Good afternoon and welcome to the webinar about using the NRCS solid liquid separation handbook.

The use of trade names during any of our webinars is for information purposes only and the trade name does not constitute a guarantee of the product by the U.S. Department of Agriculture and nor does it imply endorsement over comparable products not named. I'm please to turn the webinar over to Sandy the environmental engineer on the national animal manure and nutrient management team located at the East technology support Center in Greensboro, North Carolina and her work focuses on manure management and animal mentality management and is the coordinator for the training. Sandy, you may now begin.

Welcome, everybody solid liquid separation is something that many people have a lot of questions on. The speaker has worked hard to get the tool developed to make it available to you there is a lot of great information here and I think you will find that the document can be helpful to you in planning and design of separation facilities for producers. The speaker today is Jeff Porter. He is the team leader for the NRCS animal manure a new tray management team located at the east national technical support Center in Greensboro, North Carolina . Has responsibilities include really reviewing and evaluating innovative technology and manure management and working with states to assist in the transfer of these technologies to help create carry out the mission after working a short time for the Agricultural Research Service he transferred to NRCS and worked in Michigan, Missouri and Iowa. In September 2006, he accepted a position with the manure management team and later became the team leader. He received his bachelors in management degrees from Purdue University and agricultural engineering. Let's get started.
Wonderful and thank you, Sandy and greetings, everyone and I'm glad you can join us today. What a great opportunity to comment talk about when my favorite topics, manure a great topic and as you can see there's a picture of me mixing them anywhere and looking through different things. I want to talk to you about the new handbook and this new guide that has been put together. It was a long time in the making. We spent 11 years putting this document together. There is a lot of ins and outs and different things that had to take place for this to happen. Was started in 2008 gathering information and data and putting everything together and we are excited to have this document out and I do personally even though I have had a lot of input, I feel like this is one of the premier documents in this whole area of solid liquid separation not only in the country but around the world. It is really a Thoreau handbook and it has a lot of great information. I want to spend a little bit of time today sharing the ins and outs of the documents. As we are thinking about solid liquid separation, sometimes it looks like this. You have no idea what in the world you've got supper for you and it is kind of like this puzzle and you don't have the key of how to solve the puzzle. It is kind of like I could say and if you know the key and there I was speaking -- if you understand the key you can come up with the answer and that is what this guide is about in this handbook. It is one of the tools to help us understand this area of solid separation because now we know the key and you can find out that those words actually spelled out solid liquid separation. That is what I want to spend time talking about today is what is in this document and how can we use it and those types of things. Here is the agenda of what we will be looking at. What is the purpose of the document and why did we put this together? What did we do to get it done? I will talk to you about the contents so you know where to look and what to look for and how it can be used. And how do you find it and where is this document? Toward the end we will be looking at examples of how this document could actually be used to help you through as you are working with landowners in the planning process for different livestock operations. As we think about the NRC as we have a lot of conservation practices and more than the 20 of those are associated with waste management types of things we have things such as waste storage facility, waste treatment and we have the standard waste separation and if formerly was called solid liquid separation but to put it in line with some of the other standards where it is now called waste separation facility. Those of you that have been around for a few years may remember the standard and the previous version and it have some tables in there on the separation efficiency and equipment. With the document coming out in this handbook, we took that table out because this is a much more robust approach and a lot more information in this handbook to help with those decisions in deciding on what is the best technology or what technology to think about before dealing with solid liquid separation. What is the purpose of this document? We wanted to look at something that was not just for right now. We wanted to cover the current technologies but we also wanted to make sure that we had enough information in there that as new innovations come about, this document can also be used for that. We've got some theory in there and we've got some guidance on if this happens then this may be the technology one to go with. We wanted to make sure that we covered both current and futuristic types of things looking at some of the new

