Southern Alberta Flood Recovery Task Force Flood Mitigation Measures for the Bow, Elbow and Oldman River Basins Volume 4 - Flood Mitigation Measures – Final June 2014



Appendix B

Multi-Criteria Decision Making Assessment Process

Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure Project No. CW2174



April 1, 2014

April 1, 2014			Most Preferred Least Preferred								referred		Least Preferred			
Option Ranking	by Area & Weighting Sc	heme	1	2	3	4	5	6	7	1	2	3	4	5	6	
			Structu	ral Optio	ns					Non-	Structural (Options				
Basin	Area	Weighting Scheme	Wet Dam	Dry Dam	Levee / Dyke	By-Pass Channel	Erosion Protection	Improve Conveyance	Sediment/Debris Control	Managed Retreat	Warning / Forecasting / Management	Land Zoning (Restricted Development)	Buy-Outs	Flood Proofing	Building Code Changes	
			Note: A ra	anking of 6	or 7 may in	dicate failu	re of one o	or more mar	ndatory cond	tions.						
Bow River	Canmore	AMEC	6	7	2	4	5	1	3	2	6	3	1	5	4	
		Equal Weighting	6	7	1	4	5	1	3	2	6	2	1	5	4	
		Exclude Cost	6	7	3	4	5	1	2	2	4	3	1	6	5	
		Exclude Environment	6	7	2	4	5	1	3	2	5	3	1	6	4	
Bow River	Exshaw	AMEC	5	5	3	5	3	1	2	6	4	1	2	5	3	
		Equal Weighting	5	5	3	5	4	1	2	6	3	1	2	3	3	
		Exclude Cost	5	5	3	5	4	1	2	6	1	2	3	5	4	
		Exclude Environment	5	5	3	5	3	1	2	6	4	1	2	5	3	
Bow River	Kananaskis Country	AMEC	6	6	4	4	3	1	2	2	3	4	1	6	5	
		Equal Weighting	6	6	4	4	3	1	2	2	3	4	1	6	5	
		Exclude Cost	6	6	4	4	3	1	1	2	3	4	1	6	5	
		Exclude Environment	6	6	4	4	3	1	2	2	3	4	1	6	5	
Bow River	Cochrane	AMEC	5	4	1	6	2	7	2	5	3	4	5	2	1	
		Equal Weighting	4	4	1	4	2	7	2	5	3	4	5	1	1	
		Exclude Cost	5	4	1	6	2	7	2	5	3	4	5	1	2	
		Exclude Environment	5	4	1	6	2	7	2	5	3	4	5	2	1	
Bow River	City of Calgary	AMEC	4	5	1	6	2	3	6	2	5	4	1	3	6	
		Equal Weighting	4	5	1	6	2	3	6	4	5	2	1	2	5	
		Exclude Cost	3	5	1	6	2	4	6	3	4	5	1	2	6	
		Exclude Environment	4	5	1	6	2	3	6	2	5	4	1	3	6	
Bow River	First Nations (Siksika)	AMEC	5	3	1	7	6	2	4	2	5	4	1	3	6	
		Equal Weighting	5	3	1	7	6	2	3	3	4	4	1	2	4	
		Exclude Cost	3	2	1	7	5	4	5	2	4	5	1	3	6	
		Exclude Environment	4	3	1	7	6	2	5	2	5	4	1	3	6	
Bow River	Priddis	AMEC	4	5	1	6	2	7	2	3	2	1	6	4	5	
		Equal Weighting	4	6	1	5	2	7	2	5	2	1	6	2	4	
		Exclude Cost	2	3	1	4	5	7	5	2	1	3	6	4	5	
		Exclude Environment	2	3	1	6	4	7	4	5	2	1	6	3	4	
Elbow River	Bragg Creek	AMEC	4	5	2	6	1	6	3	5	6	2	3	1	4	
		Equal Weighting	4	5	1	6	1	6	3	5	5	2	3	1	4	
		Exclude Cost	3	4	2	6	1	6	5	6	4	3	2	1	5	
		Exclude Environment	3	5	2	6	1	6	4	5	6	2	3	1	4	

Rank Legend

Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure Project No. CW2174 April 1, 2014



Least Preferred

Option Ranking by Area & Weighting Scheme

 Rank Legend

 Most Preferred
 Least Preferred
 Most Preferred

 1
 2
 3
 4
 5
 6
 7
 1
 2

			Structu	ral Optio	ns				
Basin	Area	Weighting Scheme	Wet Dam	Dry Dam	Levee / Dyke	By-Pass Channel	Erosion Protection	Improve Conveyance	Sediment/Debris Control
Elbow River	Upstream of Glenmore Dam	AMEC	4	2	1	5	3	5	5
		Equal Weighting	4	2	1	5	3	5	5
		Exclude Cost	3	1	2	5	4	5	5
		Exclude Environment	3	2	1	5	3	5	5
Elbow River	Downstream of Glenmore Dam	AMEC	4	7	2	1	3	6	5
		Equal Weighting	4	7	1	1	3	6	4
		Exclude Cost	3	4	2	1	5	7	6
		Exclude Environment	4	5	2	1	3	5	7
Oldman River Basin	Pincher Creek	AMEC	5	6	2	7	4	3	1
		Equal Weighting	5	6	1	7	3	3	1
		Exclude Cost	3	4	2	7	6	4	1
		Exclude Environment	5	6	2	7	3	4	1
Oldman River Basin	Crowsnest Pass	AMEC	4	4	3	4	4	1	2
		Equal Weighting	4	4	3	4	4	1	2
		Exclude Cost	4	4	3	4	4	1	1
		Exclude Environment	4	4	3	4	4	1	2
Oldman River Basin	Cardston	AMEC	5	5	4	7	2	1	3
		Equal Weighting	5	6	4	7	2	1	3
		Exclude Cost	2	2	4	7	5	1	5
		Exclude Environment	5	5	4	7	2	1	3
Oldman River Basin	Lethbridge	AMEC	4	5	2	6	1	6	3
		Equal Weighting	4	5	2	6	1	6	3
		Exclude Cost	1	4	3	6	2	6	5
		Exclude Environment	3	5	2	6	1	6	4
Oldman River Basin	Fort MacLeod	AMEC	4	5	3	6	1	6	2
		Equal Weighting	4	5	3	6	1	6	2
		Exclude Cost	4	5	3	6	1	6	2
		Exclude Environment	4	5	3	6	1	6	2

Non-Str	uctural C	options				
Managed Retreat	Warning / Forecasting / Management	Land Zoning (Restricted Development)	Buy-Outs	Flood Proofing	Building Code Changes	
4	3	1	6	2	5	
4	3	1	5	2	5	
3	2	1	5	4	6	
4	3	1	6	2	5	
3	2	5	1	6	4	
3	1	5	1	6	3	
3	2	6	1	4	5	
3	2	5	1	6	4	
3	6	1	5	2	4	
3	3	1	3	1	3	
5	2	3	4	1	6	
3	6	1	5	2	4	
5	5	2	4	1	3	
5	5	2	4	1	3	
5	5	2	4	1	3	
5	5	2	4	1	3	
3	6	1	2	4	5	
4	5	1	1	3	5	
3	4	1	2	5	6	
3	6	1	2	4	5	
1	4	2	6	5	3	
2	3	1	6	4	4	
1	4	2	6	3	5	
1	4	2	6	5	3	
1	4	3	2	5	6	
1	3	4	2	4	6	
1	3	4	2	5	6	
1	4	3	2	5	6	

Score and Ranking Summary

Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure Project No. CW2174 April 1, 2014



Rank Legend Most Preferred Least Preferred Most Preferred Least Preferred 3 5 3 6 2 5

Weighting Scenario: AMEC

	3 7			ral Optio	ns			Non-Structural Options								
Basin	Area		Wet Dam	Dry Dam	Levee / Dyke	By-Pass Channel	Erosion Protection	Improve Conveyance	Sediment/Debris Control	Managed Retreat	Warning / Forecasting / Management	Land Zoning (Restricted Development)	Buy-Outs	Flood Proofing	Building Code Changes	
Bow River	Canmore	Score:	195		241	225	223	258	239	267	223	260	268	224	238	
		Rank:	6	7	2	4	5	1	3	2	6	3	1	5	4	
Bow River	Exshaw	Score:			216		216	280	261	208	213	224	217	209	214	
		Rank:	5	5	3	5	3	1	2	6	4	1	2	5	3	
Bow River	Kananaskis Country	Score:			203	203	256	273	265	242	226	219	247		214	
		Rank:	6	6	4	4	3	1	2	2	3	4	1	6	5	
Bow River	First Nations (Stoney/Nakoda)	Score:														
		Rank:														
Bow River	Cochrane	Score:	149	153	257	141	210		210	190	221	214	190	235	238	
		Rank:	5	4	1	6	2	7	2	5	3	4	5	2	1	
Bow River	City of Calgary	Score:	168	166	251		203	191		245	224	239	255	244	222	
		Rank:	4	5	1	6	2	3	6	2	5	4	1	3	6	
Bow River	First Nations (Siksika)	Score:	208	219	257		197	227	210	249	219	220	265	246	214	
		Rank:	5	3	1	7	6	2	4	2	5	4	1	3	6	
Bow River	Priddis	Score:	208	206	260	202	210	190	210	220	221	231	196	217	214	
		Rank:	4	5	1	6	2	7	2	3	2	1	6	4	5	
Elbow River	Bragg Creek	Score:	196	192	219		224		201	212	206	229	226	235	223	
		Rank:	4	5	2	6	1	6	3	5	6	2	3	1	4	
Elbow River	First Nations (Tsuu Tina)	Score:														
		Rank:														
Elbow River	Upstream of Glenmore Dam	Score:	190	210	225		197			244	245	288	209	250	214	
		Rank:	4	2	1	5	3	5	5	4	3	1	6	2	5	
Elbow River	Downstream of Glenmore Dam	Score:	205	196	241	252	225	203	204	237	247	217	250	211	226	
		Rank:	4	7	2	1	3	6	5	3	2	5	1	6	4	
Oldman River Basin	Pincher Creek	Score:	196	187	233		210	214	235	216	211	229	212	227	214	
		Rank:	5	6	2	7	4	3	1	3	6	1	5	2	4	

Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure Project No. CW2174 April 1, 2014



 Rank Legend Most Preferred
 Least Preferred
 Most Preferred
 Least Preferred

 1
 2
 3
 4
 5
 6
 7
 1
 2
 3
 4
 5
 6

 Weighting Scenario: AMEC

Score and Ranking Summary

	,			al Option	ns		Non-Structural Options								
Basin	Area		Wet Dam	Dry Dam	Levee / Dyke	By-Pass Channel	Erosion Protection	Improve Conveyance	Sediment/Debris Control	Managed Retreat	Warning / Forecasting / Management	Land Zoning (Restricted Development)	Buy-Outs	Flood Proofing	Building Code Changes
Oldman River Basin	Crowsnest Pass	Score:			216			265	257			255	202	266	214
		Rank:	4	4	3	4	4	1	2	5	5	2	4	1	3
Oldman River Basin	Cardston	Score:	194	194	207		222	247	215	238	221	251	245	233	226
		Rank:	5	5	4	7	2	1	3	3	6	1	2	4	5
Oldman River Basin	First Nations (Pikani)	Score:													
Oldman River Basin	First Nations (Blood)	Score:													
Oldman River Basin	Lethbridge	Score:	199	187	211		217		205	242	212	238	158	210	214
		Rank:	4	5	2	6	1	6	3	1	4	2	6	5	3
Oldman River Basin	Fort MacLeod	Score:	181	176	216		250		230	265	224	226	241	221	214
		Rank:	4	5	3	6	1	6	2	1	4	3	2	5	6
Oldman River Basin	River Bottoms - A	Score:													
		Rank:													
Oldman River Basin	River Bottoms - B	Score:													
		Rank:													

Assessment of Flood Mitigation Options
Prepared by AMEC Environment & Infrastructure
Project No. CW2174

April 1, 2014

Scenario ID: 1

Basin Elbow River
Area Bragg Creek

Definition

Desired Outcomes

Weighting 1 = Low Importance to 10 = High Importance

Score Weighting Scenario x Scoring System Result = Weighted Score

Category	Criteria
Mandatory	Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non-structural options can be implemented.
Conditions	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).

Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.
 Increase property protection for residents, business, and First Nations (note: business includes agriculture and irrigation, as well as provincial and municinal infrastructure).
 Protection of designated natural areas (traditional use, recreation, historical resources).

4. Ensure access to life-line services (fire, police, hospital, water & wastewater etc.) for all residents within the basin.

5. Provide adequate protection for at least the 1% annual exceedance probability event.

6. Provide adequate protection for the largest

historical flood of record.

7. Be designed and operated to meet multi-purpose

objectives (e.g., manage water resources for both

10. Ensure species (fish, wildlife, vegetation, etc.) are not adversely impacted.
 11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

8. Development and construction costs.9. Operating and maintenance costs.

of life (compared to existing situation).

12. Protection is implemented in the near term.

floods and droughts)

5

4

10

Desired Outcomes Score:



Legend

196

192

4		Strongly Positive
3		Positive
2		Negative
1		Strongly Negative
	-	

		S	truct	ural Options																		
	Mandatory Conditions	W	et Dam	1	D	ry Dai	n	Le	evee /	Dyke Dyke	В	y-Pas	s Channel	Erc	osion	Protection	lm	orove Con	nveyance	Se	dime	ent/Debris Control
	Scoring Scheme			Comment			Comment			Comment			Comment			Comment			Comment			Comment
	1 = cannot be met 4 = can be met		4			4			4			1		4	1						4	
	1 = cannot be met 4 = can be met		4			4			4					4	1						4	
	Test Result:	Р	ass		P	ass		P	ass		F	ail		Pa	ss		F	ail		Pa	ass	
MEC	Scoring System	Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score	
	1 = negative outcome 4 =positive outcome	4	36		4	36		4	36			0		3	27			0		3	27	
	1 = negative outcome 4 =positive outcome	4	32		4	32		4	32			0		3	24			0		3	24	
	1 = low benefit 4 = high benefit	1	5		2	10		1	5			0		2	10			0		1	5	
	1 = low benefit 4 = high benefit	3	24		3	24		2	16			0		2	16			0		1	8	
	1 = low benefit 4 = high benefit	3	24	Related to flood volume, not peak flow rate Related to flood volume, not	3	24	Related to flood volume, not peak flow rate Related to flood volume, not	4	32			0		3	24			0		1	8	
	1 = low benefit 4 = high benefit	2	8	Related to flood volume, not peak flow rate	2	8	Related to flood volume, not peak flow rate	4	16			0		2	8			0		2	8	
	1 = low benefit 4 = high benefit	4	16		1	4		1	4			0		1	4			0		1	4	
	1 = high cost 4 = low cost	1	6		1	6		2	12			0		2	12			0		3	18	
	1 = high cost 4 = low cost	1	7		1	7		3	21			0		3	21			0		3	21	
	1 = negative outcome 4 =positive outcome	1	7		1	7		2	14			0		2	14			0		2	14	
	1 = high risk 4 =low risk	2	20		2	20		1	10			0		4	40			0		4	40	
	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years	1	3		2	6		3	9			0		4	12			0		4	12	
	1 = meets few/none 2 = meets some 3 = meets most 4 - meets all	2	8		2	8		3	12			0		3	12			0		3	12	

0

224

0

201

CW2174_Flood Mitigation Options -Apr_1_2014_Protected.xlsb

Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure Project No. CW2174

April 1, 2014

Scenario ID: 1

Basin Elbow River Area Bragg Creek

Definition

1 = Low Importance to 10 = High Importance

1. Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.

2. Increase property protection for residents, business, and First Nations (note: business includes

agriculture and irrigation, as well as provincial and municinal infrastructure\
3. Protection of designated natural areas (traditional use, recreation, historical resources).

4. Ensure access to life-line services (fire, police,

hospital, water & wastewater etc.) for all residents

5. Provide adequate protection for at least the 1%

historical flood of record.

7. Be designed and operated to meet multi-purpose

objectives (e.g., manage water resources for both

10. Ensure species (fish, wildlife, vegetation, etc.) are not adverselv impacted.

11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

annual exceedance probability event.

6. Provide adequate protection for the largest

8. Development and construction costs. 9. Operating and maintenance costs.

of life (compared to existing situation). 12. Protection is implemented in the near term.

within the basin.

floods and droughts).

Desired Outcomes Weighting Scenario x Scoring System Result = Weighted Score

Category	Criteria
Mandatory	Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non structural options can be implemented.
Conditions	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).



Leg	<u>end</u>	
4		Strongly Positive
3		Positive
2		Negative
1		Strongly Negative

ire		No	n-Structural Optior	าร														
.0	Mandatory Conditions		aged Retreat	W		g / Forecasting / ement			oning (Restricted oment)	Вι	Jy-Out	ts	FI	ood F	Proofing	Вι	ıildin	g Code Changes
	Scoring Scheme		Comment			Comment			Comment			Comment			Comment			Comment
	1 = cannot be met 4 = can be met	4			4			4			4			4			4	
	1 = cannot be met 4 = can be met	4			4			4			4			4			4	
	Test Result:	Pas	S	Pa	ass		Pa	ass		Pa	ass		Pa	ass		Pa	ass	
Veighting aario = AMEC	Scoring System	Score	weignted Score	Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score	
9	1 = negative outcome 4 =positive outcome	3 2	27	3	27		3	27		3	27		3	27		3	27	
8	1 = negative outcome 4 =positive outcome	3 2	24	3	24		3	24		4	32		3	24		3	24	
5	1 = low benefit 4 = high benefit	1	5	1	5		1	5		1	5		1	5		1	5	
8	1 = low benefit 4 = high benefit	1	8	2	16		1	8		1	8		2	16	Ensure access to communities (e.g., subdivision entrances need to be made floodproof)	1	8	
8	1 = low benefit 4 = high benefit	1	8	1	8		2	16		2	16		2	16		2	16	
4	1 = low benefit 4 = hiah benefit	1	4		4		2	8		2	8		2	8		2	8	
4	1 = low benefit 4 = high benefit	1	4		4		1	4		1	4		1	4		1	4	
6	1 = high cost 4 = low cost	4 2	24	3	18		4	24		2	12		3	18		4	24	
7	1 = high cost 4 = low cost	4 2	28	2	14		4	28		4	28		4	28		4	28	
7	1 = negative outcome 4 =positive outcome	3 2	21	3	21		3	21		3	21		3	21		3	21	
10	1 = high risk 4 =low risk	4 4	40	4	40		4	40		4	40		4	40		4	40	
3	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years	1	3	3	9		4	12		3	9		4	12		2	6	
4	1 = meets few/none 2 = meets some 3= meets most 4 =meets all	4	16	4	16		3	12		4	16		4	16		3	12	
Desired	Outcomes Score:	212		2	06		2	29		2	26		2	35		2	23	

Assessment of Flood Mitigation Options
Prepared by AMEC Environment & Infrastructure
Project No. CW2174

April 1, 2014

Scenario ID: 1

Basin Bow River
Area Canmore

Definition

Desired

Outcomes

Weighting	1 = Low Importance to 10 = High Importance
Score	Weighting Scenario x Scoring System Result = Weighted Score

Category	Criteria
Mandatory	Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non-structural options can be implemented.
Conditions	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).

Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both upstream and downstream.
 Increase property protection for residents, business, and First Nations (note: business includes)

agriculture and irrigation, as well as provincial and municipal infrastructure)
3. Protection of designated natural areas (traditional use, recreation, historical resources).
4. Ensure access to life-line services (fire, police, hospital, water & wastewater etc.) for all residents

within the basin.

5. Provide adequate protection for at least the 1%

7. Be designed and operated to meet multi-purpose objectives (e.g., manage water resources for both

10. Ensure species (fish, wildlife, vegetation, etc.) are

not adverselv impacted.

11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

annual exceedance probability event.

6. Provide adequate protection for the largest

8. Development and construction costs.

9. Operating and maintenance costs.

of life (compared to existing situation).

12. Protection is implemented in the near term.

historical flood of record.

floods and droughts).

regulations.

5

8

4

4

6

7

7

10

3

Desired Outcomes Score:



Legend

195

0

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

		St	ruct	tural Options																		
	Mandatory Conditions	We	t Dam	1	Dr	y Dan	1	Le	Levee / Dyke			/-Pas	s Channel	Ere	osion	Protection	lm	prov	e Conveyance	Se	dime	nt/Debris Control
	Scoring Scheme			Comment			Comment			Comment		Comment		l .		Comment			Comment			Comment
	1 = cannot be met 4 = can be met	4	1			1			4			4		,	4			4		4	4	
	1 = cannot be met 4 = can be met	4	1			4		Г	4		Г	4			4			4		4	4	
	Test Result:	Pa	ss		F	ail		P	ass	1	P	ass		Pa	iss		Pa	ıss	1	Pa	ass	
	Tool Hoodil.				Ë			Ė]	Ë						`]			
ng) =	Scoring System	Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score	
	1 = negative outcome 4 =positive outcome	3	27			0		3	27		3	27	- Cougar Creek/Mountain Creek Tributaries at the apex of the alluvial fan	4	36	Silvertip Creek (back to original path) On the mountain creeks; not necessarily on the Bow River	4	36		4	36	
	1 = negative outcome 4 =positive outcome	3	24			0		3	24		2	16		4	32		4	32		4	32	
	1 = low benefit 4 = high benefit	1	5			0		3	15		2	10		1	5		3	15	Some can be negative (e.g., dredging)	3	15	
	1 = low benefit 4 = high benefit	3	24			0		4	32		4	32		3	24		4	32		3	24	
	1 = low benefit 4 = hiah benefit	4	32			0		4	32		4	32		1	8		2	16		1	8	
	1 = low benefit 4 = hiah benefit	4	16			0		4	16		4	16		1	4		2	8		1	4	
	1 = low benefit 4 = high benefit	4	16			0		1	4		1	4		1	4		1	4		1	4	
	1 = high cost 4 = low cost	1	6			0		3	18		2	12		3	18		2	12		4	24	
	1 = high cost 4 = low cost	1	7			0		4	28		3	21		2	14		3	21		2	14	
	1 = negative outcome 4 =positive outcome	1	7			0		2	14		2	14		2	14	Just the Bow River area	3	21	Dredging is negative (2)	2	14	
	1 = high risk 4 =low risk	2	20			0		1	10		2	20		4	40		4	40		4	40	
	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years	1	3			0		3	9		3	9		4	12		3	9		4	12	
	1 = meets few/none 2 = meets some 3 = meets most 4 = meets all	2	8			0		3	12	Timing issue	3	12		3	12		3	12		3	12	

225

223

258

239

CW2174_Flood Mitigation Options -Apr_1_2014_Protected.xlsb

Assessment of Flood Mitigation Options
Prepared by AMEC Environment & Infrastructure
Project No. CW2174

April 1, 2014

Scenario ID: 1

Basin	Bow River
Area	Canmore

Definition

Weighting	1 = Low Importance to 10 = High Importance							
Score	Weighting Scenario x Scoring System Result = Weighted Score							

Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.
 Increase property protection for residents, business, and First Nations (note: business includes agriculture and irrigation, as well as provincial and municinal infrastructure)
 Protection of designated natural areas (traditional use, recreation, historical resources).
 Ensure access to life-line services (fire, police, hospital, water & wastewater etc.) for all residents

within the basin.

5. Provide adequate protection for at least the 1%

Be designed and operated to meet multi-purpose objectives (e.g., manage water resources for both

10. Ensure species (fish, wildlife, vegetation, etc.) are

not adverselv impacted.

11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

12. Protection is implemented in the near term.

annual exceedance probability event.

6. Provide adequate protection for the largest

8. Development and construction costs.

9. Operating and maintenance costs.

of life (compared to existing situation).

historical flood of record.

floods and droughts)

Desired

Outcomes

5

8

4

4

6

7

7

10

3

Desired Outcomes Score: 267

Category	Criteria
Mandatory	Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non structural options can be implemented.
Conditions	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).



Legend

Positive Negative	4	Strongly Positive
2 Negative	3	Positive
- 3	2	Negative
1 Strongly Negative	1	Strongly Negative

		Non-Structural Options																	
	Mandatory Conditions					Warning / Forecasting / Management				oning (Restricted oment)	В	uy-Ou	ts	FI	ood F	Proofing	Building Code Changes		
	Scoring Scheme	Comment				Comment			Comment				Comment			Comment			Comment
	1 = cannot be met 4 = can be met		4			4			4			4			4			4	
	1 = cannot be met 4 = can be met		4			4			4			4			4			4	
	Test Result:	: Pass		P	ass		Pass			Pass			Pass]	Pa	ass		
nting rio = EC	Scoring System	Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score	
	1 = negative outcome 4 =positive outcome	4	36		3	27		3	27		4	36		3	27		3	27	
	1 = negative outcome 4 =positive outcome	2	16		4	32		3	24		2	16		3	24		3	24	
	1 = low benefit 4 = high benefit	3	15		1	5		4	20		1	5		1	5		1	5	
	1 = low benefit 4 = high benefit	3	24		4	32		3	24		4	32		2	16		3	24	
	1 = low benefit 4 = high benefit	3	24		1	8		2	16		4	32		2	16		2	16	
	1 = low benefit 4 = high benefit	3	12		1	4		2	8		4	16		1	4		1	4	
	1 = low benefit 4 = high benefit	2	8		1	4		1	4		2	8		1	4		1	4	
	1 = high cost 4 = low cost	4	24		3	18	Management included	4	24		1	6	Look at areas other than floodway (e.g., affected by debris)	3	18		4	24	
	1 = high cost 4 = low cost	4	28		2	14	Management included	4	28		4	28		3	21		4	28	
	1 = negative outcome 4 =positive outcome	3	21		2	14		3	21		3	21		3	21		3	21	
)	1 = high risk 4 =low risk	4	40		4	40		4	40		4	40		4	40		4	40	
	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years	1	3		3	9		4	12		4	12		4	12		3	9	
	1 = meets few/none 2 = meets some 3 = meets most 4 = meets all	4	16		4	16	Management included (3)	3	12		4	16		4	16		3	12	

268

224

238

260

CW2174_Flood Mitigation Options -Apr_1_2014_Protected.xlsb

Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure Project No. CW2174 April 1, 2014

Scenario ID: 1

Basin Oldman River Basin Area Cardston

Definition

Desired Outcomes

1 = Low Importance to 10 = High Importance Weighting Scenario x Scoring System Result = W

Category	Criteria
Mandatory	Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non-structural options can be implemented.
Conditions	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).



Legend

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

Weighting Scenario x Scoring System Result = Weighted Score					tural Options												
			Mandatory Conditions	Wet Dan	1	Dry Dan	n	Levee /	Dyke	Ву-Ра	ss Channel	Eros	on Protection	Improve	e Conveyance	Sedime	ent/Debris Control
/	Criteria		Scoring Scheme	_	Comment		Comment		Comment		Comment		Comment		Comment	l	Comment
	Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non-structural options can be implemented.		1 = cannot be met 4 = can be met	4		4		4		1		4		4		4	
	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).		1 = cannot be met 4 = can be met	4	May be some transboundary input required because it originates in US	4		4				4		4		4	
			Test Result:	Pass		Pass		Pass		Fail		Pass		Pass		Pass	
		Weighting Scenario = AMEC	Scoring System	Score Weighted Score		Score Weighted Score		Score Weighted Score		Score Weighted Score		Score		Score Weighted Score		Score Weighted Score	
	Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.	9	1 = negative outcome 4 =positive outcome	4 36		4 36		3 27		0		3 2		4 36		3 27	
	Increase property protection for residents, business, and First Nations (note: business includes agriculture and irrigation, as well as provincial and municinal infrastructure) Protection of designated natural areas (traditional	8	1 = negative outcome 4 =positive outcome 1 = low benefit	4 32		4 32		3 24		0		3 2		4 32		3 24	
	use, recreation, historical resources). 4. Ensure access to life-line services (fire, police,	5	4 = high benefit 1 = low benefit	1 5		1 5		2 10		0		1 5		1 5		1 5	
	hospital, water & wastewater etc.) for all residents within the basin. 5. Provide adequate protection for at least the 1%	8	4 = high benefit 1 = low benefit	1 8		1 8		1 8		0		1 8		1 8		1 8	
	annual exceedance probability event. 6. Provide adequate protection for the largest	8	4 = high benefit 1 = low benefit	3 24 3 12		4 32 4 16		3 24 3 12		0		2 1		4 32		2 16 2 8	
	historical flood of record. 7. Be designed and operated to meet multi-purpose objectives (e.g., manage water resources for both floods and droughts).	4	4 = high benefit 1 = low benefit 4 = high benefit	4 16		1 4		1 4		0		1 4		1 4		1 4	
	8. Development and construction costs.	6	1 = high cost 4 = low cost 1 = high cost	1 6 1 7		1 6		2 12		0		4 2		3 18		4 24	
	Operating and maintenance costs. Ensure species (fish, wildlife, vegetation, etc.) are	7	4 = low cost 1 = negative outcome			1 7 1 7		3 21 2 14		0		4 2 2 1		3 21		3 21	
	not adverselv impacted. 11. Must not increase potential for flood-related loss of life (compared to existing situation).	10	4 =positive outcome 1 = high risk 4 =low risk	3 30		3 30		3 30		0		4 4	-	4 40		4 40	
	Protection is implemented in the near term.	3	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years	1 3		1 3		3 9		0		4 1	2	3 9		4 12	
	13. Meets existing federal and provincial policies and regulations.	4	1 = meets few/none 2 = meets some 3= meets most 4 =meets all	2 8		2 8		3 12		0		3 1	2	3 12		3 12	
		Desired (Outcomes Score:	194]	194		207		0		222		247]	215	1

Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure Project No. CW2174

April 1, 2014

Scenario ID: 1

Basin Oldman River Basin Area Cardston

Weighting Scenario x Scoring System Result = Weighted Score

1. Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both upstream and downstream.

