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“Restoring Delta Streams” by Jack Killgore

Good Afternoon. Today I’m going to talk about the environment in the Mississippi River Valley. This has been a truly collaborative study with ERDC and Vicksburg District including Dave Johnson, Karen Myers, and Kent Parish. Together, we have conducted various studies that I will be discussing today. I wanted to be sure I acknowledge those individuals in the Vicksburg District who are part of the study.

When talking about delta streams, most people think the Mississippi River delta is below New Orleans, but it's not that coastal environment I'm speaking of when I use the term “delta,” My definition of the delta for this presentation is any delta formed by a meandering river that deposits alluvial substrates that are eventually used as farmland. In Mississippi River basin, there are several hundred tributaries that are mostly agricultural today but were once bottomland hardwood systems. Many of these streams are impaired and there is much attention being paid to restoring the streams after centuries of degradation.

The order of my presentation is first I'll go over the environmental history of the Delta - this could be for any delta basin in the United States. Next, I'll discuss some of the stressors on fish communities. One of our goals is to relate some biological response of the fish community with some physical or other habitat change so we can predict what may happen if we alter the environment. Then I'll provide some insight on restoration techniques proven to be effective and that we've been able to calculate environment benefits for. Last, I will provide the conceptual model of expected benefits.

So to begin let's look at the history of the delta. During the pre-settlement period, it was all bottom land hardwoods and at the turn-of-the-century, in the early 1900s, Europeans had moved in and essentially deforested most of the Delta. They first cut down the Cyprus trees and then moved on to the bottomland hardwoods. By 1910 and 1920, what you see on the screen is what the Delta looked like. I'm sure many of you have driven through deltas and seen a tree out there and wondered how it ever survived. Essentially it looks this way today. As part of deforestation, you had to have a way to move the lumber out. Many people floated logs downstream into the Mississippi River to the saw mills but later they began to build railroads. To protect their railroads, they began to channelize and divert the streams so the floods would not inundate the rail lines. This was the first major alteration to the streams. After clearing the bottomland hardwood forest, agriculture began to move in and cotton was king in the delta for years and years. It provided economic prosperity to this region at the expense of environmental degradation.

As part of raising row crops they also had to control pest. Chemicals were applied and the most potent chemical was DDT. As you read early accounts of people using DDT, it was really a godsend to people in the delta. It not only eliminated the vermin and pests in the house, it also controlled agricultural pests. It really brought a whole new way of life to the Delta Farms but unfortunately as we learned later, they were carcinogens. So the legacy pesticides of DDT and Toxophene persisted in the environment.

During these times, great floods were affecting these communities and the Corps began to build levees. This would prevent widespread floods but also alter the biotic integrity of the Delta. Streams were cut off, flow was reduced, and various other sundry impacts occurred. The Corps began to take a more aggressive role in channel maintenance of the streams and today what we find in the Delta is a stream as you see here on your screen - once a meandering bottomland hardwood stream which is now without a tree to be found on either bank. As a result of all these activities pervasive increases in stream sedimentation occurred. Streams sediments were not filtered by the forest trees because they were gone and other agricultural activities promoted sedimentation. We, as fish biologists, had to address this, and as you can see, my colleagues and I were trying to crawl out of streams with deep sediments that we were sampling. We have

some interesting stories of how we've attempted to get people out of these sediment traps. The low flows persisted as well because of water abstractions and the re-channeling. The low flows we used to have in the summer were essentially gone. This led to further impairment of the streams.

I mentioned the contaminants. As a result of legacy pesticides you had advisories placed on these water bodies in order to protect humans from consuming too many contaminated fish. So in the presence of all of this came the Delta Pilot Project. This was really the first attempt to systematically evaluate all these delta streams in order to come up with some sort of method to rate the quality of the stream - such as impaired or not impaired, in good condition or fair condition, trying to put some sort of classification on the streams. The way we sampled the fish was with seines. We wanted to know what the fish communities consisted of so we seined and we seined and we seined. We also have other techniques we use to evaluate fish communities but this presentation today is primarily focused on our seining data - we have 20 years of data in the Lower Mississippi Alluvial Valley. We used consistent sampling techniques, which is very important. You may want to go back and use data collected by other people but you find out that none of it was collected consistently and you can't bring it together to find spatial and temporal trends. In our case, this wasn't a problem because we used consistent techniques for sampling fish and we sampled the habitat in a similar fashion as well. We did spread out through the Mississippi embayment resulting in over 500 seined samples with 135 species of fish representative out of 200,000 individuals. It is a robust data set to determine the status of the biological community in these degraded streams.

