ADMS Task Force Meeting

Purdue University, April 21-22, 2004

Contents

Meeting Participants

1.	Ayen, Jim	NRCS - Iowa
2.	Baker, Steve	Springfield Plastics
3.	Binstock, Leonard	Ellingson Co
4.	Boyd, Bill	NRCS
5.	Brate, Art	NRCS – Ohio
6.	Bucks, Dale	ARS
7.	Clarizia, Beth	NRCS-Indiana
8.	Cooke, Richard	U. Illinois
9.	Cosby, Hal	NRCS
10.	DeArman, Paul	NRCS
11.	Dittrich, Mark	Minn. Dept. of Agriculture
12.	Drummy, Nancy	UW-Extension
13.	Duininck, Jamie	Prinsco Inc
14.	Dumoulin, Pat	National Corn Growers Association
15.	Echols, Alex	Sand County Foundation
16.	Fausey, Norm	ARS
17.	Fontenot, Wil	NRCS Louisiana
18.	Fouss, Jim	ARS
19.	Frankenberger, Jane	Purdue U
20.	Goodwin, Barry	Hancor
21.	Grigg, Brandon	ARS
22.	Gutwein, Barry	Purdue U
23.	Helmers, Matt	Iowa State

24. Huggins, Jack	The Nature Conservancy
25. Jaynes, Dan	ARS
26. Keys, Anne	ADMC
27. King, Kevin	ARS
28. Kladivko, Eileen	Purdue
29. Kollman, Fred	NRCS
30. Kunickis, Sheryl	NRCS
31. Melvin, Stewart	Iowa State U
32. Overmyer, Chris	Francesville Drain Tile
33. Reinhart, Jill	NRCS/CTIC
34. Sand, Duane	Iowa Natural Heritage Foundation
35. Schafer, Charlie	AgriDrain
36. Schlatter, Ron	Schlatters Inc
37. Skaggs, Wayne	NCSU
38. Streitmatter, Joe	Streitmatter Land Imp. Inc.
39. Torbert, John	Iowa Drainage District Association
40. Towery, Dan	NRCS/CTIC
41. Willey, Pat	NRCS
42. Wooten, Gary	NRCS

Wednesday morning

Introductions:

- Ron Turco, Associate Director of the Purdue University Agricultural Research Programs and Director of the Environmental Sciences and Engineering Institute, welcomed ADMS Task Force participants to Purdue.
- Jane Frankenberger reviewed logistics. All participants introduced themselves.
- Eileen Kladivko covered plans for the afternoon field trip to the Purdue Water Quality Field Station (drainage research site) and the constructed wetland to treat drainage ditch water.

Progress on prior work/needs

- Jim Fouss stated that the discussion at this meeting will focus on how monitoring needs to not just focus on a field or a farm, but the watershed scale. Questions are being asked by congressmen and policy makers at NRCS, and they want to know what the impacts are on a larger area. Many projects state by state are starting smaller, but sites should fit in a watershed.
- Jim passed out copies of the new ADMSTF brochure. **Comments on the brochure are needed by May 12.** He also invites everyone to send pictures for the back page.
- Wil Fontenot, who facilitated the development of the agenda, gave an overview of the agenda and meeting. He passed out a paper called “Delivery Processes for ADMS”, for discussion by the group, which he hopes will bring to closure the discussion on the Charter at Clearwater. He also passed out a World Resources Institute paper “Awakening the Dead Zone”. We need to be aware that what we do will be looked at by groups around the U.S.

- He also passed out a letter to Dean Lemke in support of Iowa's proposal to EPA, which was signed by Wil and Jim Fouss on behalf of the ADMS Task Force.
- Jane Frankenberger briefly discussed the regional extension publication called "Drainage Management Strategies to Reduce Nitrate Loads". Drafts were passed out in Clearwater. If any participants would be willing to review, they should let her know. This is a publication all of us can use to inform policy makers, farmers, drainage industry, etc.

Eighth Drainage Symposium

Norm Fausey and Wayne Skaggs presented highlights of their keynote speeches at the Eighth Drainage Symposium.

Norm Fausey spoke about their research on subirrigation, which has worked great for many years but only in a few places that have adequate water. Scaling up was limited by water supply. They also found that drainage research was limited by drought stress later in the season. For both these reasons, constructing a reservoir to hold drainage water made sense. (Not much cheaper than drilling a well, but a little more reliable.) Their reservoir takes in water from 60 acres and irrigates 20 acres. The farmer is very happy, and feels the system has good potential.