2. Increase property protection for residents, business, and First Nations (note: business includes agriculture and irrigation, as well as provincial and municinal infrastructure)
3. Protection of designated natural areas (traditional use, recreation, historical resources).
4. Ensure access to life-line services (fire, police, hospital, water & wastewater etc.) for all residents within the basin.
5. Provide adequate protection for at least the 1% annual exceedance probability event.

6. Provide adequate protection for the largest historical flood of record.

7. Be designed and operated to meet multi-purpose objectives (e.g., manage water resources for both floods and droughts).

10. Ensure species (fish, wildlife, vegetation, etc.) are not adversely impacted.

11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

8. Development and construction costs. 9. Operating and maintenance costs.

of life (compared to existing situation). 12. Protection is implemented in the near term.

regulations.

Definition

Desired Outcomes

Weighting	1 = Low Importance to 10 = High Importance

Category	Criteria
Mandatory	Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non-structural options can be implemented.
Conditions	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).



Legend

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

Score		Non-Structural Options																	
	Mandatory Conditions	Mana	aged Retreat			g / Forecasting / ment			oning (Restricted oment)	Вι	ıy-Ou	its	Flo	od Proofing	0		Ві	uildin	g Code Changes
	Scoring Scheme		Comment			Comment			Comment			Comment		Comment		Comment			Comment
	1 = cannot be met 4 = can be met	4		4	4		4	4			4		4			0		4	
	1 = cannot be met 4 = can be met	4		4	4		4	1			4		4			0		4	
	Test Result:	Pass	3	Pa	ISS		Pa	ss		Pa	iss		Pa	ss	C)	Pa	ass	
Weighting Scenario = AMEC	Scoring System	Score	weigned score	Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score			Score	Weighted Score	
9	1 = negative outcome 4 =positive outcome		27	3	27		3	27		3	27		3	27		0	3	27	
8	1 = negative outcome 4 =positive outcome	3 2	24	3	24		4	32		3	24		3	24		0	3	24	
5	1 = low benefit 4 = high benefit	1	5	1	5		2	10		1	5		1	5		0	1	5	
8	1 = low benefit 4 = high benefit	1	8	1	8		1	8		1	8		1	8		0	1	8	
8	1 = low benefit 4 = high benefit 1 = low benefit		32		16		3	24		3	24		2	16		0	2	16	
4	4 = high benefit 1 = low benefit 4 = high benefit		4	2	8	management of st mary reservoir	1	12 4		1	12 4		1	4		0	1	8 4	
6	1 = high cost 4 = low cost	3 1	8	3	18		4	24		4	24		4	24		0	4	24	
7	1 = high cost 4 = low cost		28	-	21		4	28		4	28		4	28		0	4	28	
7	1 = negative outcome 4 =positive outcome 1 = high risk	3 2			21		3	21		3	21		3	21	Ш	0	3	21	
3	4 = low risk 1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years		3	3	9		3	9		4	12		4	12		0	3	9	
4	1 = meets few/none 2 = meets some 3 = meets most 4 =meets all	3 1	2	4	16		3	12		4	16		4	16		0	3	12	
Desired	Outcomes Score:	238		22	21		25	51		2	45		2:	3	C)	2	26	

Assessment of Flood Mitigation Options
Prepared by AMEC Environment & Infrastructure
Project No. CW2174
April 1, 2014

Scenario ID: 1

Basin Bow River
Area City of Calgary

Definition

Weighting 1 = Low Importance to 10 = High Importance

Score

Desired

Outcomes

Weighting Scenario x Scoring System Result = Weighted Score

Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.
 Increase property protection for residents, business, and First Nations (note: business includes agriculture and irrigation, as well as provincial and municipal infrastructure)
 Tortection of designated natural areas (traditional use, recreation, historical resources).

hospital, water & wastewater etc.) for all residents within the basin.

5. Provide adequate protection for at least the 1% annual exceedance probability event.

6. Provide adequate protection for the largest historical flood of record.

7. Be designed and operated to meet multi-purpose

objectives (e.g., manage water resources for both

10. Ensure species (fish, wildlife, vegetation, etc.) are not adversely impacted.
 11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

Development and construction costs.
 Operating and maintenance costs.

of life (compared to existing situation).

12. Protection is implemented in the near term.

floods and droughts).

regulations.

Category

Criteria

1. Ensure flood control infrastructure can be designed and built in a suitable location. Ensure nonstructural options can be implemented.

2. Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).



Legend

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

Score		Struct	ural Options															
	Mandatory Conditions	Mandatory Wet Dam Conditions		Dry Da	am	Levee	/ Dyke	By-l	Pass	s Channel	Ero	sion	Protection	lmp	rove Conveyance	Se	dime	nt/Debris Control
	Scoring Scheme		Comment		Comment		Comment			Comment			Comment		Comment			Comment
	1 = cannot be met 4 = can be met	4		4		4		1			4	ļ.		4			1	
	1 = cannot be met 4 = can be met	4		4		4					4			4				
	Test Result:	Pass		Pass		Pass		Fa	il		Pas	ss		Pas	ss	F	ail	
Weighting Scenario = AMEC	Scoring System	Score Weighted Score		Score Weighted Score		Score Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score	Score	Weighted Score	
9	1 = negative outcome 4 =positive outcome	4 36		4 36		4 36			0		3	27		3	27		0	
8	1 = negative outcome 4 =positive outcome	4 32		4 32		4 32			0		3	24		3	24		0	
5	1 = low benefit 4 = high benefit	1 5		1 5		2 10			0		3	15		1	5		0	
8	1 = low benefit 4 = high benefit	2 16		2 16		3 24			0		1	8		1	8		0	
8	1 = low benefit 4 = high benefit	1 8		1 8		4 32			0		1	8		1	8		0	
4	1 = low benefit 4 = high benefit 1 = low benefit 4 = high benefit	1 4 4 16		1 4		3 12 1 4			0		1	4		1	4		0	
6	1 = high cost 4 = low cost	1 6		1 6		3 18		\vdash	0		3	18		2	12		0	
7	1 = high cost 4 = low cost	1 7		2 14		4 28			0		3	21		4	28		0	
7	1 = negative outcome 4 =positive outcome	1 7		1 7		3 2		Ш	0		2	14		2	14	Ш	0	
10	1 = high risk 4 =low risk 1 = 10+ years	2 20		2 20		1 10			0		4	40		4	40		0	
3	2 = 5-10 years 3 = 2-5 years 4 = <2 years	1 3		2 6		4 12			0		4	12		3	9		0	
4	1 = meets few/none 2 = meets some 3 = meets most 4 = meets all	2 8		2 8		3 12			0		2	8		2	8		0	
Desired	Outcomes Score:	168		166		251		0			20)3		19	1		0	

CW2174_Flood Mitigation Options -Apr_1_2014_Protected.xlsb

Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure Project No. CW2174

April 1, 2014

Scenario ID: 1

Basin Bow River Area City of Calgary

Weighting Scenario x Scoring System Result = Weighted Score

1. Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.

2. Increase property protection for residents, business, and First Nations (note: business includes agriculture and irrigation, as well as provincial and municinal infrastructure)
3. Protection of designated natural areas (traditional use, recreation, historical resources).
4. Ensure access to life-line services (fire, police, hospital, water & wastewater etc.) for all residents

nospital, water & wastewater etc.) for all residents within the basin.

5. Provide adequate protection for at least the 1% annual exceedance probability event.

6. Provide adequate protection for the largest historical flood of record.

7. Be designed and operated to meet multi-purpose

objectives (e.g., manage water resources for both

10. Ensure species (fish, wildlife, vegetation, etc.) are not adverselv impacted.

11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

8. Development and construction costs. 9. Operating and maintenance costs.

of life (compared to existing situation). 12. Protection is implemented in the near term.

floods and droughts).