innovations because there are new things coming out all the time and we wanted to make sure that this document would be able to handle that. Also wanted to talk about the theory. Why does this technology work here and it doesn't work in this area or why is it based on the solids content and is this a better technology? Some of the theories covered during throughout the document. We also want to provide just some guidance on some of the different technologies to help landowners take their decisions. A lot of times we say we want to do this but whenever they come to us, we want to be able to provide them with guidance and understanding and with the handbook, we can now maybe guide them in the direction that they want to go to meet their goals and their objectives on their operation. We want to help the landowner make the right choice because if we get the right choice then they don't have to come back and make a change down the road so we want to help out with that. We also one of the things that we added to this document is where we have some on farm demonstrations and a back in the appendix we have several demonstration projects that we evaluated when I actually started here in Greensboro back in 2006 and that was my main emphasis to go out and work with the demonstration projects and we looked at many different projects and we put a lot of those in this document to help understand why some things work and why some things don't and why you have to do what you do to make them work. So there is actually a really good portion in there in the appendix covering that. Also, it depends on how accurate and how much -- how many of the solids and the nutrients you want to remove from the system as to which technology you want to go with and maybe if you need to get high amounts of the solids out in high amounts of the phosphorus and nitrogen outcome maybe you need to be looking at the use of coagulant because it greatly enhances the separation process. There is a cost associated with it but it depends on what is needed for your particular operation. We make sure that we had a good section talking about this area of coagulant. We also wanted to give some examples of how to deal with sand and many were and we have a lot of areas like Sam for bedding and it creates issues and you get the great with the sand so how can we remove that sand or how can we better work with the sand. We've got a pretty good section in the documents on dealing with sand and many were -- sand laden many were we would do an example later on to show how to utilize this. Also we want to look at what is the impact and how well do some of the different types of devices and technology work and what is the longevity and how well will they hold up over time and how do they work in the system versus individual components? These are some things that are addressed in this document. What are some of the contents? To give you a few items here, we want to talk about the methods of solid liquid separation and for this one for the most part it's going to focus on these two main factors, looking at the density of your many worse -- many were and also the particle size and also days will have an impact on the method you will be using and this will focus in on that in this particular document and we also look at other things such as some of the different animal types and the impacts of the animal types looking at the animal ages and looking at the gender of the animals and you might be surprised that all of those things can have on your Manure consistency in the quantity produced and how are they house and are they inside or outside and is it roofed and how are you handling the materials and also looking at the benefits of separating the solids out for an operation and that is discussed in the document as well. Looking at the theory. There are some things in there that will talk and it will discuss the theory and some of the fundamentals looking at how two screens work and why does the screen work and not just your -- like you see in the picture with the inclined screen but if you're using a press and it actually is a screen and you have a screw that is pushing your solids through the system and it is squeezing the water out. Settling and the gravity impact. You're looking at the density and the screen is looking more at the particles in the density of the particles and then we have something called Kindred settling and we don't think much about this and don't talk about this but it's when you're particles begin to interact and start bumping into one another and it impacts the separation efficiency especially when you have lower liquid content so those types of things can affect your separation efficiency so the theory section is really a very valuable part of this to give us a better understanding of the separation process. And another thing when we work with the landowners and we work with technology providers and we need to understand how the systems perform and how they report their performance and there are two main ways that they report in this as outlined in the document and they talk about concentration reduction versus mass removal. And you may think you get the same answer but you don't and that's why you need to understand the difference between the two so when you're talking with the technology providers that you can get a better understanding of what they are talking about and to give you a quick example just like for concentration reduction, what is the % solids coming in and solids going out, that's concentration reduction. Where as mass removal, you're looking at the flow rate, the flow rate in and concentration out and the flow rate out so you are getting differences because you're accumulating solids and getting some liquids and we are separated solids so the two methods even though they are similar, they will give you are could give you significantly better results. I want to show you another thing, looking at two dairies and you think the process should be the same and we are using the exact same screen on this using the inclined screen with .06 inch screen size but we've got Jersey

