CONTROL OF PHOSPHORUS FROM AGRICULTURAL LAND IN THE GREAT LAKES BASIN

In just a few hundred years, a third of the heavily forested Great Lakes Basin--almost 19 million hectares--has been shifted to cropland and pasture. More than 3 million hectares, or 5 percent of the Basin, has gone into residential, commercial, and industrial uses.

Both Canada and the United States have profited greatly from these land use changes. The Great Lakes Basin includes the heart of North America's industrial establishment and produces a substantial part of its food and livestock feed.

Yet these changes in land use also have brought a tremendous cost in reduced water quality.

Accelerated eutrophication in the lower Great Lakes, and in certain nearshore areas of the upper Lakes, has resulted from high phosphorus loadings. Even with point-source controls in place in both nations, target loadings for phosphorus cannot be met without also reducing phosphorus from diffuse sources including agricultural lands.

Material prepared for summary presentation by Norman A. Berg at a conference on "Phosphorus Management Strategies for the Great Lakes," Rochester, New York, April 19, 1979.

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My paper summarizes the findings and recommendations of PLUARG and others as they relate to controlling phosphorus from agricultural lands. It also outlines some related strategies for implementing remedial measures mandated by the Great Lakes Water Quality Agreement of 1978, and describes some significant efforts that already are proving successful.

LIGHTS OUT - SLIDE RUN BEGINS

1. First, I want to discuss the findings, which are summarized in this familiar green book along with PLUARG's recommendations.

2. Some 24 percent (10,850 metric tons) of all phosphorus entering the Great Lakes in 1976 came from the Basin's agricultural land.

3. Within agricultural watersheds studied in Ontario, an estimated 70 percent of total phosphorus came from cropland--in one watershed it was almost 98 percent.

4. These slides have depicted sediment production, because about 60 percent of the total phosphorus was found to be associated with sediment.

5. The principal determinants seem to be: How much clay is in the soil?...How much of the watershed is in row crop use? Soils with high clay content were found to be high in phosphorus content, susceptible to erosion, and more readily delivered to streams.

6. Thus, we need to consider the soil first. Physiography, soil erodibility, drainage area, livestock population, and--to a lesser extent--fertilizer application also contributed.

7. In a given watershed, 80 to 90 percent of the sediment may be contributed by only 15 to 20 percent of the land area. This led PLUARG to the idea of "hydrologically active areas" to describe those parts of watersheds that need the most attention.

8. Second, I would like to discuss some of the technical solutions. As part of an overall management strategy to reduce phosphorus loadings from many sources...

9. There are a number of practices that can help control phosphorus losses from agricultural land. To be effective, they must be carefully selected and adapted to the soils and other conditions at each site--there is no panacea in water quality management.

10. Conservation tillage, for example, is very effective in reducing phosphorus losses on a wide range of soil types. Yet on some soils it must be accompanied by improved subsurface drainage in order to be effective. On some soils conservation tillage will not work!

11. PLUARG recommended that farmers within hydrologically active areas develop water quality management plans for their operating units in order to ensure that the practices <u>do</u> fit the site, and <u>do</u> blend with each other, and <u>do not</u> price the farmer out of farming.

12. Practices for reducing phosphorus losses from agricultural land are of three general types. Practices that reduce soil erosion--that is, reduce the detachment of soil particles--may include crop residue management, cropping sequences...

13. ...seeding methods, tillage methods, soil treatments, and timing of field work.

14. Contour farming also can reduce soil erosion. Yet these practices may not be effective where the slope is too long or the drainage area is too big. In that case the conservation system must include other practices.

15. Practices that control direct runoff may include contour stripcropping...

16. Terracing, contour listing, sod-based rotations, conservation tillage, and others. Surface runoff from cropland rarely can be eliminated--in most cases we wouldn't want to! It can be controlled, however, by increasing water infiltration rates, surface retention or storage, or interception of rainfall by growing plants or residues.

17. Practices that manage or control fertilizer and animal wastes may include limiting and timing fertilizer use...

18. Keeping livestock out of some areas near streams, and...

19. Installing systems to collect, carry, and treat or apply livestock wastes.

20. All of the practices together can make a substantial contribution toward reducing phosphorus losses from cropland and pasture.

21. In the 11 PLUARG study watersheds, the achievable reductions ranged from 36 to more than 50 percent.

22. Controlling soil erosion and sediment has other significant values besides reducing phosphorus. The soils in the Great Lakes Basin are some of the most productive in North America; keeping them in place and in good shape is important to the world's agriculture, and is a source of pride for food and fiber producers.

23. Keeping soil out of streams avoids serious effects on the physical aquatic environment, on fish populations, and on esthetics. Reservoirs will hold more water, bridges and stream channels can be maintained more easily and cheaply, and so on.

24. Benefits of reduced phosphorus loadings from erosion and sediment control would be shared by many millions of people within and outside the Basin.

25. What would the costs be? They would vary just as the watersheds and the soils and the effective practices do. In four PLUARG agricultural watersheds in Ontario, estimated costs range from $15 to $58 annually per hectare. In Black Creek, Indiana, initial applications of the practices cost $146 per hectare.