Definition

Desired Outcomes

Weighting	1 = Low Importance to 10 = High Importance

Category Criteria Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non-Mandatory structural options can be implemented. Conditions 2. Must meet existing transboundary legal commitments (i.e., downstream volumes to other



Legend

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

Score		Non	-Structural Option	s														
	Mandatory Conditions	Mana	ged Retreat		rning nage	/ Forecasting / ment			oning (Restricted pment)	В	uy-Ou	ts	Fle	ood I	Proofing	Buildi		g Code Changes
	Scoring Scheme		Comment			Comment			Comment			Comment			Comment			Comment
	1 = cannot be met 4 = can be met	4		4	1			4			4			4			4	
	1 = cannot be met 4 = can be met	4		4	1			4			4			4			4	
	Test Result:	Pass		Pa	ss		Pa	ss		P	ass		Pa	ass		Pa	ass	
Veighting cenario = AMEC	Scoring System	Score Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score	
9	1 = negative outcome 4 =positive outcome	4 36	All floodway plus Bowness	4	36	Includes management	3	27		4	36		3	27		3	27	
8	1 = negative outcome 4 =positive outcome	3 24	4	3	24		3	24		4	32		3	24		3	24	
5	1 = low benefit 4 = high benefit	3 15	5	2	10		3	15		2	10		1	5		1	5	
8	1 = low benefit 4 = high benefit	2 16	5	3	24		1	8		1	8		3	24		1	8	
8	1 = low benefit 4 = high benefit	2 16	5	1	8		2	16		4	32		3	24		2	16	
4	1 = low benefit 4 = hiah benefit	2 8			4		2	8		4	16		2	8		1	4	
4	1 = low benefit 4 = high benefit	1 4		1	4		1	4		1	4		1	4		1	4	
6	1 = high cost 4 = low cost	3 18	3	3	18	Management included	4	24		1	6		3	18		4	24	
7	1 = high cost 4 = low cost	4 28	3	2	14	Management included	4	28		4	28		3	21		4	28	
7	1 = negative outcome 4 =positive outcome	3 2	1	3	21		3	21		3	21		3	21		3	21	
10	1 = high risk 4 =low risk	4 40)	4	40		4	40		4	40		4	40		4	40	
3	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years	1 3		3	9		4	12		2	6		4	12		3	9	
4	1 = meets few/none 2 = meets some 3= meets most 4 = meets all	4 16	5	3	12		3	12		4	16		4	16		3	12	
Desired	Outcomes Score:	245		22	24		2	39		2	255		2	44		2	22	

Assessment of Flood Mitigation Options
Prepared by AMEC Environment & Infrastructure
Project No. CW2174
April 1, 2014

Scenario ID: 1

Basin Bow River

Area Cochrane

Definition

Weighting 1 = Low Importance to 10 = High Importance

Score

Desired

Outcomes

Weighting Scenario x Scoring System Result = Weighted Score

Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.
 Increase property protection for residents, business, and First Nations (note: business includes agriculture and irrigation, as well as provincial and municipal infrastructure)
 Tortection of designated natural areas (traditional use, recreation, historical resources).

hospital, water & wastewater etc.) for all residents within the basin.

5. Provide adequate protection for at least the 1% annual exceedance probability event.

6. Provide adequate protection for the largest historical flood of record.

7. Be designed and operated to meet multi-purpose

objectives (e.g., manage water resources for both

10. Ensure species (fish, wildlife, vegetation, etc.) are not adversely impacted.
 11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

8. Development and construction costs.

9. Operating and maintenance costs.

of life (compared to existing situation).

12. Protection is implemented in the near term.

floods and droughts).

regulations.

5 8

4

7

10

3

Desired Outcomes Score: 149

Category

Criteria

1. Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non-structural options can be implemented.

2. Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).



Legend

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

		Stı	uctu	ural Options																		
	Mandatory Conditions	Wet	Dam		Di	ry Dar	1	L	evee /	Dyke	Ву	/-Pas	s Channel	Er	osion	Protection	lm	prove	e Conveyance	Se	edime	ent/Debris Control
	Scoring Scheme			Comment			Comment			Comment			Comment			Comment			Comment			Comment
	1 = cannot be met 4 = can be met	4				4			4			4			4			1			4	
	1 = cannot be met 4 = can be met	4				4			4			4			4		4	4			4	
	Test Result:	Pa	ss		P	ass		P	ass		Pa	ass		Pa	ass		Fa	ail		Pa	ass	
ting rio = :C	Scoring System	Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score	
	1 = negative outcome 4 =positive outcome	3	27		3	27		4	36		3	27		3	27			0		3	27	
	1 = negative outcome 4 =positive outcome	3	24		3	24		4	32		3	24		3	24			0		3	24	
	1 = low benefit 4 = high benefit	1	5		1	5		2	10		1	5		1	5			0		1	5	
	1 = low benefit 4 = high benefit	1	8		1	8		2	16		1	8		1	8			0		1	8	
	1 = low benefit 4 = high benefit	1	8		2	16		4	32		1	8		1	8			0		1	8	
	1 = low benefit 4 = hiah benefit	1	4		2	8		4	16		1	4		1	4			0		1	4	
	1 = low benefit 4 = high benefit	3	12		1	4		1	4		1	4		1	4			0		1	4	
	1 = high cost 4 = low cost	1	6		1	6		3	18		2	12		4	24			0		4	24	
	1 = high cost 4 = low cost	1	7		1	7		4	28		2	14		4	28			0		4	28	
	1 = negative outcome 4 =positive outcome	1	7		1	7		2	14		1	7		2	14			0		2	14	
	1 = high risk 4 =low risk	3	30		3	30		3	30		1	10		4	40			0		4	40	
	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years	1	3		1	3		3	9		2	6		4	12			0		4	12	
	1 = meets few/none 2 = meets some 3= meets most 4 =meets all	2	8		2	8		3	12		3	12		3	12			0		3	12	

141

210

0

210

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257

Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure Project No. CW2174

April 1, 2014

Scenario ID: 1

Basin Bow River Area Cochrane

Definition

Desired

Outcomes

Weighting	1
weighting	

1 = Low Importance to 10 = High Importance

Weighting Scenario x Scoring System Result = Weighted Score

1. Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.

2. Increase property protection for residents, business, and First Nations (note: business includes

agriculture and irrigation, as well as provincial and municinal infrastructure)
3. Protection of designated natural areas (traditional use, recreation, historical resources).
4. Ensure access to life-line services (fire, police,

hospital, water & wastewater etc.) for all residents

within the basin.

5. Provide adequate protection for at least the 1% annual exceedance probability event.

6. Provide adequate protection for the largest historical flood of record.

7. Be designed and operated to meet multi-purpose

objectives (e.g., manage water resources for both

10. Ensure species (fish, wildlife, vegetation, etc.) are not adverselv impacted.

11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

8. Development and construction costs.

9. Operating and maintenance costs.

of life (compared to existing situation). 12. Protection is implemented in the near term.

floods and droughts).

Category	Criteria
Mandatory	1. Ensure flood control infrastructure can be designed and built in a suitable location. Ensure nor structural options can be implemented.
Conditions	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).



Legend

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

Score		No	on-Structural Op	otions	;													
	Mandatory Conditions	Ма	naged Retreat		Warning Manage	/ Forecasting / ment			ning (Restricted ement)	Вι	ıy-Out	ts	Flo	lood Proofing		Bui	lding	Code Changes
	Scoring Scheme		Comment			Comment			Comment			Comment		Comment				Comment
	1 = cannot be met 4 = can be met	۷			4			1			4			4		4		
	1 = cannot be met 4 = can be met	4			4			4			4			4		4		
	Test Result:	Pa	ss		Pass		Pa	ss		Pa	ass		Pa	ass		Pas	ss	
Veighting cenario = AMEC	Scoring System	Score	Weighted Score	,	Score Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score	ć	Score	Weighted Score	
9	1 = negative outcome 4 =positive outcome	3	27		3 27		3	27		3	27		3	27		3	27	
8	1 = negative outcome 4 =positive outcome	3	24		3 24		3	24		3	24		3	24		3	24	
5	1 = low benefit 4 = high benefit	1	5		1 5		1	5		1	5		1	5		1	5	
8	1 = low benefit 4 = high benefit	1	8		2 16		1	8		1	8		1	8		1	8	
8	1 = low benefit 4 = high benefit	1	8		2 16		1	8		1	8		3	24		3	24	
4	1 = low benefit 4 = hiah benefit	1	4		2 8		1	4		1	4		3	12		3	12	
4	1 = low benefit 4 = high benefit	1	4		1 4		1	4		1	4		1	4		1	4	
6	1 = high cost 4 = low cost	1	6		3 18		4	24		1	6		3	18		4	24	
7	1 = high cost 4 = low cost	4	28		3 21		4	28		4	28		4	28		4	28	
7	1 = negative outcome 4 =positive outcome 1 = high risk	3	21		3 21		3	21		3	21		3	21			21	
10	4 = low risk 1 = 10+ years	4	40		4 40		4	40		4	40		4	40		4	40	
3	2 = 5-10 years 3 = 2-5 years 4 = <2 years	1	3		3 9		3	9		1	3		4	12		3	9	
4	1 = meets few/none 2 = meets some 3 = meets most 4 = meets all	3	12		3 12		3	12		3	12		3	12		3	12	
Desired	Outcomes Score:	19	00		221		2	14		1	90		2	235		23	8	

Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure Project No. CW2174 April 1, 2014

Scenario ID: 1

Basin Oldman River Basin Area Crowsnest Pass

Definition

1 = Low Importance to 10 = High Importance Weighting

Desired

Outcomes

Weighting Scenario x Scoring System Result = Weighted Score

1. Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both ubstream and downstream.

2. Increase property protection for residents, business, and First Nations (note: business includes agriculture and irrigation, as well as provincial and municipal infrastructure)
3. Protection of designated natural areas (traditional

use, recreation, historical resources).
4. Ensure access to life-line services (fire, police, hospital, water & wastewater etc.) for all residents within the basin.
5. Provide adequate protection for at least the 1% annual exceedance probability event.

6. Provide adequate protection for the largest historical flood of record.

7. Be designed and operated to meet multi-purpose

objectives (e.g., manage water resources for both

10. Ensure species (fish, wildlife, vegetation, etc.) are not adversely impacted.

11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

8. Development and construction costs. 9. Operating and maintenance costs.

of life (compared to existing situation). 12. Protection is implemented in the near term.

floods and droughts).

regulations.

