02-51

Value Study Report

Volume 1: MANAGEMENT OVERVIEW

Client: **Manitoba Transportation and Government Services**

Project: **Red River Floodway Expansion**

Workshop Held: August 12 – 16, 2002

Date: September 12th, 2002

Distribution: All Value Workshop Team Members
Project Review Panel

Issued For: Project Development

Manitoba

TEAM FOCUS *Management Strategies*

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TEAM FOCUS *Management Strategies*

The TEAM FOCUS Group

Management Strategies

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October 18th, 2002

Mr. Ismail Elkholy, P.Eng., Ph.D., MBA
Director
Manitoba Transportation and Government Services
Bridges and Structures
6th Floor, 215 Garry Street
Winnipeg, MB
R3C 3Z1

Dear Mr. Elkholy:

Re. Red River Floodway Expansion- Value Study Final Report

We have pleasure in forwarding to you the final report for the recent Value Study of Red River Floodway Expansion project.

The Report comprises three volumes, as follows:

Main Report for general distribution,
- Volume 1: Main Overview

Back-up Documentation,
- Volume 2: Workshop Diary
- Volume 3: Value Study Proposals.

Your colleagues and the workshop participants are to be congratulated on their efforts. It is gratifying to recall the general level of consensus achieved among such prominent stakeholders. However, it should be noted that while the Value Study was quite exhaustive for the time spent, there still remains much related work to do in terms of validation, risk management and continuing value improvement and consultation for the various initiatives identified. This report provides an initial framework for progressing and monitoring this work.

We wish to thank you for the opportunity for the Team Focus Group to have been of assistance on this important project.

Sincerely,

MR Phillips.

The TEAM FOCUS Group
Martyn R. Phillips, Director

Third Party Disclaimer

* *This Value Engineering exercise was used solely to facilitate issues exploration among key stakeholders and comparison of alternate concepts at a very early stage of the project process.*

* *The data and opinions collated in this report by the TEAM FOCUS Group do not constitute technical opinion or financial inputs of the TEAM FOCUS Group.*

Date: September 2002

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 asterix 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	$160,080,000								
A1.2		Rail Bridges	$37,500,000								
A1.3		Highway Bridges	$42,300,000								
A1.4		Improvements at Floodway Inlet Control Structure	$16,550,000								
A1.5		Hydraulic Structures - Upgrades	$21,155,000								
		Outlet Structure									
		Other hydraulic structures									
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**		$66,575,000								
		Investigations, Environmental approval etc.									
		Design supervision etc									
C2	**Escalation of Costs during Construction**		$28,500,000								
C3	**Cost of Interest During Construction**		$57,900,000								
	Public Consultation										

Red River Floodway Expansion - Value Study Workshop Team Members

Back Row Standing: (L to R): Brad Sacher, Bob Stefaniuk, Dave MacMillan, Rick Hay, Ken Adam, Michael Hagos, Jay Doering, Michael Campbell, Martyn Phillips, Michael Thompson, Delwyn Fredlund, Larry Buhr, Duane Kelln, Walter Saltzberg, Scot McClintock, John Macpherson, Bert Lukey, Dean Gould, John Logan

Front Row Sitting: (L to R): Rick Carson, Kathy Daniels, Ismail Elkholy, Dave Chalcroft, George Rempel, Dave Wardrop,

Missing: Gerald Proteau, Bill Fisher, Rick Martin, Bert Smith

Volume 1: MANAGEMENT OVERVIEW

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Note:
Volume 2 of this report comprises a **Workshop Diary** (Appendices A - Q), which is a working record of the workshop and follow-up proceedings.
Volume 3 of this report comprises a complete record of the **Value Study Proposals** (Modifications to the Base Case, Enhanced Protection, Possible In-city Modifications and Phase 4 Trial Proposals).

Volume 2: WORKSHOP DIARY

Table of Contents

Note: **Volume 1** of this report comprises a **Management Overview** of the Value study approach and outputs. **Volume 3** of this report comprises a complete record of the **Value Study Proposals.**

Volume 3: VALUE STUDY PROPOSALS (VSPs)

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Volume 3: VALUE STUDY PROPOSALS (VSPs)

Table of Contents (Detailed)

Category I: Preferred Option, Modified Base Case VSPs

VSP Ref.	Original Proposals	Value Study Proposal
E	**Highway Bridge Retrofit: Deck Replacement and Pier Upgrade**	
	HB-5	Include replacement of deck with all retrofits
	HB-26 (Highway)	Build permanent cofferdam around existing piers foundations
F	**Rail Bridge Retrofit along the Floodway**	
	RB-3	Convert existing CNR Sprague to through girder bridge
	RB-9	CoW move GWWD to Deacon
	HB-26 (Railway)	Streamline portions of bridge facing flow
G	**Project Management for the Proposed Expansion to the Red River Floodway**	
	PM-3, 4, 15	Construction Management/Team/Consortium; Hire Program Management Firm; Prime Consultant with subs
	PM-9	Dedicated Provincial Project Management Authority (Planning to Maintenance)
	PM-14	Perform detailed GW, ENV, and Geotech Studies ASA for maximum benefit to advance project and secure cost funding
	PM-17	Incorporate Recreational values into Planning. Design and Project Management
	PM-20	Develop compensation plan for upstream and downstream communities and perhaps individuals to be followed in the advent of flood (above natural state of nature) damages
	PM-21	Recommend forum for compensation and / or mitigation issues to avoid schedule delays
H	**WPCC Pumping Capacity Upgrade**	
	FP-10	Upgrade system Protection against extraneous flows during high river levels

Category II: Preferred Option, Enhanced Protection VSPs

VSP Ref.	Original Proposals	Value Study Proposal
I	**Floodway Operating Rules**	
J	**In-City River Level Management**	
	IS-13	Modify plug with installation of box culverts
	PD-2(b)	Change Rule 2 to have 700 year level protection and change to 24.5 in city

Category III: Possible Approach to In-city Infrastructure Modifications

VSP Ref.	Original Proposals	Value Study Proposal
K	**Sump Pump and Backwater Valve Subsidy Program**	
	FP-7	Provide Sewer Back-up Valve & Sump pump for all combined sewer connections

1. Mandate and Needs

1.1 Introduction

1.1.1 Value Study & Report Structure

A value study was held for the Red River Floodway Expansion project in July/August 2002. A 5-day workshop was held August 12-16 at the Canad Inns, Fort Garry. The workshop provided the basis for developing concerns on various issues and formulating the recommendations continued herein.

The report documentation comprises:
Volume I, Management Overview
Volume II, Workshop Diary
Volume III, Value Study Proposals

1.1.2 Value Study Team

The Value Study team consisted of the following groups (the team consist and their biographies are included in **Annex I**):

- **Pre-workshop Planning Team**

  The pre-workshop planning team comprised 9 persons who guided the development of a Pre-Workshop Briefing Package as required pre-reading for all workshop participants.

- **Workshop Team**

  The workshop team comprised 29 persons representing a broad cross-section of the community. Participants included acknowledged academic and industry experts in the fields of: hydrology, geotechnical, structural and value engineering work. The workshop team consisted of the owner's representatives, the value consultants, co-ordinator/recorders and technical team.

- **Review Team (post workshop)**

  The review team comprised 11 owner representatives whose function was to participate in a post-workshop review of findings and provide feedback on the draft output from the workshop. Thereafter, the group provides direction on integrating the workshop findings within the project development process and then ensuring continuing incorporation of the value, risk and team management approach for maximum effectiveness.

1.1.3 Project Background and Status

The existing Red River Diversion was constructed in the 1960's and is a channel constructed to protect the City of Winnipeg at extreme flood events by diverting a portion of the Red River flow around the city limits. Following the Flood of the Century in 1997, an expansion was proposed to provide the City with protection from extreme events with higher return periods. KGS was engaged by the Province to carry out a preliminary study to explore the issue and has carried out design sufficient for preliminary cost estimates. The work outlined in their Report titled "Final report on Flood Protection Studies for Winnipeg", generally involves the widening and deepening of the existing

diversion channel with modifications to the inlet and outlet control structures and various structures and utilities in and around the City.

Value Engineering (VE), sometimes referred to as value analysis or value management, is a proven management technique designed to focus a multidisciplinary team on the major and critical issues of a complex project or process, where the primary focus is value improvement. Value improvement may be realized in different ways on different projects including: improved project focus or scope, improved technical approach, improved constructability, greater internal and external coordination and communication, improved scheduling, improved reliability, reduced project cost, reduced operating or lifecycle costs, reduced risk, reduced environmental impact and increased owner confidence.

Generally, the earlier the Value Engineering process is carried out in the project, the greater effect the results have on potential savings as there is more ability to make substantive changes. It was realised that greater value could be realized on the Red River Floodway Expansion Project by undertaking a Value Engineering/Value Analysis Study (hence forth called Value Study). In addition, as the project is in the early stages of development, it was apparent that the maximum potential savings could be realized by undertaking the initial study now with the possibility of a second Value Engineering study in the later part of the detailed design stage, to further improve value and manage risks.

1.1.4 Study Drivers and Objectives

The Value Study has been initiated to be sure that best overall value for money Capital Expenditures (CAPEX) and Lifecycle Costs (LCC) is obtained. With the project being at the early/concept stage, the focus of the study is Value Analysis (VA), with an emphasis on risk reduction. The overall objective of the Value Study is to provide comfort that the project is going in the right direction; this includes identifying "quick hits/early actions" to enable an early construction start.

Primary Objectives:

P1. Identify key project areas and methodologies to ensure the best, overall value-for-money In order to meet our vision and mission
P2. Identify ways to reduce/mitigate project risk in terms of cost and schedule overruns
P3. Identify early activities, "quick hits" to realize flood protection benefits
P4. Generate consensus within the local consulting/construction industry and between Government departments.

Secondary Objectives:

S1. Review/validate/modify unit prices for cost estimates
S2. Generate "Made in Manitoba Solutions"
S3. Optimize operating and Lifecycle Costs (LCC)
S4. Incorporate innovative concept(s)
S5. Improve constructability aspects of the project
S6. Identify modifications required to meet summer water level control
S7. Ensure no interruption to raw water supply to City of Winnipeg (CoW)
S8. Identify new recreation opportunities and maintain existing

Study Output Deliverables:

The facilitation team will guide the study process through the preparatory, workshop and decision-making stages such that the project will achieve the above-stated objectives. Study output deliverables will be documentation as follows:

- Management Overview for Decision-Makers
- Workshop Diary as back-up to the Management Overview
- Presentation on Workshop Deliberations and Output
- Draft Recommendations including VE ideas grouped into alternative scenarios to be incorporated into the project.
- Record of Implementation Meeting and Consensus derived.

1.2 Value Study Process

1.2.1 Value Methodology

The Value methodology was developed in 1947 by the General Electric Company in the United States. Since then, the methodology has been used extensively by organizations throughout the world and is now mandated by the US government for all federally funded projects. Typical results are enhanced stakeholder understanding and cooperation, improved project functionality, optimized project costs and accelerated project development.

A Value Study follows the process prescribed by SAVE International (formerly the Society of American Value Engineers). There are three stages to a Value Study:

- Pre-workshop (strategic review, work plan and analysis of base case),
- Value workshop, where workshop team members identify and explore alternative ideas, to develop and test most likely ideas, and
- Post-workshop (fine-tuning/ verification of proposal packages, broader consultation, recommendations, acceptance, implementation package and formal reporting).

The pre-workshop activities ensure sufficient information and analysis for a firm foundation to a Value workshop.

The standard VE workshop follows a structured sequence of phases referred to as:

1. Summary presentation of information and analysis of functions*, costs and very issue/risk areas
2. Creativity –innovating improvements and ways to address key issues
3. Judgment, extension and combination of ideas using agreed criteria
4. Coarse development and testing of the most likely options
5. Output – selection of preferred option(s) (in draft form).

There then takes place the process of verification, fine-tuning and review by other stakeholders, prior to formulation of firm recommendations and the implementation package.

1.2.2 Analysis by Function

Prior to the Creativity phase, it is essential that the Workshop Team members have a common understanding of the key issue and risk areas to be addressed. Function analysis is often described as the heart of the Value process. It forms a platform for comparison of requirements, methods, costs and options. A basic premise is that all cost is for function. An objective of VA/VE is to attain the required function at minimum cost while meeting stakeholder requirements. Various methods of function analysis may be used, including function-cost diagramming. This technique facilitates the raising and resolution of issues and thereby building of stakeholder consensus on the most appropriate way forward.

1.2.3 Value Study Work Plan

The work plan for the overall study is shown in the following table

Date	Activity
Pre-Workshop	
July 16 –19	▪ Approved for study by Treasury Board and Community and Economic Development Committee of Cabinet (CEDC), ▪ Appointment of participants ▪ Selection of VE consultant
August 02	▪ Team Orientation, pre-workshop briefing package: existing system, expenditures, process, deliverables
Workshop August 12 – 16	
Monday	▪ Phase 1: Information and analysis
Tuesday	▪ Phase 2: Creativity and judgement
Wednesday	▪ Phase 3: Judgement and development
Thursday	▪ Phase 4: Development and selection
Friday	▪ Phase 5: Review refinement and draft outputs
Saturday	▪ Draft report
Post-Workshop	
August 19	▪ Presentation to review panel ▪ Formation/fine-tuning of recommendations
August 19	▪ Complete collation of appendices
August 19-22	▪ Verification/follow-up, as required
August 23	▪ Submit value study draft deport for comments
August 26-30	▪ Review draft report ▪ Agree implementation and monitoring actions
September 2-6	▪ Address team comments, submit finalised report

1.3 Project Need

1.3.1 Existing Flood Protection System – Description & Performance

The major flood control works that provide protection for Winnipeg are the Red River Floodway (Floodway), the Portage Diversion, the Shellmouth Dam, and the diking system and related infrastructure within the City. Annex I includes the locations of these facilities (Plate 1), and additional information regarding the Floodway, the Portage Diversion and the Shellmouth Dam. Plate B-2 illustrates the extent of the Floodway and affected infrastructure.

1.3.1.1 Red River Floodway

Construction of the Floodway was started in 1962 and completed in 1968 at a total cost of $62,700,000. The Floodway consists of four main components, namely the Floodway channel, the inlet Control Structure, the CoW Primary dikes, and the Outlet Structure.

The basis of the design of the flood protection works was to provide protection for the 1 in 160 year flood to 169,000 cfs at Redwood Bridge, located a short distance downstream from the confluence of the Assiniboine River. Based on today's knowledge of the hydrology of the Red River, the current design flood return period is approximately 1 in 90 years. The following discharges and water levels applied to the 1962 design.

Design Flood (natural)	169,000cfs
Design Flood	1 in 160 years (1962)
Assiniboine River contribution to peak	38,300 cfs (average)
Portage Diversion	25,000 cfs
Reduction of flow due to Shellmouth Reservoir	7,000 cfs
Redwood Bridge (controlled)	El. 752.5 ft. el. 25 ft. (JAPSD)*
Floodway Design Discharge	60,000 cfs
Control Structure Discharge	70,700 cfs
Control Discharge James Avenue	77,000 cfs
Water level upstream of Inlet for design condition	El. 770.25 ft
Water level upstream of Inlet for emergency operation	El 778.0 ft
Floodway Discharge (1997 Flood)	Approx. 65 000 cfs
Current Safe Floodway Discharge	Approx. 70 000 cfs

*JAPSD: James St Pumping Station Datum is converted to standard datum by the addition of 727.57 ft

1.3.1.2 Winnipeg Diking System

The diking system within the City of Winnipeg was built immediately after the 1950 Flood. The dikes enclose the Red, Assiniboine, and Seine Rivers. They consist mainly of broad boulevard type dikes referred to as the Primary Line of Defence (PLD) or primary dikes, mostly built to the designated Flood Protection Level (FPL) or higher. The FPL is a water level profile (plus 2 ft. of freeboard) that corresponds to the maximum water level under flood conditions that would correspond to the design condition for the Floodway. At the time the Floodway was planned, the FPL was associated with an annual probability of being exceeded of 1 in 160 with the proposed Floodway in place. Current estimates of this probability, based on a flow record that is some 40 years longer than in the early 1960's, are between 1 in 90 and 1 in 100.

Pumping stations to lift storm water into the rivers are an important element of the diking system. Temporary Secondary Dikes for properties between the PLD and the rivers are also required during flood events.

1.3.2 Project Stakeholders and Expectations

In gaining stakeholder consensus and the requisite approvals, all stakeholders and their needs must be considered. The following stakeholder groups have been identified, but may not be complete.

Province of Manitoba	City of Winnipeg	General Stakeholders
▪ Manitoba Conservation ▪ Manitoba Transportation & Government Services ▪ Manitoba Hydro	▪ Water and Waste-water Operations	▪ CNR, CPR, GWWR ▪ Surrounding Municipalities ▪ Misc. utilities ▪ Upstream Property Owners ▪ Others

Key Expectations

Province of Manitoba	City of Winnipeg	General Stakeholders
▪ Provide adequate flood protection to CoW ▪ Advance Floodway project	▪ Prevent basement flooding	▪ Uninterruption of services

1.3.3 Vision and Mission Statements

PROJECT VISION

The City of Winnipeg will be protected against flood damage from extreme events.

PROJECT MISSION

A. To upgrade the capacity of the Red River Floodway from the current design capacity of 60,000 cubic feet per second (cfs) to a minimum of 140,000 cfs.

B. Control Red River water levels through the City of Winnipeg to:

i) Protect the city from basement flooding during extreme summer rainfall events

ii) Make the Forks walkway usable throughout the summer.

1.4 Study Considerations

1.4.1 Project Objectives, Boundaries & Key Parameters

a) Scope and Constraints

To protect the City of Winnipeg (CoW) during a range of climatic conditions without detriment to upstream (u/s) stakeholders. This work entails:

- Upgrading the Floodway channel and west dyke (widening, deepening, etc.)
- Changes to Floodway related structures (inlet & outlet control structures, Floodway lip, etc)
- Changes to CoW Primary Diking System and associated works

Reconstruct/Modify

- All bridge crossings
- CoW Aqueduct
- Seine River Syphon
- All utilities
- Others: Springhill etc

Constraints may be:

- Floodway must be useable each spring regardless of other uses or construction activities
- Floodway operating procedures
- Flooding upstream landowners
- Highways operating procedures
- Railways operating procedures
- CoW water supply
- Environmental requirements
- Utilities operation
- Local aquifer

b) Exclusions:

The following alternatives have previously been considered and rejected.

- Ste. Agathe Detention Structure
- Hydrological debate on statistical levels of protection

c) Current Operating Parameters

The following are the existing Floodway operating rules. They are a requirement for the existing Floodway and they were a requirement for the KGS base case. However, the maximum inlet water surface elevation of 778 ft under emergency condition for the 1 in 700 year Flood event is open for discussion.

Rule 1: The Floodway should be operated so as to maintain "natural" water levels on the Red River at the entrance to the Floodway channel, until the water surface elevation at the James Avenue gauge reaches el. 24.5 ft., or the river level anywhere along the Red River within the City of Winnipeg reaches 2 ft. below the Flood Protection Level of el. 27.8 ft JAPSD.

Rule 2: Once the river levels within Winnipeg reach the limits described in Rule 1, the level in Winnipeg should be held constant while river levels south of the Control Structure continue to rise. Furthermore, if forecasts indicate that river levels south of Winnipeg will rise more than 2 ft. above natural, the City must proceed with emergency raising of the dikes and temporary protection measures on the sewer systems in accordance with the flood level forecasts within Winnipeg. The water levels in Winnipeg should be permitted to rise as construction proceeds, but not so as to encroach on the freeboard of the dikes or compromise the emergency measures undertaken for protecting the sewer

systems. At the same time, the Province should consider the possibility of an emergency increase in the height of the Floodway embankments and the West Dike. At no time will the water level at the Floodway channel's entrance be allowed to rise to a level that infringes on the allowable freeboard on the Floodway West Embankment (Winnipeg side) and the West Dike.

Rule 3: For extreme floods, where the water level at the Floodway channel's entrance reaches the maximum level that can be held by the Floodway West Embankment and the West Dike, the river level must not be permitted to exceed that level. All additional flows must be passed through Winnipeg.

KEY OPERATING PARAMETERS OF EXISTING FLOODWAY

Operating Period	River Water Level and Location	Critical Parameter	Preferred Parameter	Relates to Prevention of:
Spring	760 ft at Floodway Inlet		✓	Flooding of upstream land
	774 ft at Floodway Inlet		✓	Flooding of upstream homes
	778 ft at Floodway Inlet	✓		Overtopping of Floodway embankment
	24.5 ft JAPSD	✓		Overland flooding in City
Summer	12.5 ft JAPSD	✓**		Basement flooding in City
	760 ft at Floodway Inlet		✓	Flooding of upstream land
	8 ft JAPSD		✓**	Flooding of Forks walkway

Note: ** these particular parameters were **not** requirements for the Base Case premise

d) Givens and Assumptions

The hydrological assumptions leading to selection of the level of protection being for a 1 in 700 year flood is a "given" for the purposes of this Value Study. This equates to a required Floodway capacity of 140,000 cfs.

e) Sacred Cows / "No –No" Parameters

None to date

f) Sensitivities / Unknowns / Data Gaps

- Results of summer water level control study
- Result of natural water levels study
- Compensate for detrimental impacts upstream
- Results of ice management studies
- Results of Geotechnical Investigation and Study
- Results of Recreational Study
- Results of Groundwater Study
- Optimization of Earthworks

g) Initial Listing of Risks of Existing system

Prior to Floodway Expansion, project risks identified but are not limited to:

- The existing hydraulic capacity of the structures and diversions were possibly inadequate to provide acceptable low risk of disastrous conditions in extreme events
- Vandalism/sabotage at the inlet structure
- Inability to control the gates due to various factors
- Flooding of basements caused by water level backup at high river levels combined with high local runoff due to summer storms.
- Ability to "top up" Primary dikes to 2' above existing 25.8 JAPSD not considered practical in time frame available. Note: Flood protection level is considered to be 24.5 JAPSD, however, top of dikes are considered to be at 25.8 JAPSD.
- Breach of Primary Dikes under extreme events
- Beach of primary dikes may contaminate water supply.
- No City wide evacuation plans available
- Operating the Floodway at an inlet elevation at 778 ft. was unsafe without:
  - Modifications to increase the freeboard on the West Dike, and
  - Measures to prevent failure of bridge decks along the Floodway which could lead to an unpredictable loss of hydraulic capacity.
- Reliance on temporarily raising of the crest elevation of the Primary Dikes in Winnipeg by more than 2 ft. prior to the peak of an extreme flood would be an overly optimistic assumption.
- Water levels above el. 24.5 ft. (JAPSD) in Winnipeg would bring on unacceptably high risk of failure of individual components of the existing flood protection infrastructure in Winnipeg.

