Melinda Dalton: So, I'm sitting here, and I'm trying to decide which is the worst slot to talk in. Is it the after lunch or before happy hour? And, if it were me out there, I would say before happy hour. So, bear with me, I'll try to go through this pretty quickly.

Christopher asked me to come and talk about the data and the products that the USGS provides that can be helpful in evaluating instream flows, so, I'm going to try to work within these bounds. The first thing that I want to do is provide a little bit of background information about the USGS Water Mission Area. We have four budget programs, budget programs are how USGS receives funding through Congress.

The Groundwater and Streamflow Information Program funds our stream gages, groundwater wells, and other data collection activities. They also provide funds to monitor lake levels and reservoirs.

We have the National Water Quality Program, NWQP, which contains NAWQA, and provides resources to do real time monitoring of water quality conditions in streams, lakes, reservoirs. They're doing a lot of work on HABs, Harmful Algal Blooms.

We have the Water Resources Research Institutes, which supports the State Water Resources Institutes.

And then, we have the Water Availability and Use Science Program (WAUSP). That's the program that I'm the Program Coordinator for, it's a relatively new program in water. The USGS was directed, as part of the Secure Water Act in 2009, to create a water availability science program. I'll give a little bit more information about SECURE here shortly. The rest of the talk is going to focus on products that this program provides.

The USGS Water Mission Area published a science strategy, I believe, in 2013. That science strategy outlines eight priorities, I've put into bold the four priorities that relate directly to the type of work that WAUSP supports which is focused on understanding the hydrologic cycle. One of these priorities is advancing ecological flow science.

Section 9508 of the Secure Water Act outlines several activities that the USGS is responsible for. I haven't listed them all here, I've only listed the ones that are, I think, most relevant to this audience. The first is doing water use by HUC and by aquifer. And, as a part of that, congress has told us through SECURE that we need to be applying research and statistical water use information techniques to better understand the human impacts of water use on ecological resources. Then, under water availability and use assessments, they've told us that we need to be applying predictive models and tools to better integrate the information that we have on groundwater, surface water, and the impacts of change on ecological systems.

The Secure Water Act has outlined what several federal agencies should be doing in relation to water. In response to SECURE the Department of the Interior developed the WaterSMART initiative. For WAUSP, the funding that we get related to WaterSMART supports an effort that we call the National Water Census. The National Water Census is

a fairly large set of work in WAUSP and has several components which I'll discuss in a few minutes.

Another component of WAUSP is national scale model development. These models are coarse but as they are developed at a finer resolution, depending upon the need that the user has in smaller basins, the national scale models are refined and performance is improved.

We also have regional water budget components and here, I'm going to talk a little bit about regional groundwater availability studies. Groundwater availability studies, why would they be of interest to this crowd? Well, groundwater and surface water interaction is a very important thing to understand, to know how much water is going to be in the stream under natural conditions. These studies provide a lot of information that is relevant. The majority of these studies produce a groundwater model for their basin, a fine resolution groundwater model for their basin that provides estimates of recharge and discharge to stream segments, and they also look at storage. It's essentially a water budget analysis for each of these major aquifer systems. This map shows where we're doing groundwater studies. The ones in brown are already completed. So, the models for each of these, the results, are all available online. The ones in blue are ones that are currently active. The completion dates of all these vary from next year, to three to four years down the road. But, if you go to our website, you can get more information on each of these, and get access to the data and the models.

AS part of the National Water Census, we have focus area studies. There are three that are complete and three that are wrapping up next year. In addition we work on what we call National Water Budget Components, the goal of which is to improve the information we provide for each of the water budget components. The long-term goal, over the next five years, is to be able to provide a daily estimate at the HUC 12 level for each of the water budget components nationally. And, of course, to deliver that information in a format that's useful to resource managers.

A little bit more about the water budget components. Our current focus is estimating flow in ungauged basins. This will provide a daily flow at every HUC 12, every ungauged HUC 12 and, providing a range of uncertainty for each of those flow measurements. We're also developing methods to estimate ET, and providing a landsat measurements of ET nationally. The values that we have now are monthly, produced annually. That, of course, is going to get down to daily, in a couple of years.

Finally, water use. We've put a lot of effort into water use. It's actually refreshing to hear the term water use mentioned so much during the day today. It's something that, a lot of times, we don't consider when evaluating water budgets, but it has a huge impact on the availability of water, and the water budget. Currently we've got water use activities that we've been working on or have completed. One of the most interesting, I think, is that we've developed a database of all the public supply intakes and release locations nationally. We've worked with EPA and their SDWIS database on this project whose goal is to eventually be able to track water as it moves through a public supply system. So, you know how much water is withdrawn out of a stream, or a well for use. You can track how it's moved and distributed, and then where it returns to the system.

We've done a lot of work comparing our water use reporting activities with the Bureau of Reclamation. We have a report that's coming soon that evolved during one of the first focus area studies in the Colorado River Basin. We discovered there were differences in how USGS and the Bureau of Reclamation reported water use. The basin states asked us to get together, and basically explain why our water use numbers were different, and how we determined them. That report is coming out very soon. It's in layout right now.