I know that many of you are familiar with the index of biotic integrity (IBI). This is one of several ways you can construct biological models to predict changes in fish communities. The IBI was first developed by a gentleman named Jim Carr and it really caught on in the last 10 years. There are probably hundreds of IBI that have been developed, many in the literature, and by states who are using it for biomonitoring. The way it works is you take a collection of fish, say by taking 10 seine hauls, and you begin to tease that fish collection apart to determine the taxonomic make up. Such as how many species of darters and so forth. Then you divide the fish collections by trophic preferences. Some are trophic generalist and some are trophic specialists. The more specialized the fish are, the more habitat sensitive it becomes. There are various tolerance rankings listed in literature. Some fish can tolerate water quality changes but they can't tolerate habitat changes. We were able to classify all the fish species according to their tolerance. We also had a few other metrics based on habitat preferences. Initially, you develop a long list of metrics and go through a screening process to determine those metrics that make the most sense biologically and statistically. W through this procedure to see which ones are correlated to each other and we throw out the ones that have the weakest relationships to habitat. There are also other procedures we use to develop metrics and analyze them, but the bottom line is you come up with a set of metrics that represent fish community characteristics. The IBI we've been using in the Delta streams consists of these five metrics that represent diversity, trophic composition, tolerance, abundance, and affinity to flow. The affinity to flow is a unique metric; all IBIs have one or two unique metrics. Many of these delta streams are not always flowing. You could almost call these temporary rivers because they flow part of the year and they don't flow other parts, but when we do have flow we certainly have a certain suite of species that colonize those areas.

Now the way the delta IBI index works is we have the metric on the left-hand side of the screen and we have the metric scores that are developed from our data that I described previously on the right side. You break the range of the values for each metric into a score from one, which is the lowest value, to five which is the highest value. You see in this example we have five different metrics with a maximum score of five for any one metric. Therefore, the maximum score you can have for this index is 25. We score the various samples taken in the project area and you often come up with this type of distribution - a normal distribution with some skewing indicating that you have some sites that are extremely poor, having extremely poor biologic communities, and you have other sites that have very high biotic integrity, but must scores lie in the middle. Of course

the question is how to determine the cut-off of an IBI score when a stream is impaired compared to when the stream is okay or similar to a more pristine area. This was an issue we debated with various agencies for an extended period of time - can we come up with a threshold value for any biotic metric in delta streams that have suffered widespread degradation over 100 years? There are problems with thresholds, one being the standard of comparison. If we compare a basin like the Yazoo basin in Mississippi that has been deforested with considerable channel work over the years to a more undisturbed basin, the best value you could get on a metric for example, mean species richness as you see on your screen, is a little over 10 species. You can't find other streams in the entire basin having a much higher value. However you can go across the river into Arkansas into a delta environment in the Cache River which has not been subjected to widespread deforestation in certain regions and you typically get over 15 species. You really cannot compare the Yazoo basin with the White River basin (where the Cache River is located) because all of the streams in the Yazoo would indicate that they are impaired and we would have difficulties claiming restoration benefits. So that was the first problem, there is no standard of comparison in the immediate region.

Another problem with fish metrics related to physical habitat variables is that they do not correlate well to water quality. Traditional TMDLs supported by EPA are usually associated with the nutrients or water quality. In Delta streams however, IBI metrics are not correlated to nutrients or water quality, but they are highly correlated to sediments, in-stream-flow, and degree of forested area around the streams. They are correlated with physical variables but not with water quality variables and that poses a significant problem if you are trying to use this technique to look at traditional TMDLs. In our case, all the streams in the Yazoo basin were placed on the 303d list and none of them had hardly any data associated with them - they were just assumed to be impaired. We were trying to develop a technique to delist some of the streams to reduce TMDLs. However, our database was not correlated with the water quality; it was correlated with physical variables, so that created a problem with establishing traditional TMDLs.