1.4.2 Project Success Criteria

The project must satisfy the following overall success criteria. As a subset, ideas screening / compliance criteria were identified during the workshop Judgement phase.

I Delivers Mission with least negative User impact:

- Maximize Floodway throughput
- Minimize construction interference on Floodway vegetation
- Minimize disruption to rail and highway traffic
- Minimizes operating (including maintenance) costs
- Improves reliability/ease of operation
- Minimizes sedimentation in Floodway and control structures
- Minimizes scour in the channel and particularly at bridges and changes in channel cross-section

II Demonstrates Best Value for the Money:

- Improves benefit cost ratio(s). Factors: City of Winnipeg and upstream damages
- Provides early benefits
- Provides biggest bang for the buck
- Improves implementation schedule
- Improves constructability
- Lowers construction risk
- Lowers flood risk/improves flood protection

- Optimize cash flow
- Optimizes Life Cycle (LCC) (trade off: capital expenditure for least long term expenditure)
- Least LCC impact on utilities: Gas line, hydro, power transmission, oil, water line aqueduct (sole city water supply)

III Maintains/Improves External Relationships (and ability to be funded):

- Maximizes Manitoba content
- Minimizes impacts on other resources (e.g.: groundwater, aquifer water quality, gravel, land)
- Provides for recreational opportunities
- Reduces environmental risks
- Maintain or improve land drainage ability
- Minimize induced flooding upstream
- Meets Department of Fisheries and Ocean (DFO) constraints
- Balance environmental risks against functionality

During the workshop deliberations, these criteria were refined to become compliance criteria, against which all the ideas and preferred option ideas were checked.

1.4.3 Compliance Criteria

The following criteria were agreed, by the team members, for screening all workshop ideas and concepts.

User Impact:

A. Optimizes Hydraulic Performance
B. Minimizes disruption to highway and rail traffic
C. Improves Reliability and Protection

Demonstrates Best Value:

D. Improves Cost - Benefit
E. Provides Early Benefits
F. Improves Constructibility
G. Minimizes Capital Cost
H. Minimizes Operating and Maintenance costs
I. Minimizes Construction Risk
J. Smoothes Cash Flow

3rd Party Impact:

K. Minimizes Disruption to Utilities
L. Reduces Environmental Impact
M. Maximizes Manitoba Content
N. Provides Recreational Opportunities
O. Minimizes Upstream Flooding

2. Study Base Case

2.1 Description of Study Base Case

2.2.1 Key Features

The Base Case generally involves the widening and deepening of the existing diversion channel with modifications to the inlet and outlet control structures and various structures and utilities in and around the City. The project cost is estimated at $658 Million (Can).

Specifically, the project will include the following major features:

- Expansion of the existing channel to provide a design capacity to pass a 1 in 700 year flood with a water level at the Floodway Inlet of 778 ft (this results in a reduction in flood risk to Winnipeg to less than one fifth of the current exposure).
- Mitigation works for adverse effects to groundwater resources
- Identification of benefits of summer water level control in Winnipeg. If the benefits are commensurate with the costs and environmental implications, the work plan would incorporate definition of Floodway modifications (physical and/or operational) to achieve summer water level control in Winnipeg
- Replacement of 3 major bridge structures, modification to 10 bridges, 5 transmission lines, other crossings and 9 drainage structures along the channel route
- Expansion of the Outlet Structure and the discharge channel leading from it to the Red River, including protection of private and public properties in the affected area.
- Improvements at the Floodway Inlet Control Structure, possibly including installation of backup control gates, pending further detailed analysis
- Increasing the freeboard of the West Dike to provide appropriate protection for wind effects
- Improvements and upgrades to the flood protection infrastructure in Winnipeg to maximize flood flow through Winnipeg, thereby minimizing the extent of expansion of the Floodway channel capacity. This would include upgrading of flood pump stations, fortifying existing low areas of the primary dikes, sewer isolation works, and other protection measures
- Incorporation of recreational facilities to the maximum practical extent, including but not limited to ski/hiking trails, interpretative centre(s) and vegetative coverage to support these activities to the maximum extent.

2.1.2 Key Assumptions and Standards

- Pass a 1 in 700 year event through and around the City of Winnipeg.
- The current Floodway operating rules apply
- The maximum water level through the CoW at emergency conditions would be elevation 27.8 JAPSD (where the Primary Dikes are topped up by 2' on an emergency basis)
- The Floodway Inlet Control Structure is designed to control upstream water levels to elevation 778 ft., while only releasing approximately 80,000 cfs into the city. Therefore the upstream water levels will not rise above this level, otherwise risk overtopping the Floodway dikes.
- Lowered margins of safety are expected at the 1 in 700 year event. Some bridge closures will be required as some bridge decks are overtopped or partially submerged. Bridges proposed to be submerged are strengthened to prevent unpredictable failures and cause unanticipated restriction to the Floodway channel flow. At least 2 bridges shall remain unsubmerged to allow access.

- Floodway channel shall be non-eroding up to the "state of nature" water levels. At emergency conditions limited channel erosion is considered acceptable.
- Mannings Coefficient of 0.028 assumed.
- For channel side slopes an overall factor of safety against sliding of 1.5 is required. For extreme conditions with a saturated bank at the end of construction a factor of safety of 1.2 to 1.3 can be considered acceptable.
- The practical limitation that could be provided by Floodway Expansion turned out to be the 1 in 1200 year flood
- The inlet control structure was designed to pass a Maximum Probable Flood Event considered to be a 1 in 1000 flood event without over topping of the structure.
- A dam safety review of the inlet control structure, Portage Diversion and Shellmouth Dam is recommended by KGS

2.1.3 Project Sensitivities and Uncertainties

The overriding risk of project failure would be as described below:

The concepts of expansion of the Floodway described in this report have been developed generally in accordance with the intent of the current Floodway Operation Rules. The Floodway expansion is designed to operate at maximum discharge capability under the extreme emergency conditions. At this level of capacity, there would be temporary measures required, and some increased risks of limited damage to the protection system. For example, at the water level of El. 778 ft. at the Floodway entrance:

- A series of bridge closures, and construction of temporary dikes along the Floodway would be required
- The potential of erosion in the channel would increase to the point at which some limited erosion could be expected in the granular zone near Birds Hill, and in the downstream 5 miles of the channel, particularly at the toe of the side slopes.
- The risk of damage to some of the bridges would increase to the point that some repair could be expected to be necessary after the flood subsides.
- The freeboard between the "Red Sea" level and the crest elevation of the West and East Dikes would be at a minimum, and wind events greater than the magnitude adopted for design of the West Dike upgrade could cause damage and increased risk of breach formation.
- The risk of damage due to failures in the flood protection infrastructure in Winnipeg (sewer outfalls, temporary dikes, etc.) would increase under the high flow associated with the emergency condition.

Lastly, the Operation Rules permit raising the water level upstream of the Floodway entrance above the "state-of-nature" condition ***under emergency conditions***, while the Primary Dikes in Winnipeg are being built up. This would have detrimental effects upstream that must be considered. In addition, it has been established that the CoW Primary Dikes may not be practically raised in the time frame available.

Other significant project issues and risk areas are:

- Impact on groundwater (addressed in KGS Report Appendix B, Sections B.3 and B6.6)
- Geotechnical issues related to the difficulties in excavating in the clay and glacial till (see KGS Report Appendix B , Section B.6.5 and B.6.6)
- Risk of riverbank damage at Outlet (see KGS report Appendix B, Section B.6.10)
- Public resistance to raising the upstream water level at the Floodway Inlet above the "state of nature".

- Ice conditions in early operation during a flood and the difficulty with ice management in the entire Red River, and at other associated facilities such as the Portage Diversion
- Uncertainty in best strategy of channel configuration and its implications with respect to groundwater and crossings (primarily bridges); additional planning work is required (See KGS Group Recommendation #4 for Floodway, on Page 67 of KGS Main Report)

2.1.4 Contingencies and Precautionary Measures

Contingency arrangements currently incorporated within the overall flood protection system to mitigate risk events are as follows.

- Secondary and tertiary systems of backup power for Floodway Inlet Control gates
- Diligent and extensive monitoring of the structures during all major flood events
- Closures of openings along the Floodway channel to prevent breakouts of water for very high floods
- Allowance for raising water level above the state of nature at the Floodway Inlet, if required to provide emergency discharge capacity in the Floodway
- Inclusion of a lip at the entrance to the Floodway at crest elevation 750 ft to prevent the entrance of ice into the Floodway (thereby avoiding the potential for ice jam formation in the channel and ice loads on the bridges)
- Guidelines for operation of the Portage Diversion to minimise the difficulties of water level control in Winnipeg, particularly under conditions where ice break-up and ice jams are possible
- East embankment cuts along the Floodway to provide increased discharge capacity at high water levels
- Precautionary measures in Winnipeg, such as temporary dikes, closures of sewer outfalls, pumping of water from some sewers to provide capacity to absorb runoff from rainfall during the high river levels
- Drilling of holes in the ice in the lower Red River to encourage ice to break up and release with minimal jamming (not clear that this is effective)
- Public announcements about gate operations, as well as local sounding of horn when gate position is changed and when the water level would be affected
- Tightened security in the area of the Floodway Inlet Control Structure and the Outlet Structure during the flood event

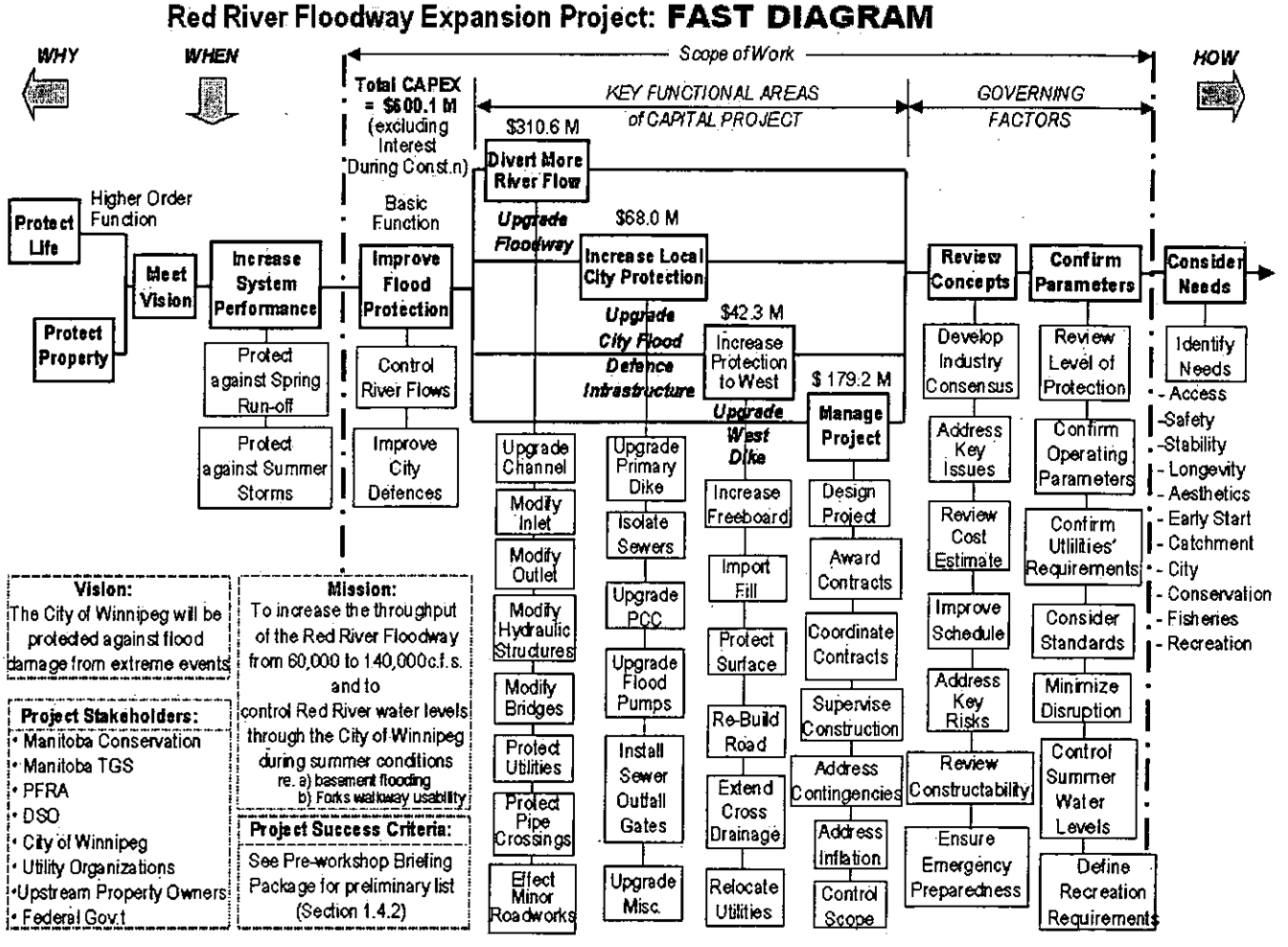
The following precautions have been incorporated within the **Base Case** considerations:

- All of the measures described above, with some modifications to suit the improvements in the new system
- Safe freeboard allowance for West Dike
- Upgrades for gate system (tentative - needs further justification based on detailed studies of the protection system and consequences and modes of failure), and for fire protection system in the Floodway Inlet Control Structure – control room.
- Floodway channel closures (see KGS Report, Appendix B, Annex B)
- Design of bridge fortification to withstand hydraulic loads due to submergence and resistance due to debris accumulation
- Recommended strict rules of operation for all floods, including floods exceeding the design magnitude (see KGS Report Appendix B – Section B.2.2.3)

2.2 Analysis of Base Case

2.2.1 Function Analysis

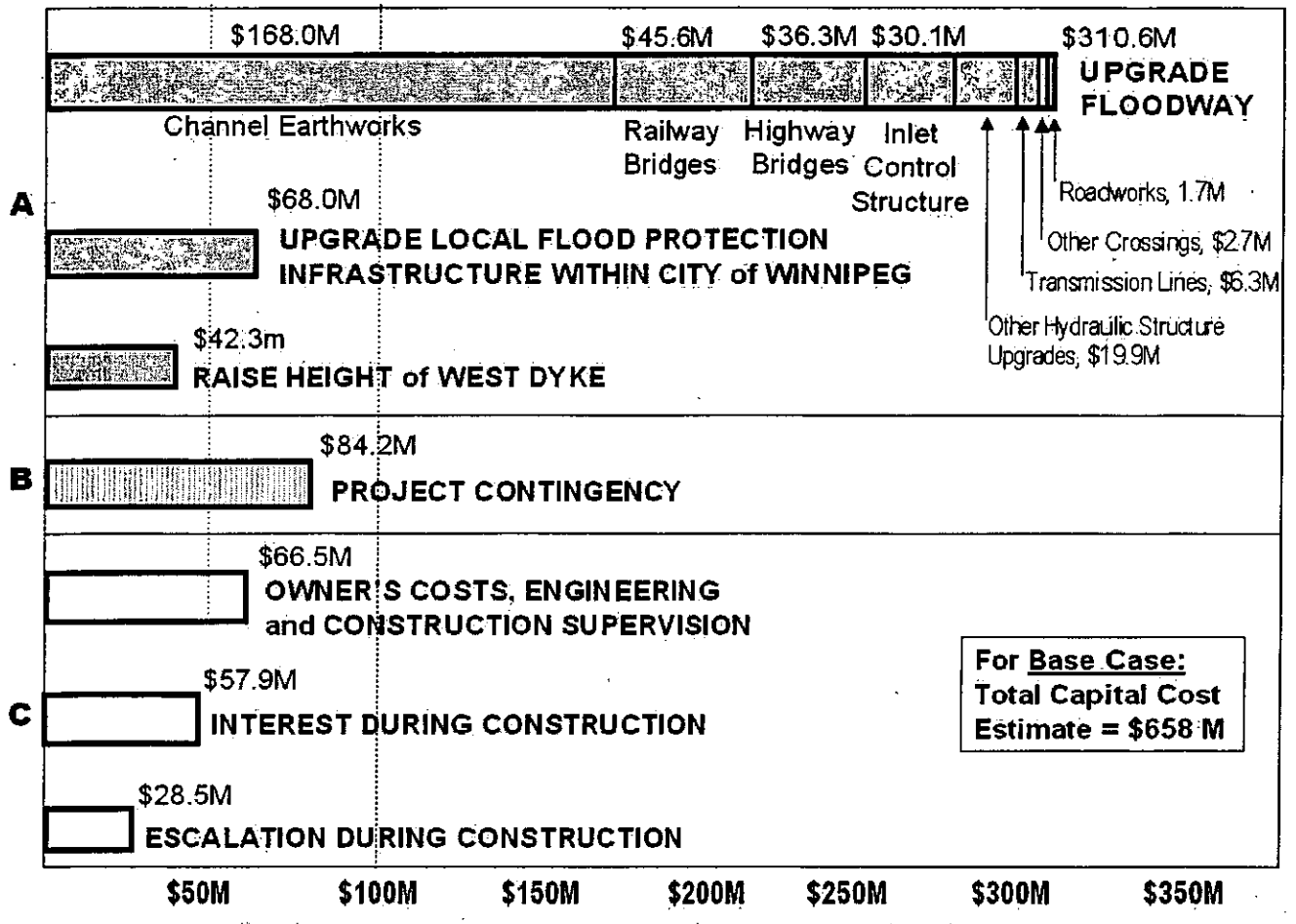
Prior to the workshop, the Base Case was reviewed for functionality and cost-effectiveness using function analysis and cost modeling. The Function Analysis Systems Technique (FAST) was used to establish a workshop framework (see FOCUS diagram below). Costs were allocated to each of the key functions.



A larger version of the diagram is included in **Annex I**

2.2.2 Cost Modelling

To encourage the VE team to focus its effort on finding alternatives to the higher cost items, capital costs per function/functional area are illustrated below. Due to the relatively low operational costs, these have not been reviewed in a similar manner.



Red River Floodway Expansion Project: CAPITAL COST MODEL: Base Case

A schedule of Project Capital Costs is shown in Annex III.

2.2.3 Basis of Cost Estimates, Data Base & Allowances

Excavation

The unit prices have been selected to represent a market condition wherein the local excavation industry is moderately busy, and bidding would not reflect cost-cutting below long-term sustainable profit levels (cost estimate is based on consultation with two local contractors, and on KGS Group's and other recent experience). The unit prices are:

- Clay above existing channel invert level, $2.50/cu.yd.
- Glacial till above existing channel invert level, $10.00/cu.yd.
- Glacial till below existing channel invert level, $15.00/cu.yd.
- Clay 0 ft. to 5 ft. below existing channel invert level, $5.00/cu.yd.
- Clay 5 ft. to 10 ft. below existing channel invert level, $6.00/cu.yd.

- Clay 10 ft. to 15 ft. below existing channel invert level, $7.00/cu.yd.

- The unit price for glacial till excavation below the channel bottom ($15.00 per cubic yard) that has been adopted has the highest uncertainty of any of the unit prices. Before the bidding process is started, test excavations are recommended to be undertaken in selected areas oftill to provide better understanding of the difficulties that may be encountered.

Bridge Construction/Modification:

See **Volume 2, Appendix H** for a Summary of Bridge Modification Costs

Interest During Construction

This has been included to represent the cost of interest on monies expended during the construction schedule prior to the completion of the project. It is considered an important cost component when comparing flood protection options. However, it is not normally a valid component of a project budget for a government-funded project, and particularly one that provides incremental flood protection benefits each year as the construction program proceeds. This aspect should be acknowledged by the three governments when establishing a final budget for the project.

Contingency

Contingencies are routinely included in cost estimation for major projects and reflect:

- The uncertainty in the actual bid price that may be tendered.
- The uncertainty in the estimated construction quantity (eg. volume of concrete, excavation, fill, etc.).
- An allowance for items that have not been identified, due to the preliminary nature of the engineering, and are inevitable to be required in the project implementation.
- The uncertainty in site conditions such as subsurface conditions.

This allowance differs from previous estimates (KGS, 2000A) that used a contingency of only 15%. However, the current allowance of 20% is considered appropriate because:

- The complexity of the individual components of the expansion are now more fully understood, and the possibility of unforeseen influences on cost is now better recognized.
- The optimization in the components has reduced the cost substantially, and there is little room for error if subsequent studies reveal justifications for modifying the optimized configuration for reasons that will only become clear in final design.