cows, Holstein cows in different animal types and different production levels and the first one is freshwater to flush with and the second is using recycled water and we have different bedding amounts and your solid content is also different and notice the difference in the performance. Total solids removed, 60% from the one that is using the high production freshwater more bedding. Versus the one 45% where it's recycled water. The performance and the effectiveness of a piece of equipment is impacted by a lot of factors and you have to take all of those into account to help you estimate what is really going on in a particular system and operation. This is another interesting item that is covered pretty heavily within this document with the whole entrainment factor and what it is saying is how efficient is the separation piece of equipment that you are utilizing and we see what the actual separation of total solids removal is versus theoretical and if you know what the screen size is you can come up with theoretical separation and get what the actual number is and if you look here for the swine operation and this is key for swine and notice that in most cases your entrainment factor is less than one. I will explain that in just a moment because I want to show you this other one in dealing with Jerry cows. Notice the difference in the entrainment factor. Almost all of them are above one. And the reason is it is the type of many were dairy cows will have fiber and larger particles that can overlap and that means that it can separate out more than what the screen size shows. Were as with swine many were, you don't have all that fiber and the material to cause that bridging effect. It can actually squeeze some of the larger particles through some of the smaller openings depending on what type of application or device you are using. Maneuver type, animal type, I have an impact on the performance of the pieces of equipment and it is all outlined in this document. To continue talking about some of the other items, the high rate separation method going with coagulant and flocculants and it goes through what is the jar test? How do you determine what chemicals to use for the separation process and are you trying to get high rates of solid and let's say phosphorus out and you might want to be looking at this. Some of your final cleanup type of practices where you could do reverse osmosis and some of those types of things and they are outlined in this as well. We cover other technologies and other processes, sand laden many were -- manure and we have different separation technology and some approaches are outlined in their weeping walls, it is something that is used in various locations and there is a section that can explain how a weeping wall works and what are the steps you need to go through and how do you keep it functioning. Also as you see in the far right at the bottom, the use of geotextile bags we can use those to cleanout lagoons, holding ponds and structures that have accumulated solids that they have exhausted the life of the structure so you can use things like this but you also have to understand that if you don't have your chemicals set up properly then you end up with a bag of manure -- where you need to make sure it will still be able to seep out and that's where your chemistry comes into play to make sure that works well, to use the belts for separating some of your liquids and also there is a small section on using sandbag filtration. I just want to show you again what kind of an impact using some of these chemicals can have on your separation processes. Generally, if you're going to use a screw press or an inclined screen for dairy you will be getting generally I would say 10 to 15% of your phosphorus out of the system. Because it is usually tied with your really small solids which are not separated out with these technologies that when you begin using some of these chemicals and these coagulant and flocculants, notice the difference in the amount of phosphorus that you're able to remove and you're getting upwards of 60 to 80% and I have seen them as high as 95% of your total phosphorus removed from the system when you utilize some of the chemicals and it will take -- there will be additional cost and other issues that come into play with this and it takes a little more operation and maintenance for this to work but if this is the goal and designer, this document does a good job explaining how that can take place. Some other items in the document, if you want to use a single stage system or multistage system. How are you going to handle the operation, if you have a large operation you may need to go multiple stages. Are you going to put in your separation -- do you want to put it in before or after the digester? It makes a difference on the application. There is also information on their on cost benefits and how would this particular product work in comparison with this one? It is really -- it is not a large section but it does provide guidance on the cost benefit consideration as you through the process. Also in the appendices we have the project coordination group and they did extensive number of projects down the road for a number of years and they looked at 30 to 50 projects and many solid liquid separation and we included this in the document to show what worked, what did not work and why. We also looked at use of polymers for your coagulant and flocculants and we will talk about how to evaluate that. And we have some additional data in there on some of the other piece of equipment that is not covered in the main documents. And as we look at this, this is what we as planners would do we would meet with the landowner and discuss, what are your objectives and what do you desire and what you want to do for your particular operation and you begin to work with them on the different alternatives and you might note in here as they are working through these different options and alternatives and you notice that if you do solid liquid separation that you no longer are dealing with just one median and you're dealing with the minimum of two with a solid component and liquid component and