Q: What will be the focus of the ADMS meeting in Ohio later this week? **A:** It will not focus on subirrigation, because acreage is limited. There is much more potential for managed drainage. Larry Brown added that they do not plan to focus only on controlled drainage, but on many technologies available for managing drainage.

Q: How were the options selected? Was it locally-led? Were farmers involved? **A:** We did teaching with farmers; options came in part from those. Good leadership from an NRCS person.

Q: Were wet periods a problem? **A:** Extra management required the first 2 years was a problem; but farmer didn't mind by 3rd year.

Q: What is the drain spacing? **A:** 15-20 foot. But the biggest cost was the pond, not the extra drainage. Estimated cost was $3000/acre, including engineering costs. In the future they may be able to do it for $2000/acre. That does not take into consideration the cost-share for wetlands.

Q: That part of Ohio has 39 inches annual rainfall. Could it work in 22-inch areas? **A:** They have run out of water, so the design is obviously site-specific.

Wayne Skaggs spoke about the effect of subsurface drainage intensity on N loss. He defines drainage intensity as the flow rate when the water table is at the surface midpoint between the drains. He used Eileen Kladivko's data, with long-term nitrate loss from 5, 10, and 20 meter spacing, which show that more closely spaced drains increase N loss. Gilliam and Skaggs have data that show N loss at 100 ft greater than N loss at 300 ft. Few other data show this as clearly. He stated that "if Eileen's data were available for two sites per state in the Midwest, we would have a gold mine." Unfortunately we don't have that – and we couldn't get it even if we had immediate funding. It would require $500,000 per year and 10 years. Therefore we need models.

Minimum Monitoring to quantify drainage impacts

Several researchers presented their thoughts on the level and type of monitoring that is vital for making conclusions.

Richard Cooke spoke of the concept of Minimum Detectable Change (developed by Jean Spooner). Need to consider variability due to soil and climate, so paired systems needed. He has developed low-cost monitoring systems using the control structure itself as a flow measuring device. He is calibrating structures from 6 inches up to 24 inches. He also studied the time frame for highly correlated samples. In rivers it is about a month, while in tile about 10-15 days. So he thinks taking samples once/week is adequate. He is also looking at bioreactors, and controlled drainage in conjunction with bioreactors.

Bill Boyd commented that for flood control, we don't do either paired fields or pre/post testing. We build it, estimate what the depth would have been without structure, and estimate benefits based on the difference. (He later called this the "predictive" approach). Richard responded that we have modeling results, but many people require real data. An additional comment was that we have a lot of modeling at the field scale, but not at the watershed scale. Controlled drainage reduces flow from the field – but where does it go?

Norm Fausey described the paired watershed design they are planning in Ohio. They will control all the outlets in one watershed. They are also installing piezometers to measure the quality of water below the drain depth. Nitrate concentration at 10 feet is much less for subirrigation or controlled drainage than free drainage. But surface runoff is too difficult to measure at the scale they are working on.

Wayne Skaggs remarked that he was not confident about sampling only once per week (because sometimes there are spikes in concentration), or that load reduction can be predicted based on flow alone (which had been suggested). North Carolina, with 20 inches of drainage/year, typically loses 30-40 kg/ha N. Minnesota, with 10 inches/year, loses about the same. He pointed out that water table depth is useful for research and for farmer to have information needed to understand how system is responding. Measurements can be as simple as a float with a flag that can be seen at a distance, but continuous monitoring is needed for research.

Larry Brown suggested a framework for this question consisting of 3 tiers: (1)Demonstration, (2) Demonstration and monitoring (3) Research

Tier	Monitoring needed	What we get
1 - Demonstration	Event-based volume, precipitation, crop yield, nitrate (can be grab samples)	Even-based load, annual load, yield, some management, some economics
2 –Demo and Monitoring	Drainage flow with time, water table depth daily, nitrate concentration with time, crop yield	All of the above + % reduction, limited input to models, not much more economics
3 – Research	Same as above plus climate, nutrient/pesticide suite, soil physical/chemical properties, carbon, plant parameters	Much more defensible

For every site, need soils information, topography, cropping and management history, yield history, subsurface drainage system map (as-built)

SWCS – ADMS TF session at National Conference in MN

Sheryl Kunickis, NRCS, presented an overview of the symposium titled "Improving Water Quality Through Agricultural Drainage Management Systems" that will be held at the SWCS meeting being held in Minneapolis, MN in July. There will be two 90-minute sessions on July 27, from 1:30-3 and 3:30-5. At the first session, Larry Clark, NRCS Deputy Chief for Science and Technology, will make opening remarks. Sheryl Kunickis will be the moderator. Speakers in this session include Norm Fausey, Wayne Skaggs, Matt Helmers, and Charlie Schafer. Mark Dittrich, MN Department of Agriculture, will give opening remarks for the second session. The moderator is Wil Fontenot. Speakers include Don Pitts, C. Madramootoo, Jim Fouss, and Gary Sands. These symposia offer include ARS, NRCS, and University scientists, as well as international participation.

