Report of the Organizing Committee on the Prairie Provinces Water Board Drainage Workshop of September 24 - 25, 2001, Saskatoon, Saskatchewan

October 5, 2004

Background

Agricultural drainage and its impact on downstream jurisdictions has been the subject of much controversy and confrontation in the Assiniboine River basin. This controversy led directly to the initiation of the Upper Assiniboine River Basin Study (UARBS) in 1996. Similar levels of drainage have occurred and continue to occur in other interprovincial watersheds including the Swan, Woody, Red Deer, Overflowing and Carrot River basins. However, the level of conflict has not been either as apparent or as public as in the Assiniboine River basin. In addition, natural flows developed for the Prairie Provinces Water Board (PPWB) for these basins have not been adjusted for the effects of historic ad hoc, unauthorized drainage activities, primarily because no methodology exists to objectively identify and determine the impacts of such works.

One of the primary objectives of the UARBS was to develop a hydrologic model which could be used to assess the impact of agricultural drainage on streamflow. Unfortunately, that objective was not attained. The Board discussed the issue at PPWB Meeting #64 in March 2000 and agreed that:

- The issue of agricultural drainage in the Assiniboine River basin and in other interprovincial basins has been and continues to be of concern to the PPWB.

- There is an ongoing need to understand and quantify on a basin scale the impact on hydrology of landscape changes including both ad hoc private drainage and organized drainage projects.

- There is a priority need for an improved methodology to properly assess the impact of individual existing and proposed drainage projects, to facilitate the provincial agencies' regulatory responsibilities for approval of drainage proposals and for investigation of drainage complaints.

At PPWB Meeting #65 in November 2000, the Board directed the Committee on Hydrology (COH) to consider holding a drainage workshop by March 31, 2001. For a number of logistical reasons, the workshop was delayed until early fall of 2001.

The purpose of this report is to document the objectives, organization, and outcomes of the Workshop which can inform the COH and its member agencies of the status, needs, and opportunities surrounding assessment and regulation of agricultural drainage in the Prairie Provinces.

Workshop Objectives

Based on the direction provided by the PPWB and the COH members, and discussions within the workshop organizing committee, the final objectives for the workshop were:

1. To review the current state of knowledge and practice for assessment of the impact on hydrology of agricultural drainage on local, watershed and basin-wide scales.

2. To identify what operational tools are needed for the assessment of agricultural drainage projects.

3. To outline a course of action which will lead to the development of the necessary operational tools.

These three objectives were condensed into the stated overall purpose of the workshop: ***"****To start the process of engaging stakeholders in a discussion about potential tools which would improve the ability to assess the effects of agricultural drainage at the on-farm, sub-basin and watershed levels on the Canadian Prairies."*

Workshop Organization

Organizing Committee:
The workshop organizing committee was chaired by Ron Woodvine (PFRA) and included Hugh Nelson and Girma Sahlu (Environment Canada), Bart Oegema (Sask Water), Bob Harrison (Manitoba Conservation), and Michael Seneka (Alberta Environment).

Workshop Agenda:
Prior to the workshop, a draft agenda was distributed to those workshop participants who had registered (**Appendix A**). Included in the package of material provided at the workshop was a one-page final agenda (**Appendix B**)

Facilitator:
The workshop was facilitated by Erwin Allerdings, a PFRA employee with extensive experience in assisting both government and non-government groups and organizations work through issues to identify problems, common understandings and values, and then move to articulating action plans for agreed priorities.

Participants:
The intention was that participants would consist of staff from the PPWB member agencies and invited experts from outside government and non-government agencies, research and academic institutions. The workshop had a total of 41 participants from Sask Water (14), Environment Canada (9), PFRA (6), Manitoba Conservation (5), Alberta Environment (3), Ducks Unlimited (3), and one private consultant. A list of the workshop participants with updated email addresses where available is included in **Appendix C**.

Workshop Outcomes

Summarized below are the workshop outcomes, organized by the three objectives set out for the workshop.

Objective #1: To review the current state of knowledge and practice for assessment of the impact on hydrology of agricultural drainage on local, watershed and basin-wide scales.

As can be seen in the workshop agenda, a number of presentations were made to update the participants on recent studies and technologies related to agricultural drainage detection and assessment. Presentations discussed:

- Background to PPWB involvement in drainage, leading to purpose of workshop
- Current drainage policy, regulation, assessment, and development in Saskatchewan, Manitoba, Alberta, and Minnesota
- Review of UARBS assessment of drainage
- Emerging technologies – Remote Sensing
- Devil's Lake Hydrologic Model
- NWRI – elements in modelling prairie hydrology

Objective #2: To identify what operational tools are needed for the assessment of agricultural drainage projects.