5

4

10

3

Desired Outcomes Score:

Category Criteria 1. Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non-Mandatory structural options can be implemented. Conditions 2. Must meet existing transboundary legal commitments (i.e., downstream volumes to other



Legend

4	Strongly Positive	
3	Positive	
2	Negative	
1	Strongly Negative	

		Structural Options																				
	Mandatory Conditions	We	t Dam		Di	ry Dar	n	L	evee /	Dyke	В	y-Pas	s Channel	Ero	sion	Protection	lm	prov	e Conveyance	Sec	dimen	nt/Debris Control
	Scoring Scheme			Comment			Comment			Comment			Comment			Comment			Comment			Comment
	1 = cannot be met 4 = can be met					1			4			1		1				4		4	ı.	
	1 = cannot be met 4 = can be met								4									4		4	ļ	
	Test Result:	Fa	ail		F	Fail		Р	ass		F	ail		Fai	iil		Pa	ass		Pa	ss	
ing io = C	Scoring System	Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score	
	1 = negative outcome 4 =positive outcome		0			0		3	27			0			0		4	36		4	36	
	1 = negative outcome 4 =positive outcome		0			0		3	24			0			0		4	32		4	32	
	1 = low benefit 4 = high benefit		0			0		2	10			0			0		2	10		2	10	
	1 = low benefit 4 = high benefit		0			0		2	16			0			0		4	32		4	32	
	1 = low benefit 4 = high benefit		0			0		2	16	Crowsnest River only		0			0		3	24	Tributaries (not Crowsnest River)	3	24	Tributaries (not Crowsnest River)
	1 = low benefit 4 = hiah benefit		0			0		2	8			0			0		3	12		3	12	
	1 = low benefit 4 = high benefit		0			0		1	4			0			0		1	4		1	4	
	1 = high cost 4 = low cost		0			0		3	18			0			0		2	12	CPR crossing bridges plus a road bridge on multiple creeks	3	18	
	1 = high cost 4 = low cost		0			0		4	28			0			0		4	28		2	14	
	1 = negative outcome 4 =positive outcome		0			0		2	14			0			0		2	14		2	14	
	1 = high risk 4 =low risk		0			0		3	30			0			0		4	40		4	40	
	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years		0			0		3	9			0			0		3	9		3	9	Does not include forestry management practice
	1 = meets few/none 2 = meets some 3 = meets most 4 = meets all		0			0		3	12			0			0		3	12		3	12	
sired	Outcomes Score:	()			0		2	216			0		0)		2	65		25	57	

CW2174_Flood Mitigation Options -Apr_1_2014_Protected.xlsb AMEC Environment & Infrastructure

Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure Project No. CW2174

April 1, 2014

Scenario ID: 1

Basin Oldman River Basin Area Crowsnest Pass

Definition

1 = Low Importance to 10 = High Importance

Desired Outcomes Weighting Scenario x Scoring System Result = Weighted Score

1. Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.

2. Increase property protection for residents, business, and First Nations (note: business includes

agriculture and irrigation, as well as provincial and municinal infrastructure)
3. Protection of designated natural areas (traditional

use, recreation, historical resources).
4. Ensure access to life-line services (fire, police,

hospital, water & wastewater etc.) for all residents

within the basin.

5. Provide adequate protection for at least the 1% annual exceedance probability event.

6. Provide adequate protection for the largest historical flood of record.

7. Be designed and operated to meet multi-purpose

objectives (e.g., manage water resources for both

10. Ensure species (fish, wildlife, vegetation, etc.) are

13. Meets existing federal and provincial policies and

not adverselv impacted.

11. Must not increase potential for flood-related loss

8. Development and construction costs.

9. Operating and maintenance costs.

of life (compared to existing situation). 12. Protection is implemented in the near term.

floods and droughts).

Category	Criteria
Mandatory	Structure flood control infrastructure can be designed and built in a suitable location. Ensure non structural options can be implemented.
Conditions	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).



Legend

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

Score		N	on-S	Structural Option	s													
	Mandatory Conditions	Ма	ınage	d Retreat		ing / Forecasting / gement			oning (Restricted oment)	В	uy-Ou	ts	Flo	ood P	roofing	Вι	uilding	g Code Changes
	Scoring Scheme			Comment		Comment			Comment			Comment			Comment			Comment
	1 = cannot be met 4 = can be met		1		1			4			4			4			4	
	1 = cannot be met 4 = can be met							4			4			4			4	
	Test Result:	Fa	ail		Fail		P	ass		P	ass		Pa	ass		Pa	ass	
Weighting Scenario = AMEC	Scoring System		Weighted Score		Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score	
9	1 = negative outcome 4 =positive outcome		0		(4	36		3	27		4	36		3	27	
8	1 = negative outcome 4 =positive outcome		0				4	32		3	24		4	32		3	24	
5	1 = low benefit 4 = high benefit		0		(1	5		1	5		1	5		1	5	
8	1 = low benefit 4 = high benefit		0				1	8		1	8		2	16		1	8	
8	1 = low benefit 4 = high benefit		0		(3	24		1	8		3	24		1	8	
4	1 = low benefit 4 = high benefit		0		(3	12		1	4		3	12		1	4	
4	1 = low benefit 4 = high benefit		0				1	4		1	4		1	4		1	4	
6	1 = high cost 4 = low cost		0		(4	24		3	18		4	24		4	24	
7	1 = high cost 4 = low cost		0		(4	28		4	28		4	28		4	28	
7	1 = negative outcome 4 =positive outcome		0		(3	21		3	21		3	21		3	21	
10	1 = high risk 4 =low risk		0		(4	40		4	40		4	40		4	40	
3	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years		0		(3	9		1	3		4	12		3	9	
4	1 = meets few/none 2 = meets some 3= meets most 4 =meets all		0				3	12		3	12		3	12		3	12	
Desired	Outcomes Score:	(0		0		2	55		2	202		2	266		2	14	

Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure Project No. CW2174 April 1, 2014

Scenario ID: 1

Basin Elbow River

Area Downstream of Glenmore Dam

Definition

Weighting

1 = Low Importance to 10 = High Importance

1. Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both ubstream and downstream.

2. Increase property protection for residents, business, and First Nations (note: business includes agriculture and irrigation, as well as provincial and municipal infrastructure)
3. Protection of designated natural areas (traditional

use, recreation, historical resources).
4. Ensure access to life-line services (fire, police,

hospital, water & wastewater etc.) for all residents within the basin.
5. Provide adequate protection for at least the 1% annual exceedance probability event.

6. Provide adequate protection for the largest historical flood of record.

7. Be designed and operated to meet multi-purpose

objectives (e.g., manage water resources for both

10. Ensure species (fish, wildlife, vegetation, etc.) are not adversely impacted.

11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

8. Development and construction costs. 9. Operating and maintenance costs.

of life (compared to existing situation). 12. Protection is implemented in the near term.

floods and droughts).

regulations.

5

8

4

10

3

Desired Outcomes Score: 205

Desired

Outcomes

Weighted Score Weighting Scenario x Scoring System Result = Weighted Score

Category Criteria 1. Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non-Mandatory structural options can be implemented. Conditions 2. Must meet existing transboundary legal commitments (i.e., downstream volumes to other



Legend

4	Strongly Positive	_
3	Positive	
2	Negative	_
1	Strongly Negative	

		Structural Options																			
	Mandatory Conditions	We	t Dam		Dr	ry Dan	n	L	evee /	Dyke	В	y-Pas	s Channel	Eros	ion Protection	In	nprov	e Conveyance	Sec	diment/	Debris Control
	Scoring Scheme			Comment			Comment			Comment			Comment		Comment			Comment			Comment
	1 = cannot be met 4 = can be met	4	4			4			4			4		4			4		4		
	1 = cannot be met 4 = can be met	4	4			4			4			4		4			4		4		
	Test Result:	Pa	iss		Pa	ass		P	ass		Р	ass		Pas	s	Р	ass		Pa	ss	
ing io = C	Scoring System	Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weignted Score	Score	Weighted Score		Score	Weighted Score	
	1 = negative outcome 4 =positive outcome	4	36		4	36		4	36		4	36		3 2	27	3	27		3	27	
	1 = negative outcome 4 =positive outcome	4	32		4	32		4	32		4	32		3 2	24	3	24		3	24	
	1 = low benefit 4 = high benefit	2	10		2	10		3	15		3	15		3 1	15	1	5		1	5	
	1 = low benefit 4 = high benefit	3	24		3	24		4	32		4	32		1	8	1	8		1	8	
	1 = low benefit 4 = high benefit	3	24		3	24		4	32		4	32		2 1	16	2	16		1	8	
	1 = low benefit 4 = hiah benefit	3	12	Glenmore Dam provides additional protection	3	12	Glenmore Dam provides additional protection	3	12		4	16		2	8	1	4		1	4	
	1 = low benefit 4 = high benefit	4	16		1	4		1	4		1	4		1	4	1	4		1	4	
	1 = high cost 4 = low cost	1	6		1	6		2	12		1	6		4 2	24	2	12		3	18	
	1 = high cost 4 = low cost	1	7		1	7		3	21		3	21		3 2	21	4	28		3	21	
	1 = negative outcome 4 =positive outcome	1	7		1	7		2	14		2	14		2 1	14	2	14		3	21	
	1 = high risk 4 =low risk	2	20		2	20		1	10		3	30		4 4	10	4	40		4	40	
	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years	1	3		2	6		3	9		2	6		4 1	12	3	9		4	12	
	1 = meets few/none 2 = meets some 3= meets most 4 =meets all	2	8		2	8		3	12		2	8		3 1	12	3	12		3	12	
sired	Outcomes Score:	20	05		1	96		:	241		2	252		225		2	203		20)4	

Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure Project No. CW2174

April 1, 2014

Scenario ID: 1

Basin Elbow River Area Downstream of Glenmore Dam

Definition

Weighting

1 = Low Importance to 10 = High Importance

Desired Outcomes

Weighted Score Weighting Scenario x Scoring System Result = Weighted Score

1. Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.

