eagle right there or maybe a hungry house cat?

TERRY EUSTON: Well, there's been a number of studies that have looked at trying to frighten fish away, light, sound, air bubble curtains, there's been a number of things, behavioral type things. I mean there's structural things that they've tried. Most of the behavioral things haven't worked all that well.

Typically, you know, structural stuff is what they've tried and that has to be a fairly specialized situation for it to be real successful.

BILL KITTRELL: We were seeing a problem in the early '90's at Carr reservoir, which is the largest reservoir in Virginia and discharge rates are 40,000 cfs would be a typical spring discharge in storm events and fish would be coming back down off of spawning run in Staunton River and they would get down to Carr reservoir and they would tend to want to pass through the dam because there was a density current following the flow downstream.

We actually worked with some research from Virginia Tech and tried some sound technology because we had seen some research on some other sound things and we were holding pens in

front the dam and using sonic booms to just try to scare the fish away, you know, like somebody comes up behind you and scared you the first time you jump but then after that the fish got used to it and so they would just come right on into it even though the boom, the noise would be pretty intense the fish wouldn't scare away.

During that same study, what I was going to tell you is that we had some empirical data on we were putting striped bass through the dam that we had gotten off a spawning run in Brookneal at the hatchery, putting radio tags in them and putting them penstocks, basically shot them through the turbans, I think those were Francis units also there --

TERRY EUSTON: These were large spawners then.

BILL KITTRELL: These were large fish, you know, 10 to 25 pound stripers just to see, because we had problems with blade strikes and mortality downstream of that reservoir --

TERRY EUSTON: Of Carr?

BILL KITTRELL: Excuse me?

TERRY EUSTON: Downstream of Carr?

BILL KITTRELL: Yes. So we went downstream of the lake so that, you know, there were some reports generated from that work that was in the early '90's but I can get those to you.

TERRY EUSTON: Yeah. We've never actually done any studies with striped bass, to my knowledge. There weren't any out there.

BILL KITTRELL: We had access to large stock, we used those just to see the amount of impact that the blade strikes would have on them.

TERRY EUSTON: I know John Copeland was pretty interested in that because there is clearly migration out of Claytor Lake into downstream areas. One of the thesis that they recently did at Virginia Tech tried to address that.

There was an instance where one of the radio hybrids I believe was found downstream and I kind of looked into that and it happened between February and April when -- I don't remember now whether there were periods of spill or not.

That's typically when you would have them and that's when the passage occurred, between February and April of, I think it was 2001 or 2002. It was one of Jacob Patrick's thesis I think. So it wasn't clear when I looked at it whether they could have come through the turbans or through spillage.

BILL KITTRELL: Or an angler.

TERRY EUSTON: Pardon.

BILL KITTRELL: Or an angler caught it in the lake and turned it loose in the river, that's a possibility.

TERRY EUSTON: I don't know, there was probably a reward associated with -- if you see an antenna hanging out of a fish that would usually get your attention.

BILL KITTRELL: We haven't noticed and correct me if I'm wrong, but we haven't noticed a history of fish kills from the past that have been turban strikes and that sort of thing downstream, but we do know that we passed live fish just from that example and other, you know, populations, hybrids and so forth below the dam.

TERRY EUSTON: Hybrids they're documented down as far as Blue Stone, I'm pretty sure that's what I read, striped bass for sure, gizzard shad and then of course alewife passed through. There was some studies back in the 1970's that documented that, actually that winter effect that I spoke about. Back in the early '70's they looked at that.

BILL KITTRELL: We actually set up at Carr reservoir based on high inflows in the spring. The inflows were such a rate during the spring you would moderate the discharge at the dam to pass water instead of passing through the turbans you would actually spill water at a certain time of year, which is not real acceptable an

idea for power companies, but that was set up with the Corps of Engineers to mitigate the fish loss downstream.

TERRY EUSTON: Was that particularly looking at the striper so you didn't lose the big spawners?

BILL KITTRELL: Yeah.

TERRY EUSTON: That probably wouldn't be an issue here I guess because there wouldn't be any spawning. I don't think -
- I know most of your other fish that move throughout the reservoir, like waleye for example, move up to the headwaters, white bass and then they tend to disburse downstream and set up their home ranges but they're not looking to -- I think the stripers and the hybrids still retain some anadromous characteristics which makes them sort of prone to move around a little bit more and move downstream.

That's fairly common where they're stocked is for them to move out, from the literature I've seen.

Anything else?

TERESA ROGERS: What we'll plan on doing is being back by 12:45, that gives us an hour, and then we'll do aquatic resources and mussels and then I'll do navigational aids and shoreline management. [Luncheon recess.]

AQUATIC RESOURCES ASSESSMENT

SCOTT FLETCHER: Good afternoon everybody. I'm Scott Fletcher with Devine Tarbell. We've got a couple of studies we'll talk about on the aquatic resource assessment side. Basically this study includes kind of three different elements. The first one is survey on the fringed mountain snail, the second one is a fisheries both desktop analysis and we talked about the W2 water quality model and the striper squeeze a little bit this morning, we'll talk about that. The other component is mussels, both within Claytor Lake and downstream on the New River.

I'm going to kind of change the order a little bit. John Alderman, who is the mussel expert well known in the southeast and certainly Virginia and the Carolinas, is going to talk about his survey assessment, both on the lake and the New River. John has to go to another meeting later this afternoon so I'm just going to get him to talk about mussels right off the bat here.

JOHN ALDERMAN: What I'm going to do so I can use the keys is just sit, hopefully small enough room and few people that everyone will be able to hear me.

Survey for Appalachian Power on Claytor Lake and the New River. We had several questions. There are other questions

but the three basic ones; so what kind of mussel diversity do we have on Claytor Lake and the New River, distribution, abundance information for the lake and the river and density in the dewatered versus the watered areas of the lake and also doing some qualitative work in those areas as well.

We have ten survey sites in the lake. Our original A was up here in this area but that was all deep water just coming straight off so there was no shallow water to work in, in other words, dewatered area, so we moved our area A down to here. But basically it's the ten sites from near the dam all the way down or up to where the river comes into the lake and that's area L down here.

There were some areas such as you see the area G not surveyed because of deep soft mud. In other words, you get into it and you wouldn't stop. We have to work with scuba gear, with weight belts on being kept down on the bottom so it's not good to sink down into mud like that, safety wise it's not a good idea.

The other area, which is H, that we dismissed as an area to survey also had the muds but they were what I termed the deep, sticky muds. So you would be working in them and you would actually stick in the mud and it's kind of hard to get up out of that mud with the kind of scuba gear we're talking about. So we

eliminated those two areas and chose two others.

You'll notice also -- what's the name of this creek that comes in here?

AUDIENCE: Peak Creek.

JOHN ALDERMAN: Okay. You'll notice that I eliminated the area E and moved it across the lake and that's because of the heavy boat traffic. There's a marina up in there, it's a dangerous place to work. The whole lake was dangerous in terms of the scuba work because of all the boat traffic, which I'll get into in just a minute, but we eliminated that E because it's near the marina, dangerous area to work so we chose another area.

So those were work areas, our sites within the lake. So we had three different techniques that we employed. The first one is a quantitative where we used quarter meter quadrats. We chose 400 quarter meter quadrats, which we had planned to excavate.

We were setting initially 200 quads in the dewatered areas and then 200 quads in the watered areas. We chose the watered areas basically the five to ten foot depths, which are very close. So you compare the dewatered area, which is zero to five feet, with the watered areas which is five to ten feet deep.

What we realized after a couple of areas that we had

worked was that there are very few mussels in the dewatered areas and we had some rare species in the watered areas and in order to hopefully capture those in the watered areas we needed to up the number of quadrats that we were choosing for the watered areas.

Of course this idea was put through wildlife agency here in Virginia and it was approved that that would work. So ultimately that was changed so that we had 40 quads in the dewatered, just so long as we had low abundance in those areas and it was consistently low abundance, low diversity in the dewatered areas.

So 40 quads in the dewatered and 360 quads in the watered areas and there were some exceptions to that but basically - - and the exceptions were because the state requested that at Mallard Point and the Bandalin property where there had been quite a few stranded animals in the past that we kept it at roughly 200 quads in the dewatered areas there.

A foot note was that you'll notice we did have 400 quads total at site J, which is in the upper area end of the lake. J watered, that's JW, J watered. The reason for that is there was no zero to five foot depth. We just stepped off the bank and it was already five feet so we did the five feet to ten feet in there.

Also LD, which is in the extreme upper end of the lake

that's where the river comes into the lake, there was no area where it was five feet or deeper so it was all 400 quads in that basically dewatered area.

We also had multiple random starts and quads and lanes are two meters apart. Basically our survey area looked like a checker board where you would take a quad, determine what was in it, etcetera and move on four flips of the quad, another quadrat taken, etcetera and then our lanes were two meters apart as well, so it looked like a checker board was how we surveyed.

Also within each quad the depth was measured to the nearest two-tenths of a foot. We were doing it in feet simply because, you know, the lake is raised and lowered in terms of feet so we kept with that. All mussels were collected, identified, length measured and returned to appropriate substrate, dominate substrate identified.

Now, there were some issues. All the fieldwork that I've done in so many different ways there's always issues with work so you don't continue to stop and ask questions you just figure out the best way to get the work done in the amount of time you have available.

So these are some of the issues. Except at the extreme

upper end of the lake mussels were significantly exposed at the surface. Now at the site L where the river basically comes into the lake it's typical of what you would expect to find in a lotic habitat. The mussels were buried.

We had to actually physically move boulders and cobble to actually find the few mussels that we would find down in that. They were buried in that substrate, which is like you usually find on a river. On the other hand, in the lake these animals are mainly sitting up on the surface or very close, in very shallow substrate.

LAURA BULLARD: In watered areas?

JOHN ALDERMAN: This was where there was watered or dewatered. They're basically sitting up on the substrate on top of it, either laying out or just barely in the substrate. So that made it easy to actually do your work. You didn't actually have to see them you could feel them on the surface.

BILL KITTRELL: Is that a species specific or more of a --

JOHN ALDERMAN: In general *Utterbackia imbecillis* might have been buried in a little bit more but across the board whether they were cyclonaias or whatever they were usually up there on the surface, well above the surface which made --

BILL KITTRELL: What month was this?

JOHN ALDERMAN: We started actually at frost in May and went on until September.

BILL KITTRELL: May through all summer?

JOHN ALDERMAN: Yeah. Also, the issues, the substrates were usually very shallow, in other words, the water has moved a lot of what used to be the soil and so the substrates are washed and you have a lot of clay hard packed substrates down there.

The next thing is sampling. Many of the sites were difficult. If you've ever done scuba work when you're working in algae up to a meter and a half thick on the bottom excessive woody debris that you had to crawl over top, under and around aquatic vegetation like you have out in this area here, which is two meters thick and trying to get your ropes in place for your lanes to sample on, trying to dig down, burrow down through that vegetation to actually get your quadrats on the bottom it's a tough place to work.

So the bottom line is we still did the excavation in the quads, physically excavated, you know, if we couldn't see what was there was actually worked the substrate that was available tactfully, removing the mussels but we really couldn't do the sieving work like we had planned to do.