- A panel discussion provided several perspectives on what is needed to assess agricultural drainage impacts. The strongest needs identified were as follows:
    - Clear understanding of the effect of a drainage project
    - Bring best information to bear in decision-making
    - Incorporate drainage into watershed management planning
    - Public and stakeholder involvement – they need to understand how drainage projects impact downstream flows
    - Assessment of cumulative drainage impacts
    - Separating impact of drainage from impact of land use/cropping changes
    - Producers need incentives to act for public good
    - Use of technology e.g. Remote sensing – radar to 15 cm accuracy
    - Modelling based on areal data rather than point data

- Breakout discussions on identifying the current challenges in drainage assessment resulted in consensus around the following five areas of need:
    - Practical Hydrologic Model
    - Data Acquisition and Management
    - Public Involvement in Watershed Planning
    - Project Assessment
    - Downstream Issues

- In each of the five areas of need, the groups then identified key operational tools for the assessment of agricultural drainage projects on the Prairies. The following boxed text in **Table1** summarizes the ideas generated in each of the five areas of need. The bolded text represents potential tools that were felt by the group to have the highest priority.

Table 1 – Summary of Needs

ɑctical Hydrologic Models
Decision support system
module (spatial data)
module (accepts input from user),
module - runs a process based on data, user input such as regional characteristics
a system where multiple methods can be used to define the results (SCS, etc.)

ta Acquisition & Management
drainage inventory and database
GIS software - continuity among agencies
(open source) policy for data
central data repository for users to access
soft data capture
common data analysis tools
Newsletter (web-site) for dissemination of information

blic Involvement in Watershed Planning
Answers - Effect of drainage on downstream areas - a) prediction, b) demonstration (**Predictive model to assess downstream effects)**
Answers - feed into decision making process - consistency across government, clear goals, policies
public education forum - provide the access
Legislative Framework
Technical Assistance
Regulatory functioning
watershed associations - establish, facilitate communications amongst different groups at sub-basin to basin level

)ject Assessment
ability to process and management data (at the local level)
hydrologic model research
economic model research
Water Quality Model
Environmental Quality Model
Downstream strategy to assess/mitigate damages

wnstream Issues
supply area/volume relationship to users
watershed plans to address downstream issues - flood plain policy, mitigation alternatives, local solutions
hydrologic models to assess cumulative downstream effects of changes in hydrologic response (**Predictive model to assess downstream effects)**
Classification of definitions - e.g. adequate outlet
Process to reveal proposals - integrate DFO, provinces

_ The group as a whole then defined five high-need operational tools out of all the potential ideas generated during the breakout groups as outlined in **Table 2** below.

Table 2 - Tools Identified

ool scription	**haracteristics / Actions** efined by workshop group)
ecision Support System (DSS) visioned to be in regional offices and used by field staff. Ranging from charts, tables, and nomographs to laptop GIS	entory of static databases am set up to develop a process for DSS ocess designed to develop DSS S design criteria and objectives
ainage inventory and database visioned as a longer term project to deal with the issue of quantifying the amount and nature of agricultural drainage to ultimately provide a reliable source of information on drainage activity	ntify all data sources (metafile) ntify data conversion schedule to GIS n pilot project(s) to evaluate data suitability (inter-provincial) idelines for data standards and for data conversion gin data conversion to digital environment nduct pilot project st different technologies for data collection
airie hydrologic model research and development visioned again as a longer term project focusing on improved understanding of prairie hydrologic processes, including wetland storage, and then developing models to simulate those processes.	ablish technical working group to review process fine clearly prairie hydrology - processes significant fine who will do the work/ contact info - coordinate agencies, funding k a pilot study area ntify data gaps and required monitoring yond one year: model selection/ development ad evaluation of existing algorithms/ components at is ready? at is missing? at needs improvement?
pen Source Policy for data ntified the need for a paradigm shift in data access	ablish working group (2 from each agency) view and suggest improvement to existing policies ablish structure of data consortium and ownership of data ablish Data Inventory /participants (hydrometric, met, air photo, private, public) rt database engine
edictive model to assess downstream effects visioned for use by hydrologists to assess incremental and cumulative effects of drainage and to separate drainage effects from those caused by changes in land use.	cess and begin analysis of available hydrometric data fine a predictive tool view of existing body of knowledge

Objective #3: To outline a course of action which will lead to the development of the necessary operational tools.