26. A significant part of the U.S. Lake Erie Basin may be treated at little or no long-term cost to farmers through the the use of

conservation tillage, although initial outlays for equipment may be an unwelcome cost.

27. Third, I would like to discuss a strategy for controlling phosphorus pollution. PLUARG's recommendations lay out a strategy for control of many pollutants from all nonpoint sources. In my paper we discuss them as they relate to phosphorus control from agricultural lands.

28. We discuss them in four components, beginning with development of plans...

29. Implementation...

30. Review and evaluation...

31. And public participation or consultation.

32. PLUARG said that management plans prepared by appropriate jurisdictions should include a timetable with program priorities...

33. Should designate the agencies that will implement them...

34. Should set formal arrangements for cooperation within and among agencies...

35. Should tell what the implementation programs are...

36. Should say how they will be funded...

37. Should estimate the reductions in phosphorus loadings...

38. Should estimate the costs to achieve them...

39. And should provide for public consultation and review.

40. PLUARG felt strongly about a role for the public and about a strong emphasis on information, education and technical assistance.

41. Every one of the 17 public consultation panels that contributed to PLUARG suggested greater emphasis on information and education. Every PLUARG member supported it.

42. "No constructive conservation program can be developed without changing the motivating attitudes and habits and redirecting the efforts...of citizens generally in the Region...In a democracy, education is more fundamental even than legislation as a force directing rational progress. It is the basis of wise legislation, promotes general acceptance of legislative and administrative measures, and guides individuals to action along lines consistent with the requirements of the society of which they are members."

43. This quotation is not from PLUARG's report, but rather from a report of the Great Plains Agricultural Council in 1936, discussing the future of the Great Plains. The thoughts are just as worthy of consideration today.

44. PLUARG also recommended that in developing management plans the existing planning mechanism should be used as much as possible...

45. That present fiscal incentives be reviewed...

46. That technical assistance programs be given more emphasis...

47. That legislation be reviewed to make sure there is a suitable legal basis for enforcement in case voluntary approaches prove ineffective, and that preventive aspects of laws and regulations be emphasized.

48. In implementing management plans, PLUARG felt that...

49. Regional priorities should be based on water quality conditions in each lake, the potential contributing areas identified, and the most hydrologically active areas within them.

50. PLUARG recommended that phosphorus loads be reduced to achieve individual lake target loads, and suggested some targets. Further reductions would be even better, PLUARG said, in order to improve nearshore water quality and prevent degradation.

51. PLUARG recommended that erosion and sediment control programs be improved and expanded to reduce the movement of fine-grained soil particles to the lakes.

52. PLUARG recommended that agencies help farmers develop and implement water quality plans for each farm in the most hydrologically active areas. These plans should consider all potential nonpoint source problems as well as the farmer's ability to sustain an economically viable farm operation.

53. PLUARG further recommended that wetlands be preserved and that farmlands with the fewest limitations be retained for agricultural purposes.

54. The U.S. Secretary of Agriculture's new land use policy also calls for advocating these same things.

55. PLUARG also emphasized that voluntary and regulatory controls would be needed, but that regulation should be used only where or when voluntary approaches do not achieve desired results.

56. In the PLUARG agricultural survey, 56 percent of the Canadian farmers and 71 percent of the U.S. farmers said the best policy for reducing water pollution was to rely solely on the voluntary cooperation of farmers.

57. Importantly, PLUARG felt that governments should maximize the use of existing programs before creating new ones. The "Section 208" agencies within the Basin, The U.S. Environmental Protection Agency (through its Great Lakes National Program office), and the Great Lakes Basin Commission have strong roles to play.

58. Soil and water conservation districts--190 of them in the U.S. Great Lakes Basin--have been actively involved in Section 208 water quality management planning as well as in aiding individual landowners. Canada has a less well defined mechanism for the on-site assistance, but there is excellent potential capability within the conservation authorities; Agriculture Canada; the Ontario Ministry of Agriculture and Food and other agencies in the Province of Ontario; and universities.

59. In review and evaluation of the strategies chosen, PLUARG recommended...

60. That nonpoint source interests be represented.

61. It felt that tributary monitoring should be expanded for more accurate stream loading estimates of several pollutants...that sampling should be based on stream response characteristics, with intensive sampling of runoff events where necessary...that the role of atmospheric inputs should be evaluated...that data should be coordinated better...and that the adequacy of nearshore and offshore water surveillance should be examined.

62. Again, PLUARG recommended a strong public consultation effort.

63. PLUARG did not recommend a rigid scheme for achieving target loads--rather, each jurisdiction should compare alternatives for cost-effective and politically acceptable solutions, and make better use of existing agencies and programs.

64. By working primarily through existing agencies, and by giving special attention to the cropland within the most hydrologically active areas--perhaps less than 25 percent of the Basin's agricultural land...

65. PLUARG felt that total phosphorus loads could be reduced by more than 1,000 metric tons a year.

66. Many recent developments in both nations in planning, workshops, research and extension, technical assistance, cost-sharing and grants have been encouraging. If they continue, phosphorus loadings to the Great Lakes will be reduced.