We did it on areas A and B up in the headwaters -- not headwaters, in the lower end where the dam is but we could not do the sieving in these other areas because of all of these complexities.

The algae, the vegetation, the woody debris and really the fact that there was very little substrate to actually put into the sampler, to actually sieve.

Bottom line was we got the information, I think, for the lake but it was a tough place to work. The other issue is the boaters here in the lake. They seem to have no idea what a dive flag meant and it's a dangerous place to work. So when we're doing the qualitative work, we only did the qualitative work, which I'll get into in just a minute.

The qualitative work we had to get in and do it quickly and get on out. What I considered was essential for it was the quantitative with the quadrats. So even though it was dangerous we still did the quantitative work, but the other, the qualitative part, you know, it might have been 15 minutes to 20 minutes that we would be in there with scuba and then we were out. So those are the issues with doing the quantitative work in the lake.

Now the next thing we did -- with quantitative work even though you say, well, 400 quads sounds like a lot for an area to be

surveyed, 400 quadrats sampled per site, it still may not be enough to actually capture the rare things, which we'll get into that shortly when we look at the data.

So we also did qualitative work, another form of survey. We did qualitative work in the areas where we actually did the quantitative work with the quadrats. We did that by using timed scuba surveys in each area and the times varied usually because of safety issues.

Initially we measured, identified and measured all the mussels collected but after a while, again because of safety issues, we simply counted them. We stayed on the bottom and we counted those mussels, kept a running tab because we don't have many species here and recorded those.

LAURA BULLARD: What kind of information were you trying to capture in the qualitative?

JOHN ALDERMAN: The qualitative is catch per unit effort. How many mussels of each species could you find in a certain amount of time. That's translated catch per one hour. That's how you do the change. In other words, even if you worked through, say 15 minutes, which is a quarter hour, you multiply it by four so the catch becomes four times the number you actually found per hour.

LAURA BULLARD: And how does that make that qualitative versus quantitative?

JOHN ALDERMAN: The qualitative helps to back up in a lot of cases the quantitative work and vice versa and you have, in my mind, more of a chance of finding the very rare things, which you'll see that in the data shortly.

The third thing we did, which wasn't part of the study but we figured, you know, what the heck we had some additional time and since we didn't spend that much time doing the qualitative in the watered areas because of safety we added one third component because we continued to see animals farther out in the deeper water.

We did some qualitative work in several of the areas from 10 to 30 feet deep and that's catch per unit effort in those areas, how many mussels could we find in a certain amount of time and again, looking for the rare things.

So these are the results and I'll go very quickly species by species. This is the pyganodon grandis, the giant floater. Yeah, I think you can see them just fine. What I want you to do is just look at the map here and just get a feeling for P. grandis qualitative. See the big red dot here.

When we're doing the scuba work did we find live

animals, yes or no. If yes then it's a red dot. Doing the quantitative work with quadrats, did we find *P. grandis* in the quadrats. If it's yes it will be a green dot. Did you see shells in the areas you worked. If so then it's a black dot. What do you see in terms of your general transit. Of course this means you didn't find any *P. grandis*.

What's happening is you go from near the dam up here and coming toward where the river flows in. As you can see, no matter what survey method you're using you get hits in terms of whether you find shells or animals in quadrats or animals by just doing the qualitative work, the scuba.

Then as you move in this direction it becomes less and less obvious. See here we didn't find any *grandis* in the quads. With the quantitative work we found none. We found live animals, we found some shells.

So let me answer your question, they help back up one another and also if you use the various techniques you're going to be able to see things you wouldn't see if you just use one technique.

LAURA BULLARD: So qualitative means they're alive?

JOHN ALDERMAN: Qualitative means that you are just -
- for us, with this work did you find them in a certain amount of time, whether they're live animals or shells. The reason I spent a lot of

time with this is as we go through this I'm not going to keep saying do you see the same trend with this species or that species, but keep this one in mind, that basically this part of the river here or this part of the lake, our survey area, this is where the lake basically begins.

This part of the lake is most influenced by the river. This part of the lake is most influenced by this part of the lake. I think that's important when you think about the freshwater mussels in the lake and also when you think about freshwater mussels in the New River.

The densities ranged from fairly low densities to half a grandis per quad. Again these are quarter meter quads. Most of your density, the most significant density is in that area closest to the dam. Catch per unit effort, the good numbers that's basic message from here and you can see area E, which is here, had the highest catch rate in the five to ten foot depths. So good numbers.

That's the take home message in that five to ten foot depth, in most of the areas, in that area in the lower half of the lake. Then you get in -- again, one reason we wanted to do this work in the ten to 30 foot depths is because we continued this and we were working along, we would look out beyond where we were actually working just five to ten in the deepest and saying, wow, there's a lot

out there and we would like to be able to see what's going on with those populations.

As you can see, fairly high abundances, 1,286 pyganodon per hour was the catch rate at area B for example. So there were a lot of animals in the deeper water too.

So what about for the dewatered areas. None documented within quadrats anywhere, that's for the entire lake, however CPUE data we did get two live grandis in area A, which is in the lower region of this area down here and we got five at site B which is down the lake and around that corner right over there. So not many.

When you look at the catch rate that we have here versus what you see in the dewatered areas there's not much in that dewatered area. The CPUE was zero from the other dewatered areas. In other words, going farther up the lake didn't find any in those dewatered areas.

Yes, I realize that Brian found animals, particularly at the Bandolin property and Mallard Point, which is what, just right around the corner here. He found quite a few animals in those areas. There may be migration coming out of the deeper water going into those shallow areas and dying off, maybe because of DO issues or other

issues, I don't know. That's not part of the study. This is just what we found.

So it could be during the course of the year animals may move into that dewatered area, just don't know. Just don't know. The bottom line is for grandis there's a good population in this part of the lake that we're looking at here.

BILL KITTRELL: Just to clarify a point, when you're saying dewatered you are talking about the --

JOHN ALDERMAN: Zero to five.

BILL KITTRELL: The historically dewatered part --

JOHN ALDERMAN: Yes.

BILL KITTRELL: Just so everybody in the room knows that, that's not dry shore and that's not out of the water that's talking about zero to five feet?

JOHN ALDERMAN: That's correct. Yeah. Exactly. Again I want to go through this very quickly because we have several species, other speakers and I don't think I have a lot of time left.

Based on the areas here in the quadrats most of the grandis were found at that area E. Taking all the grandis individuals from the lake, looking at depth as you can see there is depth somewhere between seven and nine feet, so the average depth for

these animals were in the deeper water in that five to ten foot area.

When you compare the length of the animals with the depth nothing really jumps out at you in terms of your size, structure, width, depth, the other small animals found in the shallow water, more shallowed water, you have small animals found in the deeper water so you basically form two Bell curves whether you're looking at length or depth.

Next animal, utterbackia --

BOB MUNSON: Before you move on to that. How was your age class range across that species?

JOHN ALDERMAN: We found very few young animals, as you see the fifth millimeter length here. Not much smaller than 50 millimeters.

BOB MUNSON: Is that because you weren't able to do much sieve work or --

JOHN ALDERMAN: See, we were able to find corbicula using what we did, which is tactile work. You can take a quarter meter quad, put your fingers --

BOB MUNSON: So you were finding little corbicula?

JOHN ALDERMAN: Oh, we find small corbicula, in other words, down that size --

BOB MUNSON: So you would have seen these if they were there?

JOHN ALDERMAN: Yes, we would have seen them, we would have felt them.

BOB MUNSON: What's the take home message on that?

JOHN ALDERMAN: Huh?

BOB MUNSON: What's the take home message on that?

JOHN ALDERMAN: The take home message on that is we don't fully understand the reproduction in even an animal like pyganodon. I don't know that too many people have studied pyganodon. How much recruitment that you have into a population, how quickly they grow. I mean in some species of mussels we know that they basically stop growing after a certain age.

So in terms of age I don't know but we're not seeing much sign of recruitment, but we don't see many signs of recruitment in a lot of places that we work, no matter what methods you use. So it's not good but it's not unusual.

The next species paper pondshell. Again, looking at the lake we didn't find any in this area here, the upper part of the lake.

They were all basically in that lower area and one technique complimented another technique in terms of what was seen.

Another note, this animal should have been found throughout the lake. *Pyganodon grandis* should have been found throughout the lake. There's no reason why you wouldn't find both because you find *pyganodon* below the dam. We found like 50 shells of *pyganodon* a short distance down below the dam. So it's not a flow issue.

BILL KITTRELL: Would that be, you know, silt deposition coming down the river and starts dropping out at that upper reservoir probably start losing some habitat?

JOHN ALDERMAN: Yeah, but I've seen *pyganodon* and *annadona*, *utterbackia* in places where you're wading in silt up to here and that's actually the preferred habitat that you normally find them in.

BOB MUNSON: That's what I was thinking because everything below Allisonia your heavy silt load starts dropping out and all the way around that whole --

JOHN ALDERMAN: It should have been loaded.

BOB MUNSON: Yeah. That's all big sandbars up there.

JOHN ALDERMAN: And mud galore just all through that

section through there.

BOB MUNSON: Right.

JOHN ALDERMAN: Perfect pyganodon habitat. See, that's what I'm getting at. Very shortly you'll see what I'm trying to drive us toward.

BOB MUNSON: Yeah, I'm already very confused. Yeah.

JOHN ALDERMAN: Well, it's not confusing it's intriguing.

BOB MUNSON: Does not compute.

JOHN ALDERMAN: Yes, it does not compute. In other words, where we should have found lots of them -- it should have been reversed, pyganodon, utterbackia habitat here but what do we find it there. So going at the densities, very low densities of utterbackia. That's the catchall. The other thing is CPUE we didn't find many alive, okay. We didn't find many alive. But see that compliments the density. It's a low density and catch per unit effort says the same -- remember with pyganodon we had fairly high densities relative to this and remember the CPUE's were high.

In other words, it was saying that, okay, your quantitative work is good and your qualitative work is good and with this, low

densities on utterbackia and low catch rates on utterbackia. However, in the deeper water we did find more, particularly at that area B, which is around the bend around there.

So utterbackia, paper pondshell we found none within the dewatered areas in the quadrats and we did find two in area A, which is down that direction of the lake. So not many. Elsewhere we didn't find any in the dewatered areas.

Most of the animals we found in quadrats were again found in that area E, which there's a park on the other side of the lake not very far from here that's area E. A lot of fisherman there, a lot of fishing line and hooks in the water and on the bottom, hell of a place to work.

BOB MUNSON: He's bucking for a pay raise, I can hear it.

JOHN ALDERMAN: What's that?

BOB MUNSON: You're bucking for a pay raise.

JOHN ALDERMAN: Hazard pay. Hazard pay. Again, most of the animals found, you know, around seven to eight feet deep and it varied as you go from one part of the lake to the other, but, you know, they're still found it in the deeper waters. We did find some smaller utterbackia but not very small, 30 or 40 millimeters.

Most of them were around 60.

Again, the depths varied in that area from five to ten feet deep. One of your prettiest mussels in here, the purple wartyback, that picture doesn't do this guy justice. Cyclonaias, what do you see about cyclonaias? What are its trends? It's found throughout the lake whether you're doing quantitative work or qualitative work from one end of the lake to the other.

