The following comments concern the discussions in the EPA SAB Draft Report on the Hypoxia Action Plan & Nutrient transport in the Mississippi River System as it relates to drainage water management (controlled-drainage) on agricultural cropland (pp. 134-136; 263-264) and on freshwater wetlands (pp. 136-139).
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In general I was pleased with the extent of the discussions included in the draft report about the application of agricultural drainage water management (controlled-drainage) for subsurface drainage systems as a management practice to reduce nitrate loss carried from agricultural cropland with subsurface drainage discharge. The discussion on the linkage with phosphorus was also good, and I have some comments regarding that discussion.

On page 134 the effects of drain depth and spacing is discussed and some literature cited, and it is noted that the effects of drain depth and spacing on nitrate loss in drainage discharge have not been extensively studied. This is not surprising as the original concepts behind cropland drainage was for soil-water control in the soil profile to improve the root-zone soil moisture conditions to enhance crop production, plus providing a soil-water condition that permits surface traffic with farming equipment in the spring for tilling and planting and in the fall for harvesting. It has long been known that the design requirements (depth and spacing) for subsurface drains varied widely with soil types, and especially where well defined soil layers were involved. Most of the research dealing with nitrate loss in subsurface discharge has occurred during the past 20 years, and it has been published for most soils that the deeper the drainpipe (without an outlet control) the greater the loss for nitrate with the discharge – primarily because of the larger volume of soil-water drained from the soil profile by the deeper pipes. It could be noted that decreasing drainage intensity by shallow drainpipes installed at wide spacing is one method of controlled-drainage (or, “drainage water management” as it has referred to in more recent literature). Of course the shallow depth and wide spacing configuration results in less total soil-water (and nitrate) being removed from the soil profile with drainage discharge. It needs to be emphasized, however, that a major current problem exists because of thousands of hectares of cropland already drained with subsurface pipes installed at a depth greater than 1.0 meter and at relative close spacing (e.g., 15-25 meters). This is the situation that the Agricultural Drainage Management Systems Task Force [See Web Site at URL address; http://extension.osu.edu/~usdasdru/ADMS/ADMSindex.htm] (ADMS-TF) addressed by recommending retrofitting the drainage outlet pipes with a drainage flow-control structure to control discharge volume and thus significantly reduce nitrate loss (a 50% reduction in nitrate discharge has been reported repeated by a number of researchers at numerous locations in the humid region of the U.S.). The same type of outlet control structure is recommended for new installations of subsurface drainage systems. There is considerable evidence published in various media that the controlled-drainage concept (drainage water management) is successful in significantly reducing nitrate loss in subsurface discharge from agricultural cropland; that is why the ADMS-TF was formed to begin the promotion and implementation of the practice in the Midwestern States where much of the nitrate comes from that is flowing down the Mississippi River System to the Gulf of Mexico and contributing to the hypoxic zone.

The ADMS-TF has recommended that farmers who are beginning to use the controlled-drainage concept (drainage water management) focus their initial efforts primarily on controlling the drainage outlet during the non-cropping months (winter months); it has been reported by a number of researchers that a very significant amount of the annual loss of nitrate in subsurface drainage discharge occurs during the winter (non-cropping) months; this does not apply, however, where the soil profile freezes for a large portion of the winter months. The Task Force further recommends that as the farmer gains experience with operating the drainage water management system and develops an understanding of the system response(s) to changes in the drainage outlet control structure, he/she can begin to control the drainage discharge during the crop growing season. Care would need to be taken to insure the water table is not held too shallow for lengthy periods due to the damage to the crop root system by excessive soil-water conditions and/or causing excessive surface runoff events.

It can be reported in the SAB report document that research and demonstration projects are continuing to evaluate the application effectiveness of drainage water management systems in different regions of the U.S. where prior research has not been conducted, and this is taking place primarily in the Midwestern States. These new studies will provide additional data on the evaluation and the development of design & operational criteria for subsurface drainage water management systems, as well as their effectiveness in reducing nitrate loss from the cropland. It is well to emphasize, as is done in the SAB draft report, that the loss of P in the drainage discharge should also be quantified (or monitored) in these studies and demonstration projects. The report should also recognize that there may need to be some compromise in the control of N and P discharges from cropland in sub-drainage/surface-runoff flows. One compromise that might be considered is to maintain the water table depth somewhat deeper than would normally be recommended for maximum reduction of nitrate discharge, thus avoiding or reducing extremes in surface runoff events.

The on-farm drainage water management system should be considered one of the principle methods of reducing nitrate loss from cropland that contributes to the nitrate load in the Mississippi River System. One of its main advantages is that it is an “on-farm” method, and addresses the problem at the “source” and not downstream. The same “on-farm” terminology can be applied to other worthy management practices, such as, changes (improvements) in fertilizer management (application) practices, buffer strips, changes in tillage management, post-harvest crop residue management, and cover cropping (especially post-harvest). The ADMS-TF has recommended that other management practices, such as those listed here, be combined with controlled-drainage (drainage water management) to further reduce the nitrate loss from cropland; in other words, a “suite” of management practices will likely be required rather than just one key practices being the silver bullet to resolve the current problems. Additionally, if wetlands are available on the farmer’s land for diversion of subsurface drainage water for nitrate mitigation prior to the drainage flow entering a major stream or river, then that too could be counted as an "on farm" management practice to reduce the nitrate load in the MS Rv. It is recognized that diversion of nutrient rich stream flow through wetlands can be an effective practice and it must often be applied downstream where “on-farm” practices have not provided sufficient reduction in nitrate loading of the stream.

The section of the SAB draft report on Freshwater Wetlands is quite good. I would suggest only that the management practice of diverting of major stream flow (such as from the MS Rv) through a wetland

resource area be considered a complementary or supplemental practice, and one of a major suite of practices when combined can reduce the nitrate load in the MS Rv leading to the Gulf and the Hypoxic Zone.

I recognize (as have others) the need for additional research, especially as it concerns water and nitrate balances and impact on P losses if the water table is held too shallow, but the idea of drainage management (controlled-drainage) needs to be kept in the action plan as a viable option that has been proven to work through considerable research that has been published.

And finally, the discussion on cropland slope greater than 1%; there are technological advances being made that will potentially and economically overcome this constraint in the very near future - it should not be a long-term deterrent to the application of controlled-drainage (drainage water management) on a larger scale.

Comments provided by
Dr. James L. Fouss, P.E., Supervisory Agricultural Engineer and Research Leader **
USDA-ARS, Soil and Water Research Unit
4115 Gourrier Ave. (on LSU Campus)
Baton Rouge, LA 70808
Ph: (225) 578-0743; Fax: (225) 757-7728
E-mail: james.fouss@ars.usda.gov

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I am also the current Chair of the Agricultural Drainage Management Systems Task Force.