She also said that she met with the appropriate FSA leaders to discuss the efforts of the ADMS Task Force and they are supportive. They asked that the NRCS review the buffer practice standards to see if they could be modified so that if buffers were to be installed over subsurface drains, the drainage would have to be modified. Otherwise, it defeats the purpose if the purpose of the buffer is to address nutrients. The NRCS staff responsible for the buffer standards will take it up with the standards subcommittee of the National Technical Guide Committee. It is uncertain as to how long the process will take as it will undergo a review and may have to be posted in the Federal Register. The FSA folks also indicated the importance of having the economics data that supports implementing drainage water management. They have the information that Charlie's group assembled, but they would like to have independent information.

Regarding the ADMS charter, the co-chairs of the PMT authorized Sheryl to obtain signatures from the principals NRCS, ARS, and CSREES, in order to raise this to a higher level in the USDA.

In the NRCS Science & Technology News, the message from Deputy Chiefs highlighted the activities in the Mississippi River Basin and some of the partnerships that had formed to address how to improve water quality. The ADMS is mentioned.

Finally, there was a reminder to look the Conservation Security Program (CSP) as water drainage management is a component.

Wednesday afternoon

ADM Coalition Update

Charlie Schafer thanked the Task Force for research and monitoring, without which there would be no story to tell. He described what the Coalition has done:

- Hired economic consultant to do cost/benefit analysis
- Are developing Web site – currently under AgriDrain site. Will be at admcoalition.com and admcoalition.org. Will cross-link with drainage industry, and can cross-link with Task Force.
- Networking with elected officials
- Supporting monitoring proposals when asked
- Modifying ADMSTF brochure for ADMC with Jim Fouss's approval

Anne Keys explained that Coalition meetings had been going so well they decided to take it to the appropriators.

- They asked for $2.5 million over 5 years for demonstration and research. It has been a great educational moment to talk to Congress and staffers about drainage. Staffers were very interested, happy to know that there is a Task Force. However, they note that this is a bad year – they may have to cut funding for existing research projects. This request was submitted to Senate Ag Appropriations Committee and probably to the House Ag Appropriations.
- She passed out a handout on cost-share programs
- She is helping state coalitions with state activities.
- Planning to go after foundation money. The proposal is compatible with the goals of the Joyce Foundation and Pew Charitable Trust.

Other Coalition members described their activities:

- Leonard Binstock (Minnesota) said the governor is working on funding for infrastructure to research stations to continue the work we are doing.
- Chris Overmyer of Francesville Drain Tile Co. reported that he is working with Purdue and LICA, and has had meetings with the State Conservationist.
- Barry Goodwin of Hancor said Hancor is supportive of Coalition efforts
- Illinois LICA supports ADMC financially
- Pat Dumoulin of the National Corn Growers Association said that corn growers are interested in practices that support environmental stewardship
- Steve Baker of the Plastic Pipe Institute and Springfield Plastics described the situation in Illinois, where Richard Cooke and Don Pitts' efforts have a lot of momentum. In fact they may overload Richard with so many potential sites that they can't be monitored. He also said that the Ducks Unlimited people are really excited, because migrating ducks prefer little wet pockets in the field. (He noted that EPA had also increased interest once habitat benefits were clarified.)
- Joe Streitmatter raised a concern about access to control structures in the middle of an 80-acre field. Can filter strips for access be part of the practice? Otherwise, how to keep from running over it with the combine?
- Jamie Dunnink of Prinsco said that Minnesota is a hostile environment to drainage right now, with articles on drainage problems appearing every week. But this also creates an opportunity. Pheasants Forever recently called to find out more.
- Mark Dittrich described the bonding issue in Minnesota.
- Nature Conservancy: Larry Clemens has assured the Coalition that they will help with implementation.
- Duane Sand of the Iowa Natural Heritage Foundation passed out several handouts including how to raise substantial money at the state level. He believes it is an appropriate time to think big.
    - Conservation Innovation Grants. Authorized for $100 million, appropriated at only $15 million, so more in the future. State Conservationists will also be authorized to do such grants at state level.
    - Partnerships and Cooperation: An NRCS directive to State Conservationists

