

**Citizens' Advisory Board (CAB) Meeting
Energy & Environmental Research Center (EERC)
June 28, 2005**

CAB Members Present

Leon Dubourt
Steve Edwards
David Hagert
Bob Lebacken
Willard Loing
Jerry Moran
Dale Stenerson

EERC Members Present

Beth Bolles
Lynette de Silva
Kim Dickman
Heith Dokken
Sheila Hanson
John Harju
Jim Johnson
Marc Kurz
Corey Makey
Jacquelynn McNamara
Wes Peck
Xixi Wang
Kirk Williams

Beth Bolles called the meeting to order and welcomed everyone. She presented an update of Waffle[®]-related activities, and presentations followed. Marc Kurz gave a presentation on the field trial progress, Corey Maki on the road stability analysis, Sheila Hanson on the economic analysis progress, and Beth Bolles on the preliminary modeling results.

Update

Beth explained that our primary outreach task lately has been meeting with city council board members to provide updates of the Waffle project and related progress. Among the city councils that we have targeted are those presently affected by heavy flooding, since flood-related issues are foremost on their minds at this time.

She indicated that we are also planning meetings with water boards and watershed districts again; we last visited with them 3 years ago. We believe that it is time to provide them with an update on our progress.

We sent out 15,000 surveys to landowners and producers throughout the entire Red River Basin (RRB). Just over 30,000 landowners and producers are registered in the RRB. The response rate was approximately 15% of surveys sent out. Our student, Jacquelynn McNamara, is compiling the results. Jim Johnson is following-up on survey recipients who did not respond to determine if they plan to respond and if not, why. By our next meeting, we will have the results of the survey.

A new Waffle brochure is being developed; presently, it is in draft format. It is being compiled from existing poster information. It is a simplified version of our general Waffle brochure.

As we move toward the end of the project, we are starting to formulate the format of the final report and deciding the best way to present information in a logical manner so that it will be user-friendly and well-utilized. We decided that the final report should be divided into three key areas: technical aspects of the project, which will include results of the modeling components, identification of storage areas, and other technical aspects we have been working on; the social impacts/aspects, which will include all of the outreach we have done, including the input we have gained from various groups and our advisory boards to identify the key concerns or barriers to implementation; and the economic aspects, which involve components addressed by Andy Manale and North Dakota State University (NDSU).

As we wrap up this project, we have no funding to conduct additional outreach. Our challenge now is to determine how to disseminate the results from this project, what the best format is for presenting the results and conclusions, and who are the best groups to target for dissemination of the information. We will have the report available on our Web site and will produce copies on CD. Copies of the report will also be provided to the extension services. We would appreciate your ideas or suggestions on the best way to disseminate this information.

Field Trial Progress Update

Marc delivered the field trial updates. He stated that at the last meeting we had some of the results from the first field trial and we were gearing up for the second round of field trials this spring. We have completed the water storage on all four of the sites, three in Minnesota and one in North Dakota. We have completed the storage volume, infiltration, and evaporation estimates as well as the water quality sampling and analysis and have initiated soil chemistry tests for each site. We are waiting for things to dry out on the sites to get a vehicle out there to take core samples. We hope to get these done within the next couple of weeks.

The Shelly, Minnesota, site is in the second year of testing, so we should get good information on what is going on there with the water chemistry. It is a full section of agricultural land that was planted this past weekend. Because of heavy rains, initially, it didn't look like they were going to get a crop planted this year. We stored about 150 ac-ft of water on the site. Monitoring the water through the culverts showed that the amount that came off the site was less than last year. This was likely due to debris from the former crop that was left on the field. The water was stored for 14 days, and we did reach the maximum elevation of water storage for this site.

The Lake Bronson, Minnesota, site is about 3 miles southwest of the city. This is a full section of Conservation Reserve Program (CRP) land where we stored approximately 150 ac-ft of water. We only stored water for about 7 days because a joint on the standpipe started to leak. We started releasing the water after 5 days. We are looking at studying this section again next year, because we are doing the road stability evaluation on it. Corey did get some data, but we would like to store water for about 2 weeks and see the resulting effects. We talked to one of the landowners near this area, and he stated that every year his land floods from the water coming through the coulee. This year, he ended up being high and dry by a few inches. The concept of the Waffle did work on this local scale. The University of North Dakota (UND) will fly a plane loaded with an infrared camera and look at all four sites to determine the health of the vegetation.