We've developed an irrigation consumptive use model, which is the landsat ET that I've shown earlier. We've also developed a thermoelectric water use model, in collaboration with EIA, for every plant in the nation. These plant-specific models produce a range of actual use based on construction and production. Through this process, we've helped EIA to update their surveys that they send out to the plants, to get better, more refined information.

We also have a study that's looking at the use of water associated with unconventional oil and gas development. This study evaluates not just the water that's put into a hole for fracking but also includes the water that's used for increased populations, at site locations, and the water that's sprayed to keep dust down on roads. Those sorts of things. It's being piloted in the Williston Basin, but the goal is to develop a model that can be rolled out to place all over the country, so we can see the impacts of use when production is increasing, or when it goes down.

Finally, we recently held a workshop to begin a process to develop estimation techniques for water use categories. We had folks from USGS, but we also had external participants, several university folks, folks from Bureau of Reclamation, State agencies, and Western States Water Council. The goal is development of models to estimate thermoelectric, public supply, and irrigation withdrawal on a daily basis at the HUC12 level. Currently, we are reporting water use at a county level every five years. So, we've got a lot of work to do but I think that this data product will be really helpful to a lot of folks, especially when it comes to looking at instream flows to be able to evaluate, on a daily basis, the potential impact that a stream reach may have, from a particular category of use.

Some of the other activities that we plan to work on in the future is reservoir storage, re-instituting hydroelectric water use, and putting a lot more effort on improving the information that we have on interbasin transfers.

We're going to focus our efforts, especially when it comes to estimation technique development on three, the three main categories of use, that's thermoelectric, irrigation, and public supply. Those three categories alone make up about 90 percent of water use on an annual basis. Sometimes, those percentages change, sort of, internally amongst those three. But, it's pretty standard, it's about 90 percent.

We reported consumptive use for all eight of the water use categories we report in 1995, and we haven't reported it since then. In 2015 we will report consumptive use for irrigation and thermoelectric water withdrawal. Why is that important? You can see in this slide thermoelectric and irrigation are the two main categories of water use, each

around 40 percent. But, when you start to think about consumptive use, it's a totally different story. Thermoelectric consumptive use is really only about four percent of total use, where irrigation is considerably more. So, being able to understand how much water is pulled out of a stream, or an aquifer, is very important. But, equally important, is understanding how much of that goes back into the system, versus how much is lost, totally.

Focus area studies, as I mentioned earlier we have three that are completed, those are the Colorado, the Apalachicola-Chattahoochee-Flint, and the Delaware River Basin. And, we have three that are ongoing, or active right now. I'm going to over a little bit of information about the three that are ongoing, and some of the work that they have related to Ecoflows. In the Coastal Carolina Basins, they are doing fish and invertebrate response modeling and evaluating how changes of flow, climate, and land use will impact biological conditions in two basins, the Yadkin-Pee Dee, and the Cape Fear. Then prediction out to 2050, I believe, how these predicted changes will impact fish populations.

In the Red River of the south, they're developing a linked groundwater/surface water model, MODFLOW and PRMS, to how changes in climate and land use will impact flow conditions, and in turn how that will impact fish populations over time. In the upper Rio Grande, they're not actually doing any direct work with Ecoflows, but, they are focused on improving understanding of six components of the water budget in the upper Rio Grand Basin, which I think will help to refine our understanding of water availability in that basin.

What does this all mean to you guys? We all know that water issues are complex, and they're crosscutting. But, to provide the information needed to evaluate ecoflows we need to integrate the work that we're doing in our program with the work going on in other USGS programs. We've started having some discussions with those other programs, to develop a plan for an integrative water availability study. For our program, the focus will be on developing tools and information to help resource managers evaluate water availability for human and ecological uses.

One of the main drivers of that is drought. And, last year, the USGS developed a plan for integrative drought science. The goal of this science plan would be to better understand the spatial and temporal processes associated with drought, how uncertainties affect fresh water ecosystem, and developing some key eco-hydrological parameters for that. And then, doing some linkages and commonalities of these critical differences to understand the consequences of drought. Understanding the data that we need to provide the resources that you guys really need to help make your management decisions.

How is WAUSP going to contribute to that? Well, I see the role of this program as providing the hydrologic information, to help make these, integrative assessments, to help make these ecological assessments of impacts of drought, flow change, land use, climate change. One of the things that we've been talking about a lot as a mission area, is something that we're calling the Water Prediction Work Program, or affectionately, 2WP. We're working in collaboration with the National Weather Service on this. And the

goal is to refine the National Water Model, to predict water temperature, surficial processes, and in-channel constituent transport associated with sedimentation.

What does that mean? What are we looking at producing? Some hypothetical examples would be simple dot maps of stream temperature on a daily basis, stream temperature forecast out X number of days, national maps of sediment sources, scour and deposition zones in stream channels, an NHD stream network that shows travel time for sediment and in channel constituents. And then, perhaps, some next generation HABs forecasting, where we can actually forecast the timing and characteristics of harmful algal blooms.

All of these efforts can be broken down into three main work efforts. One is delivering datasets and incorporating these existing datasets into your assessments. These integrative data products are used to develop predictive models and tools resource mangers can use to evaluate water availability. My time is up I'll end there, thank you.