Good but it's found in very low densities. Of course your catch rates -- well, let's go straight to the catch rates. Also complimenting the quantitative work the catch rates are very low as well. Again your greatest catch rate is up there at B over on that side of the lake.

What I don't show down here is that area L. There's a good catch rate down there too but that's a very shallow part of the lake, more like a river, more like what cyclonaias habitat should be. Where we did do the quantitative work in the deeper water we found this area C, 5.9 individuals per hour. That's in greater than ten feet.

So we found no cyclonaias in the dewatered areas in terms of quadrats and we found no live animals in that dewatered area. I think that compliments what you all found in your initial work.

I don't think in the spreadsheet that Brian sent me there were any cyclonaias found in that dewatered area but he did find, I think, one of these at the Bandolin property, the tritogonia verrucosa, pistolgrip and these were some big boys by the way, big guys.

Tritogonia look at it. See, it's kind of doing what pyganodon and utterbackia -- look you've got shells found, none found in the quads except for that area A. Yeah, area A is the only place we found tritogonia in quads. Tritogonia is in trouble in the lake here. It's in decline and I think it's one of the ones that's going to be going on your all's state list as endangered or threatened or being considered as such.

So something is happening with tritogonia and in my mind something is happening also with pyganodon and utterbackia in this lake, but I'll get to possible reasons why shortly. So for tritogonia only found living at sites A and B, in other words, in this part of the lake.

One found in one quad at site A, so density of .004, so very rare. Catch rates at area A, which is in this lower area, 7.1 and in B a catch rate of 2.7. So this area of the lake you still find them live but not found anywhere else live. Just shells. Mainly old shells. Also the catch rate in the deeper water in area B we did find them

was 4.5. So they're still hanging on in this area of the lake live.

We did not find any in the dewatered areas, whether you're looking at quads or just using qualitative techniques. An animal that we did find here very rarely, -- we didn't find *Lapsilis ovata*, the pocketbook. We found it live again in the lake part, in this part of the lake. We found a shell, you see that J, area J, we found a shell there, an old shell.

So it was basically in this area and it's very rare. We didn't find them using quads at area A or B. I don't think we had any shells, it was elsewhere we found the shells. So, limited to this area. So, *ovata*, none found in watered or dewatered quadrats. So that's over 4,000 quadrats, we found none.

That again, in answer to your question, even if you do thousands of quadrats the very rare things may not show up using quantitative techniques. You have to use qualitative techniques a lot of times to help out, you know, determine exactly what is there.

So we found one live individual in area A in the ten to 30 foot depth and we found one live in area B in the five to ten foot depth. So they're found from five to 30 feet deep essentially and very rare. One that hadn't turned up in the past which would be expected in this upper area of the lake and that's the spike, *elliptio*

dilatata. We found only one individual, qualitative technique.

We found them in no quads. In over 4,000 quads found none. We found one using qualitative techniques, visual survey and using scuba at that area J. That's near where the river is so you would expect to find dilatata there.

So the summary on that, none found in the watered or dewatered quadrats, out of 4,000 quads none found. One live in area J in five to nine feet during the qualitative surveys. So again the take home message for the lake is most of your diversity and your abundances are in this part of the lake where we're sitting right now, in this part of the lake, the lower half of the lake, which is most influenced by the lake itself.

Whatever this lake is doing in terms of processing the water and I'm not going to say what I think it is because I don't know, but something is happening in terms of the processing of the water that the water coming into this lake is a reflection of everything that's going on all the way up to Boone, North Carolina, which I worked a lot of the area all the way up to Boone.

There's a lot going on in terms of land use and water use within the New River basin. So it's a reflection of everything that's going on. So it takes this much lake to process that river basin

before you get into this part of the lake, the lower part of the lake.

I think that's what's going on within the lake itself in terms of mussels. So now we get on to the New River. Yeah.

BILL KITTRELL: I've got one question. Mike Bender and Brian Watson are obviously the mussel experts in our group but in your experience, the species that you documented here how shallow would they tend to appear or occur in a reservoir system?

JOHN ALDERMAN: That's one of the toughest questions you could ask but I'll give it to you this way, in a natural lake like Lake Wakama, which we were just talking about Wakama earlier, in a natural lake like Wakama you can see them start picking up around two feet deep. It's a very shallow lake, water gets really hot but then as you go deeper and deeper you see more and more animals.

In this lake it kind of reflects that and it's really not until you get down to about three feet deep do you see good numbers.

On the other hand there's some reservoirs, like I worked Lake Murray in South Carolina 2006, one hell of a rough place to work because of the heat, they had the lake lowered and then it wasn't until we got down to around nine feet deep that we started seeing a lot of animals. Those animals apparently -- and they

also had the lake drawn down about ten feet.

So even below that nine feet deep, below that level, basically 19 feet below the regular pool that's where we were finding most of our mussels and then it kind of tapered off after that, but it was around nine feet deep.

So it depends upon so many conditions. I don't have a good answer for that.

LAURA BULLARD: Given your experience here at Claytor Lake what would you say about the ability of mussels to survive with the fluctuations in the lake level, be it because of peaking or draw downs or whatever, how does that impact their ability to survive at Claytor Lake.

JOHN ALDERMAN: The way I would answer that is this, I'm more concerned about what I just presented in terms of these animals being restricted in this part of the lake to a large extent, in terms of your diversity and decline as you go up, basically up the river, your abundances decline as you go up the river.

I'm more concerned long term with what's going on within the river basin itself and the impacts on the lake because if you keep pushing, for example the pistolgrip, tritogonia verrucosa, remember there are only two places where we found them live and

not many individuals and they're all big and then old shells elsewhere, it's suggesting that the lake is in trouble in terms of what's coming into the lake from afar and nearby.

BOB MUNSON: You say you've done some work in the watershed, have you worked above Fries or even up in North Carolina --

JOHN ALDERMAN: It's mainly up in North Carolina and things like subviridis are in major decline in North Carolina, dilatata is in decline, tritogonia can't be found anymore, cyclonaias is in major decline, the animals are in trouble.

BOB MUNSON: So it's really not Claytor Lake that's the problem it's the watershed itself?

JOHN ALDERMAN: The entire river basin needs special management.

LAURA BULLARD: Do you think a draw down of five feet is detrimental to them?

JOHN ALDERMAN: Well, when you look at pyganodon for example, pyganodon is doing fine in this part of the lake. Most of the animals that I mentioned they're found in the deeper water. As a matter of fact, I didn't go into detail but we actually saw animals outside of the timed part of the survey where they were mainly nine

to ten feet deep.

As we're doing the quadrats for example, we're seeing them and then we didn't see them when we did the time survey, but even with cyclonaias and tritogonia most of those were towards the deeper part of the five to ten foot area.

I think I've got to rush through this next part. The New River survey we did that in August 2007. I only have two slides on this and I tried to combine as much information as I could to a large extent because I was running out of time in terms of putting this thing together, but I also knew I was going to be running out of time in terms of presentation.

We did about 60 miles back in August. That was surveying under what I consider to be ideal conditions. We used kayaks to a large extent so we could get into very shallow water. We could actually look for subviridis and subviridis habitat, which I won't go into a lot of detail about where subviridis habitat and where it's not, but you've got a lot of really good potential subviridis habitat up and down through this area, around the islands, around bars, heads and tails of bars.

Where we actually found some fresh shells, which I noticed in the notes that it said that we didn't find any shells of

subviridis, we did. That's actually in the area where in the past they've found them, McCoy area on the river. See where lasmigona subviridis where that's indicated. We found three preyed upon subviridis, green floaters. They had been recently crushed by muskrats and just found a fragment of one shell of one individual, a fragment of another shell of another individual and a fragment of a third individual right at that area. So subviridis is in there.

But the take home message from this slide is look at the number of mussel species, a number of mussel species plural. A black dot indicates five species like you would find up in this bend of the river. We had five species here. Now that's either live individuals or just shells.

It ranged from zero mussel species at any site that we actually stopped and did a timed survey. We were actually looking for subviridis this whole reach as we were kayaking getting in very shallow water, kayaking and walking, so we either kayaked or walked this whole area, we boated but it was mainly kayaking.

The take home message is this, yeah, you can find five species at this site in terms of shells or live animals representing the species. Some of them have, as you can see right here, a black dot, which is rare, which indicates five species. These are the larger

surface. Four is blue, green is three, etcetera, the take home message though is this, even if you had five species or four species indicated by shells or live animals so many of the dots, the little dots that's a red dot indicating zero live species.

So we would find shells of animals all up and down through the New River, we found very few live animals, very few live animals and that's the take home message for the New River, like we're seeing up in the headwaters above Claytor Lake all the way up into North Carolina animals are in decline in terms of the freshwater mussels in the river.

So like I'm seeing in North Carolina and South Carolina what's bazaar is the mussel refusia are more and more associated with the reservoirs and natural lakes like Lake Wakama, not that we have that many natural lakes and in many cases the water is just below the reservoirs, which we didn't find that to be the case here, but it's not what we're supposed to be seeing and we're seeing it in North Carolina, we're seeing it in South Carolina, we're seeing it here on this project.

These are just live animals. Only at one site did we find 19 purple warty backs, that's that bend area up here where we found evidence of five species. We also found four dilatata at that site, we

found one fasciola, wavy rayed lampmussel at that site.

So that was the greatest diversity. Three species that's all. That's the best I could muster in six days of doing rapid reconnaissance and that's all you can call it, rapid reconnaissance in the river, but it appeared to be significant decline relative to what Michael found back ten years ago in the river.

Like I said, we recorded catch rates for all these different sites here that you actually see dots, but you've got to understand we spent six days of constantly looking for animals as we were kayaking down that river under ideal conditions and it was only rarely would we stop and that's how we found the one tritogonia.

I didn't indicate it but we did find one pistolgrip in the river as we were kayaking down but none elsewhere. So, again, the bottom line is look at this, cyclonaias tuberculata found throughout the New River at very low densities, basically you can translate it as that and what did we find in the lake, the same thing, purple warty back throughout the lake at very low densities, very low catch rates.

So it's tolerating conditions better than the others but I wouldn't say too terribly well. So that's the story on the mussels and I don't know if I have time for questions beyond what --

BILL KITTRELL: Did you say how many green floaters, if

any?

JOHN ALDERMAN: Three shells.

BILL KITTRELL: Three shells.

JOHN ALDERMAN: Which in anticipation of questions such as, you know, we had planned to do some quantitative work if we had found some areas that were worthy of doing quantitative work but I'll tell you the honest truth, you would have to not do 400 quads in an area you would probably go into the thousands of quads in order to get something that comes close to being valid in terms of, statistically valid to say what the densities of those animals are.

What you all may want to consider is doing some qualitative work, particularly where we found subviridis right in this area here, maybe spend a day intensively surveying qualitatively surveying, time it all out, have adequate person power there but do some time survey in the McCoy area.

This area up here needs to be further surveyed. I have a specimen of a mussel that may be the pink mucket shell found at that site. I need to do some more work with that specimen. I'm not willing to call it pink mucket yet but that may be present here, but just because of the high abundance, relatively -- when I say high abundance we found 17 cyclonaias.