you have to figure out does this landowner have the ability to handle both? And if they do, do you have storage for both? Things that you have to think about as you're working with the landowner and also, are they land applying the material or are they trying to sell the material and are they going to reuse the material. Such as if you're going to remove the sand, are you going to reuse it for bedding or are you going to remove some of the newer solids -- manure solids and what will be the purpose of the solid separation approach that the landowner is looking at utilizing. These are things that you have to think about and also if you're going to be using the material and it is recycled water and you have to think about the impact of the recycled water on the separation process because the more solids that are in your recycled water, the less effective you are going to be in separating the solids out and also in removing the solids from the waste stream. Because we have to remember that water can only handle so many solids before they begin settling out. We have to think about that and what is the solids content in any recycled water you may be using and that would have to be considered and it is outlined in the document as well. How to find the document? I'm glad you asked that question. I put it in here and it is very easy and those that are familiar with the E direct lives, you go into the E directives page and select handbooks and you will see that in the gray box and it will be the third one down and you select handbooks and you select title 210 engineering and the national engineering handbook and go into the environmental engineering section and choose chapter 4 and once you click on that you can download the document or just review it right there online. The document is pretty extensive. It is over 200 pages in length. This is a very extensive document that covers a lot of material. I encourage you to at least check out the link and see if this is something that you might be interested in looking at. This is what the cover page will look like so you will at least have an idea that you got into the right place. So how to use the document? I think this is really important for us to understand the ins and outs of this document and how to use it. It is not necessarily made as a document that you read from cover to cover. You could do that but it is not really necessary and if there is a certain item that you're looking for and if you want to understand the theory you go to the theory section and if you want to understand satellite and maneuver you go to that section and you just look at the table of contents and it will take you to the section that you're interested in and after it goes through that if you do not understand then maybe you can go to another section and check through it. Also it allows you to see different examples. There are many, many example problems in the document and it goes through them step-by-step of how to do these various types of things. You also in the document, it goes through the assumption and I think this is really important that we understand what assumptions are being made when you are talking with a landowner and when you're dealing with what is the make up for that particular farm or operation because every operation is going to be different and every operation will have its differences that you have to take into account and those different assumptions and different alternatives will have an impact on the performance of the equipment that you're going to be looking at and evaluating. We talked about the separation efficiency and they do vary tremendously ranging because of many factors such as the age of the animal, type of animal and what type of betting and all of those things are going to have an impact on how well your piece of equipment is going to work. You have to think about that when you are talking with your producers on what options to use. For those of you familiar with the handbook, this is one of the figures in that handbook and I refer to this figure a lot because this is basically all the operations that we focus on when we are dealing with waste management types of application and when we are looking at the solid liquid separation , it can have an impact on basically every one of these depending on what is being utilized and if you're going to be reusing bedding, it will have an impact on your production and if you're going to be using sand or reusing the sand and maybe some of the maneuver solids it will have an impact on collections and if you remove some of the solids it will have an impact on your storage and it will have an impact on how you transfer your many were from place to place and also what treatments are you going to be doing. Solid liquid separation has an impact and also utilization if you're removing solids and will be dealing with liquids and solids the nice thing about this if you remove the solid is you could take the solid and from a longer distance away because you're not hauling water. If you need to get those nutrients further away the solid liquid separation might be one of those possibilities and by removing the solid you might be able to utilize different land application technologies and maybe you can go instead of having to do a slurry tank you could go with an irrigation system if you could get your solid content down enough and it might be a possibility. I utilize this diagram a lot for basically everything I do with waste management because each and every one of these elements has an impact and solid liquid separation can have an impact on everyone of those. One of the things that I try to do when I'm working with the landowner, I try to diagram the system whether I do it mentally or I draw it out and I get an idea of all the processes that are taking place and where everything is and how it is functioning and what the landowner's goals are and I try to figure out what linkages needed and what kind of process could we use to meet the goals of the landowner. I just wanted to show this as an example of how we can see the difference. We talked about the concentration reduction and this was one operation and this was for a