So why is that? It's really straightforward. If you look at this graph on the left-hand side (Dave Johnson developed this), go to the 90% exceedence value. Look at the brown line which represents the 90% - you see the low flow was 20 or 30cfs in the Big Sunflower and you go across on the 90% exceedence value to the 1980s it was near 100 and before that in the 1970s and 1950s and before the low flows were well over 100cfs. It's obvious we have lost our low flow connections, which is why physical habitat is more important than water quality in these cases.

Another example is sediments which I mentioned before. The graph on the right hand side represents a relationship between number of species and the depth of the soft sediments. We would go out with a stadia rod and push it into the stream bed to see how much soft sediment accumulated. In some cases we have well above 4 feet. You can see the very steep slope of the line shows how important soft sediment is to the type of fish community you find in these regions, so that was another problem.

If you look at the landscape features as well, I talked about the low flow and some of the hydrologic indices, but we also considered the amount of forested region around the watershed. To show you an example of that we developed this graph. These were the sites Boeuf-Macon in LA Delta; Cypress Bayou in East Texas; Grand Prairie, AR; Bayou Meto, AR; Yazoo and Bayou Bartholomew, AR. What you see is the Cypress Bayou and Bayou Bartholomew have considerable amounts of forested area around the basin. The basins are over 40% forested in those two watersheds. Then you look at the Yazoo and you have about 10% forest in the basin and you can see the results on the number of species of fish. So there is a relationship between the percent forested area in the basin versus some type of biological metric. What we ended up doing, or what we propose to do given the situation of degradation and lack of correlation with traditional water quality variables, is to evaluate different types of reference conditions based on Stoddard. He had an excellent paper that showed a gradient of stress in the streams, you have minimally disturbed similar to pre-settlement conditions that were never clear cut, but those conditions don't exist in the Mississippi Valley anymore, so that scratched out that type of

reference. Then you have least disturbed, which may be possible in the Delta but you still have up to 80% deforestation. You may find some streams in the basin considered least disturbed. If you go down to the lower right part of that graph to the least disturbed streams, you may be able to restore some of the functions of that stream and call this best attainable condition. So we are looking for the best attainable condition we can expect with any type of mitigation or restoration of these delta streams.

If you look at the historic condition there is a gentleman named Dr. Hildebrand who worked for the Fish and Wildlife Service. Even back in 1936 when he was sampling in the Yazoo basin he made these observations on sediments and turbidity and water levels. The impacts had already manifested themselves in the first part of the 1900s.

We know we can find minimally disturbed sites, so let's talk about best attainable condition. It's defined as: it can be achieved when best possible management practices are in place. What type of management practices are required to come up with the best attainable condition? Well, I want to briefly go over our prescription to restore Delta streams using the example of Steele Bayou. Steele Bayou is a sub basin in the Yazoo basin in Mississippi. It is typical of all Delta streams and in the 1990s to early 2000s the Corps removed and cleared the channels of sediments. Now I know that seems counterintuitive - that clearing and channelization of the channel would have environmental benefits, but in a Delta stream that is plagued by sediments it is really the first step required in restoration. In addition, they built weirs in certain sections of the Steele Bayou system. If it wasn't for weirs then the Delta streams would more or less dry up because the groundwater connection has been severed due to agricultural activities and low flows simply don't exist. So weirs are good in that they provide water year-round and prevent the streams from drying out. Another very important aspect of our prescription to restore Delta streams is to stop the sediments from getting back into the system. You can clean up the sediments and have a nice hard packed clay substrate, which is great for fish that were normally living in three or 4 feet of soft sediment. Sediment would return through gullies and washouts from the fields, so drop pipes were constructed to prevent sediments from returning to the streams.

What are the benefits of this project? We evaluated and monitored benefits for a long period of time. For pre-project, we found the depauperate assemblages with almost 75% of the community dominated by three species: red shiners, mosquitofish, and orangespotted sunfish. After the project we found that species richness had almost doubled and we were getting other species of fish that we had never seen or rarely seen that are intolerant of habitat perturbation. These are all signs that the streams did respond favorably to these series of management actions.

