

EXECUTIVE SUMMARY

RED RIVER FLOODWAY EXPANSION

VALUE ENGINEERING/VALUE ANALYSIS (VALUE) STUDY

INTRODUCTION

The City of Winnipeg was founded as a result of the rivers being the transportation route for the fur trade and railroads opening western Canada. Unfortunately, as we have discovered over the past 200 years, there is an inherent risk of flooding on the bed of glacial Lake Agassiz. The Red River Floodway is the single most important part of the infrastructure that exists to sustain the City of Winnipeg's future viability. The 1996 and 1997 floods clearly demonstrated that greater attention needs to be afforded to upgrading the flood protection infrastructure so that it is ready in advance of extreme flood events. We are now on the threshold of a new opportunity to improve flood protection for the inhabitants of the Red River Valley by Floodway Expansion.

KGS Group carried out a preliminary study to explore the issue of Flood Protection for the City of Winnipeg (CoW) and presented their findings in the Report titled "Final report on Flood Protection Studies for Winnipeg". The Floodway Expansion Design Concept outlined in the Report, expanded to include control of summer water levels in the City, and consideration given to operating the Floodway at water surface levels at the inlet above 778 feet, comprised the Value Study scope. The Floodway Expansion concept described in the Report was considered to be the "Base Case" for the Study.

The Project Vision was **established as** *to protect The City of Winnipeg against flood damage from extreme events*. The Project Mission was **established as** *to upgrade the capacity of the Red River Floodway from the current design capacity to a minimum of 140,000 cfs, and to control Red River water levels through the City of Winnipeg in order to protect the city from basement flooding during extreme summer rainfall events and make the Forks Walkway usable*.

The primary objectives of the Study were to identify project components/methods to provide the best overall value-for-money project, identify ways to reduce project risk in terms of cost schedule and overruns, identify early activities to realise flood protection benefits and generate consensus within the local consulting/construction industry and between government departments. The secondary objectives included reviewing unit prices for cost estimates, generating "Made in Manitoba Solutions", optimising operating and lifecycle costs, incorporating innovative concept(s), improving constructability aspects of the project, identifying modifications required to meet summer water level control, ensuring no interruption to the raw water supply to the City of Winnipeg, identifying new recreation opportunities and maintaining ones that currently exist.

WORKSHOP DELIBERATIONS

As a result of our Value Study of the Floodway Expansion Project, the Value team endorses the general concept of expanding the Floodway channel to 140,000 cfs and raising the West Dike and West Embankment to a minimum of 784' to handle a 1 in 700-year flood event. We applaud the excellent efforts completed to date on the project by KGS. However, the team addressed some project issues not resolved by the current design, many of which were noted in the KGS documents and recommended for further planning and resolution. Among the most significant were summer water level control in the City of Winnipeg, reliability and security of the inlet structure, timing of

geotechnical, groundwater and environmental studies and approvals, compensation, recreational features and reliance on emergency raising of primary dikes by more than 2 feet for protection from a 1 in 700 year flood event.

Following extensive pre-workshop information gathering which included the formation of a trial vision, mission and scope, the Value Study workshop began with a presentation of the "Base Case" by the KGS team and analysis of the "Base Case" by the Value Study team. A creativity phase then generated over 180 ideas for value improvement, in terms of improved project focus, scope and reliability, mitigation of risk, improved scheduling, reduced operating or lifecycle cost, reduced environmental impact, identification of areas of innovation, improved constructability and generated "Made in Manitoba" solutions. As a result of judgement of these ideas, and development of trial proposals, the Value Team reduced these ideas down to 30 recommendations. The surviving trial proposals were further refined and grouped into a preferred Modified Base Case option. In addition, an Enhanced Protection option was developed including focused additions to the Modified Base Case. Finally, a City Infrastructure Modification option was also developed that can be added to either of the other options.

INITIAL RISK REVIEW

An initial risk review was undertaken, where all risks associated with the major components of the project were reviewed and a Risk Register created. These included the upgrading of the Floodway, the raising of the West Dike, the upgrading of the City of Winnipeg Infrastructure and Floodway Management (including Project Development, Implementation and Operation). The risk study group brainstormed all risks to do with Management, Design and Construction, Operation and Third Parties which amounted to around 50 in total.

An initial review of the risks suggested that some 35 of the risks identified were likely to be significant. Some of them could involve fairly large costs (and related delays to implementation of the 1/700-year flood protection) if they were to occur.