The Agassiz Wildlife Refuge site is northeast of Thief River Falls, Minnesota, in the southwest corner of the refuge. It had about 400 acres of CRP coverage; this entire section was contained within a berm. The only water we held there was what fell as precipitation. We had about 200 ac-ft of storage potential, but only 120–130 ac-ft of water was held there. The water was held for 28 days, because the judicial ditch that is adjacent to the site was continuously full. The water was restricted mainly to the drainage ditches they had in place. On the back part of the property, there was approximately 40–50 acres where the water was 6–10 in. deep; this is where we did our actual testing of the soil moisture and temperature.

The Gilby, North Dakota, site is located 5 miles east of Gilby on John Scott's CRP land. The water was contained by a constructed berm on the north and east side of his land. We had about 140 ac-ft of storage. The water will not be released, since John is trying enroll his land into the Wetlands Reserve Program. We do not have a detailed survey of how much water was stored there; it varied on this section from 6 in. to 4 ft deep.

Some future activities for the field trial include retrieving the data from the soil moisture/soil temperature sensors as soon as it is dry enough to do so, finishing the soil chemistry testing, conducting infiltrometer tests, and interpreting the results. We are going to reinstall the culvert modification on Lake Bronson as soon as we obtain the necessary permits and a consensus among the landowners to do it again. We will complete the road stability analysis by holding back water for at least 14, or maybe even 17, days.

Questions/Comments

- Dale Stenerson asked how we are going to factor out the land value for someone who has a high agricultural land value and someone like John Scott who doesn't want to release the water. Beth answered that the soil productivity will be factored into NDSU's economic analysis. John originally built the berm to hold the water back in the spring to flush out some of the salt. If he does not hold water, the salt will inhibit the crop.
- Dale Stenerson asked if we would end up with wetlands in places where there were no wetlands historically and/or end up with wetlands where landowners do not want them. Beth said some landowners are concerned that areas in which the Waffle was being implemented could be subject to the government involuntarily classifying the land as wetlands. To alleviate this concern, the Waffle concept would have to be set up so that this would not happen.

Road Stability Analysis Update

Corey explained that the road stability profile analysis was conducted at the Lake Bronson site. Two profiles were monitored, both of which are located on County Road 19. The first profile was labeled the wet profile, or the north site, and is located $\frac{1}{8}$ mile south of the intersection of Kittson County 19 and Kittson County 10. The second profile was labeled the dry profile, or south site, and was located 1 mile south of the wet profile. The wet profile was instrumented with moisture sensors at eight locations, which were spaced 8 ft apart and symmetrical to the

centerline of the road. The four individual capacitance probe sensors at each location were placed at the 6-, 12-, 18- and 24-in. depths.

The temperature sensors were also placed in the wet profile. They were also installed in the dry profile to provide a control profile for the temperature data. The units were installed at eight locations spaced 8 ft apart and symmetrical to the centerline of the road. The individual sensors were placed at the 4-in., 1-ft, 2-ft, 3-ft, 4-ft, 5-ft, and 6-ft depths.

By logging the data, we were able to document the thaw progression. From this, we determined that the frost did extend below 6 ft, though we were unable to determine how far, since the sensors did not extend beyond 6 ft. We were also able to use the moisture sensors to document the storm events experienced at the sites.

Through these data, we can determine how the subsection froze. Among the results, we saw that the road asphalt allowed the ground to freeze and thaw faster, and that when full water capacity was achieved, the shoulder slopes at the site were still completely frozen.

As indicated by Marc, the stored water from this site was released early, after 5 days because of leakage at a joint on the standpipe. The results from the 5-day trial showed no adverse impact to the road surface or soil profile. However, until we have run the trial for the full 14 days, we cannot tell if it had an effect on road stability.

Questions/Comments

- Jim Johnson asked if the sensors are still in place and are useable for next year. Corey answered yes, and that we will be able to use them again next year.