2.3 Alternatives Already Considered

1. Raise Floodway Bridges
2. Remove portion(s) of East Embankment at Floodway Inlet
3. Construct a Twinned Red River Floodway
4. Raise West Dike
5. Improve City of Winnipeg Flood Protection Infrastructure
6. Permanent raise of crest level on Primary Dikes in Winnipeg
7. Improve Red River Channel in or Downstream of Winnipeg
8. Construct Pump Station at Floodway Inlet

9. Construct Eastern Tributaries Diversion

2.4 Benchmarking Comparisons

1. Cost of original Floodway $62,000,000, completed in 1968.
2. Comparable flood protection that is being planned and constructed for Grand Forks, North Dakota will cost $400 million dollars for a design flow of 1 in 200 years, and protection provided for only 35,000 people.
3. The upper Mississippi offers protection for 1 in 500 year events
4. The lower Mississippi offers protection for 1 in 1000 year events
5. Areas of the Netherlands offer protection in excess of 1 in 1000 year events
6. Thames Barrier London, UK provide protection 1 in 1000 year events

2.5 Key Issues Arising from Pre-Workshop Review

- Study scope: expanded floodway (only) vs. expanded floodway and additional works
- Relative emphasis of study on risk vs. value
- General hydraulics and geotechnical risks
- Risk of floodway being deepened
  - Stability of slopes
  - Highly plastic soils: river instability/floodway instability
  - Piezometric pressure
  - Removal of clay cover; exposure of till
  - Exposure of aquifer
  - Bedrock issue
- Summer water control for River within the City
- Floodway profiles (optimization)
- Level of protection chosen (minimum 1 in 700 years)
- Wet or dry floodway
- Scour at bridges
- Floodway inlet concerns and backwater perceptions
- Desire to accelerate schedule (looking for "quick hits")
- Perception that design is already finished (Current drawings are illustrative only)
- Inclusions and accuracy of cost estimate (cost could be much higher)
- Amount/level of contingency in cost estimate
- Environmental applications may delay construction schedule
- Power transmission lines (interference with / stability)
- Proposed hydro switching yard
- Only one company has worked on the hydraulics
- Is the current project feasible?
- Cost sharing between the Province and Federal Government
- Federal presence at workshop or on presentation panel
- Life cycle of bridges (exposure to Province)
- Level of comfort of KGS with Value study
- Improve constructability and Made in Manitoba Solutions
- Demonstrate innovation
- General consensus in industry and among decision-makers
- Procurement of contracts
- Design-build contract strategy could jeopardize local construction industry.

- Implications of instituting permanent control of summer water levels in the CoW
- Determination of compensation for upstream residents due to induced "artificial" flooding for spring and summer operations
- Navigation and effects on fish habitat/passage that arise with operation of the Floodway require clarification, quantification of the impacts and remedial recommendations,
- Impact of Recreational features associated with "Wet Floodway"

2.6 Study Target Areas

Subject to review and confirmation during workshop Phase 1b). Analysis, it is likely that the target areas for the workshop proceedings will be:

- Floodway Design and Construction
- Re-construction/modification of Bridges and channel configuration at crossings
- Landscaping and Utilities
- Floodway Inlet and Outlet Structures
- City of Winnipeg Infrastructure Upgrading

The focus of workshop Phase 2, Creativity, will likely be on:

- High Risk Areas
- High Cost Areas
  - ⇒ Earthworks (Floodway and West Dike)
  - ⇒ Bridges
  - ⇒ Related Construction Methods

During the workshop deliberations, the above Study Target Areas were refined to become the Potential Target Areas as listed below.

Potential Target Areas

Highway Bridges	$32.3 million (5.6%)
Rail Bridges	$44 million (6.7%)
Cross Section (Channels)	Excav. $132 million (20%)
Primary Dike Upgrade	$33 million (5%)
Sewer Gates/Isolation	$33.1 million (5%)
Raise West Dyke	$42.3 million (6%)
Project Management	
Scheduling (contingencies, IDC, Escalation)	

3. Workshop Deliberations

3.1 Workshop Team

The workshop team comprised of 28 persons representing the following organizations:

- Manitoba Transportation & Government Services
- Manitoba Conservation
- City of Winnipeg
- University of Manitoba
- Manitoba Hydro
- Engineering Consulting Firm – KGS Group
- Engineering Consulting Firm - Earth Tech Canada
- Engineering Consulting Firm – Buhr & Associates
- Engineering Consulting Firm – Acres International
- Engineering Consulting Firm – Tetres Consultants Inc.
- Independent Consultant – A. Dean Gould & Associates
- Independent Consultant - ISIS Canada and Retired Director of Bridges & Structures
- Retired PFRA Chief Engineer
- Retired UMA Senior Vice-President
- Adjunct Professor Hong Kong University
- Local Contractor – Munroe Construction Ltd.
- Mayor of Ritchot
- Team Focus Group (Study Facilitation)

Participant's names are shown in **Annex I, VE Study Framework.**

3.2 Workshop Information Phase

3.2.1 Summary Presentations

The workshop started with brief presentations on the following areas:

- Existing Flood Protection System
- Provincial Components
- City of Winnipeg System
- Project Stakeholders & Expectations
- Vision and Mission Statements
- Project Objectives, Boundaries and Key Parameters
- Success Criteria
- Description of Base Case
- Analysis of Base Case
- Cost Modelling & Basis for Cost Estimates
- Alternatives Already Considered
- Methods Used Elsewhere (Benchmarking)
- Key Issues Arising from Pre-Workshop Review
- Study Target Areas

A pre-workshop briefing package had previously been distributed to all team members as required reading. **Volume 2, Appendix B** contains the Executive Summary from the KGS Group Main

Report of the Flood Protection Studies for Winnipeg. Copies of the presentations and a record of the stakeholder viewpoints are provided in **Volume 2, Appendix C.**

3.2.2 Critical Issues and Risks Arising

The critical issues and risks around the project, as seen by the participants at the beginning of the workshop are as listed below. Back-up pertaining to the workshop team's deliberations is provided in **Volume 2, Appendix D.**

Topics: Channel Earthworks and West Dike; Inlet Structure; Outlet Structure

- Stability of Slopes
- Blow out as a result of aquifer (as a result of excavation – making it deeper) where clay layer is thin
- Communication Error
- Trash Jam
- Lost Productivity of Aquifer (increased pumping costs as a result of deepening)
- Deepening – Saline Front Migration
- Gates Jam up
- Gates Jam Down
- Overtopping
- Sabotage
- Erosion/Scour
- Undermining
- Power Outage
- Review extent of geotechnical investigation
- Embankment Failure
- Line channel versus widening
- Flow Velocity:
  - Ways to increase
  - Damage to increase
- Ice Jam
- "Normal" Geotechnical Investigation Program (in reality not enough)
  Trash Jam
- Operator Error
- Programming Error
- Socio-economic cost associated with operating floodway above natural levels
- Operator Access Denied
- Structural Failure
- Gate Failure
- Excavation Costs for Floodway?
- DFO Approvals for Inlet Structures
- Floodway maintenance levels
- Hazard Management
- Fire
- 778' with wind from south needs consideration
- Project scheduling
- Hoist Failure

Topics: Highway and Railway Bridges; Aqueduct; Crossings; Utilities; Drop Structures; Project Management

- Bridges
  1) Restriction of Flow
  2) Collection of Trash
- Existing Bridges Designed for 1:100 years flow
  -Damage to bridge eg. Collapsed span
- Existing Bridges Remain But Reinforced – collection of trash
- Traffic Movement Restriction Flood – during flood conditions (4 road bridges and 4 rail bridges possible but roads flooded)
- Ice Damaging Bridge
- Scour of Bridge piers and Abutments
- Stability of Slope – Collapse at Abutment
- Condition of Bridge – not checked
- Condition of Bridge – not checked abortive work as a result of discovering poor condition
- User Cost During Construction
- Extra Piers in FW during Construction
- Adverse Impacts on FW Operation During Construction
- Consolidation of Crossings/Common Bridges
- Bridge LCC
- Hazard Management
- Project Scheduling

Topics: City of Winnipeg Upgrading Works: Primary Dikes; Sewer Gates; Sewer Isolation

- Ice Blockage As a Result of Build Up in Channel Limits Response Time
- Problems with Excavation During Design Event – Must Evacuate Before
- Breaching of Primary Dike – no contingency plans - Rule 2
- Breaching of West dike – no contingency plans – Rule 2
- Breaching of West bank (floodway) – no contingency plans – Rule 2
- Failure of Inlet Structure gates
- Inadequate Time to Raise Primary Dikes
- Failure of Pumping Plant
- Heavy Rain Fall (Greater than 1 in 5 year)
- Vulnerability of Aqueduct – Maintaining Water Supply
- Vulnerability of Treatment Plants
- Hazard Management
- What is Capacity of River within City of Winnipeg
- Lack of Integrity of Sewer Service Pipes in Secondary Catchment Protection Areas
- Inflow and Infiltration into Sanitary Lift Stations – lack of pumping capacity

3.3 Creativity and Judgement

3.3.1 Ideas Generation

A structured brainstorming session took place, with no initial judgement allowed. The following categories were brainstormed for more cost-effective ways of providing the required function and provide better overall value. A record of the brainstorming sessions is provided in **Volume 2, Appendix E.**

IS	Inlet Structure
C	Channel
WD	West Dyke
OS	Outlet Structure
PM	Project Management
RB	Rail Bridge
HB	Highway Bridge
UC	Utility Crossings
PD	Primary Dyke
SG	Sewer Gates
SI	Sewer Isolation
FPU	Flood Pump Upgrade
PCC	PCC Upgrades

3.3.2 Ideas Screening

During workshop Phase 3, each idea was evaluated using a "gut feel" approach based on:

- Fit with the project Success Criteria shown in **Section 1.4.2**
- Rough indication of cost savings
- Potential likelihood for acceptability
- Advantages and disadvantages (as compared with meeting the same required function with the Base Case).

A full record of ideas screening process is shown in **Volume 2, Appendix F.**

3.4 Development of Most Likely Ideas

3.4.1 Options Considered

During the workshop Phase 4, 58 ideas were screened out as being unlikely to be acceptable for meeting stakeholder requirements. The remaining 127 ideas were grouped for outline development by sub-teams, addressing:

- Hydraulics,
- Earthworks
- Bridges and Utility Crossings
- Project Management, and
- City Upgrades.

3.4.2 Ideas Development

The most promising ideas were developed in the following categories by the persons listed below:

Hydraulics

Bert Lukey, Jay Doering, Rick Carson, Ken Adam, Dave Chalcroft, Duane Kelln

Earthworks

Bill Fisher, Rick Hay, Michael Campbell, John MacPherson, Delwyn Fredlund

Bridges and Utility Crossings

Larry Buhr, Walter Saltzberg, Ismail Elkholy, Dean Gould

Project Management

Brad Sacher, Robert Stefaniuk

City Upgrades

Dave Wardrop

Copies of the workshop development sheets (Initial Development of Potential Improvement Proposal) are provided in **Volume 3, Category IV.**

3.5 Emerging Options

The developed ideas were compared for relative cost-benefit and for overall acceptability, as shown below. The basis for estimating the rough indications of cost is shown in **Volume 2, Appendix H.**

Idea Ref. No.	*Component*	*Capital Cost Impact $M (+/-)*	LCC Benefit $M	Comments
RB-1 RB-2 RB-3	Convert CNR Redditt to through girder Bridge. Convert CNR Pine Falls to through girder bridge Convert existing CNR Sprague to through girder bridge	-5	+11.2	

Idea Ref. No.	*Component*	*Capital Cost Impact $M (+/-)*	LCC Benefit $M	Comments
C-28, C-31	Start Excavation Early on upper reaches of higher elevations	-0.12	Large Potential Savings if Flood occurs in 5th Year	Smoothes cash flow. Minimises risk to construction schedule. Advances construction schedule. Provides early flood protection benefits
WD-1, WD-2	Use excavation (spoil) material to raise west embankment approx 4'			Additional protection to CoW at little or no additional cost
FP - 10	City of Winnipeg implements improvements to reduce Inflow & Infiltration (I/I)	-2.2		Improves reliability and performance of CoW Sewer Infrastructure
IS-18	Install Alternative Backup System to Inlet Gates	+15	$30M	Minimise O&M Costs as it could act as 1 side of cofferdam for future Maintenance Activities. Cost allowance already in base case.
IS-6, IS-8	Improve security (esp. at inlet control structure)	+0.25	+1.5	Improves reliability
IS-14 C-25, C-23	Enhance Floodway Entrance area for bank efficiency & Refine Floodway Entrance Conditions for low level protection system	+0.2		Hydraulic Improvements during summer & Low Level Floodway Protection Upstream
WD-4	Optimize method of protection of west dike against wave action. Review erosion control system, such as soil cement	-7		More Options listed in Base case – could save more
OS-1	Retain East wall of outlet structure wall	-0.8		Impediment to Flow. Potential collection of debris.
PM-9	Establish Project Management Authority (Planning to Maintenance)			Project needs independent, autonomous body to Manage Project and Advance Schedule.
C-13, C-15	Accelerate investigations	+0.2		Needs Group Evaluation

Idea Ref. No.	*Component*	*Capital Cost Impact $M (+/-)*	LCC Benefit $M	Comments
PM-17	Establish recreation representation during Project Development			
PM-20	Compensation policy			Needs Real Attention. Significant risk to schedule. Resolution req'd to acquire flooding.
C-10	Use water tolerant grass in Floodway Channel		-0.55	O & M Benefit. Reduces Environmental Impact Facilitates Summer operation of the Floodway
HB-5	Rehabilitate 4 Highway Bridges	+8	-0.9	Reduces O&M Costs. Minimises disruption to public. Public Acceptability.
PM-14	Perform critical studies/investigations such as Ground water, environmental & Geotechnical			Improves Constructibility & Public acceptance. Reduces construction risk and environmental impact. Provides early benefits.
IS-12	Modify Plug to improve low level hydraulic efficiency of Floodway channel inlet (to accommodate summer water levels in CoW)	+1.2	-1.33	Same level of protection for CoW with lowers headwaters upstream. Provides/supports recreational activities. For this option, it is assumed that the base case includes summer operation to provide recreational benefits and minimise risk of basement flooding.
IS-13	Remove St Mary Rd bridge and relocate over box culvert at the Floodway inlet.	+1.8 (With St. Mary's)		Considerable increase in disruption to traffic. See notes above.
C-38	Raise Riverwalk to 10 JASP			Not enough information to Screen.
C-13, C-16, C-22	Conduct Sensitivity on Slope Stability Options			Not screened. Covered by base case except for surface treatment proposal, which requires consideration.
	Establish Maintenance Policy & Budget			
C-1	Expand Precautionary Engineering Measures to address blow-outs in Floodway channel	+0.25		Already Covered in Base Case. Impacts/benefits difficult to quantify

Idea Ref. No.	*Component*	*Capital Cost Impact $M (+/-)*	LCC Benefit $M	Comments
~~PM-17~~	~~Explore early opportunity for recreation/Partnership~~			
	Note: All components in Level 2 are Base Case + Level 1 + Level 2			
HB-1, HB-2, HB-3, HB-4, HB-27	Improve hydraulic efficiency beneath bridges: Deepen, Box culverts, line and provide square abutments/Reinforced earth			HB-1: Identification of additional benefits to merit further investigation. Costs and benefits are close. HB-2: Liming length is sufficiently long to be cost prohibitive. HB-4: Include in bridge design evaluation. HB-26 may be better alternative that HB-3. HB-27: Erosion control exercise to be part of normal bridge design. Adjunct to HB-1.
C-6, C-16, C-22, C-30	Steepen Floodway sideslopes with engineered surface	-7		Merits further investigation
RB-4	Negotiate with Railroads to combine operations over one Structure	-5.98		Need approval from Railroads
C-29 (a), (b), (c)	Use Excavated Material for Recreational Facilities	-0.75	+0.74	Creates Recreational Opportunities
OS-4	Construct Flume at Floodway outlet to provide water sports feature	+2.04		Evaluated at Birds Hill.
C-33	Reconfigure Pilot Channel			May Reduce Blowouts

Idea Ref. No.	*Component*	*Capital Cost Impact $M (+/-)*	LCC Benefit $M	Comments
RB-9	Remove GWWD Bridge & Relocate operations to Deacon Reservoir	-1	-1.03	
~~C-31~~	~~Deepen Floodway from 59N to CN Sprague~~	~~+30~~	~~-$30M~~	See HB-1
~~HP-15~~	~~Employ large abutments/Reinforced earth~~	~~15~~	~~-$15M~~	See HB-4 above
	~~Pave Floodway Bottom from _____ to _____~~	~~80~~	~~-40~~	
	~~Provide same level of protection upstream as that provided to the City~~	~~$20-$50M~~		~~Solves Social Debate~~
	~~City installs sump pumps & back up measures~~	~~80~~	~~-$100M~~	

4. Study Outputs

4.1 Preferred Option

4.1.1 Summary of Proposals

Key performance aspects for the project are shown in the following table.

KEY PERFORMANCE ASPECTS	KPA / Indicator
Visible project start: • Announcement Funding commitment (Subject to various approvals) • Public Consultation • Field Investigations • Environment review and approvals • Start Project Management Office • Construction start – advance work • Construction start – Main project	 Winter 2002 Spring 2003 Start Fall 2002 Start Spring 2003, Finish Summer 2004 Fall 2002 *Remove Lac-du-Bonnet bridge F/W 2002 *Floodway security F2002 *Start Project Build West Dike using local borrow
Correct deficiencies of existing Primary Dike	Summer 2003
1 in 700 year flood protection for City of Winnipeg	2008
Control of Summer water levels through city: a)During construction through 2008 b)Upgraded Floodway in service (after 2008)	 7 – 16 ft James 8 ft James (99% of time between June & September)
Change in operating rules to avoid reliance on and risk inherent in emergency raising of primary dike	Address uncertainty by adopting Enhanced Scenario
Resolution of compensation issues	Summer of 2003

A summary of the **Value Study Proposals** is provided in **Annex II**. Details of the Value Study Proposals are provided in **Volume 3**.

4.1.2 Study Recommendations

The study recommendations were grouped into a preferred option and a city infrastructure modification option. The preferred option includes surviving trial proposals relating to modifications of the base case (modified base case) and focused additions to the base case (enhanced protection). Finally, the city infrastructure modification option was also developed that can be added to either of the other options.

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.

Highlights of all options are listed below:

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

Note: VSP I and J have been revised following the workshop to include comments from Bert Lukey/Rick Carson and George Rempel/Dave Wardrop respectively. Copies of their correspondence can be found in **Annex IV.**

4.1.3 Revised Schedule

The revised (trial) project schedule is **Annex III.** This shows an earlier start in terms of a) more intense geotechnical investigations, b) bridge works, raising of West Dike. This schedule shows substantial completion of the project by spring 2008. This is deemed as the **likely scenario**, whereas more intensive review may show that a best case scenario could accelerate project completion by say six months. A worst case scenario, based on occurrence of unmitigated risks, as identified in the initial risk review, could possibly extend the project completion by as much as an additional two years.

4.1.4 Potential Cost Implications

In line with the schedule revisions above, **Annex III** also provides a table of comparison of costs (Base Case Vs Preferred Option). The Preferred Option could be implemented at a slightly lower cost (potentially up to $30M capital savings) than the Base Case and provide improved value along with greater protection. An optimized project expenditure profile is also provided in **Annex III**. A structured contingency fund should be identified to deal with specifically identified risks.

4.1.5 Risk Implications

An initial risk review was undertaken for the Preferred Option. This reviewed all risks associated with the major components of the project including the upgrading of the Floodway, the raising of the West Dike, the upgrading of the City of Winnipeg Infrastructure and Management (including Project Development, Implementation and Operation). A summary of the **Risk Tables** is provided in **Annex II.** Details of this initial risk review are provided in **Volume 2, Appendix J**.

The risk study group brainstormed all risks to do with Management, Design and Construction, Operation and Third Parties. These amounted to around 50 risks in total.

Having identified the risks, the group attempted to establish their significance by scoring their probability and consequences (in terms of cost and time). This was carried out for two cases, the first where **unmanaged**, the risk is allowed to take place without interference; the other case where **managed**, mitigation measures are put into effect to minimise the risk. By defining the maximum and minimum boundary conditions, it is then possible to estimate the **likely risk allowance**, through the root mean squared method or other statistical method.

It must be emphasized 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.

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.

4.2 Verification Actions / Next Steps

4.2.1 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
- Development of an evacuation plan
- Risk mitigation plans and structured contingency plan
- Distinguish between operations and construction, and mitigation
- Evacuation Plan
- 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.
- Evacuation triggers based on environmental and flood forecasting conditions have not been developed.
- Consider emergency raising of primary dikes with Jersey Barriers.

Volume 2, Appendices K to N provide details of various group discussions on these issues.

4.2.2 Stakeholder Consultation

A meeting was held August 19, 2002 with the Review Panel, the Planning Team, various members of the Technical Team and the Value Consultants. Following presentation of the workshop deliberations, the surviving trial proposals under each Issue Area was reviewed and comments made. Meeting minutes and the status of proposals at this time are available in **Annex IV**: Recommendations.

A process is necessary to ensure that stakeholder involvement is practised and consensus is developed as plans evolve.

Volume 2, Appendices P and Q also provide a record of key consultation and feedback received to date.

4.2.3 Areas of Early Potential Actions

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

4.2.4 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.

4.2.5 Further Risk Assessment

Having now undertaken the initial risk review, it is suggested that the risks are assessed further and that in particular, a formal risk management procedure is put into place through which options for mitigating them are considered, associated secondary and residual risks are identified and a plan of action put into place as to how each of the significant risks is managed. Associated with the action plan should be the identification of risk managers and a time scale over which any action plan should be activated.

It would be prudent to institute a process for a continuing value, risk and team management improvement approach.

4.2.6 Additional Ideas for Consideration / Potential for Further Savings

A number of other ideas were identified and could be examined or re-examined to ensure that maximum value is obtained. These are shown in **Volume 2, Appendix O**.

