**Feasibility of innovative water and crop management practices to reduce nutrient loading from agricultural watersheds**

Watershed Systems Research Program

Project report LOBB 2012-0893

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**Executive Summary**

The Watershed Systems Research Program (WSRP) based at the University of Manitoba (UofM) has been examining watershed management options to reduce the loading of phosphorus into Lake Winnipeg.

The management of surface water is considered to be a critical element to an effective strategy to improve water quality. Technologies and practices must target the phosphorus-loaded runoff associated with spring snowmelt especially from agricultural land in the Red and Assiniboine River basins. A suite of technologies and practices is most likely required, and they will be most effective when implemented as part of an integrated management system and operated at the local scale: the field, farm, and/or community scale.

In 2011, the WSRP began exploring the use of innovative surface water management systems integrating technology to collect, retain and reuse surface water at a farm scale.

In 2012, Manitoba Rural Adaptation Council (MRAC) and Deerwood Soil and Water Management Association funded a project to assess the feasibility of such systems at a conceptual level. This project was considered the first phase in a program of research to evaluate the effectiveness of constructing systems to collect, retain and support reuse of surface water on agricultural land at reducing the loading of nutrients to the watershed; delivering on-farm benefits; and providing flood mitigation.

In the fall of 2012, Manitoba Conservation and Water Stewardship supported a second phase (this project) to examine the potential for on-farm retention systems and identify beneficial locations to implement systems.

This project had two major components: (i) the application of the Watershed Classification Database to a regional assessment methodology for the selection of surface water retention systems; and (ii) the development of a Watershed Management Model to assess the costs and benefits of surface water retention systems.

The Watershed Classification Database is a spatial database under development at University of Manitoba, which encompasses the whole of Lake Winnipeg Watershed. Data have been gathered from Canadian and American sources and analyzed through ESRI ArcGIS and Microsoft Access. For the purposes of this project, the analyses focused on the Manitoba portion of the watershed.

The Watershed Management Model is built in Microsoft Excel and tracks water, phosphorus, costs and other environmental consequences. The key attribute of the model is that it allows various combinations of management features (blocks) to be assembled. The intent is that information about P, water and money is transferred block-to-block, and within each block the effect of the corresponding management features on these quantities is computed. The model used data collected from the Red River Valley and other sites within Manitoba.

These models were used to provide a framework for decision making both at the regional and farm levels. They are limited by the quality and quantity of the data available, but can be improved as new data becomes available and as our understanding of these surface water retention systems improves. The output from these models, at this point, is considered to be for comparative purposes to aid decision making in the next phase of this research program.

The findings of this project suggest that the need for and performance of surface water systems varies greatly across the province. The findings strongly suggest that on-farm surface water retention will provide an effective means of reducing downstream impacts of runoff and the associated phosphorus. At the same time, the benefits to the farmer may be great enough to support the adoption of such techniques by individual landowners. This work indicates that a more thorough assessment should be conducted, and we strongly recommend that example systems be established to assess and demonstrate the performance of different types of systems across the province, especially within the Red River Valley.