dairy and if you look at just the concentration reduction it says 26%. But when you actually looked at the mass reduction, the actual mass material that was removed and reduction efficiency it's 42%. Again, the same manure sample and the same farm and same test just depending on how you are looking at the data and you could get two different reduction values. I think that is important to know which factor is being used when you are talking with the landowner and/or technology provider because it will have an impact on your results. Let's go through a couple of examples. I think this will help bring some of these things together. We have a swine operation, it's a finishing barn or several barns with 10 buildings approximately 700 animals per building and the buildings are flushed on a daily basis and we have an anaerobic treatment lagoon and the lagoon is nearing it's treatment volume capacity and we have many of those around the country where the treatment volume is almost near to the capacity and once you get beyond the treatment volume your lagoon no longer functions as a lagoon and generally you will see a lot of odors and additional issues can come about if you don't address that properly. The landowner says I want to reduce the amount of loading going into my lagoon so I can extend the life and so we look at it and currently they are putting in under 1% solids into the lagoon so the question is, what options are available for waste separation? You think through this and you think what could the landowner do and what options are available to the landowner? Can they do a mechanical type process or can they do a gravity type process? These are the thought process you go through when you're working with the landowner for those elements and there is a nice table and we need to understand that it doesn't necessarily mean it's for every case but it is a good rule of thumb to help you make decisions on some of the different types of facilities that you're working with. Here we have the swine operation less than 1% solid and as we look here, it shows the four pluses it shows gravity settling and also centrifuge would be the prime candidates to evaluate and think about as possibilities. There are some others that could potentially be used but maybe not as effective. One thing I do want to mention was swine, member the issue we had and we don't have a lot of fiber and since we are already down and it's less than 1%, one of the items you try to do with a screw press is you have to build up a plug at the end of the screw press and when you're down less than 1%, it's very difficult to develop a plug especially with swine many were -- Manure prac not saying it cannot be done but it is very difficult . We need to understand the performance values are based on non-enhanced treatments. What I mean by that is it does not include anything with polymers and/or coagulants to enhance the performance of the separation system. If you added those in some of the other types of systems could be utilized. I know of some operations and I have been looking where we added the chemicals in their and they are using rotary presses and they are very effective in removing solids. They get 90% of the solids out using a rotary press because it enhanced it with the chemicals. This is relative as to what you might look at and it gives you a first cut to consider when you're working with the landowners. Most solids and fiber content could limit the options you have for separation for this operation. You have to think about that. Then also how many solids do you want removed? Do you want to get the majority out or just a few of them out? That will have an impact and as you look in here, you've got a gravity settling and that is kind of a passive type of system or centrifuge which could be relatively expensive and it depends on how much separation you want to take place. Going into the cost-benefit section in the document and it will help you to understand and to work with the landowner on what process might work best for this particular operation. One thing we did not talk about is you could potentially use maybe one of these geotextile bags and take the solids out and fill the geotextile bag with solids and it would increase the volume, the treatment volume within your existing lagoon. There is other alternatives to think about. Think about chemical enhancement because that will increase the separation efficiency and it will increase the amount of nutrients. The final example I want to look at is we have a 500 cow dairy that has free stale -- freestyle barns and bedding in their flushing twice a day at 3000 gallons per flush and the landowner wants to reuse the sand to reduce operation costs in the storage volume in the holding pond so the landowner is asking, can you size the sand Lane for this operation? I will tell you the sand Lane design is both science and art and it takes and it takes skill to begin to understand all the ins and outs and there are some processes outlined in the document and we will go through one of those at this time. Remember, what are the assumptions and we have to know what assumptions are made for the particular operation because it will have an impact on the performance and do you have the proper dilution ratio and you need to have 2 to 1 liquid to solid ratio and if you don't have that your sand separation process will not work and they recommend 4 to 1 or higher and also what type of sand will be used? Is it uniform sized sand? If it goes over a wide range than the process will not work effectively because you will are going to have various sand sizes settling out at different times. What is the slope recommendation anywhere from 0.15 talk to 0.25% and we are assuming there is 4 to 1 or better. The sand is the same size and the sand Lane is within that slope range. Here is the flow rate and it is about 3000 gallons per flush and that means that within one minute 3000 gallons comes out of the flush tank or the flush system or whatever they are using and it comes up through 401 cubic feet per minute. When we are looking at acetylene Lane for sand