Another example of what we were able to quantify was an increase in mean species richness from 1994 to 2006. The period 1994 to 2000 was pre-project, 2000 was when the construction project was finishing, and we went back in 2005 right after hurricane Rita. Rita came through and created floods and severe hypoxia throughout the basins and it really hammered the fish populations. The following year, especially in Black Bayou, the fish community rebounded and the levels were well above what they were pre-project. We're getting ready to go out and resample these areas to see if this type of fish community has sustained itself and persisted over time or if it was just an artifact. This is the trend that we would expect to see and I think that would be a trend anyone would expect with a similar project. Other signs of recovery are all around us as well including bryozoans forming on aquatic vegetation. Aquatic vegetation may be all smartweed and alligator weed, but in these delta streams, alligator weed provides an important habitat. It usually doesn't grow to problem proportions in the streams because of the relatively high turbidity. We see emergent vegetation coming back and a variety of fish species returning, and even snails. This is a picture of little brown spots along the rocks - those are brown snails that have colonized the rocks. So other signs are evident as well.

An advisory has been in place for many years and they are now considering lifting those advisories because the Vicksburg District and the MS DEQ have shown through repeated sampling of sediments and fish tissue that the levels of DDT has dropped dramatically and do not

pose a serious health risk to humans upon the consumption of the fish. Another good story. When we remove the soft sediments from the streams you are also removing the contaminants associated with it. By preventing new sediments from coming in from the fields, where you still have fairly high levels of DDT, you are not re-contaminating the streams.

Another action we're working on is establishing riparian buffers. Now when you tell a farmer you want to establish a riparian buffer he's thinking, "I don't want you to take 100 or 200 feet on either side of my stream that's prime agricultural land". We're not talking about that for Delta streams, we're talking about one or two rows of trees on either side. They not only provide shade, but more importantly, they provide woody debris to the aquatic system. We all know the importance of woody debris. Considering all the streams were once bottomland heartwood systems and now there's not any bottomland hardwoods left, the debris would be expected to have a real positive effect on new species coming in and also enhance survival of existing species.

In addition to these measures, I think the ultimate solution is environmental flows. I know many districts are dealing with environmental flows, such as breaching the levee of the Mississippi River. Bringing Mississippi water into the Delta streams was unheard of several years ago but now it's a common practice in South Louisiana where the Corps is building these giant diversions and bringing fresh water into the marshes for coastal restoration. In the summer when you're sitting and watching the Delta streams dry out and you look right across the levee at the Mississippi River that has 1 million cfs going downstream, you wonder why can't we also provide fresh water diversions into some of these delta streams to establish or reestablish the minimum flows that once existed. We may have to work on this because of concerns on going through levees. The only other alternative is to build weirs or use groundwater, and these techniques are being used in the Delta, it's just not enough water to really make a huge difference in my opinion.

So let's look at the conceptual model than that my colleague, Jan Hoover, developed from this database. You have a typical model of the drivers, stressors, endpoint, management actions, effect, and new endpoints. You can see these on the left-hand side. In this case the driving force is agricultural practices of the Delta, which results in no trees, a lot of sediments, and hardly any flow leading to degradation of fish communities. As you saw in the Steele Bayou example, they cleaned-out the channel, put drop pipes in, established weirs, and we're working on a riparian buffer. Because of these management actions we have seen positive effects resulting in new endpoints associated with the biological community - that's what we're measuring, these green boxes at the bottom. We are trying to show the type of responses we see from these management actions and this is what I think you would expect if you also engage in a similar project.

Some key points here: we cannot find minimally disturbed conditions for the most part, and that is the classic definition of a reference steam or reference water body that the EPA likes to use - they just don't exist, and if they do exist, they provide unrealistic values that we could never reach to demonstrate that our stream was unimpaired. So in light of that, we suggest that you go into negotiations with resource agencies with the idea of best attainable conditions. Even if you go into a stream like Steele Bayou and engage and complete all these management activities it's not cheap. I believe the entire flood control and restoration part of that project was $65million and of course, you did obtain flood control benefits as well. But it does take a lot of time and a lot of money to restore the streams back to some sort of condition where you will see favorable aquatic communities established as a result. TMDLs need to consider more of the local conditions and we need to get away from national standards. National standards do not work in areas that have been subjected to massive changes over the years - they're just not going to work. We need a mindset change on how we evaluate TMDLs in certain ecosystems. Let's look at the physical variables first and then maybe the water quality variables could be addressed later.

I would like to mention too, it's just not unregulated streams unassociated with dams, but we also have an IBI for oxbow lakes and are also working on an assessment of large regulated streams likely the Yazoo that comes out of the flood control reservoirs. So we continue to expand this

work to cover all different types of water bodies.