    - Clean Water State Revolving Fund: Some grants? And 0% interest loans, which represent 35% grant equivalent over 20 years
    - Drinking Water State Revolving Fund: Good for high nitrate watersheds affecting drinking water. There are several of these in Iowa.
    - State Soil Conservation Agency
- John Torbert of the Iowa Drainage District Association explained that they are trying to move Drainage Districts to a more water quality mode
- Charlie Schafer said that AgriDrain is developing automated structures to make water control easier for the producer.

What Coalition would like to see: Charlie handed out 8 priorities of the ADMC, which focus on obtaining conservation program cost-share assistance on main line and control structures. The ADMC needs a better understanding of what is required to meet this objective. The questions listed below are meant to facilitate an understanding about this process.

a) Has the national practice standard 554 been finalized? Is it now a reportable practice in all NRCS field offices?

b) Is each state required to customize 554?

c) Have the state NRCS offices and State Technical Committees been briefed on 554?

d) For state 554 practice standards, can the ADMC provide technical assistance in creating specific design considerations, including site criteria and system operating requirements based on area, soil type, crop and planting date for each state?

e) Can ADMS help achieve establishing a TSP Course with out P.E. signoff requirement?

f) Does the ADMS have enough information based on existing research to estimate yield increases per crop, per region? Can you provide system operating guidelines for specific crops for various regions and soil types?

g) What are the needs to achieve flow reduction estimates to calculate N loss reduction (Drainmod-NII?)

h) Will USDA, NRCS, FSA, CTIC promote the practice to make producers aware of benefits and cost share opportunities

Training for Technical Service Providers

Pat Willey described training needed for contractors, TSPs, agency personnel (NRCS, State, District, etc.). This is being developed by a team including Larry Brown, Gary Sands, Art Brate. 1 to 1.5 day session, with core agenda. Could be portable from state to state, locally modified. Prerequisites for training: Should already be trained in subsurface drainage design, installation, and operation. Topics would include the following:

- Overview
- Controlled drainage (Why do it? Misconceptions)
- Practice 554 and associated practices
- Site requirements (soil, topography, size)
- Components of systems (control structures, open ditches, subsurface drains, etc.)
- Design of new systems with controlled drainage
- Retrofitting previous installations

- Management

This brought up questions about the requirements of certifying and designing practices.

- In some states, to design a grassed waterway, a Contractor has to show that he knows how to design and approve a waterway. However, he doesn't specifically get paid for the design.
- Beth Clarizia stated that in Indiana, you have to be a professional engineer (PE) to design a waterway. No provision for others to design and PE to approve.
- TSP process is different
- Comment: Could training be made available via CD-ROM?
- Major ADMC concern is that if PE sign-off is required on all designs, this is a big bottleneck. In reality, often engineers don't know much about drainage design so contractor does it, then a PE signs off.
- Professional Engineers pay liability insurance and are liable for their designs. It is a violation of engineering ethics for engineers to sign something they don't understand. The PE needs to review all the data, software used, etc.

Widening the Partnering Circle

Alex Echols talked about the Sand County Foundation's efforts. He introduced Nancy Drummy, who is doing farmer outreach in Wisconsin.

Dan Towery of the Conservation Technology Information Center (and NRCS) said the systems approach is fundamental. He described a visit the previous day to an innovative farmer to discuss drainage water management. The farmer's immediate question was the effect on nightcrawlers. (It is important that we don't solve one problem and create another.) He was also interested in cost-share aspects of the practice, especially if the entire system was cost-shared, and pointed out that the new tax code allows writing off $100,000 for improvements. Dan also discussed the use of remote sensing. Can we pick out conservation tillage vs. conventional tillage? How can it be used with drainage?

CTIC included an article on drainage management in *Partners* magazine. They could do another. They can also arrange tours for congressional staff. Dan also suggested another influential group that is often overlooked: Farm Managers/Rural Appraisers.

National Association of Conservation Districts (NACD) is another key player, with whom CTIC has a very close relationship. Anne Keys said she met with the new CEO. NACD is divided into regions, and the North Central Region is key for managed drainage.