settling, we generally look, the rule of thumb is 2 to 4 minute contact time. For the sand to settle out. 401 cubic feet for 3 minutes so it is 134 cubic feet per minute the contact time that you're going to have for this particular example problem. Now you have to figure out what is the cross-sectional area for this to happen? You want to keep your velocity down and you don't want to get too low but not too high because generally sand settles out and you need to know your sand type and sand size and the sand generally settles out if we could keep it above 1.5 feet per second then you could keep the manure in suspension but the sand settles out and you get much below that you get more sand settling with your Manures so the sand will stay in and a flow and the Manures will settle too. You want to keep it around 1.5 and if you get up to 2 the sand starts flowing and you get down to one and you're starting to get them and they were to settle in. Here are some of the things that are more of an art. You want to figure out the flow area so you take the rate divided by the settling velocity and we end up with 1.5 square feet so that is your area of the flow area for that particular flow rate that you've got coming down 1.5 square feet so how wide? It can vary in it depends and a lot of times I talk with the Landover and -- landowner with what equipment you have and how will you clean about in this case we need a minimum width of 12 feet so we take 1.5 square feet divided by 12 foot with and that gives us a depth of about 1.5 inch. And that is how deep it will be flowing through your sand Lane so you get your length with the three minute contact time at 90 feet per minute and that gives you about 270 feet and you're going to need wherever your material is entering the sand Lane you will need some distance to establish a sheet flow and the rule of thumb is two times the width and that ends up being 294 and we rounded up to 300 feet. That is how we would estimate for that. Sand removal efficiency with the sand Lane can be 75% and you can get a little higher depending on how well the system is performing and depending on your flesh water and how much material is in that. The recovery area will be required so the sand can drain and it can be reused. Also, you're not going to remove all of the manure solids. It does a good job but you will still have some in their. As I mentioned your water quality can impact the separation effectiveness and I have a picture here to show you that. If you have a lot of solids in your sand after your separation process what I've seen people do is they will take the sand and move it up to the upper end and run it through the system again and let the water come through and we rewash it. This shows you a couple pictures and the one on the right is where the material is just being released into the sand Lane and you can see the wave being produced and the one on the left shows the design that's being used will also notice that we do have some sand still making it down to the outlet as we see down toward the center right of that particular picture. It is in arts and science when you're dealing with the sand Lane design. With that, I want to give up for special thanks to a couple of groups the South Atlantic or the Piedmont South Atlantic Coast Cooperative study unit and also Doctor John Chastain. He spent many hours putting together this document and he did some research because he did not have all the data he needed so he did additional research for information to be added to the document and he did a tremendous amount of work and I think it is a document that can be used and it can be used for the foreseeable future down the road. Special thanks to all of them. With that, thank you for the opportunity to share with you today and hopefully this got you excited about waste management and waste separation and this is kind of my mascot so with that, I'm going to give control to Sandy and see if we have any questions.

We have a couple questions. The first one goes back to the sand Lane problem and can you explain dilution ratio for sand Lane and is it a volumetric ratio of water to men they were -- water to manure.

It is a volumetric ratio of water to manure and you need to have at least 4 to 1 to get a good flow and if you don't you start getting the hindrance settling so that the particles begin to interact with one another so you need to have four parts water to one part solid which would be the you are Manures and sand.

The next question is 1.5 is the horizontal velocity of the fluid for the sand to settle out and not the vertical velocity of the sand going down?