I would like to acknowledge the team who has been with us over the years and sampled these delta streams. You can see they're pretty happy working here. We receive most of our funding from the Vicksburg District, but we also received funding from the Ecosystem Management Restoration Research Program in the past, which helped us come up and develop these ideas. So I will end it there and open it up to discussion.

Well thank you Jack - that was an excellent presentation and some very good pictures in there as well. If anyone has any questions feel free to ask, just remember to take your phone off of mute.

Jamie from San Francisco: Did adaptive management and monitoring factor into the project at all?
Jack: Monitoring is an essential part of this project. We go in and monitor well after the project construction is complete. Adaptive management has been brought in because if something is working, let's continue downstream with cleanout of sediments and putting in drop-pipes in other areas. So it has caught on it seems. I would say we've learned some as we've gone along and we've incorporated modifications in the design and approaches but certainly adaptive management and monitoring is a part of all these projects.

Tracy Martin from Omaha: I have a question about when the sediment was cleared out of Steele Bayou, when it was cleared I'm assuming it was dredged. Was it dredged up into the thalweg of the main stem?
Jack: No these are fairly small streams and they used dragline to remove the sediment, then disposed sediments on top bank or somewhere beyond. There wasn't any other type of dredging technique in this particular case, it was all dragline.

Mike from Memphis : Did y'all have any feedback from the landowners on the drop-pipe structures? I've heard some farmers actually like using them because they help them keep soil on their fields. I was just wondering if they were open to using that or if you had to talk them into it.
Jack: Well I noticed Kent Parish is on line, Kent can you unmute and address that question?
Kent Parish: Yes the farmers love them. We don't have any problems with them putting the pipes in and wanting the pipes. Occasionally we'll get into something but usually they're eager to keep soil on their property.

Tracy Martin from Omaha: I have one more question about the soil. You say you put it back on the farmer's property or on the banks. Was there any question or problems with what was in the sediment and any responsibilities with that?
Jack: maybe Dave Johnson can answer that question
Dave: The sediments were contaminated with DDT and other historically used pesticides. Putting them back on the farmers' fields was perfectly acceptable because that's where the contaminants came from. The concentrations of the contaminants in the materials we dredge was less than 6% of what was currently on the field, so we improved the conditions on the ag field and in the stream.

Rhianon Payne from Rock Island: I was wondering if you all did anything with re-forestation considering how much you talked about lack of forestation being part of the problem.
Jack: Yes there are several strategies of re-forestation. I mentioned that we are trying to establish riparian buffer strips along the streams, but in addition to that there are also opportunities to re-forest the floodplain as part of restoration or mitigation, so that option is always there and there have been examples of large blocks of areas that were set aside and have been re-forested and are now being linked up to national forest land, for example. I don't think there is a comprehensive plan of re-forestation that I'm aware of. It's more of an opportunistic thing at this point. Kent may have some other insights into that.
Kent Parish: We have re-forested over 137,000 acres here in the District as part of various Yazoo

basin projects. We took ag land and planted it back to trees and it's now in public ownership and being managed by the state wildlife management or Fish and Wildlife Service. We've done some studies on large tracts of mitigation land and we're seeing the nitrogen stay about the same whether it's in row crop or in trees, so as far as the sediments go, the nutrients have stayed about the same.
Dave: In addition the Department of Agriculture programs WRP and CRP have probably re-forested 200,000 to 300,000 acres of farmland in the Delta to date so although those aren't our programs there is some re-forestation going on.

Arun from Chicago: Did you run into any permitting challenges regarding floodways or alteration of the floodplain when establishing buffers?
Jack: On this particular project it wasn't an issue but when there is channel work and we do have changes in the inundation frequency of the floodplain, the Corps has to evaluate the impacts, and we have various tools that we use to quantify impacts to floodplain reduction for example on spawning and rearing fishes. Then those impacts are translated into mitigation and what Dave and Kent were speaking to is that we can calculate the amount of re-forested ag land that's necessary to offset a reduction in the flood inundation period. So there are other tools out there that I didn't get into, but that's certainly a requirement on flood control projects. On restoration of course, we're not trying to impact the floodplain and for the most part in the floodplain is an agricultural field going to top bank of the river and there's nothing really left of the floodplain in those cases.