Field Trip

- 25 people left for a tour of the Water Quality Field Station, earthworm middens, and a constructed wetland to treat drainage ditch water.
- Remaining members discussed strategies for looking at global warming and economics.

Thursday morning

Wil Fontenot opened the meeting by reviewing the previous day and the insights that have been provided. He said that today's agenda focuses on implementation.

Summary of Midwest Research Accomplishments

Wayne Skaggs presented preliminary results of a simulation study to evaluate the effects of management such as controlled drainage on nitrogen losses to surface waters yields. Together with Mohammed Youssef, he developed a new version of the Drainmod nitrogen model - Drainmod NII. The objective is to use this model on two soils per state in the five states. It is a complex model, and many elements in it haven't been tested yet, including freezing and fall fertilization. Work so far has focused on the Drummer soil in Illinois. Calibration is in process and not yet complete, so today's presentation is not on the results of calibration, but rather an application of the model with the first level calibration.

He showed graphs of two relationships:

1. N loss as a function of drainage intensity for various depths, and
2. Relative yield as a function of drain spacing for various depths.

These two curves are needed for each soil, in order to estimate benefits of various drainage management strategies, which could be used in trading, etc. He showed a preliminary economic analysis, which shows how focusing on farmer income rather than yield is important, if a cost for N loss is instituted (as either a carrot or stick). These results are preliminary, but if we have the response surfaces we can conduct such economic analyses.

He also showed graphs of yield for both conventional and controlled drainage over time. Each is higher in some years. People are sometimes disappointed with results, because they do not show a strong yield advantage to controlled drainage. There is more yield advantage on more intensively drained fields.

These were only preliminary results, but their importance is to show what could be done if adequate data are available. Design, management alternatives, and economic analyses depend on such data ("the gold standard"). Because we don't have enough, model can be used, if it is tested and validated.

Planning and Implementing Locally Led Projects

Wil Fontenot introduced Bill Boyd to talk about planning at the watershed scale and locally-led watershed management. Groups often have a local steering committee and a local technical committee. People at this meeting would be the technical committee. It is essential that we have participation from the extension service and researchers on technical committee to set parameters give guidance, tools, info, and references.

Bill Boyd: Our objective is to provide reliable, clear information so decision-makers can make good decisions. Farmers deal with risk all the time, so the key is to lay out our information with the uncertainty.

Why would someone use controlled drainage? 1. reduce nitrates. 2. conserve water (crop production) 3. subsurface irrigation. 4. use controlled drainage to force seepage through root zone of buffers. 5. to control phosphorus. 6. reduce subsidence in organic soils. 7. seasonal wetlands. 8. apply wastewater (block preferential flow). 9. kill night crawlers (need to think about effect on microbial life; also for some livestock farmers who think of fields as primarily being for manure disposal, reducing preferential flow might be a

concern.) The point is that different areas will be treated for different reasons. We can accomplish multiple objectives.

NRCS addresses multiple problems with systems of practices

- National practice standard 554 (Drainage water management). Not something you put in the field, but how you manage it. Cost-share would be incentive payment per acre for some number of years.
- National practice standard 587 (Structure for water control). This is an old practice that is used for many reasons. Not expensive – 50% cost-share, or could be raised to 75% or more.
- National practice standard 606 (Subsurface drainage). Could cost share on the added expense of a conservation drainage system. (Caution: can't increase drainage intensity on farmed wetland)

We need case studies, examples, various alternatives. Are we doing systems approach in Farm Bill right now – yes. Do we need projects to do that? Nothing in Farm Bill prohibits from doing it that way. It will help our people in the field working with landowners to keep thinking systems instead of practices.

State activities

Wisconsin

Matt Otto from NRCS Wisconsin reported by telephone. He said that NRCS is looking forward to their role with technical assistance, technical review, training, and watershed planning. Sand County Foundation and Discovery Farms are working on a tour for technical folks. Employees from NRCS will go to central Illinois June 1-2 see some drainage management practices, bioreactors, monitoring. Will bring information back to Wisconsin and create some pilot projects.