ANNEX I

VE Study Framework And Description of Existing Flood Protection System

Value Study Team Consist

VA/VE Study Sponsor: Andy Horosko
VA/VE Study Project Manager: Ismail Elkholy
Proponent: Steve Topping

Planning Team

Name	Title	Company/Affiliation
Andy Horosko	Deputy Minister, Transportation	Gov. of Manitoba
Steve Topping	Director, Water Branch	Conservation
Brad Sacher	Executive Director, Transportation	TGS
Ismail Elkholy	Director, Bridges & Structures	TGS
John Logan	Bridge Design Engineer	TGS

Owner's Representatives

Name	Title	Company/Affiliation
Rick Hay	Flood Control Infrastructure	Conservation
Dave Wardrop	Wastewater Operations Engineer	City of WPG
Ismail Elkholy	Director, Bridges & Structures	TGS

Value Consultants

Name	Role	Company/Affiliation
Martyn Phillips	Lead Facilitator	The Team Focus Group
Scot McClintock	Asst. Facilitator	The Team Focus Group
Michael Thompson	Risk Manager	The Team Focus Group

Co-ordinator / Recorder

Name	Role	Company/affiliation
John Logan	Co-ordinator	TGS
Katherine Daniels	Recorder	TGS
Michael Hagos	Recorder	TGS

Technical Team

Name	Company/Affiliation	Background
Ken Adam	Earth Tech Canada	Environmental
Larry Buhr	Buhr & Associates	Geotechnical/ Civil & Structural/ Hydraulics/Hydrology
Michael Campbell	U of M	Landscape Architecture
Rick Carson	The KGS Group	Original Design Consultant

Name	Company/Affiliation	Background
Dave Chalcroft	Retired UMA Senior V.P.	Civil & Structural
Delwyn Fredlund	Adjunct Prof. Hong Kong University	Geotechnical
Jay Doering	U of M	Hydraulics/Hydrology
Bill Fisher	Munroe Construction LTD	Constructibility/ Scheduling
Dean Gould	Independent Consultant: A Dean Gould & Associates	Geotechnical
Duane Kelln	Conservation	Hydraulics/Hydrology
Bert Lukey	Retired – PFRA Chief Engineer	Hydraulics/Hydrology
Dave MacMillan	The KGS Group	Design Consultant
John MacPherson	Acres International	Civil & Structural
Rick Martin	The KGS Group	Design Consultant
Gerald Proteau	MB Hydro	Transmission Line
George Rempel	TetrES Consultants Inc.	Environmental
Brad Sacher	TGS	Planning
Walter Saltzberg	Independent Consultant / ISIS Canada / Retired Director, Bridges & Structures	Bridges
Bert Smith	The KGS Group	Design Consultant
Bob Stefaniuk	Mayor, RM of Ritchot	Municipal Representation

Review Panel

Name	Title	Company/Affiliation
Paul Vogt	Secretary to Cabinet for Policy – Executive Council	Gov. of Manitoba
Andy Horosko	Deputy Minister, Highways	Gov. of Manitoba
Norm Brandson	Deputy Minister, Conservation	Gov. of Manitoba
John Hosang	Assistant Deputy Minister, TGS	Gov. of Manitoba
Brad Sacher	Executive Director, Highways	TGS
Ismail Elkholy	Director, Bridges & Structures	TGS
Steve Topping	Director, Water Branch	Conservation
John Logan	Bridge Engineer	TGS
Bill Borlase	Director of Water & Wastewater Operations	City of WPG
Dave Wardrop	Wastewater Operations Engineer	City of WPG
Rick Carson	Manager, Water Resources Group	The KGS Group

Workshop Team Consist Biographies

Ken Adam, P.Eng., Ph.D..is a Senior Engineer with over 40 years of experience in teaching, research and consulting. Ken's areas of expertise include groundwater, hydraulics, hydrology, cold regions engineering and environmental licencing of large projects. Ken taught a wide range of courses in Civil Engineering at the University of Manitoba including groundwater at both the undergraduate and post-graduate levels. Ken's major projects include the siting and runway design at Rothera Point, Antarctica; runways and water supplies at six sites of the North Warning System from Gjoa Haven to Coppermine; numerous groundwater projects from Caron, Saskatchewan to Dryden, Ontario; and, the environmental licencing of Louisiana Pacific OSB plant-Swan River, Tolko Industies OSB plant-Kenora, and, Maple Leaf Pork in Brandon. Ken is currently working on the licencing of the Maple Leaf second-shift in Brandon and the associated Industrial Wastewater Treatment Facility for the City of Brandon. Ken runs his own consulting firm - Adam Stevenson & Associates; and, is currently a contract employee with Earth Tech (Canada) Ltd.

Larry Buhr, M.Sc., P.Eng, is a professional engineer involved in the Design and Construction of large Civil Engineering Projects for nearly 40 years, with special emphasis on Hydraulic Structures. He has offered specialized hydraulic and other civil/structural/geotechnical services to Governments and Corporations on a vast list of Bridge Projects and Hydraulic Structures, acting as an independent consultant and as Regional Manager and Director of Business Development for Dillon Consulting Ltd. His experience includes a great knowledge of the Red River Floodplain Hydrology and the Manitoba Flood Control Infrastructure

Michael Campbell, Ph.D. is an Assistant Professor of Recreation Studies at the University of Manitoba with a background in both parks and protected areas and geomorphology. Dr. Campbell's research interests focus upon managing human impacts in parks and other protected areas with special emphasis upon abiotic features and processes. In addition, he has recently completed a 3 year study regarding communications and public opinion as it relates to hunting as wildlife management.

Richard W. Carson, M.Sc., P.Eng., is the Manager of Water Resource Services at KGS and acted as the Manager and Technical Director for the KGS Final Report on Flood Studies for the City of Winnieg. His experience spans over 30 years as a consultant specializing in large water resource projects both in Canada and internationally with KGS and Acres International. He is Adjunct Professor of Hydraulic Engineering at the University of Manitoba and member of various professional associations. He is author/co-author of many manuals in the field of water resources and over 20 technical papers published in various engineering journals.

Dave Chalcroft, P.Eng. is an independent consulting engineer with a civil engineering background. During his 37-year career with UMA Engineering Ltd., he has managed engineering teams on a number of significant civil engineering projects including the Oldman River Dam and the Dickson Dam in Alberta, as well as transportation and industrial projects. Currently he serves on a number of project review boards for project owners including the Little Bow Dam, and the Carseland Bow Headworks projects for the Alberta Government

Delwyn G. Fredlund, Ph.D., Professor Emeritus at the University of Saskatchewan and Adjunct Professor at the Hong Kong University of Science and Technology is a leader in the field of soil mechanics and slope stability with research focused on unsaturated soil mechanics and the behaviour of unsaturated soils in general. His experience with the National Research Council of Canada, the Private Consulting Industry and numerous Universities spans over 40 years and includes providing expert services to Governments, Corporations, Institutions and Agencies

throughout the world in the Geotechnical Field. Other accomplishments includes co-author of "Soil Mechanics for Unsaturated Soils", authored on over 300 journal and conference research papers, founder of Engineering and Software companies and numerous International awards in the Geotechnical Field

Katherine Daniels is an Administrative Officer with Manitoba Transportation and Government Services, Engineering and Operations Division (Management Services), and has 16 years experience with the Department in the field of administration. She has been directly employed with the Bridges and Structures Branch as well as with the areas of Transportation and Construction and Maintenance, providing administrative support to Senior Management

Jay Doering, P.Eng., Ph.D., is the Head of Civil Engineering at the University of Manitoba and a registered professional engineer with 14 years experience. He has won numerous awards for excellence in teaching and research, and has published nearly 90 technical papers in hydraulics, coastal processes, and ice engineering. He has provided expert opinions in the field of water resources to many clients, including the UN Geneva. He became involved with Red River flooding when he assisted the province during the 1997 flood and has recently been outspoken on how to best upgrade Manitoba's flood infrastructure.

Ismail Elkholy, Ph.D., MBA, P.Eng., is the Director of the Bridges & Structures Branch, Manitoba Transportation and Government Services. In nearly 30 years of diverse experience in senior management with the Province and previously CN Rail, Ismail has focused on the planning, design, construction, maintenance, evaluation and rehabilitation of highway and railway infrastructure. He also possesses a personal interest and professional competency in business administration, strategic planning, project management, and financial and economic analysis. Ismail was nominated on two separate occasions for the CN President's Award honoring innovation and dedication to the rail industry.

Bill Fisher, P.Eng. is a civil engineer with Hugh Munro Construction Ltd. He has been involved with heavy construction projects in western Canada since 1963 when his first employer, Monarch Construction Ltd. got the first contract on the Winnipeg Floodway.

Dean Gould, P.Eng., is a professional engineer that has been involved in geotechnical engineering for over 40 years. He has been involved in a wide array of projects which include the Red River Floodway design and construction, Alaska Highway as materials Engineer, design and construction of the Manitoba Hydro Lake Winnipeg Regulation project and was Provincial Engineer for Ducks Unlimited. Since 1984 he has offered specialized Geotechnical consulting services to Government , Corporations and large Consulting organizations on many major bridges, building foundations, riverbank stabilization, retention ponds, landfills and road projects throughout Manitoba and western Canada.

Duane Kelln, M.N.R.M., P.Eng., is a Hydrologist with the Water Branch of Manitoba Conservation with over 20 years of experience on various public sector water projects and activities in Manitoba and the other prairie provinces. His primary work has been in performing hydrologic and hydraulic analyses for design, planning, licensing and environmental purposes. His experience has encompassed computer simulation modeling and forecasting

John Logan, P.Eng, is a Bridge Engineer with Manitoba Transportation and Government Services, Bridges and Structures Branch with over 10 years of experience working in both the Public and Private sectors. He has been involved with all aspects of bridge management, inspection, design

and construction and particularly, assessment, structural and foundation design and hydraulic analysis on a variety of bridge projects in Manitoba and Western Canada.

Bert Lukey, M.Sc., P.Eng., is an engineering consultant with over 40 years of experience in the planning and implementation of water management programs and projects in the public and private sectors. He was Director of Engineering and served in other senior positions with the Prairie Farm Rehabilitation Administration, involved in all aspects of the negotiation, planning, investigation, design, construction and operation of many hundreds of projects, mostly on the Canadian prairies. Most recently, he has served in an external review capacity on developments in western Canada and internationally, including advising on and reviewing recent studies for Red River flood mitigation proposals.

John G. Macpherson P.Eng., with nearly 50 years of experience with Acres International and Crippen Acres Ltd in roles as Geotechnical Department Head, Executive Engineer, Regional Manager and Vice President has extensive experience in the study, design and construction of large water resource projects with particular expertise in the civil and geotechnical fields. Most notable projects include the Nipawin, Wuskwatim, Conawapa, Gillam, Limestone, Long Spruce, Kanuchuari, Kettle and Grand Rapids Hydroelectric Generating Stations. In addition, he was Project Engineer for the Assiniboine River - Portage Diversion Project, the Inlet and Outlet Control Structures and the Seine River Drop Structure on the Red River Floodway.

Scot McClintock is a well-qualified value management practitioner with 19 years of VE/ VM experience. Scot has balanced cost and quality in over 130 VE/VM project and training workshops to identify value improvements of over $500 million on projects totaling nearly $3 billion. He has facilitated VE/VM studies for civil, environmental, and building projects around the world and highway and bridge projects throughout Canada. He is also an Adjunct Professor of Value Engineering & Management at Syracuse University.

Martyn Phillips, CVM, CVS, FICE, FCIWEM, P.Eng., PVM is a Value and Risk Management consultant with a civil engineering background. He has represented owner organizations, contractors and traditional consultants in a variety of posts since 1964 and on major infrastructure projects up to US$3.6 Billion construction cost. He has conducted value management/analysis/engineering studies for a variety of topics in several different parts of the world.

Gerald Proteau, P.Eng, is a Transmission Line Design Engineer with Manitoba Hydro, Transmission & Civil Design Department with 10 years of experience. He has been involved in all aspects of transmission lines from project management, design and maintenance, project estimating, and inspection on a variety of transmission line projects in Manitoba and Canada.

George Rempel, P.Eng. is a consultant specializing in the water resources and environmental fields. He has extensive experience in the planning, functional design, and implementation of public works facilities. He has directed multidisciplinary engineering/environmental teams on a very wide range of projects. He has managed and been a participant in several Value Engineering workshops.

Brad Sacher, P.Eng., is the Executive Director of Highway Engineering with Manitoba Transportation and Government Services. Brad has more than 17 years of traffic and transportation engineering experience in both the public and private sectors. He has been involved in all aspects of highway engineering including transportation planning, traffic engineering, functional and detailed design, urban and rural construction contract administration and asset management.

Walter Saltzberg P.Eng. is a Technical Consultant with ISIS Canada a network of centers of excellence located at the University Of Manitoba as well as Associate Professor Engineer-in-Residence with the Faculty of Engineering University of Manitoba. He has been involved with the design, construction, inspection and maintenance of bridges for 50 years both with the CNR and Manitoba Transportation. Mr. Saltzberg's experience includes management at very senior levels with Manitoba Transportation.

Bob Stefaniuk, BA, CIM, as Mayor of the Rural Municipality of Ritchot (first elected to Council in 1995) faced the Red River flood of 1996 and then the following year, the 1997 Red River "Flood of the Century". He served in the Canadian Navy from 1964 to 1966 and subsequently worked in the aerospace industry holding a variety of positions in the Quality Assurance field. He serves on many boards and committees.

Gerald Tencha, P. Eng., MCIP, is a Contract Engineer with Manitoba Transportation and Government Services, Engineering and Operations Division for the last ten years. He provides consulting advise on procurement matters to the Department and also administers contracting services for an annual procurement of approximately $60 million in Construction Contracts and $25 million in Material Purchases.

Michael Thompson, BSc(Eng)(Hons), FICE, MCIWEM, is a very experienced project manager and practitioner of Partnering, Value Management, Value Engineering and Risk Management, having worked in excess of 35 years in the construction industry, gained in the United Kingdom, in the Near East, in the Middle East and in the Far East. He was director of a large international consultancy, responsibilities including the design of the River Tees Barrage, until he established his own business in late 1996, now part of The Team Focus Group. Since 1996, Michael has promoted all that is necessary to achieve 'Best Practice' and 'Best Value' through the use of the value methodology, and risk and performance management within a partnering or team culture.

Dave Wardrop is a graduate of the University of Manitoba with both a Bachelor's and Master's of Science in Engineering. Mr. Wardrop holds the position of Field Service Operations Engineer with the City of Winnipeg Water and Waste Department and has been responsible for the operation and maintenance of the City's flood control infrastructure since 1995. During this period, Dave has been intimately involved with Winnipeg's flood control operations, including the successful flood fighting efforts of 1996 and 1997.

Existing Flood Protection System

Floodway Channel

The Floodway channel is approximately 29 miles in length with a difference in water surface under design flood conditions, of approximately 18 ft. between the inlet and the outlet. The alignment and location of the channel as well as all infrastructures on the channel is shown in Attachment 2. It is located in the high plasticity lacustrine clays of glacial Lake Agassiz, which are underlain generally by glacial till, with an exception, Birds Hill ridge which is a granular fluvio-glacial deposit.

The base width of the channel varies from 380 ft. to 540 ft., and the top widths range from 700 ft. to 1000 ft. The inlet to the Floodway is located in the east bank of the Red River and consists of a broad-crested earthen weir 700 ft. in width, with a crest elevation of 750 ft. There is a transition section below this weir, which widens gradually to the normal Floodway cross section. The crest at El. 750 ft. ensures that flows below approximately 30,000 cfs pass down the Red River and do not enter the Floodway. The reach from the inlet to Birds Hill has a channel base width of 540 ft., with 6H to 1V side slopes in clay. The reach through Birds Hill has base width of 420 ft., with side slopes of 3H to 1V in granular material, and the reach north of Birds Hill to the outlet, has a base width of 380 ft. with 6H to 1V side slopes in clay and glacial till. The design depth of flow in the channel is approximately 26 ft. The greatest depth of excavation was 65 ft. in the Birds Hill area where side slopes are 3H to 1V in the granular zone. The side slopes are reduced to 9H to 1V in clay near railway and road structures, due to slope stability considerations, with a corresponding reduction in base width. Transition sections are incorporated in the channel at points of change in cross section and above and below structures where the side slopes are flatter.

The Floodway Inlet Control Structure is situated in the Red River downstream from the inlet to the Floodway Channel. The structure consists of concrete abutments and a central pier with two large submersible type gates, each 112.5 ft. wide (see sketch 1 Attachment 2). The gates normally are in the submerged position, with about 8 ft. of water over them in the summer months. Under these conditions the crest of the channel inlet at El. 750 ft. permits flows to enter the Floodway when the Red River discharge exceeds 30,000 cfs. As the natural river stage increases above 30,000 cfs, there is a division in flow between the Floodway and the River. The purpose of the Floodway Inlet Control Structure is to counteract this drawdown and to regulate the division in flow between the Floodway and the Red River. The gates in the Floodway Inlet Control Structure are operated to maintain a water surface elevation upstream of the structure at the level that would occur under natural conditions.

Dikes on either side of the Floodway Inlet Control Structure retain the flood waters (see sketch 2 in Attachment 2). East of the Red River, the East Dike is incorporated into the embankment created by the Floodway channel excavation. The dike extends parallel to the Floodway and on its west side for a distance of 6 miles. West of the Red River, the West Dike extends a distance of about 20 miles in a southern and a westerly direction from the Inlet Control Structure up to the point where the natural ground is above the design flood elevation. The West Dike contains the floodwaters of the Red River and prevents the flow from passing into the LaSalle River Watershed, where it would bypass the Floodway Inlet Control Structure and enter Winnipeg directly. During large floods, the river water level is well above the natural bank level and flooding extends laterally over many miles (some 25 miles in 1997, for example). This wide body of water has been called the "Red Sea" in local engineering circles, and this name has been used throughout this Brief. Extension of the West Dike westward along PR 305, to the vicinity of Brunkild was undertaken in 2001.

The difference in water level over the entire reach of the Floodway channel from inlet to outlet is 18 ft. under design conditions but the corresponding difference of the Red River between those same points is about 32 ft. The purpose of the Outlet Structure therefore is to dissipate the energy in the water at its point of re-entry into the Red River near Lockport, thereby preventing damage and erosion in the River. The outlet structure is founded on bedrock and is constructed of mass concrete with an uncontrolled rollway, having a crest length of 162 ft. and a stilling basin 120 ft. in length (see sketch 3 in Attachment 2). The design capacity of the outlet structure is 60,000 cfs.

Portage Diversion

The Portage Diversion is an 18 mile long channel designed to carry up to 25,000 cfs of flood flow from the Assiniboine River at a point upstream of Portage la Prairie northward to Lake Manitoba. The removal of flood flows via the Diversion provides flood protection not only to the City of Winnipeg but also to the City of Portage la Prairie and the area adjoining the Assiniboine River between those cities. Construction of the project commenced in 1965 and was completed in 1970 at a total cost of $20.5 million. It involved approximately 10,000,000 cubic yards of excavation as well as construction of several structures including three highway bridges and three railway bridges across the Diversion. The major elements of the project are the dam in the Assiniboine River, the concrete spillway control structure (River Control Structure), the Diversion Structure that controls water entering the Diversion, the Diversion channel itself, two gradient control structures and the Outlet Structure.

Shellmouth Dam

The Shellmouth Dam is located about 30 miles northwest of Russell in an area where the valley of the Assiniboine River is wide with high banks. The dam is about 70 ft. high and 4,200 ft. long. It has a reinforced concrete horseshoe-shaped conduit 15 ft. in diameter by means of which reservoir releases are made. Flood flows in excess of conduit capacity are either stored in the reservoir or are passed over an un-gated concrete chute spillway.

The reservoir created by the Shellmouth Dam is approximately 35 miles long and is capable of storing 390,000 acre-ft of water. The protection afforded by the reservoir extends over the entire reach of the Assiniboine River between the Shellmouth Dam and its confluence with the Red River at Winnipeg. The Cities of Brandon and Portage la Prairie as well as Winnipeg benefit by both flood reduction and low flow augmentation. Construction of this project was initiated in 1964 and was completed in 1972 at a cost of $10.8 million.