It must be emphasised that this was a very preliminary review, so that any results are crude at this stage. It is normal with this type of study to review the results several times, adding risks and removing duplicates, gradually improving the confidence in the Risk Register. Future work on Risk Assessment should include:

- Investigate/Quantify Risks and Establish a Comprehensive Risk Register and Management Plan
- Investigate risk impact on cost and schedule
- Develop risk management plan as project develops
- Identify Roles and Responsibilities for Effective Risk Management

ISSUES OF POTENTIAL CONCERN

The following items were raised several times during the course of the workshop. Many appear to have been resolved, with the identification of the Preferred Option. However these items can be quite contentious and are listed as a precautionary note for future reference.

- Uncertainty of emergency raising of city dikes
- Risk mitigation plans and structured contingency plan.
- Distinguish between operations and construction, and mitigation;

- Evacuation Plans & Evacuation Plan triggers based on environmental and flood forecasting conditions have not been developed.
- Lack of time to complete thorough pre-design planning and investigations/designs.
- Flood preparedness and continuing maintenance.
- Resistance to new methods and technology.
- Design horizon
- Maintenance Implication for future generations
- Potential failure of saturated city dikes
- Restricted access to fill materials
- Difficulties in extending city primary dikes
- In moving project along, be sure all necessary engineering studies and compensation/environment information are done. Additional studies on critical path include:
 - Dam Safety evaluation
 - Risk evaluation of inlet control structure
 - Additional topographic mapping
 - Review of hydraulic studies with additional mapping information
- Changes to operating rules.
- Challenge 778 ft. maximum HWL
- Priority/considerations over who gets protected or flooded first
- What is a "Super Flood"?
- What is the management plan for dealing with a flood greater than the 1 in 700 flood event (or Super Flood)?
- Raising of West dike and west bank: what height, what Implications.
- Current modelling is based on dated river cross-sectional information, which may not be reflective of current states or trends.
- Consider emergency raising of primary dikes with Jersey Barriers.

GROUP DISCUSSION AND VE PROPOSAL TRACKING

A meeting was held August 19, 2002 with the Review Panel, the Planning Team, various members of the Technical Team and the Value Consultant. Following presentation of the workshop deliberations, the surviving trial proposals under each Issue Area was reviewed and comments made. The proposals approved at this time are listed below and those marked with an asterisk were approved for future study only.

It should be noted at this time that, although expanding the Floodway appears to be a simple concept, the Project as a whole is quite complex with many extensively inter-related components requiring effective integration, timing and co-ordination. Further, these recommendations from the Modified Base Case, the Enhanced Option and the City Infrastructure Modifications are conceptual only and require further examination and engineering assessment. The potential cost savings are preliminary in nature and require verification at the detailed design stage.

The proposals include the following:

Modified Base Case:

A Red River Floodway Channel

- Seed the lower channel with water tolerant vegetation
 - Enlarge gaps in East Embankment and Richardson's Coulee
 - Excavate upper sides of channel concurrent with lower flow channel where reasonable
 - Increase soil investigations relating to "blow-out" avoidance
 - Design side slopes of Floodway at 5:1 with designed surface layer at top of slope*
 - Cross-country ski/mountain bike park on West Embankment near Seine River Siphon / Expand & raise Spring Hill with excavation material
 - Design pilot channel wider and shallower to reduce risk of "blow-outs"
- B Inlet Structure**
- Investigate means of providing backup gate system (ie: Bulkheads) downstream of existing gates - limit flows through Winnipeg to 80,000cfs*
 - Retain security expert to improve security at the inlet structure
 - Provide Flow Regulation in Floodway channel: Remove existing earthen plug & install staggered pile "fence" for ice jam control*
- C Outlet Structure**
- Extending outlet structure: use west retaining wall as concrete "pier"
 - Construct flume for "Whitewater Park" at outlet structure*
- D West Dike**
- Investigate alternate erosion control systems to protect the west dike (ie: soil cement)*
- E Highway Bridges**
- Replace bridge decks at time of bridge retrofits.
 - Utilize permanent steel sheet piles to upgrade bridge piers
- F Railway Bridges**
- Convert existing CNR Sprague Bridge to through girder bridge*
 - Remove GWWD Bridge & relocate GWWD facilities to Deacon Reservoir*
 - Utilize permanent steel sheet piles to upgrade bridge piers
- G Project management**
- Create Red River Valley Flood Protection Authority to own, manage, operate & maintain the Floodway
 - Conduct necessary geotechnical, groundwater, and environmental studies as soon as possible*
 - Organize a Project Management Team with internal and external representation as soon as possible
 - Include a recreation representative for the above Project Management Team
 - Develop compensation plan in consultation with affected parties, the Province, and insurance industry
- H WPCC Pumping Capacity Upgrade**
- Perform infiltration/inflow analysis of CoW sanitary sewer system in south end & upgrade in lieu of funding upgrades to WPCC pumping stations*