Q: The Rock River watershed is very large. Are they focusing on a particular part of it?
A: Initial work is pilot – a couple of small watersheds where DNR is doing monitoring. Working with a small number of farms in order to see results soon.
Q: What's your vision for Discovery Farm information and transferring on a wider scale?
A: Looking at drainage management projects, at pilots, see how effective they are and if so incorporate that into some of our other conservation projects EQIP – on a state wide basis.
Q: What role will partners play?
A: Large role – Rock River coalition, other groups involved in watershed activities, DNR, Discovery Farms, Sand County Foundation

Iowa

Jim Ayen said that NRCS Iowa has not yet approved Standard 554. He described the State Technical Committee in Iowa, which is one of the most active. More than 50 people show up for each meeting, and discuss EQIP rankings, etc.
Q: How might showcase watershed be chosen?
A: We could just choose one – but State Conservationist Leroy Brown would prefer to go through a much bigger process.

Stew Melvin introduced Matt Helmers, the new Extension Specialist and faculty member at Iowa State University. They continue to monitor controlled drainage plots in SE part of state.

Dan Jaynes of ARS in Iowa described data they are generating, including controlled drainage in a producer's field. They also have a CEAP watershed project, although that has not specifically included controlled drainage. Dan also described the multi-state research committee **NCR-207**, which was recently approved and will start Oct. 1. The committee will probably meet for two days each year, possibly in conjunction with the ADMS Task Force. Some funds are made available to universities through CSREES for this effort. It is a good opportunity to communicate more.

Minnesota
Mark Dittrich described a locally-led effort in Minnesota on the South Branch of the Root River.

Indiana
Jane Frankenberger presented five lines of activity that Indiana participants at the December meeting agreed on to advance drainage management.

1. *Get NRCS standard 554 approved*. That is done and Beth Clarizia will talk about it.
2. *Explore with FSA whether drainage management could be a subcomponent of CRP buffers*. LICA members and others met with the FSA CRP director in January, who said it could be done on a research basis.
3. *Figure out what parts of the state have the most potential*. Preliminary maps have been made.
4. *Set up demonstration/monitoring sites*. Dr. Barry Gutwein, agricultural engineer and former drainage contractor, is working short-term to develop some sites. We have identified one with two separate mains in the same field where we can monitor. We will focus in northwest part of the state, and also on a Purdue farm with high visibility.
5. *Conduct education on drainage management*. A number of people, including Purdue specialists, are conducting education.

Beth Clarizia, Assistant State Engineer, reported that the 554 standard had been revised slightly for Indiana and approved. It was not in place when EQIP signup started, but now has been decided as $40/acre for up to 3 years, with a maximum of $6000. For the 587 standard a percentage of installation is cost-shared. She also explained the priority setting. Every state has their own way of setting up their ranking variables between states. Some states send to different counties as to how to spend how they want to. In Indiana we made an effort to go through the EQIP ranking systems approaches, research concerns, split into state ranking 20 some odd maps – locally they also have ranking to identify resource concerns. To promote 554 practices, need to talk to local groups about fall/winter when locally led groups will decide what their concerns are for EQIP program. Resource concern first then ranking on state where they are and what condition on farm. Local process added to the state.

Ohio
Ohio has a kick off meeting next Wednesday, together with NRCS and the State technical committee. Dean will welcome people, they will introduce concept, NRCS will introduce standard. This meeting will begin the discussion process, so state technical committee can consider this as they meet again and rank things. They have ideas about showcase watersheds, and may identify others next week.

Q: Will farmers be there? How do you get the landowners input? **A:** We have a couple of farmers who do control drainage in Ohio. They were invited to be a part of this, but it's corn planting season. We hold many other meetings with farmers.

Report from Wednesday's Work Groups

The group that did not attend the field trip identified three topics that need to be addressed at the next meeting.

1. Global Warming Gases

The concern is what happens to the soil nitrate when the water table is raised in the non-growing season. Some may go into atmosphere as N2O (global warming gas). We need to know the current state of science and what our assessment is on those impacts. **Dan Jaynes** will identify a strategy for addressing this at the next meeting.

2. Economics

This needs to be addressed at three levels:

- Micro level (need answers for the producers)
- Watershed scale
- Analysis

Wayne pointed out that the economics is not very difficult to do. What's limiting is the input data. Until we get these model runs done, an economist would be data-starved. **Larry Brown, Wayne Skaggs, and Gary Sands** will work on a strategy for how to address the micro needs.

3. Design criteria

Art Brate and Pat Willey will report at next meeting. One strategy would be to ask the state engineers for each state.

Next meeting

It was decided that the next meeting would be held on July 28-29, in conjunction with the SWCS Annual Meeting in St. Paul.

The meeting adjourned at 12:30 p.m.

Notes by Jane Frankenberger, Purdue University, with assistance from Ann Houser of ARS.