Economic Analysis Progress

Sheila Hansen presented information pertaining to the economic analysis Larry Leistritz, Ph.D.; Eric DeVuyst, Ph.D.; and Dean Bangsund from NDSU are working on. They have developed a research plan and completed most of the data collection, with the analysis to follow. All of the NDSU researchers have agricultural backgrounds. Larry is a research professor, working primarily on agribusiness and applied agricultural economics research projects. He and Dean conducted research through the Plains CO₂ Reduction (PCOR) Partnership, which was well-received by the EERC. Eric has experience working on flood-related projects, including flood easement analysis after the 1993 midwestern flood.

The first objective of the economic analysis is to look at the cost-effectiveness of the Waffle. As an initial assessment, it is an overview at the basinwide level. NDSU is developing estimates of potential mitigated flood damages; which in essence could be of benefit if we could prevent those damages from occurring. This involves cost estimates using a multitude of variables. Phase 1, the data collection phase, is nearly complete. They are collecting data to develop a flood stage damage function. Their Phase 2 activities are driven by what data they are able to collect in Phase 1. The Waffle team is providing some of the data that will be input in their models, such as culvert costs. NDSU already has flood damage costs provided by the U.S. Army Corps of

Engineers (USACE). We understand that USACE has looked at eight to ten cities within the basin. The data are not publicly available but will be utilized in the models NDSU is developing for us.

Larry and Eric believe that their numbers from USACE show approximately 90% of the flood damages, so we will have a conservative estimate. Eric mentioned in his presentation to the Agency Advisory Board (AAB) members that damages that might occur in rural areas during a flood will not be in the model such as roads or bridges being washed out. NDSU is kicking off Phase 2 in July 2005. They will finalize the flood stage damage functions and produce cost-benefit estimates. Then they will run a sensitivity analysis that looks at various input values or parameters. For example, they could look at how sensitive the model is to increases or decreases in landowner payments.

To address the benefits of Waffle implementation, they will compute expected future flood damages if the Waffle were in place versus if it were not. These computations will rely on probability functions. They will look at the probability of floods occurring in different magnitudes like the 100-year or 200-year flood and use those flood stage damage functions. The benefit would be a reduction in flood severity due to the Waffle. They will look at the net present values to account for changes in the value of the dollar over time.

Beth added that Howe Lim, a Civil Engineer at UND, is conducting analysis of the probability of various magnitude floods occurring in the next 10, 20, and 30 years and up to 50 years from now; for example, what are the chances this region will experience a 1997-type flood in the next 20–50 years?

With respect to the cost associated with the Waffle implementation, there are numerous variables, including the cost of implementing and maintaining the Waffle. Incurred are infrastructure costs up front, like the culverts, road modifications, and modification/installation of any other physical structure, along with periodic maintenance and repair of the culverts. One area of significant interest is the land enrollment, where the social science aspect of the project interacts with the economics (land enrollment fee, payment to landowners/producers, etc.). If benefits still outweigh the costs, then it would indicate economic feasibility. Potential losses in agricultural productivity and profits will be factored into the equation. There are also the overhead and administrative costs of running the program, including initially enrolling the landowners and maintaining the program over time.

In the end, we would like a report from them that would be useful to policy makers and other interested parties that includes a conservative estimate of the cost-effectiveness of a program like the Waffle.

Questions/Comments

- Bob Lebacken asked where the money for farmer-induced incentives would come from. Sheila answered that Andy Manale is investigating various agencies and government programs that could facilitate this kind of economic policy.

- Beth explained that the people who are going to benefit the most from flood reduction most likely reside in an urban area. In a typical market, those people would pay the rural residents for this type of flood reduction approach. Unfortunately, cities have come to rely on the federal government to pay for their flood protection. So ultimately, it probably would be the federal government that would be paying.
- Sheila added that the NDSU economists are considering this temporary storage of water as a federally subsidized crop.

Preliminary Modeling Results

Beth gave an overview of the modeling tasks. She stated that, so far, computer models have been developed for each of the watersheds in the RRB. All of the models are linked for each of the tributaries in the RRB, allowing us to conduct Waffle storage analysis throughout the entire RRB.