It is both. If your horizontal velocity is greater than 1.5 then the sand will stay in suspension and it will move the sand along. If you have two feet per second, the sand will keep in the system. If you're down around the 1.5 due to density and the flow characteristics and it will settle out. It is actually both. You need that flow velocity so it will settle out and I guess I would go more horizontal flow than the vertical settling of the sand. You've got to have that -- when you have the flow of your water, what that does, your velocity and things will have an impact on how much, how many solids can be carried in and as you get to that 1.5 the sand says, I could settle out now. So it is more of the horizontal and vertical flow. I know I really butchered that one. But it is looking at your horizontal flow.

Are there any known impacts of --

What we have seen the use of polymers and the amounts have been so low that they are almost nondetectable in the -- in your soil and also in your waters and things. We have not seen any impact on it yet. I have been looking through the literature and you don't want to just super dose it, you want to be

careful with it and one thing I will say is there was a study that was done on the use of alum and I know that's not for solid liquid separation but the use of alum and son of -- some of the poultry houses and they were looking at the impact of that and alum has aluminum in it and they were concerned about the aluminum content increasing out in your pastures and fields and if I remember right it was going to take 700 years at the current application rate before you were able to change the aluminum content 1% in the soil. At this time, we did not know of any adverse effects as long as things are done in the -- as prescribed.

And they will do chart testing before they implement this. They will do testing with different chemicals with the manure they have before they put it into implementation to see what the outcome is.

Exactly.

Would it make more sense to help dairy producers change bedding type by adding mattresses or waterbed rather than trying to separate the sand later?

That comes down to an operation and maintenance type of thing what are the objectives of the landowner and some are using the waterbeds and summary using the mattresses. I've seen it work both ways. For many of the landowners that are using the sand bedding, they are looking at animal health and animal comfort. Many will attest to that the animals just like the sand bedding because it conforms to their bodies better and it's a preference to the landowner and how they're taking and looking at their animals and their animal health.

Even in that preference, you go back to the planning of the sand Lane and as a planner you would play net but also test the sand that the producer plans to use and see if it is suitable. They can use a lot of sand.

Shore. Sure I've heard of folks that are using straight sand or they go out and have a Sand Hill and are using that usually that will not be a good sand source because it has multiple grain sizes. You really need to have the uniform size sand for that to work. I'm still going to go back to it is the landowner's preference on what they want to do with their operation but I've seen people make the conversion.

You say it is the landowner's present preference but he wants to change and we can help assist him to separate the solids out and reuse them.

Sure. And we have seen landowners that have made the switch going from sand to manure or from manure solids to sand. At the landowner's goals and objectives and that's what I usually do come I sit down and talk to the landowner and ask what you want? What are your desires? And what are your goals? There are times when I will say, have you thought about this and it's okay to bring up those ideas and sometimes they have not even thought about it. It is their decision and we leave it up to them to decide which direction they want to go.

I think the document does a good job of describing the advantages and disadvantages of the different technology.

Yes.

How do you deal with small property with topographic influence?

Small property -- I would need more information.

Every site is different.

That's exactly right. If you've got a small property and maybe -- how many animals and what type? Can you were could use gravel -- gravity setting -- gravity settling and you may be able to use a natural topography to do some gravity types things that are mechanical. It depends on so many different factors. What do they want to do with the many were -- Manure. There are so many questions that would need to be answered to effectively work with the landowner and I know it sounds like a girding around the question but there are too many unknowns for me to really give you a good answer work with the landowner and decide what they want to do and see if they can find the technology that will match what the landowner's desires are.

Does feed management play a role?