BOB MUNSON: Relative.

JOHN ALDERMAN: Yeah. I mean that's still very poor. If you were doing quantitative work, like I said, for the chances of finding any is pretty slim. There you would have to actually go down through the substrate because these animals are down in the substrate.

So in my mind if you could establish some current CPUE data for this area here, this area at McCoy, which is where you had the green floater, those are fresh, relatively fresh. This field season munched by muskrats.

The area where *lampilis ovata*, where Brian was with us one of the days, where we found *ovata*, which is a short distance down from the dam, that first major set of islands below the dam and the New River, might want to spend a day in there doing qualitative work.

I can't really recommend the quantitative just because of you could get in there forever and not find them in the quadrats.

TERESA ROGERS: I guess what would be the best thing to do is get these study results to Brian and Mike Splendor and then have a conference call and kind of go through those. I know they wanted to be here but they had another conflict. Maybe we can

get together so they can ask questions and that type of thing and figure out what to do next.

JOHN ALDERMAN: Okay, sounds good. Appreciate it. Thanks.

SCOTT FLETCHER: All right. Let's talk about the snail. Another species we surveyed for besides the mussel group was the fringed mountain snail. That's a species listed as endangered by the Fish and Wildlife Service and actually the only place in the world is found right here in this county on the New River right along Claytor Lake.

The objective for that study was we did desktop analysis, we hired -- there's only two living mountain fringed snail experts in the world and we hired the one, he actually lives up in Maine, Ken Hotopp. He came down and one of the first objectives we did was we did a desktop analysis, which we got all the information, the known locations from the state and the Natural Heritage Program, Department of Game and Inland Fisheries and Fish and Wildlife Service and then we did kind of a landscape analysis in which we determined where likely habitat was.

Likely habitat for this species is that it prefers -- it's a calcium calciphile. That means it loves calcium or circumneutral soils

usually found associated with the Elbrook limestone formation, which is right in this area here. So it likes limestone based soils at the foot of colluvial deposits, scree, bouldery, rotten rock slopes that you can see along a lot of these areas, somewhat wooded to scrubby shrub areas.

It's also a difficult species to find because it burrows, it's a soil animal, it burrows in the ground 10 to 40 centimeters into the ground. So the only reason you ever find them a lot of times is you find dead shells, snail shells setting on the habitat or downslope like on the shoreline of the lake.

So not a lot of them, very rare and difficult animal to survey. So we did the desktop analysis, narrowed down the potential habitat areas and then we also did a habitat reconnaissance, which we went out with Ken to 16 sites and basically looked for evidence and habitat of the species and did a resource assessment on that species to determine what kind of likelihood it would be effected by the project operations.

The other phase, besides the mussels and the snail was fisheries. We did a desktop analysis on all the available fisheries information. As we heard earlier today, there is quite a bit out there. The state has been doing a lot of sampling, gill netting, shocking,

Virginia Tech has been doing a lot of studies on this lake, both on the fisheries and ichthyoplankton, fisheries dynamics.

So right now we are compiling and in the process of going through all that data and determining temporal and spatial distribution and habitat of the various fish game and non game species.

The other aspect of that is we employed Reservoir Environmental Management Incorporated. Jim Moraine and his folks, ex TVA employees and they are experts in using the CE-Qual W2 water quality model, actually a Corps of Army Engineers model and we're using that model to help on the water quality end and the striper squeeze phenomena that we talked about this morning.

So Jim is going to talk about that in a couple of minutes. Very good model. We've used it on just -- almost every relicensing project in the southeast has used that model. We used it extensively down on Duke's Catawba Wateree the last four years to do the exact same modeling we're doing on Claytor, so a very good tool.

Then we're also doing a resource assessment on fisheries using that model and the available literature to see if there are any indications of project operation effects on fisheries.

Talked about the fringed mountain snail a little bit, talked

about the desktop analysis we did. Like I said, we looked at it -- it's a terrestrial snail by the way, it's found on land not in the water. We visited 16 sites along the lake, 6 of those sites were determined to have potential habitat, had the criteria, the conditions I just mentioned.

Interesting to note, all were above 1850 foot elevation project boundary and were above any effects of project operations on those species. Some of those sites are on Appalachian Power Company lands, outside of the boundary but some land holdings they have around the lake, some of those habitats are found in but not -- we determined that those habitats would not be effected by project operations because basically they're too high up.

On those sites, based on the reconnaissance, no evidence of any snails were found. Like I said, it is evident that project operations are not going to effect that species much above, meters above any fluctuation zone or even contact with the water. That study is now with AEP and we'll shortly discuss if there's any additional studies or surveys that need to be conducted on that snail.

TERESA ROGERS: I sent the recon study out to Game and Inland Fisheries and Wildlife and now I'm wondering if I shouldn't have gone ahead and sent it to Conservation Recreation. I

didn't think about it.

BOB MUNSON: I think our Natural Heritage folks would be particularly interested in knowing where you found the habitat because we need to work with AEP and other neighbors around the lake to establish some conservation areas where we protect that habitat for the future. I think that would be real important.

TERESA ROGERS: I --

BOB MUNSON: And if there's any houses, any private landowners that have the habitat on it we'll condemn their houses and move them. I'm just trying to scare our friends from -- there aren't many of them here today. I can't scare anybody.

JON MAGALSKI: Should I go to Chris?

BOB MUNSON: Huh?

JON MAGALSKI: Should I go to Chris.

BOB MUNSON: Yes.

TERESA ROGERS: I'll send that to you and then what we'll do is have a conference call, but that will be like one of the things that we'll need to incorporate into that shoreline management because even though it's outside the project influence, you know, activity within that area potentially, so we may can protect that by making sure that nothing happens in those areas type of thing. So,

we'll conference in after we get that data.

I guess I was a little unsure, since it was an endangered species, you know, how open I could make that information. I guess maybe, you know --

BOB MUNSON: Our heritage folks would prefer that it not be and I know our Game Commission and Wildlife folks. They work very tightlipped about that stuff because there are people who are collectors.

BILL KITTRELL: Don't give out specific locations.

TERESA ROGERS: Just so you, in our shoreline classifications we'll have it classified someway but people won't know why specifically it's classified that way. So that information will still be protected. We'll know internally that if anybody comes and tries to do something there why we can't allow it to be done but it won't be like a snail on our map so people won't know it's there.

BOB MUNSON: Special habitat type.

TERESA ROGERS: Exactly.

BILL KITTRELL: Why were those 16 areas chosen versus 16 other areas? Were those the only 16 areas of potential habitat or were those a subsample of all the habitat or what?

SCOTT FLETCHER: No. That was basically the entirety

of the potential habitat areas. Like I said, it's in a limited area for one thing and those 16 sites, based on soil type, geology, cover type --

BILL KITTRELL: All potential habitat.

SCOTT FLETCHER: On all the potential and all the known that's out there also.

BOB MUNSON: So we have a band of that particular type of limestone and it only shows up at the surface in a few areas?

SCOTT FLETCHER: Correct.

BOB MUNSON: And that's where you see them?

SCOTT FLETCHER: Yeah. At the surface or very close to the surface, that's where you get that calcium circumneutral soils and stuff. So as you can see on the map it's spread out along the reservoir and site 14 is fairly close to the dam too.

Like Teresa said, in one of those, in some of those areas it's very, they think it's very susceptible and you think it's obvious to road building, lumbering, timber harvesting and development too. It basically is, it lives in the ground and any disturbance probably would effect that in its habitat.

So those 16 sites were basically the entire potential sites known and had that criteria, habitat criteria and then it was narrowed down to six that were of high potential or had potential based on field

assessment.

BOB MUNSON: Did you find any of the 16 sites that had been badly disturbed by --

SCOTT FLETCHER: No, they were all fairly, you know, kind of like that slope over there, wooded, undisturbed --

BOB MUNSON: You didn't have construction --

SCOTT FLETCHER: There was some nearby, you know, and there was some potential for it to be in the future outside, certainly outside of the project lands. It was starting to encroach down through there but --

BOB MUNSON: That's the sort of thing that we would be very interested in is lands that were outside the ownership of AEP where there may be some urgency in trying to acquire those lands or get an easement on them or something from the current landowner if it's someone other than AEP.

SCOTT FLETCHER: We typically didn't go into a lot of private land, we had to get access, but those conditions basically continued into private lands also.

TERESA ROGERS: I'll get that report to you.

BOB MUNSON: That's the kind of stuff that Chris would be very interested in having and would probably want to work with a

lot of folks to establish a protection plan for the snail and work with you guys on that.

TERESA ROGERS: I'll get that to you.

SCOTT FLETCHER: I think that's it. Here's some photographs of some typical habitat areas. You can see pretty much what I talked about, relatively steep slopes, wooded, undisturbed. You can see some of the livestock, livestock -- limestone outcrops poking up right there.

BOB MUNSON: That's cobble coming downhill?

SCOTT FLETCHER: Yeah, that's some of the bedrock poking out, some of the colluvial rolled downhill or was exposed in that site. That's the kind of conditions -- a good root mat, which they fed on, you know. They're herbivores. So typical kind of habitat that was found, potential habitat for that snail.

Any questions on that? Interesting species of survey. Like I said, not many people know about it or have any --

BOB MUNSON: Which is a good thing.

SCOTT FLETCHER: Yeah. Next area were fisheries. Mention that we're in the process of compile and review of existing literature quite a bit. Like I said, Virginia Tech, University of Virginia has done a lot of work on this lake for fisheries, ichthyoplankton, some

good papers on that, several published reports and then the departments report is on there, electro shocking and their fish surveying.

Impingement entrainment reports, both come in handy both from what Normandeau is doing and we're using some information from the Glen Lyn project downstream. Probably at least, you know, 30 to 50 references right now that are pertinent and we're going to provide some good results.

We're also looking at literature review on the fish versus plankton community, actually some good Virginia Tech papers on that also. We had talked about, you know, a couple of months ago that there may be, you know, some of the department fishery biologists thought that there may be some relationship between plankton and amounts of foraged fish which provide the food base for the striped bass and we kind of talked about that a little bit this morning about, you know, where those zones of plankton were and where the stripers were during the summer.

Sampling locations, mentioned that. Approximately 50 locations in the lake and the river upstream and downstream of the dam, both historical information, which is good for determining trend analysis on species and quite a bit of recently sampled information,

gill nets, electro shocking that the department has been doing on the reservoir.

When it's all said and done we'll use all this information to create a species list, pretty much well known already, determine a temporal and spacial fisheries characteristics.

You know, we talked about waleye and the stripers being relatively pelagic, moving around in the lake during different times of the year, both vertically and horizontally, laterally and determine what kind of potential effects this project may have on the fisheries community and certain species.

Here's kind of a map. You can see it's pretty good coverage of the reservoir on the known department Game and Inland Fish fish sampling site. So a lot of good information upstream, in the reservoir and downstream.

We also -- another component of this was using the W2 model, CE-Qual W2 model. Jim is going to talk about that in a minute. Jim, you on the phone?

JIM RUANE: Yes, we are. I've got Andy Sawyer on here with me too.