There are 28 watersheds within the U.S. portion of the RRB. A watershed is the area that contributes to the drainage that flows into a certain tributary or water body. We have developed models for each of these watersheds except Devils Lake—all the water in the Devils Lake basin stays in that basin. When you do computer modeling you build your model to represent existing conditions. You put factors into the model like soil types, topography, and drainage course, then run the model and compare model output to actual measured data. For example, your model output might be flow values at certain points along a tributary. You compare those flow values to flow values that were measured by the U.S. Geological Survey (USGS) for different flood events. When the model output does not match the actual conditions, then something was not taken into account. One needs to go back and look through the reports and maps to determine if there is a feature such as a dam that needs to be factored into the equation. Once the missing factor is determined, a readjustment is made. The model is then rerun to see how well it matches the measured values.

All of this was done based on the 1997 flood event. We compared all of our flows to what was measured during the 1997 flood. In the model, precipitation data for 1997 was entered. Essentially, one's flow data should match what was actually measured. One compares this with 1997 conditions. This also determines how well it works for other flood events. One then repeats the process with precipitation and climate data from other flood events, like 1950. The model is run and its output compared to actual measured values.

Beth said the goal of doing all of this modeling for the whole project was to reduce flows or flood peaks enough to prevent flooding in localized areas. These models could be used to simulate various flood mitigation scenarios, such as incorporating dams, wetland restoration, and no-till farming. With the model, one can change land management practices, such as adding no till-farming, which increases infiltration that, in turn, helps reduce runoff. Through these modeling capabilities, one can evaluate different types of flood mitigation scenarios.

Through the Waffle project, we hope to reduce flood peak and mitigate flood damages at key points in the basin. As the flood height or flood stage increases, it gets to a point where damages

will start to accrue. Our goal is to reduce the discharge rate and redistribute the excess water that causes major spring flooding. This is reflected on the hydrograph by leveled peak discharges and gentle rather than steep discharge slopes.

Wes, Troy, and several other people have reviewed the entire RRB to see where we can store water. For each section of land, adjustments were made to account for the reduction in volume as a result of free board, which would reduce the amount for any natural storage that may already exist. A map displaying square mileage was developed to account for water storage throughout the entire RRB. We then went back and determined what would or would not constitute a “good” storage area. This criterion was based on the relief differences found within a given section. A favorable section was regarded as one that was flat with little or no relief and was expected to store more water, while a section with more relief and greater topographic variance was regarded as less favorable.

These storage locations are lumped together into subunits that are based upon divisions that are generated by the model. We then run the model to see how we can reduce those flows or peaks as a result of Waffle storage. We block out all of the areas that were already flooded during 1997 and areas that have too much relief.

Storage areas that we have modeled ranged anywhere between 5–10 ac-ft up to 100–300 ac-ft. The model divides each watershed within the RRB into smaller subwatersheds based upon topography, soil type, land use, etc. It divides it up based on physical conditions that actually exist. Within each of those subwatersheds, Xixi, Doug Davidson, and Kirk will enter in certain storage values based upon work that Wes did. The average subwatershed size is small, about 5 sq mi. There might be 2 or 2½ sections encompassed by that unit. For each subwatershed, we simulate the flow going into and out of that division. For Waffle storage, ideally you would like to have less water leaving than entering a section.

Initially, we are modeling 100% of the storage areas that we have identified for their potential to store water. However, in reality we are not going to get 100% participation in the Waffle project.

If we see a significant reduction in flooding when modeling with 100% available storage, then we will cut that storage down to 75% availability, 50%, and 25%–10% to see where significant flood reduction benefits cease.

Beth emphasized that one can evaluate any point in the basin to see the localized effects of Waffle storage. Beth then illustrated two Waffle scenarios. The first one, using the Bois de Sioux watershed as an example, showed significant reduced peak flows during various spring flood events, indicating that the Waffle would have reduced flooding. Provided were actual results from the model.

The second scenario, using the Buffalo River in Minnesota, did not illustrate a significant reduction in flows. There is little storage upstream. The location of the storage and the characteristics of the watershed make a big difference in what type of effects you can achieve in using Waffle storage. In this case, very little reduction in flow is achieved, indicating that this is

not the best area to store water. Over time, if many watersheds were combined together, you might achieve a significant reduction.

Our preliminary modeling results show that the effects of Waffle storage vary depending on the characteristics of a watershed and the location and distribution of the storage area.