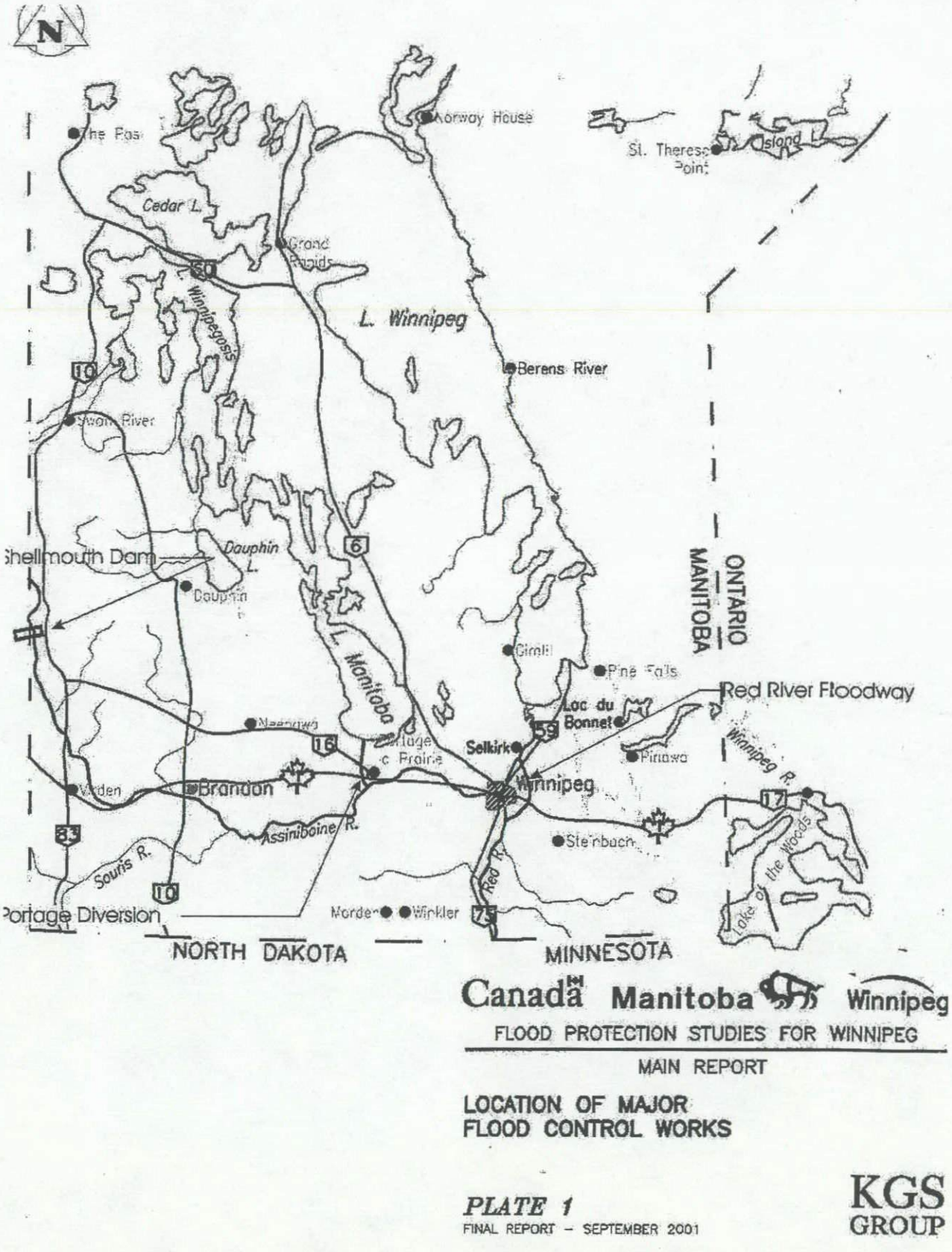


Plate 1 – Location of Major Flood Control Works (from KGS Main Report)

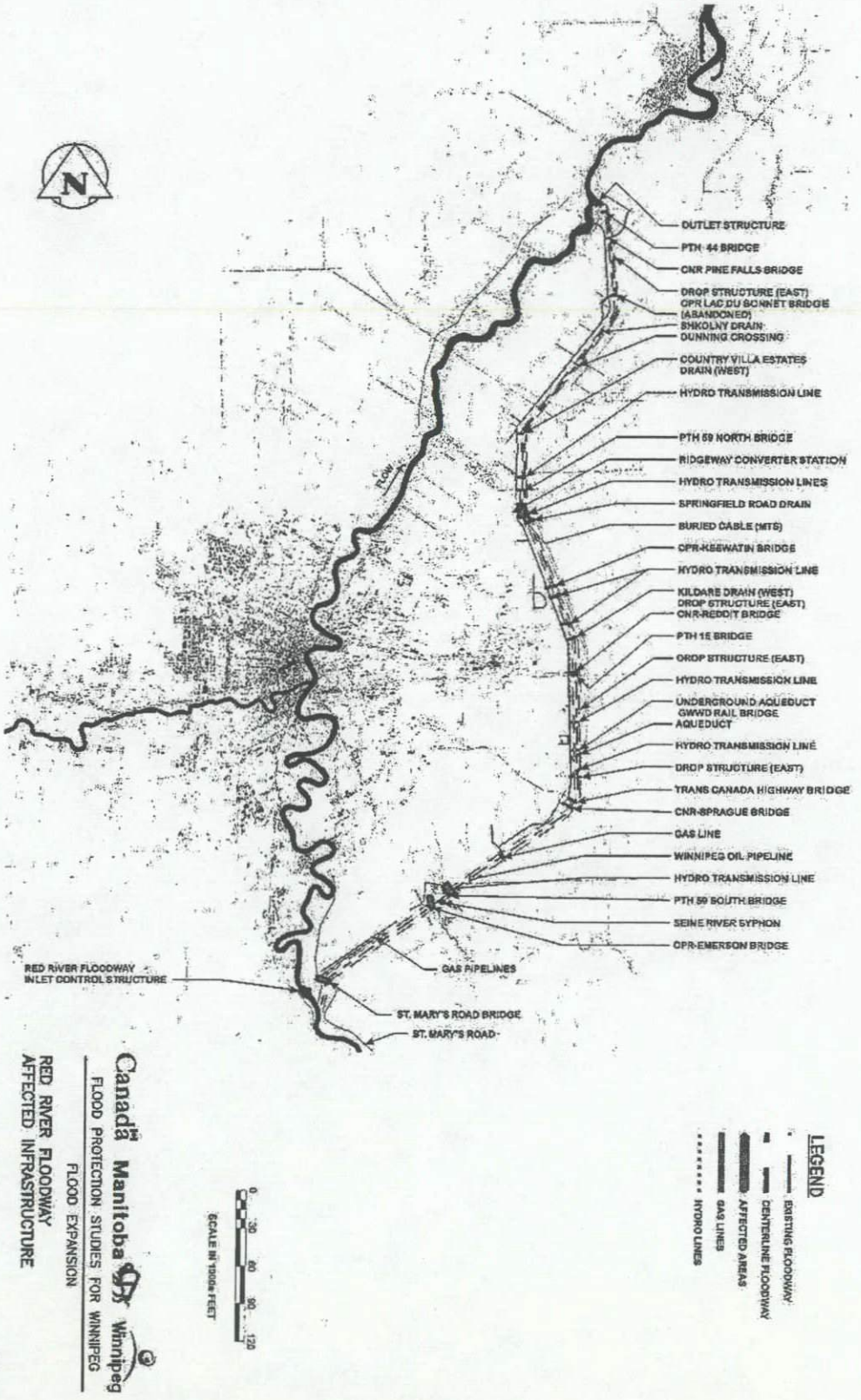
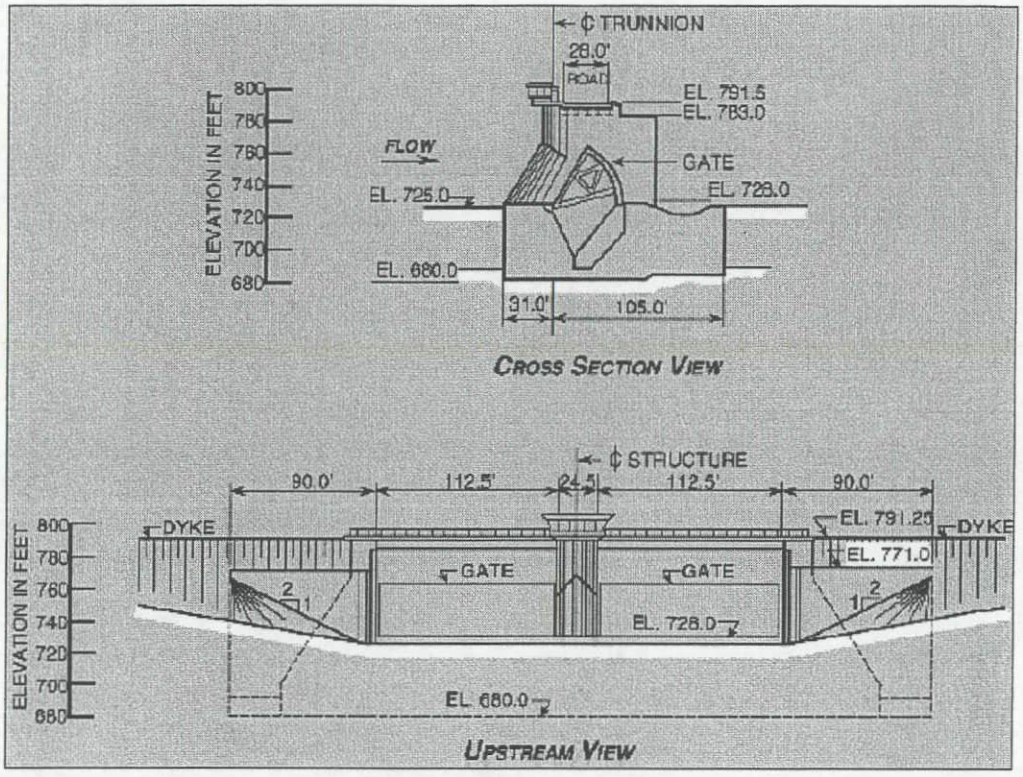
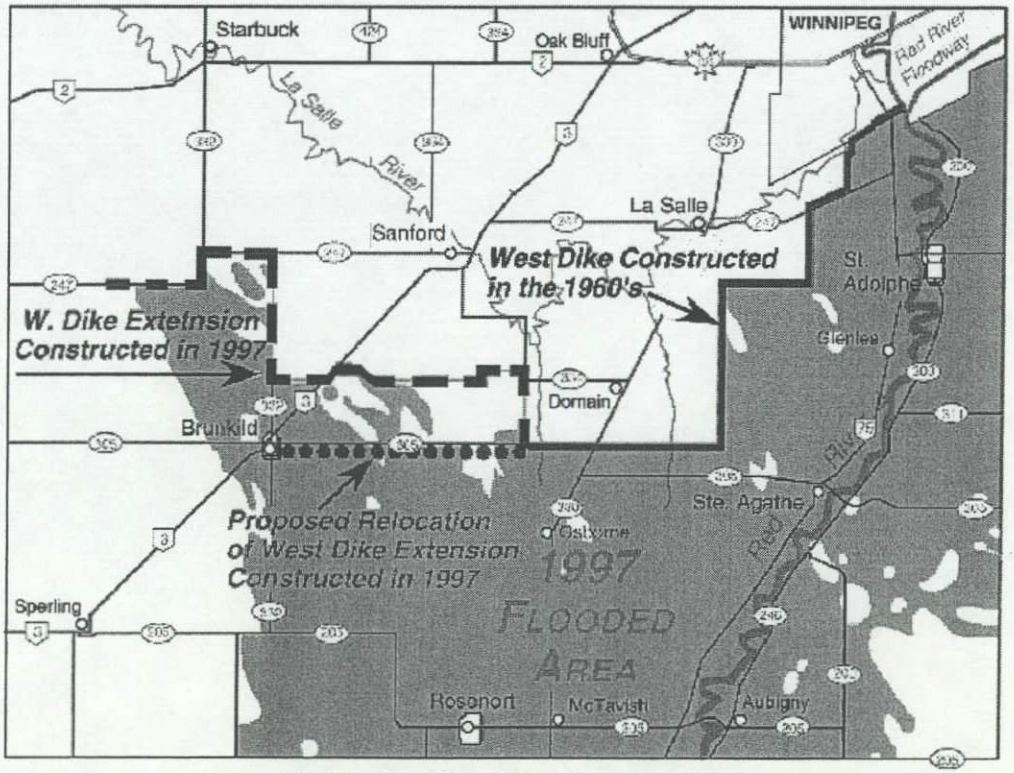


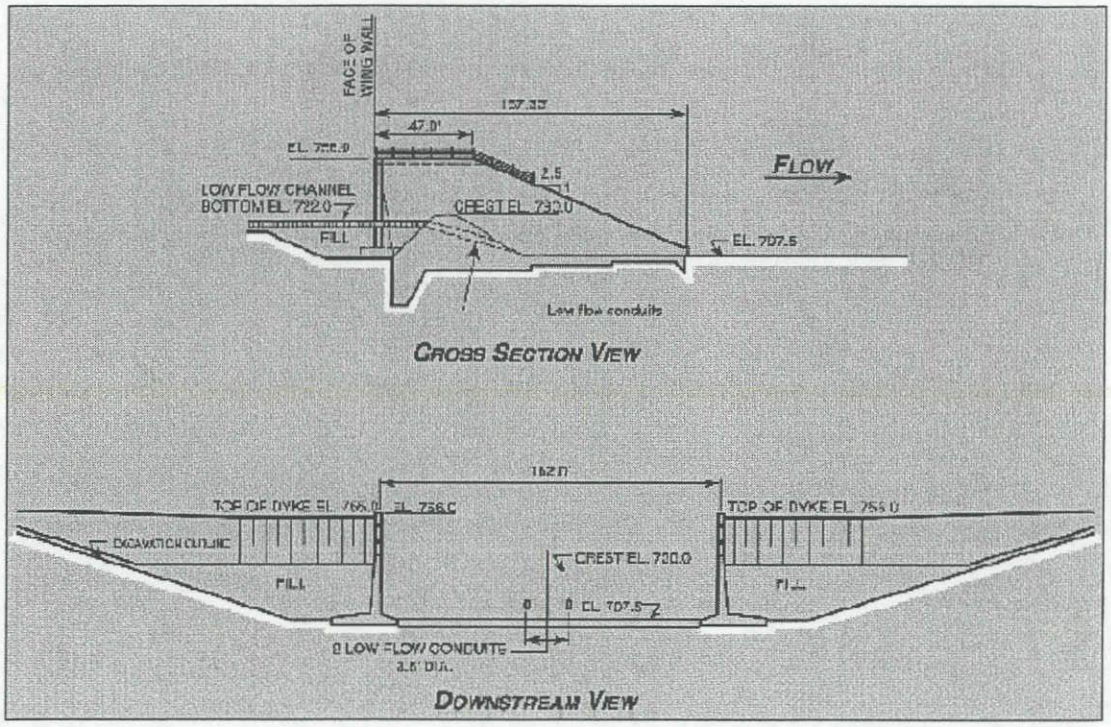
Plate B-2: Red River Floodway Affected Infrastructure (from KGS Appendix B)



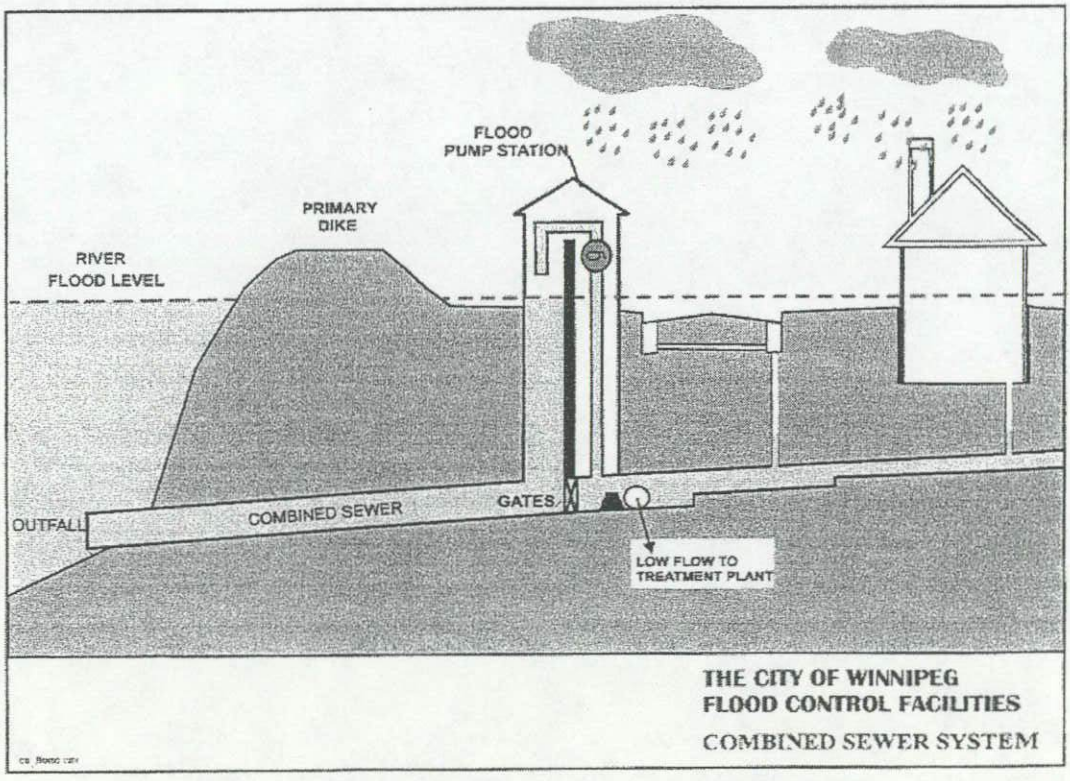
Sketch 1 – Inlet Control Structure



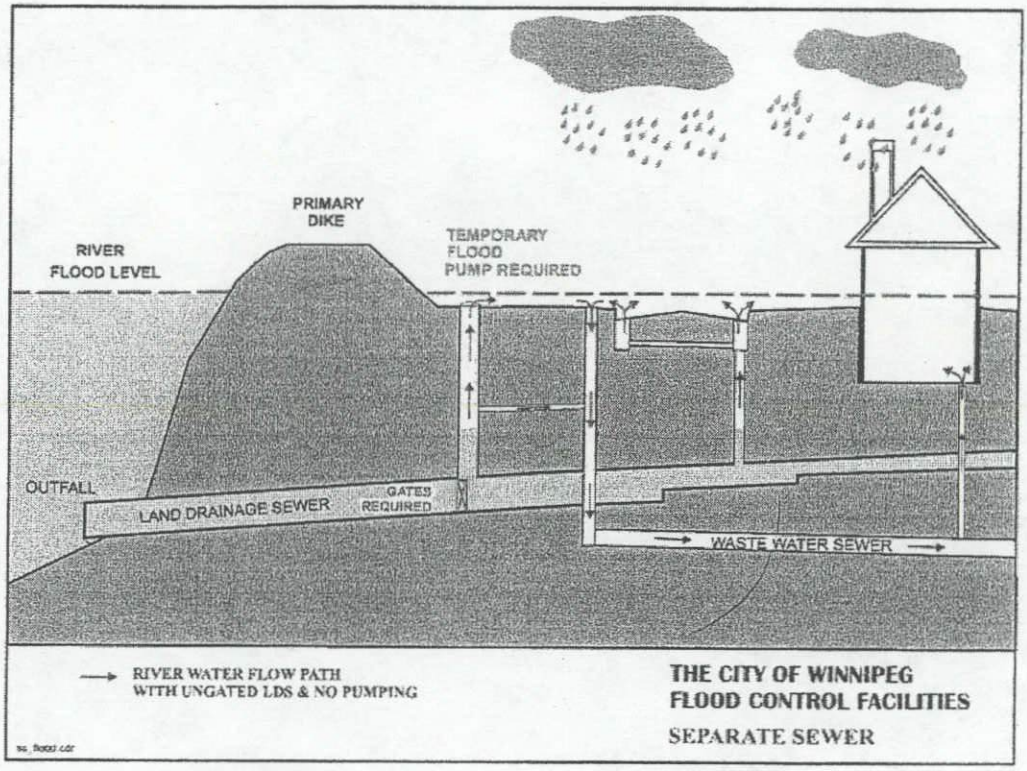
Sketch 2 – West Dike Construction



Sketch 3 – Outlet Control Structure

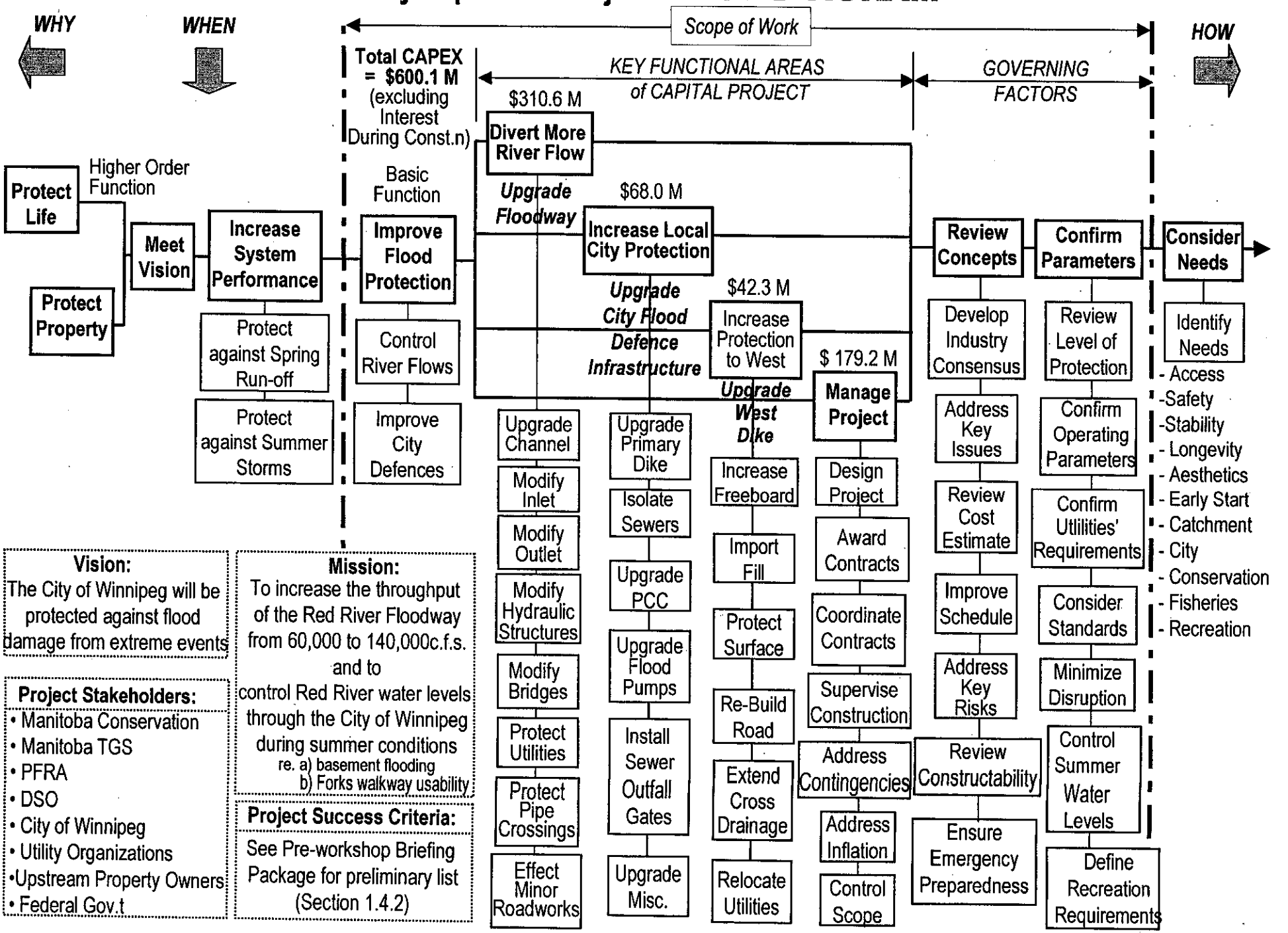


Sketch 4 – City of Winnipeg Flood Control Facilities



Sketch 5 – City of Winnipeg Flood Control Facilities

Red River Floodway Expansion Project: FAST D AGRAM



ANNEX II

Preferred Option:

- Value Study Proposals (VSPs)
- Summary of Risk Appraisal

VALUE STUDY PROPOSAL (VSP) BRIEFING NOTE
MODIFIED BASE CASE

VSP REFERENCE: **A (includes idea C-1; C-6, 16, 22, 30; C-10; C-13, 15 & C-23, 25; C-28, 31; C-29 a,b,c; and C-33)**

ISSUE: **RED RIVER FLOODWAY CHANNEL**

DATE: **AUGUST 2002**

ISSUE SUMMARY:

- Modifications to channel and embankment excavation are needed, as well as spoil transport and vegetation cover.