Detroit District: When you remove the sediments out of the river channel did you look at rebuilding low flow channels and using those sediments on both sides instead of just taking them out and removing all this soft material?
Jack: Not on Steele Bayou, you still have kind of a classic trapezoidal channel. I wouldn't be promoting channelization a stream that had never been channelized but these have been altered to point where many of them lost their sinuosity, therefore the sediments were their main impairment. But there has been discussion of using bench cuts. There are certain channel excavation features or guidelines that could be used to maximize depths and heterogeneity of these channels rather than simply just a trapezoidal channel.
Detroit: Well, that was one of the questions. If you had no low flow in the summer, could you make the low flow channel that was significantly smaller and put the meanders within the existing channel so you have a two-stage channel given that you had such low flow in the summer?
Jack: One thing is that there has not been a lot of headcutting in these regions. There is some of that and that 's one reason weirs were put in the delta, but you don't really have a real wide low flow profile or bank-to-bank profile, but I understand what you're saying. We have seen those designs and I think that you could create a meandering low flow channel. And actually what happens is they're creating themselves when you just leave the stream alone and you do start seeing some smaller meanders. However, streams almost re-establish non meandering patterns in floods because of the enormous level water that goes down during a flood. So we have challenge to try and keep these alluvial clays and sands in a position where they can be maintained as low flow features. It's something to consider and it's a good recommendation that we can continue to work on.

Detroit: One more question. With your low head weirs, did you find that those block of up stream fish migration?
Jack: Not at all because these were like roller weirs and have very low elevation. The top elevation was well below the top bank. The percent of time that the water surface elevation exceeded the crest elevation was probably well over 50% of the time. It's just during the low flows that they just trickle across and create temporary blockage to upstream movement. But you have these freshet's that come in so you have numerous opportunities for fish to move about before the water recedes again. However, we haven't monitored fish movement over these weirs. We don't have that type of data at this point.

Detroit: One question. On your drop pipes that are on the side banks, I don't understand exactly

how those work if you got a few seconds to tell me. You have one picture that showed two tubes going through a weir and the statement was “this keeps the sediments out of the stream. I don’t understand how the dirty water discharges to the pipes.
Jack: Well you have a washout in the field and people put these drop types in and they reconfigure the field around it and as the water comes in the water goes in the pipe as the sediments are dropped off along the periphery of the pipe in the field itself. So the water that's actually going into the stream is actually not the sediment laden water because the sediments were dropped off in the field. It's more clear water, so not only are you discharging clearwater but you're also keeping all the sediments from going through that gully like it was previous. I'm not sure if that described it. Did you understand that?
Detroit: Are you just increasing retention time on the field side of the dikes so the sediment settle out?
Jack: Yes that's right. The sediments stay below in the field itself, it's a riser pipe.
Detroit: the clay sediments probably have at least 48 hours or more for settling time
Jack: Yes these are really great structures.
Dave: In the Delta the primary source of sediment is gullies not sheet erosion and so what is happening is we're healing the gullies that are formed by providing an inward elevation that is only about 2 feet below the field elevation so we are stopping the major sort of sediment which is from a gully. We cannot stop sheet erosion, but we can reduce the sediments by about 95% through these structures.
Jack: Better farming practices are also addressing sheet erosion.
Dave: We find that these areas heal themselves in about a year to two years.

Arun from Chicago: Are there some resources where we can look at some of these technologies or descriptions of some of these methods and mitigation features a little more closely
Jack: We have some tech notes on the procedures we used. It doesn't really get into details of the drop pipes or construction of the weirs. Dave, do you have information on some of the specific designs?
Dave: Yes I think we do. We did a few small reports outlining the drain control structures. I think we've done five or six phases of these structures since then and I think there's a 30 page report for the original Steele Bayou project and then subsequent reports describing these structures in a fair amount of detail.
Arun: Where can these be found?
Jack: I have the technote. Dave, if you could send the report to me I can send that to Courtney and she can post it on the website.
Mike: the NRCS also has a lot of information on drop pipes. They even have plans on how to build them and stuff like that. I think they work with landowners a lot on that.
Jack: Thank you Mike, I know they have a lot of good info on that.

Courtney: Thank you very much Jack and also those others who chimed in. Those were some good questions and really great presentation Jack and I want to thank you all for participating today as well.