67. Conservation authorities and conservation districts in particular have shown a great ability to adapt to changing needs and priorities.

68. Application of water-quality management practices already has begun in several watersheds within the Basin as part of special projects and as part of ongoing assistance programs.

69. Systems already in place for waste management on farms are equivalent to the capacity needed to handle wastes produced by a city of 360,000 people.

70. Soil surveys have been completed on almost 90 percent of the potential contributing areas within the U.S. Great Lakes Basin lands.

71. These are an essential tool in locating specific hydrologically active areas and in selecting practices.

72. Every Soil Conservation Service office has a technical guide and several field manuals, and Canada has similar working tools.

73. A new cost-sharing program in the U.S., the Rural Clean Water Program, may well become the most important implementing authority in the Basin.

74. Influenced greatly by PLUARG's findings, the program applies only in critical contributing areas identified in EPA-approved Section 208 plans.

75. Farmers receive technical assistance and cost sharing under 5- to 10-year contracts.

76. Finally, I would like for a few minutes to think with you about the future...

77. The challenge of the future. May we have the lights back on?

LIGHTS UP -- SLIDE RUN ENDS

As far as agriculture is concerned, the principal planning and implementing mechanisms are in place to make its contribution toward meeting the goals. What seems to be needed is the commitment--on the part of federal, provincial, State, and local governments--to direct the needed technical, financial, and educational resources toward meeting the phosphorus goals described in Annex 3 of the 1978 Great Lakes Water Quality Agreement and (hoped for) by the public.

Will this happen?

The long-term implications of diffuse source control programs are well recognized, but we are admonished that this should not be used as an excuse for delay. We now have a management strategy to follow which is adaptable to physical, social, and political conditions throughout the Great Lakes Basin.

Will strategies for phosphorus control be meshed with overall strategies for achieving water quality in the Great Lakes? We do not want to unnecessarily and unwisely polarize pollution abatement into single-pollutant pigeon holes. We will be most effective by taking a holistic view that permits taking advantage of "piggyback" benefits of programs as well as avoiding contradictory results from separate programs.

Will these things happen?

They can, I think they will, but I think we must resolve to move a little faster.

--We have not yet fully addressed the recommendations of the Lower Lakes Reference Group to the International Joint Commission ten years ago.

--We have not yet fully addressed the early-action suggestions of PLUARG in 1974. Note, for example, that those proposals included the use of land for recycling wastes. As land use pressures within the Great Lakes Basin become heavier to meet many needs, one such pressure will likely be for locating land suitable for recycling wastes.

--As of December 1977, the U.S. and Canada had obligated more than $4.5 billion for sewage treatment in the Great Lakes in just six years; expenditures for controlling non-point source pollution are--to be kind about the comparison--minimal even in 1979.

--It will soon be a year since PLUARG gave its report to IJC on an "Environmental Management Strategy for the Great Lakes System." Its recommendations--and the nonpoint source water pollution that it addressed--need a higher public profile than they have yet received. This conference will help.

--Meanwhile, as I have mentioned earlier in this paper, not everybody in the several States and Ontario is waiting for final reports and assignments. We see some very positive efforts underway, with grass-roots public support and local leadership. I might add that not one of these efforts resulted in any new agencies being formed!

I am also greatly encouraged by a meeting I attended just two weeks ago, of agricultural experts from Ohio, Indiana, Michigan, New York,

Pennsylvania, and Ontario. There was a tremendous sharing of experience and knowledge:

--I saw dedication.

--I heard open and frank discussion of successes and failures.

--I heard a repeated challenge to get the best possible information to farmers in the best possible way.

--I heard about great differences in areas, in soil type and its response or behavior, and in climatic conditions and patterns.

Out of this session I became more convinced than ever that we need to use all of our tools in the tool box, in whatever mix is called for a specific situation--focusing, say, on erosion control in Ohio, livestock waste controls in New York. No one strategy, no one practice will do it all; no-till is great where it fits, but we should not "throw away the plow."

I am likewise convinced that water quality is more likely to improve if final land use and treatment decisions are made in the field. By far the best way to achieve an effective and acceptable program would be through one-on-one assistance to landowners. With the small number of employees and volunteers that we'll have to do the job, however, we will have to augment the one-on-one with some other ways of sharing our knowledge with landowners.

As PLUARG suggests in its final report, we will need to expand our knowledge by:

--Looking more closely at near-shore areas, which are the most affected by man's activities.

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--Studying the biological availability of pollutants.

--Measuring in-lake contamination.

--Quantifying the loadings from various lands.

--Better defining pollution and better identifying hydrologically active areas.

--Studying the short-and long-term effectiveness of remedial measures.

I am very optimistic about the future if, while we seek to expand our knowledge, we will move quickly to help landowners use what we already know. In the United States, we have learned much through working with our Canadian friends in the PLUARG studies. These efforts will help our nations separately and jointly proceed with action programs to accomplish our goals for the Great Lakes.

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