BACKGROUND:

- The current design of the expanded Floodway channel will handle 140,000cfs, but does not address summer flow conditions.
- The current channel design is based upon 6:1 side slope and deeper channel.
- A grass-lined channel similar to existing Floodway conditions is subject to die off after inundation.
- Recreation has been identified as an issue but no explicit plans are in place.

DISCUSSION:

- The lower channel vegetation can be a water-tolerant species to accommodate increased summer usage;
- The gaps in the East Embankment and Richardson's Coulee can be enlarged to enhance water entry to the Floodway channel;
- The excavation schedule can be expedited by allowing excavation on the upper sides of the channel while work on lower channel is in progress;
- Conducting additional soil investigations can enhance "blow-out" management;
- Using proven slope stability techniques, based on necessary slope stability testing, channel side slopes can be increased to 5:1 with significant capital cost savings;
- Excavated material can be used to create a cross-country ski/mountain bike centre near the Seine River Syphon, and expand and elevate Spring Hill;
- The pilot channel can be reconfigured to a wider, shallower profile to reduce risk of "blow-outs" of glacial till.

FINANCIAL IMPLICATIONS:

- Potential capital cost-savings estimated at $7.92 million.
- Potential life cycle cost savings of $548,000.00.

RECOMMENDATION:

- Seed the lower channel with water tolerant vegetation;
- Enlarge gaps in East Embankment and Richardson's Coulee;
- Allow excavation to proceed on upper sides of channel concurrent with lower flow channel excavation 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, subject to results of soil tests;
- Construct a cross-country ski and mountain bike park on the West Embankment near the Seine River Syphon, and expand and raise the hill at Spring Hill, from excavated materials;
- Design pilot channel wider and shallower to reduce risk of "blow-outs".

COMMUNICATION STRATEGY:

- Not required.

VALUE STUDY PROPOSAL (VSP) BRIEFING NOTE
MODIFIED BASE CASE

VSP REFERENCE: **B (includes idea IS-2a, IS-6, IS-8, and IS-12)**

ISSUE: **INLET STRUCTURE AT THE RED RIVER FLOODWAY**

DATE: **AUGUST 2002**

ISSUE SUMMARY:

- Concerns at the existing inlet structure include a lack of redundancy for the gates, security of the facility, and the current inability to accept lower summer level flows.

BACKGROUND:

- The current design suggests provision of a second set of gates at the inlet structure at a construction cost of $30M.
- The existing inlet structure is currently at risk to vandalism and sabotage.
- The Floodway channel plug, which protects against ice jamming in the Floodway channel, prevents operation at lower summer levels and causes upstream effects.

DISCUSSION:

- Provision of simple bulkheads downstream of the present gates would limit flows into Winnipeg to 80,000cfs, yielding adequate redundancy for an estimated $15M.
- A security expert should be retained to advise on inlet structure security, and steps taken to implement recommendations into design of the Floodway expansion.
- Removing the existing earthen plug will allow summer flow regulation with minimal upstream impact. Piles can be installed to prevent ice from entering channel during spring flood.

FINANCIAL IMPLICATIONS:

- An estimated construction cost savings of $13.55M.

RECOMMENDATION:

- Design and install bulkheads downstream of existing gates to limit flows through Winnipeg to 80,000cfs.
- Retain a security expert to advise on steps to improve security at the inlet structure, and incorporate recommendations into the design.
- Remove the existing earthen plug in the Floodway channel to allow flow regulation, and install a staggered pile "fence" for spring ice jam prevention.

COMMUNICATION STRATEGY:

- Not required.

Date: September 2002

VALUE STUDY PROPOSAL (VSP) BRIEFING NOTE
MODIFIED BASE CASE

VSP REFERENCE: **C (includes idea OS-1 and OS-4, 5)**

ISSUE: **OUTLET STRUCTURE AT THE RED RIVER FLOODWAY**

DATE: **AUGUST 2002**

ISSUE SUMMARY:

- Current design includes $11.8M modifications to the outlet structure.

BACKGROUND:

- Current design expands the outlet structure by removing one training/retaining wall completely and adding additional width of rollway/basin. No recreational amenities are provided.

DISCUSSION:

- At the outlet structure, the retaining wall on the west side of the structure can be retained during reconstruction for an estimated saving of $785,000.
- A flume can be built into the west side of the reconstruction to create a "Whitewater Park" feature, at an estimated additional cost of $2.04M, with no adverse hydraulic implications.

FINANCIAL IMPLICATIONS:

- Estimated additional construction cost of $1.26 million for outlet structure.

RECOMMENDATION:

- Retain west retaining wall as a concrete "pier".
- Construct a flume for "Whitewater Park" at the outlet structure.

COMMUNICATION STRATEGY:

- Not required.

VALUE STUDY PROPOSAL (VSP) BRIEFING NOTE
MODIFIED BASE CASE

VSP REFERENCE: **D (includes idea WD-4)**

ISSUE: **WEST DIKE AT THE RED RIVER FLOODWAY**

DATE: **AUGUST 2002**

ISSUE SUMMARY:

- The west dike must be protected from wave erosion.

BACKGROUND:

- The current design calls for use of rip-rap to protect the west dike from wave erosion.

DISCUSSION:

- Protect the west dike from wave erosion using soil cement in lieu of rip-rap.
- Other options to protect west dike from erosion include creation of an offshore berm (sandbar), a beach slope to dike, and vegetating foreshore area.

FINANCIAL IMPLICATIONS:

- Potential construction cost savings of $7 million.

RECOMMENDATION:

- Utilize soil cement to protect the west dike at the Red River Floodway.

COMMUNICATION STRATEGY:

- Not required.

Date: September 2002

VALUE STUDY PROPOSAL (VSP) BRIEFING NOTE
MODIFIED BASE CASE

VSP REFERENCE: **E (includes idea HB-5 and HB-26(H))**

ISSUE: **HIGHWAY BRIDGE RETROFIT: DECK REPLACEMENT AND PIER UPGRADE**

DATE: **AUGUST 2002**

ISSUE SUMMARY:

- As a result of the proposed Floodway Expansion, four highway bridges will be retrofitted to withstand and/or allow passage of a 1 in 700 year event.

BACKGROUND:

- Base case does not replace decks, which may require replacement within five years.
- The present design of pier upgrades involves installation of a temporary coffer dam and excavation around existing footings and piles, which may be difficult to construct.

DISCUSSION:

- Replace decks on bridges at time of retrofit to eliminate a second disruption to traffic in five years.
- Use permanent steel sheet piles to simplify bridge pier upgrades.

FINANCIAL IMPLICATIONS:

- Additional construction cost of $8.0M would eliminate additional traffic disruption five years after bridge retrofit (life cycle cost increase is only $0.9M).
- Potential construction cost savings of $2M by simplifying pier upgrades.

RECOMMENDATION:

- Replace bridge decks at time of bridge retrofits.
- Utilize permanent steel sheet piles to upgrade bridge piers.

COMMUNICATION STRATEGY:

- Not required.

Date: September 2002

VALUE STUDY PROPOSAL (VSP) BRIEFING NOTE
MODIFIED BASE CASE

VSP REFERENCE: **F (includes idea RB-3, RB-9, and HB-26 (R))**

ISSUE: **RAIL BRIDGE RETROFIT ALONG THE FLOODWAY**

DATE: **AUGUST 2002**

ISSUE SUMMARY:

- As a result of the proposed Floodway expansion, the CNR Sprague Bridge will be replaced and the Greater Winnipeg Water District (GWWD) Bridge raised and retrofitted to allow passage of a 1 in 700 year event.

BACKGROUND:

- Replacement of the CNR Sprague Bridge adds $14.6M to the cost of the Floodway expansion project.
- Retrofit and raising of the GWWD Bridge adds $4.5M to the cost of the Floodway.
- Current design of pier upgrades involves installation of a temporary cofferdam and excavation around existing footing and piles. Construction may be difficult.

DISCUSSION:

- Convert existing CNR Sprague Bridge to a through girder bridge and thereby raise it out of the water to clear the channel and avoid need for new bridge.
- Permanently remove the GWWD Bridge by relocating some facilities from City Yard to Deacon Reservoir.
- Utilize permanent steel sheet piles to simplify bridge pier upgrades.

FINANCIAL IMPLICATIONS:

- Potential construction cost savings of $8.1M.

RECOMMENDATION:

- Convert existing CNR Sprague Bridge to a through girder bridge.
- Remove GWWD Bridge and relocate GWWD facilities to Deacon Reservoir.
- Utilize permanent steel sheet piles to upgrade bridge piers.

COMMUNICATION STRATEGY:

Meet with railroad officials to begin approval processes.

VALUE STUDY PROPOSAL (VSP) BRIEFING NOTE
MODIFIED BASE CASE

VSP REFERENCE: **G (includes idea PM-3, 4, 15; PM-9; PM-14; PM-17; PM-20 and PM-21)**

ISSUE: **PROJECT MANAGEMENT FOR THE PROPOSED EXPANSION OF THE RED RIVER FLOODWAY**

DATE: **AUGUST 2002**

ISSUE SUMMARY:

- A project of this magnitude and importance requires effective project management.

BACKGROUND:

- Currently, there is no single authority responsible for Floodway planning, design, construction, ownership, management and maintenance.
- All necessary groundwater, geotechnical and environmental studies for an expeditious, technically sound and cost-effective Floodway expansion project have not been performed as of this date. The environmental approval process needs to be initiated soon.
- A plan is not yet in place for coordination of the internal and external components of the Floodway project management.
- A specific plan for incorporation of recreational opportunities into the Floodway expansion project is not yet in place.
- A consensus compensation plan for affected upstream and downstream communities and individuals is not yet in place for post Floodway expansion conditions.

DISCUSSION:

- Create a Special Operating Agency modeled on the St. Lawrence Seaway or Tennessee Valley Authority (e.g. Red River Valley Flood Protection Authority--RRVFPA) to plan, own, manage and maintain the Floodway.
- Carryout groundwater, geotechnical, and environmental studies and begin environmental approval process as soon as possible.
- Organize combined internal (government) and external (private) management team.
- Include a recreation representative on the project management team to champion recreational issues and opportunities.
- Develop compensation plan for upstream and downstream communities and individuals through consultation with communities, the Province, and the insurance industry.

FINANCIAL IMPLICATIONS:

- Owners' cost to provide effective project management will be offset by financial benefits of a smoothed project delivery.

RECOMMENDATION:

- Create the RRVFPA to own, manage, operate and maintain the Floodway.
- Conduct necessary geotechnical, groundwater, and environmental studies and begin environmental approval process 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 a compensation plan in consultation with affected parties, the Province, and the insurance industry.

COMMUNICATION STRATEGY:

- Press Releases and Advertisements will be issued to notify affected parties of compensation plan consultations.

Date: September 2002

VALUE STUDY PROPOSAL (VSP) BRIEFING NOTE
MODIFIED BASE CASE

VSP REFERENCE: **H (includes idea FP-10)**

ISSUE: **WPCC PUMPING CAPACITY UPGRADE**

DATE: **AUGUST 2002**

ISSUE SUMMARY:

- Intrusion of wet weather flows into City of Winnipeg sanitary sewer system..

BACKGROUND:

- The current design includes $5 million to increase the capacity of City of Winnipeg WPCC pumping stations to handle river water in the sanitary sewers.

DISCUSSION:

- An infiltration/inflow analysis of the City of Winnipeg sanitary sewer system in the south end of the city would identify sources of river water entry for an estimated $0.8 million.
- The resulting corrective actions to reduce infiltration/inflow are estimated at $2 million and would reduce the vulnerability of the south end of the City of Winnipeg to widespread basement flooding.

FINANCIAL IMPLICATIONS:

- Potential construction cost savings of $2.2 million.

RECOMMENDATION:

- Perform infiltration/inflow analysis of City of Winnipeg sanitary sewer system in the south end of the city and necessary corrective actions under the Floodway expansion project in lieu of funding upgrades to WPCC pumping stations.

COMMUNICATION STRATEGY:

- Not required.

Date: September 2002

VALUE STUDY PROPOSAL (VSP) BRIEFING NOTE
ENHANCED PROTECTION

VSP REFERENCE: **I (Revised to include comments from Bert Lukey & Rick Carson)**

ISSUE: **FLOODWAY OPERATING RULES**

DATE: **AUGUST 2002**

ISSUE SUMMARY:

- There is a degree of risk associated with dependence on raising the primary dikes in the City of Winnipeg during an emergency operation, as called for in the Floodway Operating Rules. The dikes will be constructed under emergency conditions on ground that is very likely frozen/partially frozen/thawing and/or near saturated in weather conditions that are most likely to complicate the construction process.

BACKGROUND:

- The Red River Floodway is part of the infrastructure that exists to protect the City of Winnipeg from flooding. Given the strategic importance of ensuring that the City of Winnipeg is not flooded as it was in 1950, it seems prudent to consider strategies for dealing with floods approaching and greater than the design event of 1-in-700 years.

- The significant risks associated with not being able to raise the primary dikes in the City of Winnipeg (which has been highlighted by KGS Group) suggests that thought should be given to revising the operating rules during expansion, to permit passing the design flow without requiring water levels above El 24.5 ft JAPSD.

- During a flood comparable to the design event, it is likely either that the primary dikes could not be raised in time or that the working conditions at the time would yield a dike of questionable reliability. This would pose too great a flood (breach) risk to the City of Winnipeg.

- The floodway operating rules require that a controlled flooding of the City of Winnipeg be initiated for floods that would cause the upstream water level to exceed a static forebay level of 778'. It is likely that the question of increasing the upstream water levels above 778 ft. would arise, before a controlled flooding of the City would be undertaken. This would encroach on the freeboard of the West Dike (and possibly the West Embankment) and may necessitate the raising of these dikes on an emergency basis, in an attempt to prevent the City of Winnipeg from flooding.

- The cost and incremental cost-benefit ratio associated with raising these dikes under favourable conditions, should be considered as part of the expansion project. The design levels could be determined during the detailed design. Alternatively once final costs and cost benefit ratios have been established, consideration could be given to the proposal of accepting a design capacity somewhat lower than the 1 in 700 year event and not increasing the west dike/embankment nor increasing the level of the primary dikes until the level of protection is exceeded.

DISCUSSION:

- The current base case assumes that the primary dikes in the City of Winnipeg would be permanently raised to accommodate river levels to 25.8' James, to provide a consistent level of protection throughout the City. Given the high degree of risk associated with temporarily raising the primary dikes above 25.8', and that upstream damages above the state of nature are highly likely to occur when the upstream water level is at El 778 ft, it is proposed that consideration be given to revisions of the floodway operating rules to maintain the Red River level at 24.5 James during major flood events. That target level, combined with the upgrade to protect against water levels up to El 25.8 ft would provide adequate freeboard at all locations in Winnipeg, regardless of the makeup of the flood as a combination of Assiniboine and Red River flows.

- The components of this proposal include:

  - Maintain river levels at 24.5' James for floods up to and including the 1 in 700 year design flood;
  - Raise/extend west dike and raise west embankment approximately 3' to 4' more than the base case, and improve the impervious core of the dikes at the Floodway Inlet Control Structure. Consideration would also have to be given to the capability of the Floodway Inlet Control Structure to dissipate energy without risking erosion damage under the increased differential head.
  - Operate forebay at 780' (this will require detailed verification in final design, and may be as much as El 781 ft)
  - Maintains 1 in 700 year (estimated) event as the design condition

- Advantages of this proposal include:

  - Decreasing the high risk associated with being able to raise the dikes in time and the questionable reliability, which poses risk of a breach.
  - Allowing emergency forces to concentrate on flood protection efforts in areas outside the City of Winnipeg.

FINANCIAL IMPLICATIONS:

- Raising of west dike and enhancing the impervious core of the tie in dikes at the inlet structure, and modifications (if proven necessary) to deal with increased energy dissipation for an estimated cost of $40 million.
- Relative incremental damage upstream are expected to be small in comparison to the offset costs of a primary dike failure in the City of Winnipeg.

RECOMMENDATION:

- That the operating rules be revised to reflect the reality and risks associated with raising 69 miles of primary line of defence during a major flood event.

- That the west dike and west embankment be raised approximately 3' to 4' and the impervious core of the tie-in dikes at the Floodway Inlet Control Structure, and the energy dissipating capability of the structure be enhanced as appropriate.

- That the forebay be operated at levels exceeding 778', if a flood occurs that requires that action to be taken to protect Winnipeg.

COMMUNICATION STRATEGY:

- To minimise potential delays to the schedule, discussions regarding revised floodway operation rules should be undertaken as soon as possible.

- The discussions should be facilitated by insurance industry experts and include both public (federal, provincial and municipal) and private stakeholders.

Date: September 2002

VALUE STUDY PROPOSAL (VSP) BRIEFING NOTE
ENHANCED PROTECTION

VSP REFERENCE: **J (includes ideas IS-13 and PD-2(B))**

ISSUE: **IN-CITY RIVER LEVEL MANAGEMENT**

DATE: **AUGUST 2002**

ISSUE SUMMARY:

- Means to reduce river levels in the City of Winnipeg during summer Floodway and marginal spring events include structural enhancements to the Floodway inlet structure and a revision of the Floodway operating rules.

BACKGROUND:

- Frequent high water events in the City of Winnipeg result in basement flooding damages and a reduction in aesthetic and tourism opportunities along the Forks Walkway.

- Damages due to the summer flooding and coincident rainfall in 1993 was estimated at $140 million and a similar set of circumstances occurred in July 2000. Numerous extended high water events have also limited the utility of a Forks Walkway, which is flooded at 8.5' James Ave. Datum.

DISCUSSION:

- A revision to the Floodway inlet would provide a reduction in river levels within Winnipeg and upstream of the Floodway by diverting more flow in the channel. Revised operating rules to hold Winnipeg river levels to as low as possible without exceeding 760' upstream would avoid the upgrade of City flood gates.

- Ice jams could be avoided with the construction of an ice screen (IS-12) or an addition of box culverts (invert 742' sill 750') with gates to provide control at summer flows (IS-13). Revision of the operating rules to minimize flooding in Winnipeg, while maintaining in-bank flow upstream, would also reduce basement flooding risks and maximize tourism opportunities.

FINANCIAL IMPLICATIONS:

- Additional construction costs of $1.8 million would provide the necessary benefits with the control option included.
- Revised operating rules cited above would yield an estimated construction cost savings of $12.7 million in base case, city flood gate upgrades.

RECOMMENDATION:

- Reduce Floodway lip to 743' above sea level and add box culverts with control gates across Floodway between the river and St. Mary's Road. Revise operating rules to hold Winnipeg river levels to as low as possible without exceeding 760' upstream.

COMMUNICATION STRATEGY:

- Not required.

Date: September 2002

VALUE STUDY PROPOSAL (VSP) BRIEFING NOTE
POSSIBLE APPROACH: CITY INFRASTRUCTURE MODIFICATIONS

VSP REFERENCE: **K (includes idea FP-7) (Revisions include comments from George Rempel & Dave Wardrop)**

ISSUE: **SUMP PUMP AND BACKWATER VALVE SUBSIDY PROGRAM**

DATE: **AUGUST 2002**

ISSUE SUMMARY:

- Assessment of the capability of the City's combined sewer flood pumping stations to deal with rainfall under high river levels in order to reduce potential, and damages arising from basement flooding.

BACKGROUND:

- Widespread basement flooding damages can occur during extended flooding events with heavy rainfalls.

- Reduce potential, and likely, damages during extreme flood events through assessment of the capability of the City's combined sewer flood pumping stations to deal with rainfall events under high river levels. This could result in a program to either:
  - upgrade the station capacities, or
  - provide backwater valve/sump pump installations in individual sewer connections

DISCUSSION:

- Upgrading the Capacity of the Flood Pumping Stations would reduce levels of Basement Flooding Compensation to individual homeowners and may reduce the need for widespread infrastructure improvements within the City of Winnipeg. Assessment of the capacity of the system would determine the extent of the required work to achieve both of these benefits.

- Protecting individual properties from basement flooding reduces both the levels of basement flooding compensaiton to individual homeowners and the need for widespread infrastructure improvements within the City of Winnipeg.

- The risk of widespread basement flooding from rainfall is substantially reduced under both options and the additional benefit of protecting properties from extreme rainfalls under normal conditions also exists.

FINANCIAL IMPLICATIONS:

- Total cost of pump station upgrades or full subsidisation for backwater valves and sump pumps is estimated at $80 million.
- Life cycle cost benefit to the City of Winnipeg estimated at:
  - Flood Pumping Station Upgrades: $36.5M resulting in net savings of -$43.5M. Note: LCC benefits require further investigation based on the outcome of the assessment

- Backwater valve and sump pump Installation: $111.3M resulting in net savings of $31.3M

RECOMMENDATION:

- Offer City of Winnipeg residents a sump pump and backwater valve subsidy program valued at $80 million pending the results of the Assessment of the capacity of the Flood Pumping Stations.

COMMUNICATION STRATEGY:

- Press Release and Advertisements would be necessary to notify residents of program availability.