Time ran short for the final session of the workshop, however an attempt was made to identify actions and time lines for each of the five tools using a worksheet developed by the Canadian Institute of Cultural Affairs. The partially completed worksheets are attached as Appendix D. In the wrap-up session, an optimistic timeline for next steps was identified to move ahead on tool development as outlined in **Table 3** below.

Table 3 – Next Steps

ext Steps	hen
Discussion by COH & recommendation to Board to move forward on one or more tools	p. 26/01
Board discussion and commitment of agency resources to develop specific tools	t. 16/01
Workshop Report	t. 31/01
Develop action plan	c. 31/01
Begin to develop tools	ar/02

Post - Workshop Developments

While neither the workshop organizing committee nor the COH have taken steps to implement the suggested actions coming out of the workshop, a number of significant initiatives and changes have been made by member agencies and others since September 2001.

Open Source Policy for Data:

- PFRA have initiated the National Land and Water Information Service (NLWIS)
- Environment Canada has made all hydrometric data available over the Web
- The Saskatchewan government is moving towards a coordinated GIS strategy whereby datasets held by various departments and agencies will be accessible to all.
- Manitoba has a strategy whereby GIS datasets will be available on the Manitoba Land Initiative web-site. Manitoba, in conjunction with PFRA, has been delineating watershed boundaries, which will be on the site.

Decision Support System

- The Saskatchewan Watershed Authority (SWA, formerly Sask Water) is developing an internal GIS Strategy to coordinate with the provincial strategy and to enhance access of all SWA staff to GIS. The proposed vision statement for this strategy is: *Providing enhanced access to high-quality geographical information that increases the effectiveness of business operations and decision-making through improved information, process integration, and coordination with other government agencies.*

Public Involvement in Watershed Planning

- With the support of Manitoba Water Stewardship, the Swan River basin Round Table recently completed the Swan Lake Basin Management Plan. Drainage was recognized as an important issue, however specific actions on resolving drainage issues were deferred in favour of actions centered around four key themes: a Basin Education Plan, a plan for a basin Annual Water Report, a Riparian Enhancement Plan, and a Surface Water Runoff Plan. As a transboundary watershed, this planning process was led by stakeholders from both Manitoba and Saskatchewan with support from Manitoba Water Stewardship and a 21 member Technical Advisory Group.
- SWA has embarked on watershed planning with high local involvement in a number of watersheds across the province including the Lower Souris (i.e., Pipestone, Jackson, Gainsborough creeks, and Antler River) in which drainage has been a significant concern. Follow-up continues from the UARBS, and SWA has participated in the recently completed Swan Lake Basin Management Plan.
- Currently, there are 16 Conservation Districts in Manitoba covering over 60% of Agro-Manitoba. Individual District boundaries may vary, however they are usually based on the drainage basin or watershed of the major river in the area.
- Manitoba is developing a Water Strategy to deal with new legislation, improved financial foundations, and integrated water planning and management on a watershed basis.

Prairie Hydrologic Model Research and Development

- NWRI has a PhD student working on the issue of variable contributing drainage area from year to year. The current hydrology practice assumes the entire “effective” drainage area contributes in all years with median inflow or less and that increasing portions of the non-effective area contribute in increasingly high flow years. A more sophisticated paradigm for contributing area would be welcomed by practicing prairie hydrologists.
- Modelling by NWRI of the Peace-Athabasca river system has been modified to incorporate routing through wetlands. This effect was seen to be an important factor in the hydrology of the Peace-Athabasca.
- NWRI and the Canadian Centre for Remote Sensing (CCRS) conducted a joint project for the Roseau River basin in southern Manitoba. Remotely sensed areal data and automated data collection via meteorological instrumentation was utilized in a hydrology model. This data focused on the areal distribution of soil moisture, a critical parameter for the vertical water balance and horizontal routing of flow.

Appendix A

Prairie Provinces Water Board (PPWB) Drainage Workshop
September 24 and 25, 2001
Saskatoon Inn, Saskatoon, Saskatchewan

Workshop Objectives

1. To review the current state of knowledge and practice for assessment of the impact on hydrology of agricultural drainage on local, watershed and basin-wide scales.