It can pick one of the things, you get out into many of these places that are using -- you have ethanol plants and they have the grains and they are feeding this to a lot of animals and it is a waste byproduct for the companies and they just want to get rid of it so landowners are taking it and the one thing that is not really thought about is it tremendously increases the amount of phosphorus that is produced in the men newer -- Manures. When you start feeding distiller grain and that impacts your nutrient management plan do you have the Lantus spread on and if not you may need to look at doing enhanced separation to remove some of the phosphorus so that you can still stay within your current nutrient management plan and another impact is the type of feed. I was on a Terry many years ago that they went from traditional feed to starting to feed way -- whey to dairy cows and that changed it from 90% liquid to 98% liquid so the way you handle the material was completely different once they started feeding whey and the can have an impact on nutrient content and consistency.

How often should the sand be removed? It looks like it would wreak havoc with the uniform 1.5 inch of flow.

They can and generally what I have seen them do is they will clean the amount and it's going to be more of a visual type of thing what they see out there. Normally they don't do it after every/because they must make flush three or four times a day but depending on the amount of material or two or three times a week. It depends on the situation and how effective the system is functioning and operating. If you start to see a lot of meandering then I probably just looking at the one picture I had, if I were to clean it out before the last/because it looks like a lot of the sand did make its way down to the outlet. That means it was getting into the storage facility. The art of this is you have to get the feel of it and say, let's see what happens after each flush and when do we need to do -- gather the sand. You're going to have to develop that for your plan over time to figure out what works best for your operation.

The document goes through a bunch of different methods of technology to separate waist. But there is also a labor factor that there is going to be labor needed.

That is correct and depending on what technology you use, it may impact the skill level required. If you're going to be using polymers and chemicals, you're going to need someone that understands chemistry and someone who can keep an eye on your system to make sure that everything is operating properly. Many of these devices, let's say in the inclined screen, as long as the pumps and things are operating properly then the screen usually works because there is no moving parts. Except for the pump that is pumping the liquid. The application technology can impact the skill level that is needed and the amount of labor that's needed to actually do an operation. We discussed some of these farms that have automated a lot more and so if they get solid starting to separate it will go onto a belt and the belt will take it to another location and it minimizes the amount of time and commitment it takes for labor but it depends on the operation and the amount of financials to spend and all these factors have to come into play as you work with your landowners.

How does dumping milk into the pond impact the stream?

Melky is -- milk has a lot of solids in it but they are small. In your adding nutrients. It will increase your nutrient level of your system and it's going to increase your biological oxygen demand and even though the solids content may technically go up, it's still going to be a very liquid material and because you're solids and milk are very small, to run them through some type of system, it is going to have an impact. I have not studied the separation using milk solids a lot or putting the milk into the system but you are changing the consistency of the material and you're making it more fluid even though you're adding solids, you're making it more fluid and it could have an impact on the performance of the system because you may have a little more difficulty if you're going to use the screw press and may have more trouble getting the plug form with milk and it will depend on how much milk. There is a lot of factors that come into play and that is something that I need to study more and I do not have a good thorough answer for that one.

From your experience and solid separation, is there anything you would want to pass along to listeners?

I spent a lot of years with them and I learned a lot from them on things not to do and I guess that is one of the big lessons I learned. But never tell and I think this is one of the big things that I've learned and not just -- never tell a landowner you can't do it because a land owner, they are some of the most ingenious people I ever met and they can do more with the pair of pliers, duct tape and wire than I could ever imagine. So they are very creative. They can make things work and that is why I listened very carefully to what a land owner is saying because I really value their opinion. They know their operations better than we do. We are coming in on the outside but we work with them and we can help them. And also, you can make the technology work. I think that was one of the big things that I did learn. I can make the technology work but it just comes down to is a cost-effective. I can use the polymers and remove 70% to 90% of the polymers but there is expense associated and also, is it needed and those are questions you have to ask the landowner to what extent do you need this piece of equipment to perform. And I will leave it with that.

Thank you. It's been an informative webinar.

Without -- with that I will close out the webinar. On behalf of the conservation service I want to think Sandy and Jeff for taking time out of their busy schedule to provide an excellent presentation about using the solid liquid separation handbook and thank you again to everyone for attending the webinar.

[Event concluded]