SCOTT FLETCHER: Okay. Well, let me just do a little intro here and I'll get with you. Preliminary information what we

always gather for this modeling effort is bathymetry, key point. Without bathymetry it's very difficult to work, you can't work this model.

Operations data, very important on how the project is being operated during certain times of the year obviously, powerhouse drawings, where the intake is located, what depth, USGS stream gage data.

This river has got some good gauge data on it so that's always helpful to get the flows and the flow duration curves. Met data, weather data very important and historical water quality data. Jim will go into that in a minute.

We're also going to use -- Mark talked about the water quality data this morning. We're going to be using the 2007 data that Normandeau has been gathering. Mark is going to get that information to Jim when he's done compiling it, but as you could see this morning there's quite a bit of information, useful information out there too, both on DO, temperature, conductivity, PH and chlorophyll a.

Model input and development is underway. Get some of that water quality data, Jim can go ahead and his crew can go ahead and do the calibration on the model in January and February and

then run model applications on various operational scenarios and get a report out probably sometime in the spring, late spring period.

Jim, I'll just go through, I've got your slide show up.

JIM RUANE: Okay.

SCOTT FLETCHER: So I'll just go through -- just tell me when to click the slides. Jim, I'm going to give you a quick introduction here. Jim Ruane is with Reservoir Environmental Management out of Chattanooga, Tennessee, that's one reason he's not here, but his voice is. Andy Sawyer works with Jim also on these water quality models.

So you want to go ahead, Jim?

JIM RUANE: Yes, sir. If you could go to the first slide showing lake bathymetry.

SCOTT FLETCHER: All set.

JIM RUANE: Okay. Andy is going to lead the discussion on the first two slides just to give you a background on the bathymetry.

The data were actually collected by AEP and processed and a lot of the slides we're going to show you here were processed by DTA, Tim Leonard in Charlotte.

ANDY SAWYER: This is the contour map of Claytor and

this was created by Tim Leonard at DTA. Once Tim created the contour map he sends it back to me and I start segmenting for the model.

Go to the next slide, it's the same slide but now you'll see a bunch of lines on it. That's where I segmented the lake. In general those are one kilometer segments, some are a little smaller, some are larger, it kind of depends on what the contours are doing as to whether I decide, you know, how big the segments are going to be.

The segments are a little shorter going up Peak Creek in there just because it's a smaller water body, little denser contour. So once I do this segment I send it back to Tim.

Tim then takes he puts it back in a GIS program and basically what he's trying to do is turn this lake into something I can use for the model, which is width, length and width, so we're going to have a 2B model. What I'll end up with once Tim processes it if you'll go to the next slide and this is what the model sees.

It's squared everything off. It's basically just a 2B model so what we're looking at here is we're looking down on the lake and these are the model segments. You can see the main branch, which at the bottom left it says Branch 1, that's the upstream end of Claytor

where the New River comes into the lake and so that's the main branch, Branch 1.

That goes all the way down to the upper right end of the picture. You see a bright blue square that's the segment right upstream of the dam, the last segment of the lake. Then we have two other branches that we're modeling.

There's all kinds of little embankments and coves but the only two that we actually broke out to model as separate branches are the Peak Creek embankment, which is Branch 2 and then I'm not sure the name of the other one down closer to the dam but that's also being, that's separated out as a branch and that's Branch 3. That's pretty small.

A side view of what the model sees is in the next slide if you go to the next slide. What we're looking at here is we're looking at the side view of Claytor Lake, the Branch 1. We're only looking at the main branch here with the upstream end of the lake being on the right-hand side and the dam on the lefthand side.

You'll see a couple of segments that are in red, that just shows where the other branches are coming in. I've got them marked there with Peak Creek coming in right about halfway and then you'll see Branch 3 also coming down closer to the dam, the

other segment that's red.

This is what the model sees. These cells vary in length but for the most part it's pretty consistent, roughly around a kilometer in length and they're all one meter deep. So one meter deep cells throughout the lake. There are some things that will have to be -- when we get further in the modeling there are some things that might have to be looked at a little closer and that's these.

Towards the upper end of the lake we've got some holes that may or may not be that pronounced but that's the way the model, that's the way the bathymetry comes to me, it's raw, it takes real contour data and turns it in so we take it as is and we go from there.

The model may have trouble with these deeper spots up here around the upper end of the lake. You can see where I'm talking about where it's actually deeper and then gets shallow again around kilometer 2.

Those are things that may have to be verified and for model reasons be smoothed out, but we won't know that until we kind of get into modeling it. We would model it as is for now and go from there and make any bathymetry adjustments based on what we're seeing on preliminary runs.

JIM RUANE: Okay. We'll just use the same -- this is Jim again. Use the same figure just to give you a little bit of background on a W2 model, CE-Qual W2 and how it processes water and water quality in the lake. The water enters in at the upper end kilometer 32 and moves down towards the dam.

All these cells, we call those cells different segments in the layers, each one of those between them creates the cells. The model actually processes and moves the water, transports the water and water quality cell by cell through the lake.

So there's a lot of number crunching that goes on with a lot of equations involved and calculating the water movements, velocities, water quality. It's essentially an eco system model so on every cell there's a lot of calculations going on to predict water quality.

We haven't started modeling yet. We're going to start on the 2007 data when we get it and what we have done up to now is started summarizing the next few slides and sort of give you a little progress report and where we think we're headed based on the data we've analyzed.

The next few slides are going to show profiles of temperature and then dissolved oxygen. Temperature is a very

important water quality variable for two reasons. One, it helps define the thermal structure of the lake, which is essentially all density based, the physical part of the model.

So lighter water will be on -- warmer water will be on the top of the lake and colder water will be on the bottom. As you can see on this first slide it's not isothermally -- you don't see isothermal conditions at many depths, so generally you're going to see this planted kind of temperature characteristic.

Those are all important because they define the density of the water and the layers of the various -- different water layers are important because they'll have different temperatures in them and of course striped bass habitat is very dependent on dissolved oxygen and temperature conditions.

The CE-Qual W2 model is really an excellent model for modeling temperature and thermal structure in turn that defines the water currents through the lake, the layers that water moves through. The data I'm going to show you came from the data that Normandeau put together back in May and so we're going to show you the temperature and DO profiles as I move through here.

It's pretty much data available in the late '90's and the 2000's up through 2006. So what we've got, generally we've got

monthly data available for most of the years and there's a few years where there is a month or two missing or wasn't collected.

So we're starting off with April, going to May. You can see in May below about elevation 540, that's in meters, you can start to see where the cool bottom water is not changing as much as the water above it. That's due to the water moving through the project and out through the releases.

You'll see that same characteristic as I go to the next one, which is June. There again you see in the bottom part of the lake roughly elevation between 535 and 540, especially below elevation of 535. That water layer down there hasn't really moved much, if any and the water above elevation of 540 has changed quite a bit since the previous graph. This is now in June.

I move to July. In July the surface water has warmed up a bit. August looks similar to July. One thing I want to point out about August is in the year 2005 and in 2006 we didn't have full profile so all you see are the dots where data were plotted, but we didn't have a full profile and that's going to play into our recommended years to model as we go forward.

September profile. Moving on down to this is October, not much of interest there. Going on to DO, dissolved oxygen, I'm

on April DO profiles. Of course you start off with pretty high dissolved oxygen levels in April. That's May, I'm sorry. I went to May and then go to June.

You can see near the bottom of the lake, elevation 535, the dissolved oxygen in all the different years that have been collected that's around two or three or less and then above there and up at the surface here have dissolved oxygen levels of around eight to 13 and then in the middle layer it's anywhere from roughly two to seven.

As we go on to July the oxygen levels, DO levels at mid layers elevation of 545, 550, 555 as you can see varies from zero to 4.

[Phone trouble.]

BILL KITTRELL: Where do the temperature profiles come from? Is that Kilpatrick's data that goes into the model right there?

SCOTT FLETCHER: You know, I'm not sure. Mark, do you know?

MARK HUTCHINS: Some of it is Kilpatrick's and some of it is DEQ's stuff. We collected everything that was reasonably available back to ten years, so it is a combination of both of those.

SCOTT FLETCHER: That kind of mirrors what we were talking about this morning as far as you get into that June through October period, typical of southeastern reservoirs too.

Jim?

JIM RUANE: Hey, yeah.

SCOTT FLETCHER: Hey, we lost you. Thought you ran out of DO.

JIM RUANE: Might have been. Sounded like I was running out of breath.

SCOTT FLETCHER: Good break. So we're on July DO I think, weren't we?

JIM RUANE: That's good I was afraid -- how long have we been disconnected?

SCOTT FLETCHER: About three months worth.

JIM RUANE: Not bad. Not bad. On July dissolved oxygen levels I was saying that the middle layer around elevation of 545 to 555 you'll see dissolved oxygen levels varying from near zero to around four. I might mention at this point where you see the lower dissolved oxygen levels at 2002 that's a low flow year.

2001 was somewhat of a low flow year but not as low in the New River as it was in other places in the southeast, but it tended

to be on the low side. Those other ones, the green and the red curves, those are more like normal years. In fact, 2003 was a very high flow year.

So that gives you some idea about how the DO varies with flow in a general sense. August, there again like we had for the temperature profiles there's a couple of years we don't have profiles for, 2005 and 2006, so you have curves shown on there.

You can see though that in 2002 the dissolved oxygen was fairly low from elevation 550 on down. This is just September profiles and October. Going on down to the temperature at Allisonia, this is a time series of temperature data for 2004, 2005 and 2006 is the slide I'm on.

We show this primarily because this is very useful data for the W2 model. It's very dependent on the inflow of temperature, especially in a lake like Claytor with a relatively short residence time. Normal or what we call nominal residence time in Lake Claytor is roughly 30 days.

So inflow temperature and the flows that move through it are very important so knowing what the temperature is helps out a lot. Again, a critical thing here is the amount of flow but it's also the temperature and that effects, between the temperature and the inflow

and the water flow, between that and the stratification of the lake it effects the water currents through the lake a lot.

So having these data, as well as in 2007, inflow data were collected for 2007 as well, those years are going to be as a big plus on the modeling those years. Temperature below Claytor Dam is the next slide. Again, this is 2004, 2005 and 2006. Very important data for calibrating the W2 model.

The temperature and the releases integrates a lot of what goes into the lake between that and what we call the withdrawal zone. The model is going to draw water from the lake over a range of depths and defining that range of depths is really important for having a good calibration and all the effects, again the water currents through the lake.

I keep mentioning the term water layers because with striped bass habitat typically where you end up with a range of depths where habitat occurs or is sensitive and then at certain depths like where oxygen may be too low there is very limited or no habitat.

So these data as well as like -- this is temperature for 2004, 2005 and 2006 and we have that for 2007. Also in 2007, as you all have probably already talked about, there's dissolved oxygen data and I think PH and conductivity.

This next slide is a table and it's a work in progress. I just wanted to show you what our current thinking is as far as years to model. The original plan called for modeling only temperature primarily in 2007 to define the withdrawal zone and then looking at two other years, like a low flow year and a normal flow year to actually calibrate to the water quality.

So in consideration of that plan we developed this table.