2. To identify what operational tools are needed for the assessment of agricultural drainage projects.

3. To outline a course of action which will lead to the development of the necessary operational tools.

Draft Workshop Agenda

Monday, September 24

1500 Registration

1530 Opening Remarks (Workshop Chair – Ron Woodvine)

1535 Purpose of the Workshop (Richard Kellow)

1545 History of PPWB Involvement in Drainage Issues (Jim Rogers)

1615 Provincial Perspectives – Manitoba (Darwin Donnachuk and Perry Stonehouse), Saskatchewan (Jim Gerhart and Doug Johnson) and Alberta (John Taggart)
- General Legislative Framework
- Type and Scale of Drainage Activity
- Magnitude of the Problem
- Routine Assessments / Case Studies

1830 Dinner (Provided)

2000 Panel Discussion on Necessary Operational Tools

2100 Day 1 Adjourn

Tuesday, September 25

0800 Review of Upper Assiniboine River Basin Study (Bart Oegema, Bob Harrison, Larry Wiens)
- Conceptual Overview
- Contributing Drainage Area Approach
- Area-Volume Relationship for Prairie Wetlands
- Statistical Analysis of Hydrometric Data
- SLURP Modelling

0900 Emerging Technologies
- Remote Sensing Application to Blackbird and Smith Creek Basins (Lyle Boychuk, Ducks Unlimited Canada)
- Devils Lake Basin Hydrologic Model (Rick Bowering, Manitoba Conservation)
- Enhancements to Conventional Hydrologic Models (Alain Pietroniro, NWRI)

1000 Break

1030 Breakout Groups to Determine Necessary Actions to Develop Operational Tools
- Define Appropriate Operational Tools
- Develop Action Plan
  - Field Monitoring
  - Hydrologic Modelling
  - Remote Sensing
  - Empirical Techniques
  - Other Technical Approaches

1200 Lunch (Provided)

1300 Conclusion of Breakout Group Discussion

1500 Break

1530 Workshop Summary and Identification of Next Steps

1600 Adjourn

Appendix C

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Appendix D

PPWB Drainage Workshop: Operational Tools for Assessment of Agricultural Drainage

Sept 24 -25th, 2001, Saskatoon Inn, Saskatoon

	TOOL - DECISION SUPPORT SYSTEM		**POSSIBLE ACCOMPLISHMENTS** Brainstorm possible accomplishments for this time period that build on the advantages and
PRESENT	**STRENGTHS** In implementing this strategy at this time, we have the following strengths: Modular, flexible Users at different levels Can become more sophisticated Start with what you have -	**WEAKNESSES** In implementing the strategy at this time we have the following weaknesses: Needs resources Only as good as the data	Inventory of data holdings design decision support prototype (conceptual) team to develop inventory and begin process
FUTURE	**BENEFITS** In the future, the benefits of implementing this strategy are: Visual presentation Rapid process for decisions Improves consistency / logical progression	**DANGERS** In the future, the dangers of implementing this strategy are: Needs buy-in from staff Could be resource intensive ("money pit")	**MEASURABLE ACCOMPLISHMENTS** Choose an accomplishment which Is catalytic Is realistic Will have a substantial impact Will inspire commitment and action Taking all the above into consideration, we are committed to the following measurable accomplishments: By March 31, 2002 we: By Sept. 30th, 2002 we: -

PPWB Drainage Workshop: Operational Tools for Assessment of Agricultural Drainage

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	TOOL - DRAINAGE INVENTORY AND DATABASE		POSSIBLE ACCOMPLISHMENTS Brainstorm possible accomplishments for this time period that build on the advantages and acknowledge the limits are:
PRESENT	**STRENGTHS** In implementing this strategy at this time, we have the following strengths: Communicating locally Credibility Inter-agency – work together	**WEAKNESSES** In implementing the strategy at this time we have the following weaknesses: Old data – need accurate data Keeping data current – costs Initial cost (high)	Identify current conditions Assist in resource management Pilot project – data collection Guideline for data standards
FUTURE	BENEFITS In the future, the benefits of implementing this strategy are: Standard data formats Agency being able to use other agency data	**DANGERS** In the future, the dangers of implementing this strategy are: moving too quickly without data conversion standards	**. MEASURABLE ACCOMPLISHMENTS** Choose an accomplishment which Is catalytic Is realistic Will have a substantial impact Will inspire commitment and action Taking all the above into consideration, we are committed to the following measurable accomplishments: By March 31, 2002 we: By Sept. 30th, 2002 we: -