Modified Base Case - Enhanced Protection:**I Floodway Operating Rules**

Revise the Floodway operating rules and do associated works to reflect the reality and risks associated with raising 69 miles of primary dikes during major flood events*. These revisions and works include:

- maintain the Red River level at 24.5 James during a 1 in 700-year flood event
- operate the forebay at approximately 780 feet (in emergency mode).
- raise the West Dike and West Embankment by approximately 3 to 4 feet
- enhance the impervious core of the dikes at the inlet structure

J In-City River Level Management

Provide additional control of flow into Floodway channel and revise the Floodway operating rules to hold City River summer levels to as low as possible without exceeding 760' upstream*.

Control flow by installing box culverts (invert 742 feet, sill 750 feet) with control gates across the Floodway between the inlet and St. Mary's Road, in addition to the Floodway plug removal cited above under Modified Base Case.

City Infrastructure Modification:**K City Infrastructure Modifications**

The City Infrastructure Modification option recognizes that flood events result in long durations of high river stages during which there is considerable risk of widespread and costly flooding of basements and the City's combined sewer system during heavy rainfall events. It therefore recommends assessment of the capability of the City's combined sewer flood pumping stations to deal with rainfall and high river levels*. This could result in a program to:

- upgrade the combined sewer flood pumping station capacities
- provide backwater valve/sump pump installations in individual sewer connections possibly through a homeowner subsidy program

POTENTIAL FOR EARLY ACTIONS

The following areas of early potential actions were identified:

- Remove Lac-du-Bonnet Bridge F/W 2002
- Floodway Security F2002
- Start Project Build West Dike Using Local Borrow
- Start Excavation of Pilot Channel

NEXT STEPS

The following next steps were proposed following discussions of the Formal Presentation material at the August 19, 2002 meeting with the Review Panel:

- Prioritise/schedule KGS future studies/Develop Study Management plan.

- Advance Environmental work to secure funding. Note: Construction cannot advance until the Environmental Hearing Process is complete.
- Compensation measures should be addressed as federal funding process is linked to measures. Federal process is lengthy and iterative.
- Transportation issues:
 - Develop Management Plan for all Highway and Railway Bridges to minimise Capital and LCC costs. Explore use of salvage material from Lac Du Bonnet Bridge.
 - Address policy/position on Bridge Submergence:
 - Consider Risks & LCC
 - Determine highway and railway access requirements for routes leading to bridges.
- Investigate establishment of Red River Floodway Management Authority and Red River Floodway Expansion - Project Management Team. Consider continuity of VE Team Involvement.
- Determine the project "Owner". Consider establishing an "Owners' Technical Advisor" to review technical decisions/aspects of the project.

A "trial schedule" for the project is illustrated on page (vii).

Trial Schedule

			2002	2003	2004	2005	2006	2007	2008	2009
A1	Upgrade Floodway									
A1.1	Channel Earthworks	\$180,080,000								
A1.2	Rail Bridges	\$37,500,000								
A1.3	Highway Bridges	\$42,300,000								
A1.4	Improvements at Floodway Inlet Control Structure	\$16,580,000								
A1.5	Hydraulic Structures - Upgrades <i>Outlet Structure</i> <i>Other hydraulic structures</i>	\$21,155,000								
A1.6	Transmission Lines	\$6,300,000								
A1.7	Other Crossings	\$2,700,000								
A1.8	Roadworks	\$1,680,000								
A2	Upgrade Flood Protection Infrastructure City of WPG	\$65,800,000								
A3	Raise Height of West Dike	\$35,300,000								
B1	Contingencies (Summation for all items)	\$84,200,000								
C1	Owner's Cost/Engineering/Construction Management <i>Investigations, Environmental approval etc.</i> <i>Design supervision etc.</i>	\$66,575,000								
C2	Escalation of Costs during Construction	\$28,500,000								
C3	Cost of Interest During Construction	\$57,900,000								
	Public Consultation									