One thing before I get too far, one thing I want to mention, one thing we're currently thinking about is on 2007, instead of only modeling temperature, if DEQ data is available for water quality, like they might normally collect, it might be good to use 2007 as a main calibration year because of the -- there's a lot more profiles in the lake and that helps give us more calibration quality and credibility for the model.

But here's the range of years we looked at for consideration, '97 through 2007. This table is probably a little challenge to understand so I'll describe it. UP here under the first column is called year and on the left is low and on the right is normal and down below low and normal are the years, left or the right.

On the left like '99, 2000, 2002 and 2007, those are low flow years. A normal '97, 2001, approximately 2001 is a normal year and 2004, 2005 and 2006 tend to be more like normal flow years.

The next column is just sort of an inventory of profiles. 1997 we didn't find any profiles. In 1999 there were some missing depths of data on the profile. 2000 we had monthly profiles. 2001 monthly profiles. 2002 we had monthly profiles plus the Virginia Tech data. 2004 monthly profiles. 2005 and 2006 we had monthly profiles in general but we were missing August and 2006 was missing August and September. A real plus sign on 2007 is that we have weekly data.

Another key thing we like to look at is release temperature like we were just showing. We don't have any release temperature that's continuous up through 2002. So it's not until 2004 that that starts and it goes through 2007.

Missing water quality data, we use missing here because there was quite a few parameters collected by particularly DEQ. What I've listed here as missing are things that we normally use for inputs for your W2 model. The key one that's missing for all these years is total organic carbon, TOC. Those data are available for '94, '94 and '96 and might be sufficient because TOC is relatively low compared to some projects.

TKN value, total kjeldahl nitrogen, is relatively low. What that means is whatever organic matter there is tends to be refractory,

like 70 percent of it is refractory and doesn't oxidize very much as it passes through a lake like Claytor.

We are looking for any data up in the watershed that might be available on TOC and plus we also have TOC data -- in the data that's available on Claytor that we saw in the middle '90's is fairly consistent with like on the Catawba, upper Catawba and also on the Watauga River and South Holston River. So those rivers all drain from sort of similar situations there.

So I think we can work through that and we're still working through it. The last column over here is just some information on flows and why it might be good to pick these particular years that I've got some discussion about.

2002 ends up being the lowest flow year in the time frame June to August. For instance, there are 910 cfs, cubic feet per second. That's an average flow in 2002 for those months, June, July, August. Down in 2007 it's 1,381 roughly 1,400 cfs.

So 2002 would be a good year to model, especially from a flow perspective and also you saw the DO profiles there a while ago for 2002 so it's going to show that it's a pretty critical year. But we might have similar DO profiles like that in 2007, it might very well be. We haven't seen any of that data yet, but.

So it's conceivable at this point in time if we can get DEQ data for 2007 and if we see the low levels of oxygen in 2007 like 2002 -- you all still there?

SCOTT FLETCHER: Yeah.

JIM RUANE: Okay. We might be able to model only 2007 and 2004, 2004 being a normal flow year and 2007 being a low flow year. If we can't get the DEQ data for 2007 then we also model 2002.

So originally we were planning on modeling three years and we can still do that or we can just focus on 2004, 2007. That's sort of where we are in our analysis. We'll get more done and move more quickly after we get the 2007 data.

These next slides were in the proposal and I don't know how many people have already seen them but I thought I would give you some idea about the kind of outputs you might see from W2 and these are just examples.

We might have something even better for Claytor as we move along but this first one is a rather complicated slide. It's simply giving you an overview of the water quality, temperature and DO as well as the striped bass habitat. This happens to be for waleye habitat and it's a particular day like August 28, 1969.

On the left side we have temperature plotted for two conditions and on the right side we have DO plotted for two conditions. The upper curves are baseline, that would be sort of like current conditions and the two lower curves you'll see is titled mutual gains. That's what DTA and Duke were working with as far as coming to agreements on how to operate the Catawba system.

It was called a mutual gains or mutually beneficial to the range of users that were interested in various operations, So between the upper two graphs and the two lower graphs that's our baseline versus mutual gains.

Another thing that's on these graphs is like the preferred habitat like this happened to be for waleyes defined by the North Carolina state fisheries folks. Preferred habitat, temperature less than 24, DO greater than 4 and the zones that you see on there that's sort of like where the zones would be for the preferred habitat.

On the right-hand side you have the tolerable habitat, temperature less than 29 and DO greater than two. You can see of course you've got more habitat for the entire habitat which is not as restrictive. So that gives you some idea about the ways that habitat analysis can be reviewed and summarized.

I might mention that these criteria that you see for the

habitat we can define those as --

[Phone disconnected.]

SCOTT FLETCHER: That's the phone system in Tennessee I guess. You're back.

JIM RUANE: We're on again.

SCOTT FLETCHER: Sorry about that.

JIM RUANE: I don't know if I got this out before we got messed up or not but I was simply wanting to make sure that everyone understood that these criteria can be defined as the group wants to look at them or consider, you know, sensitivity to these criteria for Claytor.

The next graph is one that we find pretty useful. This graph summarizes the volume of water in the lake. At the top of the graph there is like the total volume of the lake and then the red and the blue, those are the striped bass habitat volume, for example. This is for waleye but it could be for whatever fish species you pick.

Then also defined by the habitat on the top curve it's habitat and the bottom curve is the tolerable habitat and of course you see a whole lot more volume in the bottom curve where you have the tolerable habitat.

But what we're showing here, if you noticed the black

curves at the top, that's the volume and that volume is different because it varied between what was called baseline and then the mutual gains conditions.

So they were changing cool levels and things like that so you'll see a little difference in volume. Then the two, red and the blue, is the difference between baseline and mutual gain. You can sort of see that in this case the effects of -- operations didn't effect the habitat too much.

The last graph I've got here is something I just want to mention, it's not anything important that I will go through in detail but I just wanted to show that this is the kind of output that's available for model runs that's quickly and easily accessible. We call them the summary of metrics and they give you an example.

On the first line up there it says the sum of volume days and I apologize for all the nomenclature but I'll tell you what it means in simple terms in a second. Sum of volume days with DO greater than five May through October as the percent of a volume of days, May through October that are totally available the DO was all above five.

So what it's specifically showing is like 73.3 percent of the volume of the lake on average is greater than 5 on the baseline

and 73.8 percent for the mutual gains, so there wasn't much difference there.

The next line is the minimum percent of volume greater than 5 and this happens to be a particular day typically and it's just like the most critical day that it would happen and the least amount of volume you would see is like 44.2 percent and 46 percent for a baseline versus mutual gain.

I have similar things down there, you know, like for DO less than one and how much volume that might be created and the maximum volume that might occur and so forth and then a summary of the habitat conditions.

The last one down there at the bottom is the number of days for the release DO less than a certain value that would be five and three. So those kind of metrics are available on different runs and if you change operations or look at other things you can see the sensitivity of these metrics to changes you might make.

And that's where we are. I think we've mentioned everything I believe we were going to mention.

SCOTT FLETCHER: Any questions for Jim. Bill.

BILL KITTRELL: A quick one. I'm not familiar with the model itself but are there any negative ramifications of calibrating the

model?

I mean obviously we've got good data for 2007 but it is the, you know, one of the driest years on record, are there any negative ramifications in calibrating the model based on that particular water year versus a normal water year?

2003 was the highest, some of the highest flows on record in Virginia, which we don't have any data for that year, does that affect the ability to model some of these years accurately? I'm just not sure.

JIM RUANE: Yeah, it would if that was the only year we were going to calibrate to 2007. We also wanted to calibrate to 2004 and that's more of a normal flow year, so I think between the two of those that would help address what you're asking about.

Does that answer your question?

BILL KITTRELL: I think so.

JIM RUANE: Okay.

SCOTT FLETCHER: Anything else? All right. Thank you, Jim. Andy.

JIM RUANE: Yes, sir, thank you all.

SCOTT FLETCHER: Appreciate it.

JIM RUANE: Look forward to having some results to

show you next time we get together.

SCOTT FLETCHER: Sounds good. Thanks for the help.

JIM RUANE: Thank you. See you all.

SCOTT FLETCHER: Any other questions on this study anybody?

TERESA ROGERS: We still need to go through the navigational aids and the shoreline management. I think what we'll do is go ahead and do them but not wait any time between and I'll hang around if anybody else comes in for shoreline management and catch them up and that way -- because it's not going to take an hour to go through navigational aids it's really quick. I don't know what I was thinking when I did my schedule.

NAVIGATIONAL AIDS

TERESA ROGERS: Navigational systems. The objectives for this study, we were going to go out and inventory the existing shoal and rock markers that are out there and develop the GIS mapping.

Before I finish don't let me forget, Mark McGlothlin is here, he's our GIS person. He's been very involved also with a navigational aids study at Smith Mountain so he's very familiar with the bathymetry and he will also be helping us up here as well.

The next step is to develop the guidelines for determining what conditions that we want to mark or install additional navigational markers, whether they be channel markers or shoal markers or -- this is going to be a philosophy thing that we're going to have to work out through the work group to see what best meets the needs at Claytor.

Claytor is a little bit different, as you kind of have gathered from the study results, is that we do have a section that's very river like and we've got a section that's very lake like so I think we do need to kind of take those two things into consideration when we come up with our philosophy for marking different things. That's just something we'll have to work out through the workgroup.

We'll determine the need and location for additional markers like I just said and use our bathymetry, use our knowledge of the reservoir and how we operate to develop those guidelines.

Then we'll identify processes to address safety related issues on the lake, including how we're going to do approvals for markers, installation and the maintenance of these markers and verify information related to the heights of the line crossings for Claytor Lake and evaluate the needs for modifications.

The activities to date, yesterday we had an update on the bathymetry, it has been done, it is in our GIS system. Mark has been working with it already a little bit putting some information in. He did field surveys of the existing markers in May and September and they're going to be going out again sometime this fourth quarter.

We were going to do it during the draw down and of course that was postponed. We will do it during the next draw down so that we can just make sure that there's nothing under water that we're missing when we actually do the draw down.

Each marker that's existing has been characterized by type and conditions. They've taken pictures of it in a GIS point so that we can put it in the mapping and it's all actually been incorporated into our mapping so far. I've got an example.

So far on the inventory there are 21 no wake buoys, 16 mooring buoys, 5 swim area buoys, 7 no boat buoys and 4 danger rock buoys. This is an example of a report that Mark was able to generate. That's the State Park actually with the swim buoys and you see some no boat buoys.

You can actually, when he puts the GIS on top of the bathymetry you can see where those are located. The next is just a picture of that same information laid overtop the aerial mapping

that's been done. It's kind of dark on there but you can actually see like the beach area, you've got the project boundary map, you've got the different water levels map.

The red dark lines -- you can't tell colors but you can see the ten foot contours are in red and the two foot contours are in green. So we do have two foot contour data for the lake that we'll be able to review as a work group when we're determining additional markers for the lake.

That's just a picture. All of this will be incorporated into our GIS so that if you want to call up a specific marker on the lake you can go to that GIS point and it will have a picture attached to it so you can call it up. That will be a good record for what's out there and conditions that they're in.