ACTION PLANNING WORKSHEET THE CANADIAN INSTITUTE OF CULTURAL AFFAIRS 1985, 1998

PPWB Drainage Workshop: Operational Tools for Assessment of Agricultural Drainage

Sept 24 -25th, 2001, Saskatoon Inn, Saskatoon

	TOOL - PRAIRIE HYDROLOGIC MODEL R&D		POSSIBLE ACCOMPLISHMENTS Brainstorm possible accomplishments for this time period that build on the advantages and acknowledge the limits are:
PRESENT	**STRENGTHS** In implementing this strategy at this time, we have the following strengths: 20 years of expertise – directive, research, technician Other agencies in same position Momentum of Assiniboine River Study	**WEAKNESSES** In implementing the strategy at this time we have the following weaknesses: Too much window shopping Point well understood but scalable	Pilot study – 1 year Define prairie hydrology (synthesis of processes) – what drives and what outputs - 6 months Define who will do work/ contact info – coordinate individual/agencies – funding - 6 months Establish technical committee to review process - 6 months Pilot study area and identify data gaps or potential additional monitoring – 1 year Broad evaluation of existing components – what works, what is missing and what needs improvement – one year plus
FUTURE	**BENEFITS** In the future, the benefits of implementing this strategy are:	**DANGERS** In the future, the dangers of implementing this strategy are: View to distributed modelling in the future	**. MEASURABLE ACCOMPLISHMENTS** Choose an accomplishment which Is catalytic Is realistic Will have a substantial impact Will inspire commitment and action Taking all the above into consideration, we are committed to the following measurable accomplishments: By March 31, 2002 we: By Sept. 30th, 2002 we: -

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	TOOL - OPEN SOURCE POLICY FOR DATA		**POSSIBLE ACCOMPLISHMENTS** Brainstorm possible accomplishments for this time period that build on the advantages and acknowledge the limits are:
PRESENT	**STRENGTHS** In implementing this strategy at this time, we have the following strengths: Have control data collection agency Pooling of resources – cost effective Eliminates repetition Fed/Prov cooperation agreements already exist	**WEAKNESSES** In implementing the strategy at this time we have the following weaknesses: Current cost recovering policies Lack of sharing databases due to security and maintenance responsibilities Duplication of costs Not having a specific agency to be owner of the databases	1. Establish working group (2 from each agency – data and resources) 2. Review and suggest improvements to existing policy 3. Establishment of structure of data consortium and ownership of data 4. Establish data inventory / participants (e.g. hydrometric, meteorological, air photos etc) – private and public 5. Start database engine
FUTURE	BENEFITS In the future, the benefits of implementing this strategy are: Sharing of information Ease of access to more information Data standards/ quality control One stop shopping	**DANGERS** In the future, the dangers of implementing this strategy are: Reallocation of resources from other programs Disparity in value of data to partners Incomplete sources of data	**. MEASURABLE ACCOMPLISHMENTS** Choose an accomplishment which Is catalytic Is realistic Will have a substantial impact Will inspire commitment and action Taking all the above into consideration, we are committed to the following measurable accomplishments: By March 31, 2002 we: 2 By Sept. 30th, 2002 we: 3,4 and 5

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	TOOL - PREDICTIVE MODEL TO ASSESS DOWNSTREAM EFFECTS		POSSIBLE ACCOMPLISHMENTS
			Brainstorm possible accomplishments for this time period that build on the advantages and acknowledge the limits are:
PRESENT	**STRENGTHS** In implementing this strategy at this time, we have the following strengths: Easy of use Consistency in results Readily accessible data Generally acceptable results Can be incrementally improved as new research is completed	**WEAKNESSES** In implementing the strategy at this time we have the following weaknesses: Site specific accuracy may be suspect	Accessing and analyzing available hydrometric data on drained watershed which will provide the basis for tool development Identify pertinent major watershed characteristics and effects on runoff hydrograph
FUTURE	**BENEFITS** In the future, the benefits of implementing this strategy are: Facilitates development of watershed plan Facilitates policy, program and legislative decisions Results in public confidence that assessments are done in a technically sound manner Quantify changes in hydrograph (peak, volume, timing)	**DANGERS** In the future, the dangers of implementing this strategy are: May fail to produce acceptable results	**. MEASURABLE ACCOMPLISHMENTS** Choose an accomplishment which Is catalytic Is realistic Will have a substantial impact Will inspire commitment and action Taking all the above into consideration, we are committed to the following measurable accomplishments: By March 31, 2002 we: Will access and begin analysis of available hydrometric data