Annex II Risk Tables

Design and Construction risks of significance are listed as follows, in reducing magnitude:

SECTION OF WORKS	RISK No.	RISK CATEGORY	HAZARD (or Source)	RISK (or Consequence)
All	01	Construction	Adverse weather	Construction delays
City Gate Chambers	41	Construction	Problematic siting of gate chambers	Lack of space to build chamber
Floodway	31	Construction	Excess groundwater pressure	Blow outs - delay and cost to construction
Floodway	32	Construction	Excess pore pressure	Slope instability and failure
Floodway	34	Construction	Surface infiltration	Slope instability and failure
Floodway	35	Construction	Weaker than expected soil	Slope instability and failure
River Bank Upgrades	49	Design	Lack of stability	Lack of geotechnical information could cause long term failure
Floodway	33	Construction	Excessive groundwater draw down	Decrease in well water levels - reduced quality and increased mitigation costs
Primary Dike Upgrade	47	Design	Existing condition uncertainties	Leading to cost over runs and potential breaches
City Infrastructure	28	Construction	Vulnerability during implementation	widespread flooding, economic impact

Management risks of significance are listed similarly as follows:

SECTION OF WORK	RISK No.	RISK CATEGORY	HAZARD (or Source)	RISK (or Consequence)
All	07a	Management	Failure to establish early on a dedicated independent project management structure	Inefficient expenditures / ineffective works
All	07b	Management	Failure to establish early on, dedicated funding for investigation	Inefficient expenditures / ineffective works
All	19	Management	Protracted resolution of the compensation issue	Project implementation delay
All	20	Management	Spring or summer flood flow in the channel	Significant cost overruns and/or protracted completion (delay in realisation of full benefits)

SECTION OF WORK	RISK No.	RISK CATEGORY	HAZARD (or Source)	RISK (or Consequence)
All	08a	Management	Failure to establish early on a dedicated independent project management structure	Project implementation delay
All	08b	Management	Failure to establish early on, dedicated funding for investigation	Project implementation delay
All	16	Management	Protracted Environmental assessment approval processes	Inefficient expenditures / ineffective works
All	17	Management	Protracted Environmental assessment approval processes	Project implementation delay
All	10	Management	Failure to establish timely funding agreements	Project implementation delay
All	06	Management	Failure to address all risks	Basement flooding and public outrage
All	09	Management	Failure to establish timely funding agreements	Inefficient expenditures / ineffective works
All	14	Management	Protracted engineering investigations and analysis	Inefficient expenditures / ineffective works
All	15	Management	Protracted engineering investigations and analysis	Project implementation delay
All	21	Management	Summer flow in the channel	Significant cost overruns and/or protracted completion (delay in realisation of full benefits)
All	18	Management	Protracted land acquisition	Project implementation delay
All	13	Management	Lack of political commitment to funding by the City	Delayed implementation and continued vulnerability
All	12	Management	Lack of Global Emergency Response Plan	Failure of ability to evacuate
Pilot channel	1	Management	Environmental Impact Assessment Review Process	Schedule Delays

SECTION OF WORK	RISK No.	RISK CATEGORY	HAZARD (or Source)	RISK (or Consequence)
Project Management	2	Management	Missing windows of opportunities	Approvals/schedules delays

Operation risks of significance are listed similarly as follows:

SECTION OF WORKS	RISK NO	RISK CATEGORY	HAZARD (or Source)	RISK (or Consequence)
Secondary dikes	50	Operation	Lack of integrity in existing services	Flooding of sewer systems
Inflow / Infiltration Control	42	Operation	Uncertainty about effectiveness under high river status	Basement flooding and WPCC problems
Primary Dike Upgrade	48	Operation	Lack of long term integrity	Unknown openings in the dike
Inlet	44	Operation	Ice jam	Release of flood surge – flooding downstream
Inlet Control Gate	45	Operation	Sabotage during a flood	Inoperable gates leading to flooding
All	26	Third Party	Protracted Stakeholder acceptance (Buy in)	Project implementation delay
All	30	Operation	Superflood	Downstream / upstream environmental damage
All	22	Operation	Greater than 1/100 year flood	Flooding of upstream communities
All	23	Operation	Ice jam	flooding upstream
All	24	Operation	More extreme events	overtopping the system (exceeding design) and flooding
Pilot channel	1	Operation	Expose of Aquifer	Potential of groundwater
Backup gates	2	Operation	Exclusion	Project Failure (Winnipeg Floodway)
Bridges	3	Operation	Submergence of bridges	Bridge breaks loose

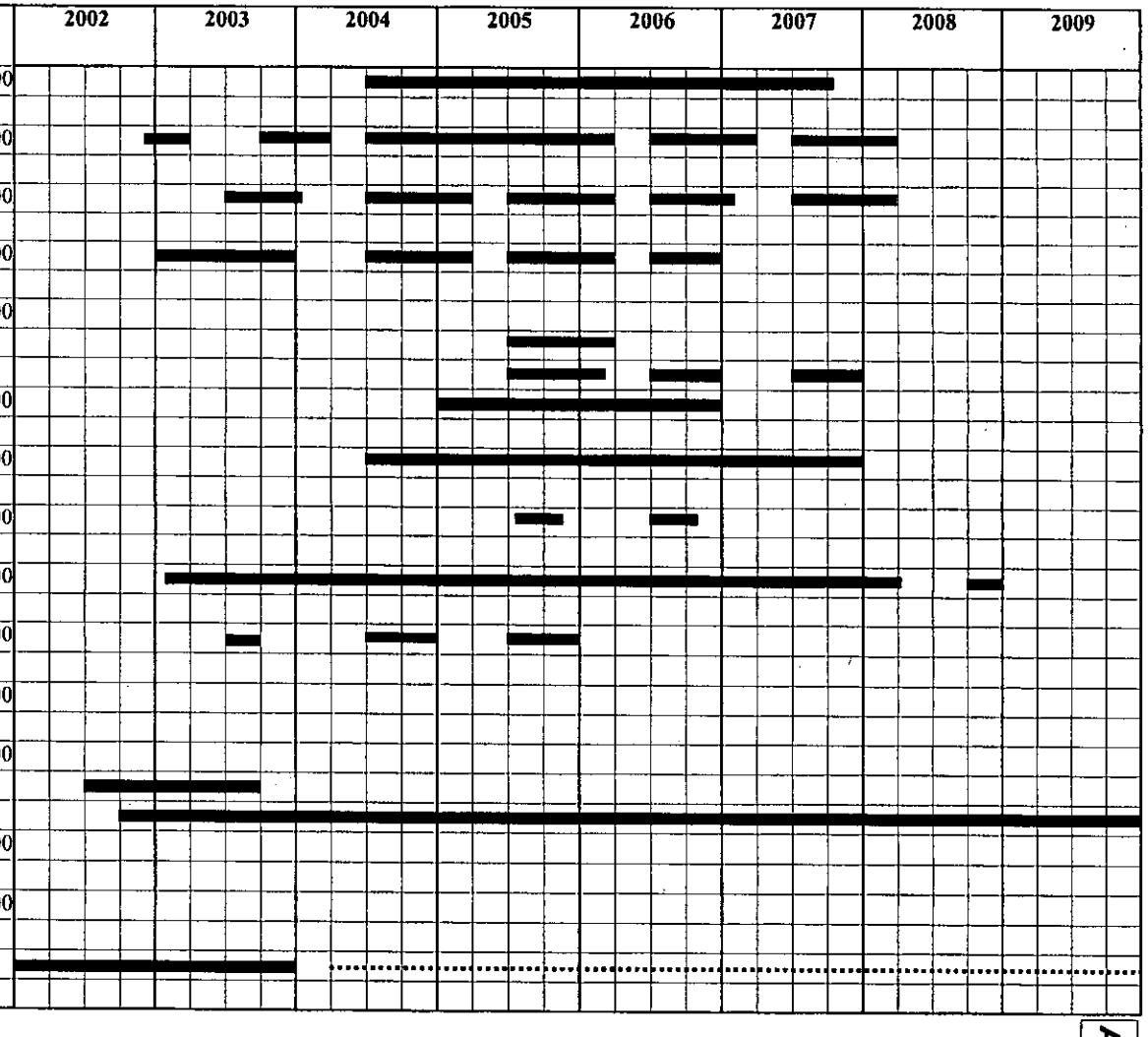
ANNEX III

Preferred Option:

- Proposed Implementation Schedule
- Revised Expenditure Profile

Trial Schedule

			2002	2003	2004	2005	2006	2007	2008	2009
A1	**Upgrade Floodway**									
A1.1	Channel Earthworks	$160,080,000								
A1.2	Rail Bridges	$37,500,000								
A1.3	Highway Bridges	$42,300,000								
A1.4	Improvements at Floodway Inlet Control Structure	$16,550,000								
A1.5	Hydraulic Structures - Upgrades	$21,155,000								
	Outlet Structure									
	Other hydraulic structures									
A1.6	Transmission Lines	$6,300,000								
A1.7	Other Crossings	$2,700,000								
A1.8	Roadworks	$1,660,000								
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**	$66,575,000								
	Investigations, Environmental approval etc.									
	Design, supervision etc									
C2	**Escalation of Costs during Construction**	$28,500,000								
C3	**Cost of Interest During Construction**	$57,900,000								
	Public Consultation									



Annex III (a)

Trial Expenditure Profile (Capex)

			Prefered Option - Modified Base Case Cash Flow							
			2002	2003	2004	2005	2006	2007	2008	2009
A1	**Upgrade Floodway**									
A1.1	Channel Earthworks	$160,080,000			40,020,000	40,020,000	40,020,000	40,020,000		
A1.2	Rail Bridges	$37,500,000	500,000	3,000,000	7,500,000	7,500,000	7,500,000	7,500,000	4,000,000	
A1.3	Highway Bridges	$42,300,000		3,000,000	9,000,000	9,000,000	9,000,000	9,000,000	3,300,000	
A1.4	Improvements at Floodway Inlet Control Structure	$16,550,000		1,000,000	1,550,000	9,000,000	5,000,000			
A1.5	Hydraulic Structures - Upgrades	$21,155,000				11,230,000	7,030,000	2,895,000		
	Outlet Structure					*8,000,000*	*3,800,000*			
	Other hydraulic structures					*3,230,000*	*3,230,000*	*2,895,000*		
A1.6	Transmission Lines	$6,300,000				3,000,000	3,300,000			
A1.7	Other Crossings	$2,700,000			600,000	700,000	700,000	700,000		
A1.8	Roadworks	$1,660,000				830,000	830,000			
A2	**Upgrade Flood Protection Infrastructure City of Winnip**	$65,800,000		2,000,000	15,500,000	15,500,000	15,500,000	15,500,000	1,800,000	
A3	**Raise Height of West Dike**	$35,300,000		5,000,000	15,000,000	15,300,000				
B1	**Contingencies (Summation for all Items)**	$84,200,000								
C1	**Owner's Cost / Engineering / Construction Management**	$66,575,000	4,000,000	16,000,000	14,000,000	9,000,000	8,000,000	8,000,000	6,000,000	1,575,000
	Investigations, Environmental approval etc.		*2,000,000*	*4,000,000*						
	Design, supervision etc		*2,000,000*	*12,000,000*	*14,000,000*	*9,000,000*	*8,000,000*	*8,000,000*	*6,000,000*	*1,575,000*
C2	**Escalation of Costs during Construction**	$28,500,000								
C3	**Cost of Interest During Construction**	$57,900,000								
			4,500,000	30,000,000	103,170,000	121,080,000	96,880,000	83,615,000	15,100,000	1,575,000

Annex III (b)

Comparison of Costs

			Base Case	Preferred Option - Modified Base Case		Prefered Option - Enhanced Protection	
				Change	Total	Change	Total
A1	**Upgrade Floodway**		**$310,560,000**	**-$22,315,000**	**$288,245,000**		
A1.1	Channel Earthworks	$168,000,000		-$7,920,000	$160,080,000		
A1.2	Railway Bridges	$45,600,000		-$8,100,000	$37,500,000		
A1.3	Highway Bridges	$36,300,000		$6,000,000	$42,300,000		
A1.4	Improvements at Floodway Inlet Control Structure	$30,100,000		-$13,550,000	$16,550,000	$600,000	$17,150,000
A1.5	Hydraulic Structures - Upgrades	$19,900,000		$1,255,000	$21,155,000		
A1.6	Transmission Lines	$6,300,000		$0	$6,300,000		
A1.7	Other Crossings	$2,700,000		$0	$2,700,000		
A1.8	Roadworks	$1,660,000		$0	$1,660,000		
A2	**Upgrade Flood Protection Infrastructure City of Winnipeg**		**$68,000,000**	**-$2,200,000**	**$65,800,000**	**-$12,700,000**	53,100,000
A3	**Raise Height of West Dike**		**$42,300,000**	**-$7,000,000**	**$35,300,000**	$40,000,000	$75,300,000
	Sub Total		**$420,860,000**	**-$31,515,000**	**$389,345,000**		
B1	**Contingencies (Summation for all Items)**		**$84,200,000**	**$0**	**$84,200,000**		
C1	**Owner's Cost / Engineering / Construction Management**		**$66,500,000**	**$75,000**	**$66,575,000**		
C2	**Escalation of Costs during Construction**		**$28,500,000**	**$0**	**$28,500,000**		
C3	**Cost of Interest During Construction**		**$57,900,000**	**$0**	**$57,900,000**		
	TOTAL PROJECT COST		**$657,960,000**	**-$31,440,000**	**$626,520,000**	$27,900,000	$654,420,000

Note:
The proposed ideas are conceptual only and require further examination and engineering assessment.
The potential cost savings are preliminary in nature and require verification at the detailed final design stage.

ANNEX IV

Recommendations:

- Summary Presentation
- Record of Acceptance
- Immediate Workshop Follow-up & Project Monitoring

Value Engineering Study Report to CEDC

Red River Floodway Expansion Project

September 10, 2002

Confidential

Manitoba Transportation & Government Services

Manitoba Conservation

Agenda

- Background - CEDC Proposal
- VE Consultant Selection Process
- VE Study Team
- Floodway Expansion Project Objectives
- VE Study Objectives
- VE Study Approach
- Analysis of Base Case
- Project Success and Ideas Evaluation Criteria
- Initial Risk Review
- VE Workshop Accomplishment/Output
- Group Discussion/Feedback
- VE Proposals
- Next Steps & Proposal Tracking

Background - CEDC Proposal

- CEDC directive to carry out VE Study on Floodway Expansion to Achieve Greatest return at Preliminary Design Concept Stage
- Value Engineering
  - Recognized Formal Process
  - Used Extensively to Increase Project Quality
  - Significant Return on Investment
- Specific Areas of Interest:
  - Alternate proposals for bridges and other crossings
  - Impacts on aquifer
  - Enlist broader engineering community support for the selected approach
  - Investigate possibility of removing two railway bridges

Background - CEDC Proposal

- Proposed VE Benefits
  - ✓Improve Project Focus, Scope & Reliability
  - ✓Manage/Mitigate Risk
  - ✓Improve Scheduling
  - ✓Minimize Environmental Impact
  - ✓Explore Areas of Innovation
  - ✓Improve Constructability
  - ✓Generate Consensus in Manitoba Consulting/Construction Industry
  - ✓Generate "Made in Manitoba" Solutions

VE Consultant Selection Process

- Initial list of 25 North American Consultants
- Initial Review/Telephone Interviews: Short List to 5 Consultants
- Issue RFP
- Team Focus Group: Strongest Facilitators, Risk Manager, Sole Canadian Consultant
- Interviewed Consultant
- Recommendation to Treasury Board Approved

VE Study Team

- Pre-Workshop Planning Team
  - TGS, Conservation, City of Winnipeg, VE Consultant, KGS
- Workshop Team:
  - 26 Leading Engineers, Community Rep, Recreational Expert
- Review Team (post Workshop)
  - TGS, Conservation, City of Winnipeg, Policy Secretariat, Workshop Team, KGS

Floodway Expansion Project Objectives

VISION

- The City of Winnipeg will be Protected Against Flood Damage from Extreme Events

MISSION

- To upgrade the capacity of the Red River Floodway from the current design capacity of 60,000 cubic feet per second (cfs) to a minimum of 140,000 cfs.
- Control Red River water levels through the City of Winnipeg to:
  - Protect the city from basement flooding during extreme summer rainfall events
  - Make the Forks walkway usable throughout the summer

VE Study Objectives

Primary Objectives:

- Identify project components and methods to provide the best, overall value-for-money project to meet the project mission
- Identify ways to reduce project risk in terms of cost and schedule overruns
- Identify early activities to realize flood protection benefits
- Generate consensus within the local consulting/construction industry and between Government departments.

VE Study Objectives

Secondary Objectives:

- Review/validate/modify unit prices for cost estimates
- Generate "Made in Manitoba Solutions"
- Optimize operating and life cycle costs
- Incorporate innovative concept(s)
- Improve constructability aspects of the project
- Identify modifications required to meet summer water level control
- Ensure no Interruption to raw water supply to C of W
- Identify Recreation Opportunities
  - Maintain Existing
  - Identify New

VE Study Approach

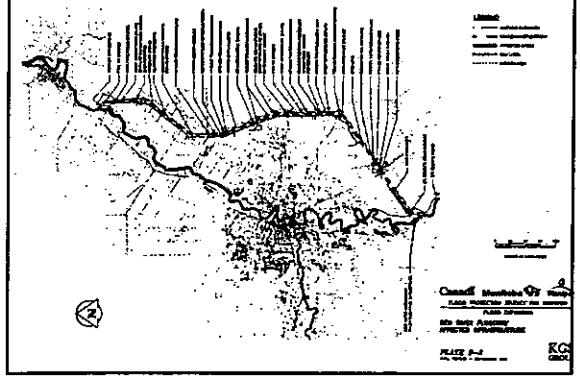
STEPS COMPLETED

- ✓ Information Gathering
- ✓ Analysis of Needs & Base Case
- ✓ Creativity by Functional Area / Section of Work
- ✓ Coarse Judgement of Ideas
- ✓ Combination /Classification of Most Likely Ideas
- ✓ Judgement & Rough Costing
- ✓ Draft Report
- ✓ Formal Acceptance or Rejection of Proposals

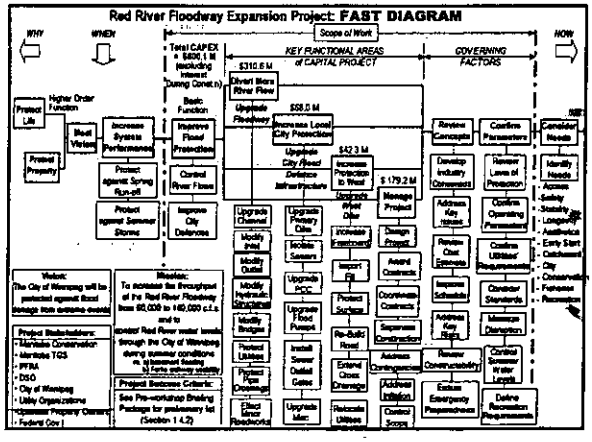
STEPS REMAINING

- Review by Stakeholders
- Technical / Financial Verification of Concepts
- Continuing Consultation & Refinement

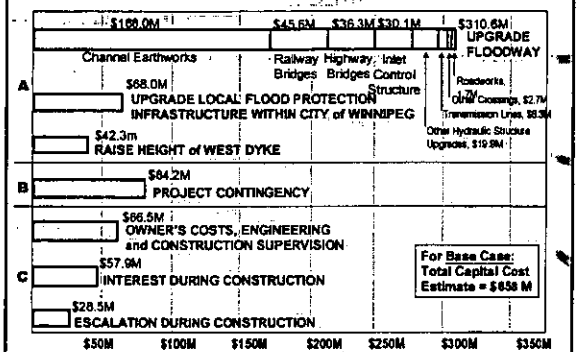
Analysis of Base Case



Red River Floodway Expansion Project: FAST DIAGRAM



Cost Breakdown: Base Case



Project Success and Ideas Evaluation Criteria

- Optimizes Hydraulic Performance
- Improves Reliability and Protection
- Improves Cost-Benefit
- Provides Early Benefits
- Improves Constructibility
- Minimizes Capital Cost
- Minimizes Operating and Maintenance Costs
- Minimizes Risk to Project Schedule
- Smoothes Project Cash Flow
- Minimizes Disruption to Transportation and Utility Services
- Reduces Environmental Impact
- Maximizes Manitoba Content
- Provides Recreational Opportunities
- Minimizes Upstream and Downstream Impacts
- Improves Public Acceptability

Initial Risk Review

AREAS STUDIED

- Floodway upgrade and raising of West Dike
- City of Winnipeg Infrastructure upgrade
- Management of Project Development, Implementation and Operation

RISK CATEGORIES

- Management Risks
- Design, Construction, and Operational Risks
- Third Party Risks
- Environmental Risks

STUDY FINDINGS

- Some 54 Risks were Identified during Brainstorming
- Some 35 of these risks could be significant
  - 10 Design and Construction Risks
  - 15 Management Risks
  - 10 Operational Risks

Initial Risk Review

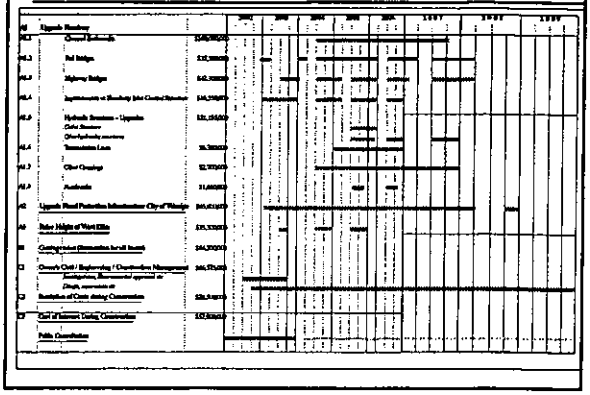
The Way Forward

- Study identified most significant risks
- 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

VE Workshop Accomplishments/Output

- Common stakeholder understanding of key issues
- General agreement on preferred concept
- Generated consensus amongst local experts
- Identified early action areas
- Identified Risks
- Improved Project Focus and Reliability
- Improved Scheduling and Constructability
- Generated "Made in Manitoba Solutions"

Implementation Schedule



Potential for Early Actions

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

Issues of Potential Concern

- Uncertainty of emergency raising of City Dikes
- Development of an Evacuation Plan
- Risk Mitigation Plans and Structured Contingency Plan
- Distinguish between Operations and Construction, and Mitigation
- Not enough time if evacuation required
- 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; when will the next expansion occur?

Issues of Potential Concern

- Maintenance Implication for Future Generations
- Potential Failure of Saturated Dikes
- Restricted Access to Fill Materials
- In moving project along, be sure all necessary engineering studies and compensation/environment information are done
- Changes to Operating Rules
- Challenge 778 ft. HWL
- Priority/considerations over who gets protected or flooded first
- What is a "Super Flood"?
- What is the Management Plan for dealing with a "Super Flood"?
- Raising of West Dike and West Bank: What height, What Implications.