I have collected the existing standards that are out there right now and that includes the Coast Guard, the state agency standards. Right now Pulaski has zoning ordinances related to navigational markers, there's Rules for Establishment of Uniform Regulatory Markers on Public Waterways in Virginia, that's DGIF's.

The Coast Guard has Private Aids to Navigation and then there is an agreement between the U.S. Coast Guard and the State of Virginia permitting the state to regulate private aids to

navigation. So that's just one of those agreements that had to be worked out so that the state could approve certain types of things.

So we'll have to, you know, work within the existing regulations that are out there. We'll be working with all these different groups within the workgroup as well. I'll just go back to this, this will come into play like when you're, if you're putting some aids to navigation, things like color and size of markers so that it's uniform.

We don't want to put something out there that if someone coming from another state would look at it and say, well, what does that mean. You want some uniform guidelines so that boaters from all different areas, when they see the color or the size or the shape of the marker they know what that means. We're not going to make stuff up on our own. That's why it's important to know what guidelines are out there.

Our next steps and we have not met as a workgroup, in fact I have not sent the information out, that's my next step is to send all the existing information out to the workgroup so they can start reviewing it and becoming familiar with it, but we will be working within a workgroup setting for developing those guidelines and determine the conditions for additional markers using those existing

standards.

We'll be working with the Coast Guard Auxiliary, Game and Inland Fisheries, Conservation Recreation, Friends of Claytor Lake and we'll also be contacting the area fishing clubs and marina owners to get their perspective on their use and their customers use as well of safety related issues.

Then we're also working with our T&D department to go through and mark all the lines on our GIS and reviewing their heights and that type of thing, so we have a good database on that information.

I'll be providing the workgroup the existing guidelines probably December January period so you have some time to review it and then we'll schedule a meeting the beginning part of the first quarter so we can actually start sitting down and figuring out, you know, where to go next as far as navigational markers on Claytor.

Any questions so far? I guess there's two philosophies, you can mark the good water so that if you're in that area you know that you're not going to hit something or you can mark hazards. I think that's something we're going to have to work out with the workgroup, you know, what philosophy works best here at the lake.

BILL KITTRELL: Is that something that Appalachian

Power is looking at doing, you know, the Corps of Engineers, for example, TVA would maintain bay markers or channel markers on their facilities, is that something that Appalachian Power is looking at doing is putting in mile markers or channel markers, channel buoys or something like that since we have such good mapping now?

TERESA ROGERS: I think that's the direction we want to go because anybody that's been on this lake knows, especially when you get above the bridge, you have to know which side of the river to stay on, so especially up there --

BILL KITTRELL: Channel buoys or channel markers of some sort that, you know, for navigation that would really help and also, you know, if the DCR Blue Lake concept gets up and running, you know, folks moving down through the -- it would be nice to know what river mile you're at, you know, how much further it is to the dam and that sort of thing.

TERESA ROGERS: Those are the type of things -- we're very fortunate here that since it is very linear mile markers might be the way to go because you have Peak Creek basically you don't want to -- you could get lost I guess. It's hard to get lost on Claytor if you know kind of where you are in relationship to how many miles up to the dam that type of thing, so those are the kind of things

we'll work out through the workgroup, what works best.

We will have to rely a lot on that bathymetry to know where to put those markers and we'll just have to kind of discuss amongst ourselves the different scenarios that could be out there so that we cover different types of conditions.

BILL KITTRELL: The problem I know that TVA always says is once they put a marker out there then you have to continue to maintain it from now on, you know. You're accepting responsibility for maintenance and accuracy of the marker or of that buoy, so that's something Appalachian Power, I would assume, would have to take on that responsibility.

TERESA ROGERS: Yeah.

BILL KITTRELL: Get into the business of marking channels and mile markers and that sort of thing.

TERESA ROGERS: Exactly. I guess that's why we want to figure out what's needed, you know, what do we need to do. It's not going to probably be Cadillac system but, you know, we need to make sure that people know, you know, how to navigate up and down and we'll just kind of work through that as a workgroup.

We're very fortunate up here because, you know, the way we can operate you're not going to have that good water

channel as far as because fluctuations isn't going to change a lot because we're not continually dropping down in elevations and during a drought. We can maintain levels up here during a drought, so that's a good thing.

But if we couldn't then we would have to take into account for drought periods what elevation could your water go to and then make sure you had sufficient water above that when you're placing your markers or your shoal markers or that type of thing.

So those are just some things that we'll just have to work through. You can start kind of thinking in your mind, you know, anybody that's out there on the lake what you've experienced and that type of thing, but the bathymetry is going to be very, very helpful because Mark can, if we can give him an elevation he can just call up that contour line and we can see exactly where it is around the entire lake.

If we pick having a five foot depth at all times he can, as long as it's on a two foot contour, sorry, he can call it up and then we can see where that shoal is going out, you know, all the way up and around. So it's very, very helpful when you're trying to key in on a certain depth elevation using that bathymetry.

We don't actually have to go to the maps and look

around he can call that up and do his own map of just that contour elevation.

BILL KITTRELL: That's the problem, the reluctance I think of some operators to mark all the hazards, quote, "all the hazards" because particularly in reservoirs that fluctuate a lot tributary impoundments and that sort of thing, you know.

TERESA ROGERS: That's kind of what we're running into --

BILL KITTRELL: Hazards are all based on water elevation.

TERESA ROGERS: Yeah. We're kind of running into it at Smith Mountain because of the drought conditions and what could happen during a drought. So it is something that we need to keep in mind because we want people to be able to trust the system that's out there so we need to be able to convey what that system marks and, you know, know when you're in good --

BILL KITTRELL: If it's only a hazard during extreme drought conditions that happens once every ten years.

TERESA ROGERS: Exactly. I guess some of the way that that's handled down there is that during -- you can always like in certain conditions go out and deploy for short periods of time markers

if you know where those are and there's different ways to handle that.

Those are things that we will work through as a workgroup. But we've got the background data I just need to get it out to everybody and we'll start sitting down and hammering this kind of thing out.

Any questions so far? It's easy when you, you know, there will be more questions later.

I'm going to go ahead and go to shoreline management and like I said, I'll hang around a little bit later in case someone comes at 3:15 and I can just go over that with them individually.

SHORELINE MANAGEMENT

TERESA ROGERS: Because we have not met as a workgroup but throughout these last two days we have mentioned at different times that when we get into the shoreline management plan we will be setting up guidelines for these different areas that we've gone over for the last two days, so I kind of try to give you that vision during this presentation so you can kind of see what's going to come together later on.

It was during the scoping for relicensing that we've had several stakeholders indicate that we needed a shoreline

management plan. Right now what we have, we have guidelines where if you want to build a dock your dock needs to meet these certain guidelines.

If you want to build like a commercial facility then we've got another set of guidelines and then we issue permits for shoreline stabilization but we don't get to the point where we say like this is a wetland area you shouldn't be doing X in this area because it's wetland.

We haven't gotten to the point where, you know, here is a scenic area, we need to take that into consideration. So that's what that shoreline management plan is going to do, it's going to -- we're going to actually classify the entire hundred miles of shoreline going all the way around the lake and you're going to have different types of classifications in that shoreline and there will be maps put together and it will be color coded.

Some of the things that we've done in the past is that you'll have areas that are good for -- and of course we need the county involved in this as well because it does impact, you know, zoning and land planning and that type of thing so they'll be involved in this plan as well, but you'll be looking at different things to decide is this a good area for or what makes an area good for high density

commercial like a marina.

What's your existing boat densities in those areas, is it in the back of a cove or is it on the main channel. These are what we call parameters. Parameters are a description of the area that make it good for a certain use.

So you'll be looking at high density commercial, high density multi use for like an access lot. Where on the lake is a good area for a community lot. I mean do you want a community lot with a ramp at the back of a narrow cove where, you know, off water could be 100 homes and you're feeding in 100 homes into the back of a cove.

So these are things that we will work out as a workgroup deciding, you know, where those types of uses should be on Claytor Lake.

LAURA BULLARD: So we'll be setting those parameters?

TERESA ROGERS: Those parameters.

The way that we've done it before is you know what your classifications are going to be and without looking specifically at specific areas you come up with what these parameters are.

For example, boating density, you decide as a

workgroup this type -- we're collecting boating density through the recreation plan so we'll know the different areas and what that density is and we decide as a group, well, this is considered high density, this is considered low density and this is medium density.

This will be something that has to be reviewed periodically because it will change as the lake changes. Your shoreline management plan in itself is going to have a review period every so many years, probably every five years where you'll go back and you'll look at it and see if it's still valid or not.

LAURA BULLARD: How much will that restrict residents, for people who already live here who come in here as to what they do with their property?

TERESA ROGERS: Well, that's something that we'll look at because I mean we ran into that exact same thing at Smith Mountain where, you know -- this is not easy, this is a hard process, it's not for the faint at heart, but you're looking for the rest of life history.

At some point you've got to say, you know, this area should only have additional low density use instead of high density and these are things that we're going to have to work out as a workgroup.

Like I said, this is one thing that gets a lot of people interested in relicensing is the shoreline management plan because it does. We're going to get into wetland areas and areas that are scenic and you'll be placing restrictions within the project boundary.

You know, we can't restrict anything outside the project boundary but this will restrict some things within the project boundary for future use.

LAURA BULLARD: Project boundary being 1850?

TERESA ROGERS: Yeah.

BILL KITTRELL: I think a perfect example is Smith Mountain Lake, you know, where the question arises should all non publicly owned land on the entire lake be rip rapped. That question some people don't have a problem with that at all and other stakeholders do. You know, obviously those questions are going to create a lot of intense back and forth between stakeholders.

TERESA ROGERS: And I'll, as we get toward the end I'll kind of bring up some of those scenarios too because I'm only talking about development. You'll also get into what you consider -- well, public use will be another area.

Any type of public use will be classified a certain way and that includes areas that are designated for future public use, it

will be designated a certain way. That way, you know, you have those maps out there and in the future when someone does purchase a piece of property they'll know what that property is classified as.

You were asking about people's ability to do certain things on the property if they are adjacent to the project boundary and we have worked out what we call variance process where we'll try to work with them. It may not be exactly what they want, it may not be the number of docks or it may be they have to locate their dock outside the area that they want. We try to work with those individuals that already own a piece of property.

You're not going to change. If you have a single family dock there it's not going to revert back to something else, it will stay single family or low residence -- low use, low density use. It's not going to like change something that's already been developed.

If you have a marina out there no matter where it's located it will still be classified as that existing use, so that's some of that. But if you have a very large, you know, looking across you see a very large piece of property that hasn't been developed yet, depending on what those parameters are that you develop, you know, that could make that piece of property a certain classification.

So in the future within that project boundary then they can only do X, Y or Z.

For example, on low density use you may be restricted to like two slips per hundred feet of shoreline. Some of those things are already in place up here like I believe 100, you have to have 100 feet of shoreline now for a new subdivision going in after we developed those guidelines.

That doesn't mean if you had an existing lot that was on the -- that was already recorded at the county that was less than 100 they can still do a dock. They may need to meet setbacks and that type of thing but, you know, we don't go back and make someone have to have 100 feet after it's already been subdivided and platted.