Questions/Comments

- Steve Edwards asked if the economists will attribute values to those flood reductions. Beth said that information will be provided by NDSU. Essentially, they will develop a flood damage curve, so that for a given river approximate damages can be determined. NDSU agricultural economists working on the Waffle project will analyze how the duration of storage may effect planting dates, crop yields for different types of crops, and various crops during different types of flood years. They will assess a number of scenarios including when the melt happens early, allowing water to be stored earlier, and when the melt occurs later, causing a delay in planting.
- Bob Lebacken asked if the most advantageous water storage was in the lower watersheds. Beth answered that relief does determine how much water can be stored, and that the lower watersheds could store considerable amounts of water. The Red Lake Watershed has potential storage and does contribute to the RR. While storage may not be possible in upper watershed areas, intermediate areas may play a significant role in water storage.
- Beth asked for suggestions on how to disseminate the results of this project when it comes to a close in June 2006. A board member remarked that the best way to get the word out is to converse with farmers and landowners in local settings, such as talking to them over coffee and breakfast in cafes. Jim added that brochures tend to be really informative and might be the best approach.
- Beth said it will be interesting to see the survey results since there are questions regarding landowner perceptions of the Waffle. The survey will help us better understand landowner opinions.
- It was remarked that last year at the Shelly site, planting was delayed by 5 days. How long was planting delayed this year? Marc said he had not talked to the landowner himself yet but thought it was delayed by 1 day. Marc said he would report those results at the next meeting. Beth added it's hard to compare last year's results with this year's, since it was extremely wet everywhere this year. She wondered how one might differentiate between what may have been the impact of waffle storage versus all of the rain that occurred. She suggested that the best that can be done is to compare the surrounding fields and see when planting occurred.
- Bob Lebacken said this spring was a classic year. If you got your fields planted in a timely manner, things are looking good. If it happened that you were not able to start seeding this year because you had participated in the Waffle and were waiting for the soil to dry out prior to seeding and then got caught by the 3-week monsoon, then the opportunity to make up for that time delay attributed to rain was lost.

- Beth said that if people who store water encounter major delays, preventing them from planting, then maybe the cost outweighs the benefits. This would be determined in the economic analysis.
- Steve Edwards asked what our ideas are of disseminating information. Beth answered we are brainstorming right now, but we do plan on continuing outreach through extension services, radio talk shows addressing agricultural groups, and the distribution of pamphlets. Jerry Moran commented that through local talk shows, a lot of people are exposed to the information, and it makes a difference. Jim suggested making question-and-answer fact sheets available in restaurants. Beth suggested doing a one-time mailing in the Luncheon News.
- A member indicated that county farm bureaus hold annual meetings in the fall. This would be the last fall before Waffle funds expire. It was indicated that we should work towards 20–30-minute presentations.
- Steve Edwards suggested presentations to kids. Beth said that was a good potential avenue. Jim said he has presented to some science classes, some of which built Waffle demonstration models. The kids thought it was fun and educational at the same time. Jerry Moran suggested talking to elementary school kids since they still talk to their parents.
- Dale Stenerson said we talk about the agricultural component 90% of the time, because the agricultural community is going to hold the water. The rural people are going to make it work, and they are not concerned about the technical side. How can we help urban populations like Grand Forks understand the impacts to the rural community? Dale Stenerson said the data will be valuable if it is understandable to the local population. Beth remarked that it would be interesting to know how many people we have informed about the Waffle through our various outreach efforts.
- Corey asked if we are targeting our final product to government agencies. Beth answered we would present to the key entities that would be responsible for, or interested in, implementation. Also, we would get the results out to the general public.
- Corey suggested that if we moved toward large-scale implementation then a video would be a good idea. Beth added that a video is expensive to produce. Sheila added that the Plains CO₂ Reduction (PCOR) Partnership project at the EERC spent \$60,000 on a recent video that averaged around \$1000 per minute.
- Dave Hagert asked if an actual program for Prairie Public Television could be produced. Beth said she would talk to them again. If they take an interest in something, they usually sponsor part of it.
- Bob Lebacken asked if we would be mailing out the results from the landowner surveys. Beth said that the results will be compiled and put into a document. The survey includes

scenarios about water storage periods, landowner payments, and willingness to participate. Sheila added that we will have those results at the next meeting.

Beth asked whether there were any additional questions or comments. She indicated that our next meeting will be at the end of the summer, before harvest. She encouraged the board to contact the EERC at anytime and thanked everyone for coming. Beth adjourned the meeting.