Key Performance Aspects/Index

KEY PERFORMANCE ASPECT	KPI
Visible Project Start	
• Announcement Funding Commitment (Subject to Various Approvals)	Winter 2002
• Public Consultation	Spring 2003
• Field Investigation	Start Fall 2002
• Environmental Review and Approvals	Start S 2003, Finish S 2004
• Start Project Management Office	Fall 2002,
• Construction Start – Advance Work	*Remove Lac-du-Bonnet Bridge F/W 2002 *Floodway security F2002 *Start Project
• Construction Start – Main Project	Build West Dike using local borrow
Correct deficiencies of existing Primary Dike	Summer 2003
1 in 700 year flood protection for City of Winnipeg	2008
Control of Summer water levels through city: a)During construction through 2005 b)Upgraded floodway in service (after 2005)	 7 – 16 ft James 8 ft James (99% of time b/w June & Sept.)
Change in operating rules to avoid reliance on and risk inherent in emergency raising of primary dike	Address uncertainty by adopting Enhanced Scenario
Resolution of compensation issues	Summer of 2003

☞Group Discussion / Feedback

- Meeting Held - August 19, 2002
- Workshop Team, TGS, Conservation, City of Winnipeg, KGS, Policy Secretariat
- Formal Presentation of Workshop Deliberations
- Formal Acceptance, Rejection & Action Plan of Report Recommendation

☞VE Proposals - 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 Syphon / Expand & raise Spring Hill with excavation material
- Design pilot channel wider and shallower to reduce risk of "blow-outs"

VE Proposals - Modified Base Case

B: Inlet Structure

- Investigate means of providing backup gate system (ie: Bulkheads). Install 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

- 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)*

VE Proposals - Modified Base Case

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

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*

VE Proposals - Modified Base Case

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

VE Proposals - Enhanced Flood Protection

I: Floodway Operating Rules

- Revise operating rules to reflect reality and risks associated with raising 69 miles of primary dikes during major flood events*
- Raise west dike & west embankment by 3-4' and enhance the core at the inlet*
- Operate forebay at levels exceeding 780' (in emergency mode)*

J: In-City River Level Management

- Reduce Floodway lip to 743' above sea level & add box culverts with control gates across Floodway between the river and St. Mary's Road*
- Revise operating rules to hold City River summer levels to as low as possible without exceeding 760' upstream*

VE Proposals - Enhanced Flood Protection

K: City Infrastructure Modifications

- Assess capability of the CoW combined sewer flood pumping stations to deal with rainfall & high river levels. Possible Options:
  - Upgrade capacity of combined sewer flood pumping stations
  - Provide backwater valve/sump pump installations in individual sewer connections (homeowner subsidy program)*

- *Approved for Future Study

- The proposed ideas are conceptual only and require further examination and engineering assessment.
- The potential cost savings are preliminary in nature and require verification at the detailed final design stage

☞Next Steps & Proposal Tracking

- Prioritize/schedule KGS future studies/Develop Study Management plan
- Advance Environmental work to secure funding

  Note: Construction cannot advance until the Environmental Hearing Process is completed
- 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 minimize Capital and Lifecycle Cost (LCC)
  - 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

Next Steps & Proposal Tracking

- 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

THANK YOU

GROUP DISCUSSION / FEEDBACK

MINUTES FOR EXPANSION OF THE RED RIVER FLOODWAY
AUGUST 19, 2002

Ismail Elkholy thanked everyone involved in the study, including KGS for their support and valuable suggestions in their report. Although many good ideas are included, a lot of work has to be done yet on the proposals to enhance the ideas and develop cost-savings. We are at the beginning stage, and investigation is still needed. The value engineering exercise is to explore what else can be done.

Andy Horosko added that he is pleased on the way the study turned out, as this is the first time for Manitoba to be involved in a Value Engineering Study. We have achieved a great number of objectives in this study. He is interested to hear the results and the support is very positive. It was noted that this is a preliminary report.

Norm Brandson mentioned that he is not disappointed in the report's executive summary, and thanked everyone for the time and effort during the week of the study. He also asked about groundwater implications not being identified in the executive summary, and the use of the floodway is a concern while the earthwork is being carried out. It was felt that staging the excavation should be addressed. Martyn replied that groundwater is a proposal developed to a certain extent with all the smaller proposals in the report. This could be part of Risk Management.

Paul Vogt thanked everyone involved, and pointed out that the project seems very promising while the team took to heart the government's objectives. He is looking forward to the results, and is very appreciative.

Martryn Phillips proposed to go through the presentation with the 41 identified ideas, and asked that the group agree to accept (A), reject (R) or accept but needs further study (AFS), as this is still part of the workshop. There were 185 ideas generated during the weeklong session.

Group Discussion/Feedback—Formal Acceptance, Rejection and Action Plan

The specific categories identified were reviewed and discussed as follows (See attached spreadsheet for proposal tracking. Additional comments are below):

C = Channel, IS = Inlet Structure, OS= Outlet Structure, WD= West Dike, HB= Highway Bridges, RB= Railway Bridges, PM= Project Management, PD= Primary Dikes, and FP= Flood Pumping Stations.

C-6 – Discussion was held on further clarification needed for this idea. The objective is for a steeper slope. It was agreed that C-6 and **C-22** needs further study with more details, and should be together. A risk would be involved as well as increased maintenance, etc. 5:1 slopes have been investigated, but the excavation was flooded when the channel was used. The 5:1 is permanent. The reluctance is because there's separate clay. Concerns were expressed over the susceptibility on the erosion. The cover system technology is the insurance over the 5:1 in place.

C-10 – increases the cost, but gives a benefit. This was related to summer time operations and seems reasonable.

C-13, C-15 – is a no cost item and in the Base Case, tentatively accepted.

C-23 – is a benefit for medium sized plugs, therefore it's a must-do.

C-28 – cost-savings.

C-31 – provides early protection, ties into constructability and the need to use the floodway upstream where you get the most benefit.

C-29 – the main recreational features were highlighted in the executive summary, and keeping it dry for purposes of recreation could affect design alternatives. It was generally agreed to be problematic, unless the issues are dealt with. Clarification of this idea is needed as it shows a saving, but it's not an actual saving to the floodway -- it was meant to be a savings of haul cost with local material.

C-33 – Making the floodway wider and shallower. The floodway's long-term function is the key. If it can work as 2' wider and reduces blowouts, then it's a good idea. This is a detailed design consideration. It's a depth issue primarily as lowering 5-6 ft. may not be a significant change -- widening and deepening could be the additional change and then not a major impact.

- A concern was identified with the exposure of the aquifer. It is likely that this type of migration would not be major, but should be studied further. There is risk identification on page 11 of the report, and it will be added as an operation risk. It will be added into the management report as well.

IS-2a - It should be stated that this is in lieu of providing a second set of gates. Installation of bulkheads could cost more than the original system. This idea was addressed as an alternative and should not be disregarded. It would be a good idea to have redundancy. The concern is the time for installation of any back up option. This is a risk management issue that needs more study. Back-up gates require a lot of work, but have the capability to control the flow. The logical answer has been to use the existing structure, but there was some doubt of what's in the base case.

IS-8 – is fairly inexpensive and minimizes the public access to the structure. An expert opinion to study and possibly close the road to public access should be considered.

IS-12 – To modify the plug, there may be no variation in the control during summer flows. We need to study the various flow levels, particularly during the summer. The question was asked that when you lower the sill, could you manipulate the gates? The base case and the modified base case with summer flows were also discussed. The planning team was not looking at the wet floodway as a base case, it was largely ruled out before the value engineering exercise.

OS-1 – the present cost includes handling new floods, the suggestion is that some demolition not be done. Detailed design feasibility left.

OS-4 – to create drop structures at the flume, and perhaps move it up to the spring hill area. Potential revenue was previously discussed but is not known at this time. All recreational aspects would have some capital expenditure but some cost recovery. Needs further study due to justification of $2 million. The timing on its use was questioned -- can it be used during a flood?

OS-5 – Feasibility needs to be determined.

WD-4 – potential for savings in optimizing cost of erosion protection of the west dike. Needs a wave action study maybe through the UofM. Whether the existing grass cover is enough or can it be enhanced, needs to be looked at.

HB-5 – When the deck rehabilitation is required, the rehab needs to be done during the retrofit. Opening the deck will allow you to do the retrofit. The cost for replacing the decks should be lower. It was noted that the cost would be checked.

HB-26 – proposal in base case. The main problem was sliding. Instead of constructing new foundations, construct cofferdams, then a bridge would be created that wouldn't move. Make the cofferdam the permanent structure. This should save money and has merit to work at some locations. Part of the detailed design.

RB-3 – raising the bridge and putting in a new bridge in Sprague -- an alignment review might be needed. A through girder on the bridge could result in a good alignment (strong possibility as opposed to building a brand new bridge). There is potential for replacement but not finalized.

RB-9 – Approve further study due to feasibility, construction of superstructure, and entering into agreements. Needs further discussion with the City of Winnipeg. This also affects the water facility at Deacon, and there will be a connection to CN associated with construction. The operating policy has been to maintain a corridor for the track.

HB-26 – not completely accepted, as it would need modeling for hydraulics. This might have merit, but it's questionable in a 1:700 year flood.

PM-3 – we need to have project management in place ASAP. A number of alternatives were previously discussed, and some were not accepted outright. Project management would be the evolution of these alternatives in how the unfolding stages of the project are handled. A lot has to be studied before the work is underway. It was suggested that this idea be a focus. Still begs the question of whether you go into the phases separately, but a management entity is needed. Andy agreed that there should be a team in place, moving ahead/pushing the project. It ensures that all the relevant information is going forward.

PM-4 – due to the need for a prime consultant to take on the whole project. This must be resolved. A question was raised about federal involvement in the management role. We may need to look for federal participation.

PM-17 – it was noted to mention recreational aspects in the planning. Cost considerations.

FP-10 – save $2M, and reduces the risk of basement flooding. The intent was undertaking infiltration studies, and it's in the base case. By doing the study, residents save. Existing and long-term budgets as well as time scheduling for work in the city were discussed. It offers the opportunity to save on pump upgrades.

I Floodway Operating Rules: General Discussion– due to public consultation and links with compensation matters. There would be a savings with pump upgrades and potential damages with basement flooding. Potential damages are also related to riverbank instability and recreational facilities. There are capital cost benefits to this idea. Although there is a possibility of raising the primary dike, it's not the sort of effort to count on, there is a risk associated.

WD-1 and WD-2 – $10 million. Additional 2 feet above 784. The west dike and west embankment must both be raised.

IS-13 – Needs further study but has merit. Part of the works is to give summer water control. Two groups felt differently about this idea with 2 different concepts. We would have control with box culverts. Further study on the summer diversion is needed. It should be tied with IS-12.

PD-2 (b) – need a full public process for a new set of operating rules. Tied to PM20 and 21. The savings of $12 million were questioned.

FP-7 – Needs further study due to the $660 million expenditure and not being directly involved with the floodway study. If the City gets hit with a heavy rainfall, there may be significant basement flooding, then the project would be deemed unsuccessful. We should consider a subsidy of sump pumps and backwater valves to protect City residents from basement flooding. Saving of $120 M. There may not be a summer level concern assuming sump pumps and backwater valves are being maintained. Substantial benefits in future years during heavy rainfall.

Martyn asked if there is anything missing, did we meet our goals, and what are the next steps?

Manitoba Transportation's ideas were related mainly to the bridges. Some cost implications are part of the detailed design, but could be incorporated into the study, for example with a submerging bridge. The KGS report outlined many ideas that ought to be studied. Andy would like to see if there is a tally of recommended studies that are lower priorities. If there is a long list of ideas that should be studied, then these are identified priorities. There should be some ideas that are not as much of a risk, etc. A geotechnical study should be undertaken, a list of the recommendations to Cabinet was made and this list will be made available.

The next step is to review the list from KGS for priority. The groundwater drilling and the geotechnical work will be used as preliminary information.

Following that step is the environmental process, as the federal funding is linked to that work. It was noted that this is included in the geotechnical studies. We need to move forward to prioritize, and project management being in place is a main issue. Next step is the mandate for the value engineering study, and submitting the report to Cabinet Committee as part of the mandate. The recommendations will be in the report, and will have to go quickly.

The Objectives of the study were reviewed as follows:

1. Primary Objectives

   Under C-3, there was suggestion to prioritize scoping in the channel. A question was asked if the structures could be a priority from the report. It was agreed on the Lac du Bonnet structure, but as there are several railway bridges, we need to prioritize as to where to focus first. KGS spelt it out in the report, but not in order of priority. We need full-scale excavation, and it may be perceived as not part of the floodway. Need to know where to start in terms of most beneficial.

2. Secondary Objectives

   Widening of the gaps at the inlet structure could give early benefits. The bulk excavation proposed in the upstream channel could be started at a higher level. As the material is beyond the slopes, it could be started before the pilot channel is completed to save some time and receive benefits upstream. Other ideas might provide some protection that would be quite cost effective. Modifications to the inlet structure, security, installation of rip rap, etc. could be done.

Schedule:

The environmental hearing process was to occur first from upstream and down. The desire is to fast track but we need to address those issues and this should be prioritized. The environmental assessment and public hearings are needed for feedback before a final decision is made on mitigation measures. Clearly established mitigation is what people want. Discussion took place on federal government funding.

It was questioned as to whether we should have a start and finish date from KGS. A lot of studies need to be revised and updated, and major tasks have been rescheduled. It was mentioned that Cabinet would not require a start and completion date -- what public consultations will be required is what Cabinet will ask. There's a whole sequence of events that must be carried out properly for completion, and time lines must be around this. It was suggested to review the KGS studies and insert required time lines.

Manitoba Conservation has been working on what needs to get done. Their expectation was not a lot of detailed answers but a reality check on the right questions being asked, the right flags and critical issues, as well as the sequencing of what has to be done now. The most critical of all is the management entity of this project. The environmental issues cannot work without project management. There is a need to maintain this momentum of collective thought, and continuity of a wide set of issues that need to be addressed as we move into the detailed design. It takes time and ideas have to develop. A database is now established.

Norm also indicated that the environmental process should be discussed further. It would be helpful and important to have consensus and support locally on this issue. A broad consensus is important as well. How we continue to nurture that process was discussed. We're not as far down the road as we would like to be for construction to start in 2004, based on the environmental approval. Feasibility with a tight schedule was mentioned.

Andy added that with respect to Value Engineering, there is value in bringing back the team later on. It is recommended to undertake the value engineering now and again during the design.

With the Value Engineering system, information was pointed out that we wouldn't know about. It was also noted that compensation may create a major roadblock for Cabinet. As to the public

consensus on the project, there are no definite answers at this time, but this needs to be addressed. The government must be a big part of this as well. This was a testing opportunity for Manitoba, and we will be involved in further studies with Value Engineering.

Problem solving, or cost improvement could be other areas of value engineering. There could be a Value 2 as separate smaller studies on bridges, etc. Furthermore, a continuing process on risk management is needed, and the last necessity is project management (alluded to in the executive summary). It's beneficial to have a consultative team with a continuing value approach (the owner and project manager working together). These options could be considered. The owner must be established for this project.

The meeting was finalized with a brief discussion on the public's awareness of the proposed floodway project. The detailed documents should remain confidential, and costs not to be forwarded to the public. Although it is best to have one spokesperson on this issue, we rely on people's discretion and common sense on this process and it is not necessary to contact Conservation if the media inquires.

Recorded by
Kathy Daniels
Manitoba Transportation and
Government Services

VALUE STUDY PROPOSAL TRACKING/STATUS

Reviewed at August 19/02 Review Panel Meeting – See Meeting Minutes for further information.

Status Key:	Cost Impact Key:
A: Accepted	Units: $M
R: Rejected	+ Increase to Base Case
AFS: Accepted Future Study	- Savings over Base case

VSP Ref.	Proposal ID	Proposal Description	Cost Impact Capital	Cost Impact LCC	Status	Comments
A	**Red River Floodway Channel**					
	C-1	Incorporate specific design measures to address blow out (locally)	-0.3		A	
	C-6	Incorporate better cover system technology: e.g.. Silt or fine sand upper portion (existing materials) combined with steeper side slopes			AFS	**Partial Solution. Groundwater effect on clays needed to complete solution. Related to C-6 & C-22. Items are not additive.**
	C-16	Re-visit approach to dealing with Winnipeg clay, based on latest experience and technologies			A	
	C-22	Steepen side slopes to 5:1	-7.0		AFS	
	C-30	Utilize existing materials to provide silt/sand cover (for upper portions)			AFS	
	C-10	Use sedge grass type liner (inundation tolerant)	+0.2	0.5	A	
	C-13	Conduct sensitivity analysis on slope stability options (increased activity), change characteristics of surface			A	
	C-15	Do major trial excavations (allow contractors to witness and to fine tune design)			A	**Rec. in Base Case**

VSP Ref	Proposal ID	Proposal Description	Cost Impact Capital	Cost Impact LCC	Status	Comments
	C-23	Modify new gaps in the spoil - East side	+0.2		A	
	C-25	Focus some hydraulic improvements specifically for less than 1/700 floods, i.e. Look for incremental benefits			A	
	C-28	Construct higher berm modifications first	-0.1		A	
	C-31	Excavate upstream sections earlier (**ref-C-28)			A	
	C-29 (a)	a) Use excavated material for recreational feature(s),	-0.8		A	
	C-29 (a)	b) determine recreational needs			A	
	C-29 (a)				A	
	C-33	Reconfigure pilot channel (Shallower & wider in places to minimise blowouts & potentially minimising impact to aquifer)			A	**Add risk to Risk Register. Include mitigation comments to Enviromental Applications**
B	**Inlet Structure at the Red River Floodway**					
	IS-2a	Make provision for emergency installation of bulkheads (incl. bridge deck mods)	-2		AFS	**Investigate the need for redundancy. Investigate method of gate control. Add to Risk Register**
	IS-6	Improve security (year round)	+0.3		A	
	IS-8	Sabotage proof structure			A	
	IS-12	Modify plug to control summer flows	+1.2		AFS	**Study underway to establish cost/benefit of summer water control.**
C	**Outlet Structure at the Red River Floodway**					
	OS-1	Retain existing wall as pier	-0.8		A	

VSP Ref	Proposal ID	Proposal Description	Cost Impact Capital	Cost Impact LCC	Status	Comments
	OS-4	Create white water park at outlet downstream	+2.0		AFS	**Pursue partnering & site selection.**
	OS-5	Create white water park upstream through water storage			AFS	**Pursue partnering & site selection.**
D	**West Dike at the Red River Floodway**					
	WD-4	Optimise cost of erosion protection system. Ie.:soil cement	-7.0		AFS	**Wave action study, cost optimisation.**
E	**Highway Bridge Retrofit: Deck Replacement and Pier Upgrade**					
	HB-5	Include replacement of deck with all retrofits	+8.0	-0.9?	A	
	HB-26 (Highway)	Build permanent cofferdam around existing piers foundations	-2.0		A	**Detailed design will have to be site specific.**
F	**Rail Bridge Retrofit along the Floodway**					
	RB-3	Convert existing CNR Sprague to through girder bridge	-5.1		AFS	**Requires Rail authority approval: comprimised freeboard & track outages. Review alignment.**
	RB-9	CoW move GWWD to Deacon	-1.0		AFS	**Requires further discussions/considerations by CoW. Issue involves relocation of rail support facilities.**
	HB-26 (Railway)	Streamline portions of bridge facing flow	-2.0	AFS		**Requires further consideration.**
G	**Project Management for the Proposed Expansion to the Red River Floodway**					
	PM-3	Construction Management/Team/Consortium			AFS	**Project has an immediate general need of a Project Management Team. Composition needs Review**
	PM-4	Hire Program Management Firm			AFS	
	PM-15	Prime Consultant with subs			AFS	

VSP Ref	Proposal ID	Proposal Description	Cost Impact Capital	Cost Impact LCC	Status	Comments
	PM-9	Dedicated Project Management Authority (Planning to Maintenance)			A	**Investigate Federal Involvement.**
	PM-14	Perform detailed GW, ENV, and Geotech Studies ASA for maximum benefit to advance project and secure cost funding			A	
	PM-17	Incorporate Recreational considerations into Planning. Design and Project Management	+0.8		A	
	PM-21	Recommend forum for flood compensation and / or mitigation issues to avoid schedule delays			A	
	PM-20	Develop compensation plan for upstream and downstream communities and perhaps individuals to be followed in the advent of flood (above natural state of nature) damages			A	
H	**WPCC Pumping Capacity Upgrade**					
	FP-10	Upgrade system Protection against extraneous flows during high river levels	-2.2		AFS	**I/I needs further investigation.**
I	**Floodway Operating Rules**					
	WD-1 WD-2	Raise West Dike by additional 2' to 786' Use Spoil material to raise west embankment of Floodway Channel by 2'	+10		AFS	**LCC benefits identified. Summer and spring benefits identified. Review effect on Inlet Structure**
J	**In-City River Level Management**					
	IS-13	Modify plug with installation of box culverts & add flow control.			AFS	**Review in conjunction with IS-12**
	PD -2(b)	Change Rule 2 to have 700 year level protection and change to 24.5 in city	-12.7		A	**Revise operating rules to meet needs of Expanded Floodway. Link to PM-20 & 21.**

VSP Ref	Proposal ID	Proposal Description	Cost Impact Capital	Cost Impact LCC	Status	Comments
K	**Sump Pump and Backwater Valve Subsidy Program**					
		Carry out assessment of combined sewer flood pumping station capacity: consider upgrades to pumping station capacity.	+80	+44	AFS	**Benefits during heavy rainfall events.**
	FP-7	Provide Sewer Back-up Valve & Sump pump for all combined sewer connections. Protects against basement flooding due to heavy rainfall during periods of high river water levels.	+80	-31.3	AFS	**Potential cost avoidance regarding sanitary sewer upgrades. Benefits during heavy rainfall events.**