BOB MUNSON: The size of the dock might be controlled.

TERESA ROGERS: Exactly because if they only have 15 feet they may, you know, you can only fit so much within that 15 feet because we already have things like you have to have setbacks already, that's already in place. When I say setbacks, you know, from those extended sidelines out, so that's already in place.

Size limitations are already in place, that type of thing. But what this will do is it's going to look at the entire resource and it's

going to look at things like habitat, boating densities. Before we didn't have any boating density information so you really couldn't, you know, say one way or the other that, yeah, a marina here would be great because there's no boats there anyway or a marina shouldn't be there because it's already a high density.

We didn't have that information that we're going to have now to make some of these decisions. Like I said, it's not for the faint of heart. While this is not a study we did decide, you know, to put that workgroup together so we could come up with some of these guidelines.

The first thing we will do and we did do some extensive work when we were developing these initial guidelines in the first place, worked very closely with Friends of Claytor Lake and they had a committee put together and then we worked with these different state agencies when we were developing these initial guidelines for docks and shoreline stabilization, dredging, that type of thing.

So those have already kind of been initially reviewed but I think it is a good time to step back and look to see what we did develop is it working well, do we need to tweak it and that type of thing, but we're not going to like start all over, it's more of a refinement for the actual guidelines that are already in place.

What I was saying before, the next step is to look at the resources that need to be protected. For example, the cultural resources, what we'll do is within so many feet of known cultural resources that shoreline will be classified a certain way so that how it is -- what we've done in another project is we made it impact minimization, which means you can do some development in there but you have to consult.

We would go to the shoreline and see that it's impact minimization because of a cultural resource and the person wanting to do that work would have to work with a state agency, the Department of Historic Resources on identifying what that cultural resource is and if it's going to be impacted by that proposed construction and if it is what kind of mitigation would be required.

An example also like a really small wetlands or impact minimization where, you know, you can may do some things like you may can build a dock overtop of the wetland without disturbing it but before you could decide to do that we would have to consult with some different agencies on that.

You'll also have areas that you consider aesthetic that you, you know, you don't want to have it lined picket fence with docks, so we would want to identify those types of areas. But the

key there is we have to identify what makes that area aesthetic, that type of thing because we'll be applying that parameter everywhere.

So that's something we need to be able to nail down. That's going to be hard because it is kind of subjective, but we've got to work through that with the different stakeholders.

Riparian habitat, that type of thing. Fringed mountain snail I can already see that's going to be probably higher level conservation environmental, which you can't do anything in those areas. So those are things that we're going to have to work out through a workgroup.

What kind of things can be protected and mitigated for, that would be like an IMZ or impact minimization area. What types of areas would you not want anything to happen in because there is no mitigation kind of thing, it's just a higher level.

I know this is a lot of stuff to throw out but that's kind of the way a shoreline management plan goes ultimately. We'll be utilizing the information obtained from all these different studies to identify what those resources are and then we'll have to identify measures to protect those. We'll revise the guidelines as necessary to include those measures.

To date we are currently gathering all the existing

information as you've heard like the last two days and we're completing that first year of field work. We'll start getting those maps and then the graph studies out. That's when we can actually start identifying specific areas, but even before that we can start sitting down to figure out, you know, what level of protection or what type of resource do we want to look at.

It's almost better to set your parameters without actually knowing where these things are because that way you apply them consistently across the reservoir. You've got to be very careful that you treat everybody the same all the way across the reservoir.

It's almost more important to start setting aside some of those parameters first and identifying those parameters and then after those are identified map them and apply them and then you get your maps and you see where they are. Does that make sense?

It's not like you're going mile or foot by foot around saying, you know, I think this should be this, I think this should be this. It's more -- I don't know how to say it. It's more like you're applying it uniformly across the reservoir based on what that resource is, not up in a specific area. Am I speaking English? I'm sorry. It's getting really late.

LAURA BULLARD: That makes sense to me. I think as

you apply, for instance, erosion control and what they're going to be finding with these studies I think it will be very site specific. I mean, well, I'm just saying, you know, Bill, you were mentioning about putting rip rap everywhere, well that's not appropriate to put rip rap everywhere.

I think there are going to be definite recommendations given slope, soil type, everything, you know, that -- I guess we could do that on a generalized thing but it's going to take going to the map and saying this type of stabilization will appear and this here and this here. Anyway.

TERESA ROGERS: I see what you're saying. I guess the big concepts like if there is no erosion we're going to say nothing is going to happen as far as rip rap or bulkhead or anything like that at all in those areas, so then we'll be able to go to the mapping to find out, you know, where is there no erosion and then we can plot those so we know those.

MARK MCGLOTHLIN: That type thing will be very site specific when you get out --

TERESA ROGERS: Exactly.

MARK MCGLOTHLIN: To look at it.

TERESA ROGERS: Exactly. We still need to make sure

we have a very good and this is very critical to the shoreline management plan, making sure we do identify all the stakeholders, all the agencies, the counties, the Friends of Claytor Lake, any property owners' associations, the marinas and the business community.

It's going to be very important that we get them involved.

The dock builders, the people that are doing the stabilization. We have to get them involved up front. We'll need to bring in the realtors because, you know, everybody has a different role and we need to make sure everybody is involved as we're putting this together.

I'm hoping that we will actually have a meeting the very first of 2008 at the beginning of that quarter because we need to get going on this. Any questions?

I mean I know it's hard. If you go to the Smith Mountain website you're going to see the mapping. They've got mapping in there and you'll see different colors going all the way around the shoreline. The approach that we took and you'll see the parameters that were developed down there. I'm not saying those are

the right parameters for Smith Mountain necessarily but it will give you an idea some of the things that we looked at because they are very different lakes. We don't want to lose that when we're coming

up with these parameters but you can kind of see what we did down there.

The main thing is getting that mapping together so that we know where those resources that need to be protected are.

BILL KITTRELL: I think that's probably all project lands including -- are you going to incorporate non project lands in that process or not?

TERESA ROGERS: This will only, for the shoreline management plan we'll only be including project lands because that's all that's covered under the license is project lands. Now some of those project lands --

BILL KITTRELL: Wouldn't it be a good time to think about those non project lands? I don't know what that equals --

TERESA ROGERS: When we start looking at the mapping we'll be able to see where -- because some of that is project lands that are above the 1,850 and those will be included. If it's project land it will be included even if it's above 1,850, but land management takes care of non project lands and I don't have -- I can do stuff within the project but it's going to be harder outside the project.

BOB MUNSON: He's got snails all over that land.

TERESA ROGERS: Well, and that --

BOB MUNSON: He's been trying to hide them I can tell.

TERESA ROGERS: That will be the little asterisks, you know, with the endangered species and that's why we'll need to work --

WAYNE ALEXANDER: Also too, Teresa, in previous discussions on those aquatic resources all those areas that we, you know, have sampled are project lands above the 1,850 contour. So project lands are not, you know, private property and they are not our non project lands, so that's --

LAURA BULLARD: For the snails or for --

WAYNE ALEXANDER: For the snails.

TERESA ROGERS: And two areas that were already identified for future recreation use are also included in that. Right?

WAYNE ALEXANDER: Yes. Those are project lands. They were put in the project back in the 1980's at the last relicensing so they were included.

DEBBIE LINEWEAVER: How does property above 1,850 get designated as project land versus other below the 1,850 that is not project land?

TERESA ROGERS: There's areas out there where

we're a property owner just like anybody else is a property owner and how that came to be when they built this site probably had to do with when they were obtaining the land for the project and there was different scenarios out there.

I don't know if Wayne can -- somebody may not want to just do below the 1,850, they may say you've got to take it all type of thing. I don't know.

WAYNE ALEXANDER: I think a lot of it too stems from the fact that back in the 1930's in order to protect the resource, water quality or what have you I think they had the foresight to see that some areas on almost vertical cliffs it would be better to include that property in the project because we wouldn't have any control over someone building a house, running their sewer or whatever and drop directly into the lake.

BOB MUNSON: There are two houses on that hill right in front of cabin 6, I wish you hadn't sold that land. They had their lights on all last night and they spoiled the ambiance.

WAYNE ALEXANDER: I think a lot of it stems from the location of the land and the characteristics of it. It was a situation where they felt like they needed to acquire it to protect the water quality in the project and that land was put into the project boundary.

BILL KITTRELL: Some of these isolated tracts off lake, I guess non project lands, they could have bought those same landowners would have sold two or three tracts to get this tract and had to buy those other tracts too.

WAYNE ALEXANDER: Most of the when the additional land was bought like that. It was that situation that they didn't want to split up the farm or whatever, that land may have been in the family for years so, you know, they say we're willing to give you what you need if you take all of it. So that's how we ended up with a lot of that excess land.

BILL KITTRELL: Does Pulaski County have zoning because most counties don't in Southwest Virginia.

LAURA BULLARD: They do.

BILL KITTRELL: Do they?

LAURA BULLARD: Yeah.

TERESA ROGERS: There's like an overlay district for the lake.

BILL KITTRELL: I wonder if it's progressive.

TERESA ROGERS: Yeah. The other side of this too in

--

BILL KITTRELL: It depends on whose viewpoint you

look at I guess.

TERESA ROGERS: This is very important to the economy too and we can't forget that as well so it will be very important to work with the counties as we're developing this. With the county which makes it nice there's one, one county.

So what I'll be doing next, I'll be sending those existing guidelines out so people can start becoming familiar with the existing ones and we will start setting up some meetings and I'll be sending some emails.

Probably a lot through Focal because there's a lot of different user groups so to speak that are part of Focal, so I'll get with them to help to identify and Wayne knows too a lot of the dock builders, the shoreline stabilization people as well, so I'll start identifying some of those people to make sure they're in the loop because you don't want to get to the end and not have included them because it doesn't work well that way.

LAURA BULLARD: Are you familiar with the green infrastructure group that's developing with the planning commission? They should be involved too. I'm not sure who --

DEBBIE LINEWEAVER: Abi Convery.

BOB MUNSON: I think that would be good a group of

folks other than lake property owners and have the respective community as a whole that thinks of Claytor Lake as their recreation resource, their scenic amenity and not just a place where a house is.

TERESA ROGERS: Right. That's a good point. So there's still a lot of questions out there but we'll kind of work through them as we go. Anything else?

I think everybody was here for either the main presentation yesterday or the end of yesterday and know those deadlines that are coming up. The process plan is over there. At the very beginning of the meeting today John was talking about how not having the final results at this point has happened to other facilities and how we're going to address that is we're going to have an update meeting in May and by then we should have, you know, a lot more information on which to comment, but you still need to comment now if you have any questions or concerns about where we are right now.

It's still important that you comment -- let me back up a little bit. I'll be submitting a meeting summary by December 17 and then there's 30 days for you guys to comment. So it's important still that if you have any comments to still comment but know that we'll have another update meeting in May and between now and then

you'll be seeing more information and you'll have an opportunity to comment on draft reports and that type of thing as well.

This isn't the last opportunity to comment on studies.

Do you want to add anything, John.

JOHN SMITH: No, that sounds fine.

TERESA ROGERS: That's all I have unless anybody has any questions. Thank you guys for being through this for the last two days, I know it's hard.