2. Increase property protection for residents, business, and First Nations (note: business includes

agriculture and irrigation, as well as provincial and municinal infrastructure)
3. Protection of designated natural areas (traditional

use, recreation, historical resources).
4. Ensure access to life-line services (fire, police,

hospital, water & wastewater etc.) for all residents

within the basin.

5. Provide adequate protection for at least the 1% annual exceedance probability event.

6. Provide adequate protection for the largest historical flood of record.

7. Be designed and operated to meet multi-purpose

objectives (e.g., manage water resources for both

10. Ensure species (fish, wildlife, vegetation, etc.) are

not adverselv impacted.

11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

8. Development and construction costs.

9. Operating and maintenance costs.

of life (compared to existing situation). 12. Protection is implemented in the near term.

floods and droughts).

Category	Criteria
Mandatory	Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non structural options can be implemented.
Conditions	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).



Legend

4		Strongly Positive
3		Positive
2		Negative
1		Strongly Negative
	_	

Score		No	on-Structural Optio														
	Mandatory Conditions	Ма	naged Retreat		ng / Forecasting / Jement			oning (Restricted oment)	Вι	ıy-Ou	ts	Fle	ood Proofi	ing	Bu	iilding	Code Changes
	Scoring Scheme		Comment		Comment			Comment			Comment			Comment			Comment
	1 = cannot be met 4 = can be met	۷	4	4			4			4			4		4	4	
	1 = cannot be met 4 = can be met	4	4	4			4			4			4		,	4	
	Test Result:	Pa	ISS	Pass		Pa	ass		Pa	ass		Pa	ass		Pa	ISS	
Veighting cenario = AMEC	Scoring System	Score	Weighted Score	Score Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score	
9	1 = negative outcome 4 =positive outcome	4	36	4 36		3	27		4	36		3	27		3	27	
8	1 = negative outcome 4 =positive outcome	4	32	4 32		3	24		4	32		3	24		3	24	
5	1 = low benefit 4 = high benefit	1	5	1 5		1	5		1	5		1	5		1	5	
8	1 = low benefit 4 = high benefit	1	8	2 16		1	8		1	8		1	8		1	8	
8	1 = low benefit 4 = high benefit	3	24	3 24		1	8		4	32		2	16		2	16	
4	1 = low benefit 4 = hiah benefit	2	8	3 12		1	4		4	16		2	8		2	8	
4	1 = low benefit 4 = high benefit	1	4	1 4		1	4		1	4		1	4		1	4	
6	1 = high cost 4 = low cost	2	12	3 18		4	24		1	6		2	12		4	24	
7	1 = high cost 4 = low cost	4	28	2 14		4	28		4	28		3	21		4	28	
7	1 = negative outcome 4 =positive outcome 1 = high risk	3	21	3 21		3	21		3	21		3	21		3	21	
10	4 =low risk	4	40	4 40		4	40		4	40		4	40		4	40	
3	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years	1	3	3 9		4	12		2	6		3	9		3	9	
4	1 = meets few/none 2 = meets some 3= meets most 4 =meets all	4	16	4 16		3	12		4	16		4	16		3	12	
Desired (Outcomes Score:	23	37	247		2	17		2	50		2	11		2:	26	

Assessment of Flood Mitigation Options
Prepared by AMEC Environment & Infrastructure
Project No. CW2174
April 1, 2014

Scenario ID: 1

Basin Bow River
Area Exshaw

Weighting 1 = Low Importance to 10 = High Importance

Category	Criteria						
Mandatory	Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non-structural options can be implemented.						
Conditions	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).						



Legend

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

1 = 20W Importance to 10 = 1 light importance																		
Weighting Scenario x Scoring System Result = Weighter	d Score		Struc	tural Options														
		Mandatory Conditions	Wet Da	m	Dry Da	ım	Lev	ee / Dyke	Ву	-Pass	Channel	Er	osion Protection	ln	Improve Conveyance			ent/Debris Control
Criteria		Scoring Scheme		Comment		Comment		Comment			Comment		Comment			Comment		Comment
Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non-structural options can be implemented.		1 = cannot be met 4 = can be met	1	No place on Exshaw Creek or Jura Creek, or upstream on the Bow to put a dam		No place on Exshaw Creek or Jura Creek, or upstream on the Bow to put a dam	4			1					4		4	
Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).		1 = cannot be met 4 = can be met					4								4			
		Test Result:	Fail		Fail		Pa	SS	Fa			Pa	SS	P	ass		Pass	
	Weighting Scenario = AMEC	Scoring System	Score Weighted Score		Score Weighted Score		Score	Weighted Score	Score	Weighted Score		Score	Weighted Score	Score	Weighted Score		Score Weighted Score	
Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both upstream and downstream.	9	1 = negative outcome 4 =positive outcome	0		0		3	27		0		3	27	4	36		4 36	
users/basins both uostream and downstream. 2. Increase property protection for residents, business, and First Nations (note: business includes agriculture and irrigation, as well as provincial and municipal infrastructure).	8	1 = negative outcome 4 =positive outcome	0		0		3	24		0		3	24	4	32		4 32	
infrastructure). 3. Protection of designated natural areas (traditional use, recreation, historical resources).	5	1 = low benefit 4 = high benefit	0		0		2	10		0		2	10	2	10		2 10	
Ensure access to life-line services (fire, police, hospital, water & wastewater etc.) for all residents within the basin.	8	1 = low benefit 4 = high benefit	0		0		2	16		0		2	16	4	32		4 32	
the basin. 5. Provide adequate protection for at least the 1% annual exceedance probability event.	8	1 = low benefit 4 = high benefit	0		0		4	32		0		1	8	4	32		2 16	
Provide adequate protection for the largest historical flood of record.	4	1 = low benefit 4 = high benefit	0		0		3	12		0		1	4	4	16		2 8	
Be designed and operated to meet multi-purpose objectives (e.g., manage water resources for both floods and droughts).	4	1 = low benefit 4 = high benefit	0		0		1	4		0		1	4	1	4		1 4	
Development and construction costs.	6	1 = high cost 4 = low cost	0		0		2	12		0		4	24	2	12		4 24	
Operating and maintenance costs.	7	1 = high cost 4 = low cost	0		0		3	21		0		3	21	4	28		3 21	
Ensure species (fish, wildlife, vegetation, etc.) are not adversely impacted.	7	1 = negative outcome 4 =positive outcome	0		0		2	14		0		2	14	2	14		2 14	
11. Must not increase potential for flood-related loss of life (compared to existing situation).	10	1 = high risk 4 =low risk	0		0		2	20		0		4	40	4	40		4 40	
12. Protection is implemented in the near term.	3	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years	0		0		4	12		0		4	12	4	12		4 12	
Meets existing federal and provincial policies and regulations.	4	1 = meets few/none 2 = meets some 3= meets most 4 =meets all	0		0		3	12		0		3	12	3	12		3 12	
	Desired	Outcomes Score:	0		0		21	6	(0		2	6		280		261	

Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure
Project No. CW2174

April 1, 2014 Scenario ID: 1

Basin Bow River Area Exshaw

Definition

Weighting 1 = Low Importance to 10 = High Importance

Score Weighting Scenario x Scorin

Category	Criteria
Mandatory	1. Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non-structural options can be implemented.
Conditions	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).



Legend

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

y	T = Low importance to To = riight importance																		
	Weighting Scenario x Scoring System Result = Weighted	Score		Non-	Structural Options	;													
			Mandatory Conditions	Manag	ed Retreat		ng / Forecasting / gement		d Zon elopn	ing (Restricted nent)	Buy-C	outs	Flo	ood Pi	oofing	0		Build	ling Code Changes
ry	Criteria		Scoring Scheme		Comment		Comment			Comment		Comment			Comment		Comment		Comment
ry	Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non-structural options can be implemented.		1 = cannot be met 4 = can be met	4	Suggested that this should be N/A - nothing really to manage retreat of (unless flood mapping	4		4			4	Suggested that this should be N/A - nothing really to buy out	4	4				4	
ıs	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).		1 = cannot be met 4 = can be met	4		4		4			4		4	4				4	
			Test Result:	Pass		Pass		Pas	s		Pass		Pa	ass		0		Pas	3
		Weighting Scenario = AMEC	Scoring System	Score Weighted Score		Score Weighted Score		Score	Weighted Score		Score Weighted Score		Score	Weighted Score				Score	weignted acore
	Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.	9	1 = negative outcome 4 =positive outcome	3 27		3 27			27		3 27		3	27			0	3 2	
	Increase property protection for residents, business, and First Nations (note: business includes agriculture and irrigation, as well as provincial and municipal infrastructure).	8	1 = negative outcome 4 =positive outcome	3 24		3 24		3	24		3 24		2	16	Includes industrial areas in the flood fringe		0	3 2	4
	Protection of designated natural areas (traditional use, recreation, historical resources).	5	1 = low benefit 4 = high benefit	1 5		1 5		3	15		1 5		1	5		_	0	1	5
	Ensure access to life-line services (fire, police, hospital, water & wastewater etc.) for all residents within the basin.	8	1 = low benefit 4 = high benefit	1 8		2 16	;	1	8		1 8		1	8			0	1	В
	Provide adequate protection for at least the 1% annual exceedance probability event.	8	1 = low benefit 4 = high benefit	1 8		1 8		1	8		1 8		1	8			0	1	8
	Provide adequate protection for the largest historical flood of record.	4	1 = low benefit 4 = high benefit	1 4		1 4		1	4		1 4		1	4			0	1	4
s	Be designed and operated to meet multi-purpose objectives (e.g., manage water resources for both floods and droughts).	4	1 = low benefit 4 = high benefit	1 4		2 8		1	4		1 4		1	4			0	1	4
	Development and construction costs.	6	1 = high cost 4 = low cost	4 24		3 18	3	4	24		4 24		4	24			0	4 2	24
	Operating and maintenance costs.	7	1 = high cost 4 = low cost	4 28		3 21		4	28		4 28	1	4	28			0	4 2	28
	Ensure species (fish, wildlife, vegetation, etc.) are not adversely impacted.	7	1 = negative outcome 4 =positive outcome	3 21		3 21		3 2	21		3 21		3	21			0	3 2	11
	Must not increase potential for flood-related loss of life (compared to existing situation).	10	1 = high risk 4 =low risk	4 40		4 40)	4 4	40		4 40)	4	40			0	4 4	0
	12. Protection is implemented in the near term.	3	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years	1 3		3 9		3	9		4 12		4	12			0	3	9
	13. Meets existing federal and provincial policies and regulations.	4	1 = meets few/none 2 = meets some 3 = meets most 4 = meets all	3 12		3 12	2	3	12		3 12	2	3	12			0	3 1	2
		Desired	Outcomes Score:	208		213		224	1		217		20	09		0		214	

Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure Project No. CW2174 April 1, 2014

Scenario ID: 1

Basin Oldman River Basin Area Fort MacLeod

Definition

Desired

Outcomes

1 = Low Importance to 10 = High Importance Weighting Scenario x Scoring System Result = Weight

Category	Criteria
Juliagory	Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non-
Mandatory	structural options can be implemented.
Conditions	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).



Legend

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

	Weighting Scenario x Scoring System Result = Weight	nting Scenario x Scoring System Result = Weighted Score					Structural Options													
			Mandatory Conditions	Wet Dan	n	Dry Da	m	Levee /	Dyke	By-Pa	ss Channel	Erosion Protection			Improve Conveyance			ent/Debris Control		
/	Criteria		Scoring Scheme		Comment		Comment		Comment		Comment		Comment			Comment		Comment		
,	Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non-structural options can be implemented.		1 = cannot be met 4 = can be met	4		4		4	For the campground	1		4			1		4			
S	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).		1 = cannot be met 4 = can be met	4		4		4				4					4			
		•	Test Result:	Pass		Pass]	Pass		Fail		Pass		F	ail		Pass			
		Weighting Scenario = AMEC	Scoring System	Score Weighted Score		Score Weighted Score		Score Weighted Score		Score Weighted Score		Score Weighted Score		Score	Weighted Score		Score Weighted Score			
	Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both upstream and downstream.	9	1 = negative outcome 4 =positive outcome	3 27		3 27		3 27		0		3 27			0		3 27			
	2. Increase property protection for residents, business, and First Nations (note: business includes agriculture and irrigation, as well as provincial and municipal infrastructure). 3. Protection of designated natural areas (traditional	8	1 = negative outcome 4 =positive outcome 1 = low benefit	3 24		3 24		3 24		0		3 24			0		3 24			
	use, recreation, historical resources). 4. Ensure access to life-line services (fire, police, hospital, water & wastewater etc.) for all residents	5 8	4 = high benefit 1 = low benefit 4 = high benefit 4 = high benefit	3 24		1 53 24		2 101 8		0		1 5 4 32	Highway 811 abutment protection	H	0		1 5 2 16			
	within the basin. 5. Provide adequate protection for at least the 1% annual exceedance probability event. 6. Provide adequate protection for the largest	8	1 = low benefit 4 = high benefit 1 = low benefit	2 16		2 16		3 24		0		4 32			0		2 16			
	historical flood of record. 7. Be designed and operated to meet multi-purpose objectives (e.g., manage water resources for both	4	4 = high benefit 1 = low benefit 4 = high benefit 4 = high benefit	2 8 4 16		2814		3 12 1 4		0		4 16 1 4		H	0		2814			
	floods and droughts). 8. Development and construction costs.	6	1 = high cost 4 = low cost	1 6		1 6		3 18		0		3 18			0		4 24			
	Operating and maintenance costs. In Ensure species (fish, wildlife, vegetation, etc.) are	7	1 = high cost 4 = low cost	1 7		2 14		3 21		0		2 14			0		4 28			
	not adversely impacted. 11. Must not increase potential for flood-related loss of life (compared to existing situation).	7 10	1 = negative outcome 4 = positive outcome 1 = high risk 4 = low risk	1 7 3 30		3 30		2 14 3 30		0		2 14 4 40		\vdash	0		2 144 40			
	Protection is implemented in the near term.	3	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years	1 3		1 3		4 12		0		4 12			0		4 12			
	13. Meets existing federal and provincial policies and regulations.	4	1 = meets few/none 2 = meets some 3 = meets most 4 = meets all	2 8		2 8		3 12		0		3 12			0		3 12			
		Desired	Outcomes Score:	181		176]	216		0		250			0		230			
							-				_		_			-				

Assessment of Flood Mitigation Options
Prepared by AMEC Environment & Infrastructure
Project No. CW2174

April 1, 2014

Scenario ID: 1

Basin Oldman River Basin
Area Fort MacLeod

Definition

Desired

Outcomes

Weighting 1 = Low Importance to 10 = High Importance

core Weighting Scenario x Scoring System Result = Weighted Score

1. Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.

2. Increase property protection for residents, business, and First Nations (note: business includes agriculture and irrigation, as well as provincial and municinal infrastructure).

3. Protection of designated natural areas (traditional use, recreation, historical resources).

4. Ensure access to life-line services (fire, police, hospital, water & wastewater etc.) for all residents within the basin.

5. Provide adequate protection for at least the 1% annual exceedance probability event.

6. Provide adequate protection for the largest historical flood of record.

7. Be designed and operated to meet multi-purpose

Section 10. Ensure species (fish, wildlife, vegetation, etc.) are not adversely impacted.
 Must not increase potential for flood-related loss.

13. Meets existing federal and provincial policies and

10

3

Desired Outcomes Score: 265

objectives (e.g., manage water resources for both

Development and construction costs.
 Operating and maintenance costs.

of life (compared to existing situation).

12. Protection is implemented in the near term.

floods and droughts).

regulations.

Category

Criteria

1. Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non-structural options can be implemented.

2. Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).



Legend

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

		Non-	Structural Option	s																
	Mandatory Conditions	Managed Retreat Warning / Forecasting / Management				Land Zoning (Restricted Development)				uy-Oı	its	Flo	od P	roofing	0			Building Code Changes		
	Scoring Scheme		Comment			Comment			Comment			Comment			Comment		Comment			Comment
	1 = cannot be met 4 = can be met	4		4	4			4			4		4	4			0		4	
	1 = cannot be met 4 = can be met	4		4	4			4			4		4	4			0		4	
	Test Result:	Pass		Pa	ISS		P	ass		Р	ass		Pa	ss		0		Pass		
ting rio = :C	Scoring System	Score Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score				Score	Weighted Score	
	1 = negative outcome 4 =positive outcome	4 36		3	27		3	27		3	27		3	27			0	3	27	
	1 = negative outcome 4 =positive outcome	4 32		3	24		3	24		4	32		3	24			0	3	24	
	1 = low benefit 4 = high benefit	1 5		1	5		1	5		1	5		1	5			0	1	5	
	1 = low benefit 4 = high benefit	1 8		1	8		1	8		1	8		1	8			0	1	8	
	1 = low benefit 4 = high benefit	4 32		2	16		2	16		2	16		1	8			0	1	8	
	1 = low benefit 4 = hiah benefit	4 16		2	8		2	8		2	8		1	4			0	1	4	
	1 = low benefit 4 = high benefit	1 4		2	8		1	4		1	4		1	4			0	1	4	
	1 = high cost 4 = low cost	4 24		3	18		4	24		4	24		4	24			0	4	24	
	1 = high cost 4 = low cost	4 28		3	21		4	28		4	28			28		\vdash	0	4	28	
	1 = negative outcome 4 =positive outcome 1 = high risk	3 21		3	21		3	21		3				21			0	3	21	
	4 =low risk 1 = 10+ vears	4 40		4	40		4	40		4	40		4	40			0	4	40	
	2 = 5-10 years 3 = 2-5 years 4 = <2 years	1 3		4	12		3	9		4	12		4	12			0	3	9	
	1 = meets few/none 2 = meets some 3= meets most 4 =meets all	4 16		4	16		3	12		4	16		4	16			0	3	12	

241

221

0

214

CW2174_Flood Mitigation Options -Apr_1_2014_Protected.xlsb

226

Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure Project No. CW2174 April 1, 2014

Scenario ID: 1

Basin Bow River Area Kananaskis Country

Definition

1 = Low Importance to 10 = High Importance

Desired

Outcomes

Weighting Scenario x Scoring System Result = Weighted Score

1. Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.

2. Increase property protection for residents, business, and First Nations (note: business includes agriculture and irrigation, as well as provincial and municipal infrastructure).
3. Protection of designated natural areas (traditional use, recreation, historical resources).
4. Ensure access to life-line services (fire, police,

hospital, water & wastewater etc.) for all residents within the basin.
5. Provide adequate protection for at least the 1% annual exceedance probability event.

6. Provide adequate protection for the largest historical flood of record.

7. Be designed and operated to meet multi-purpose

objectives (e.g., manage water resources for both floods and droughts). 8. Development and construction costs.

10. Ensure species (fish, wildlife, vegetation, etc.) are not adversely impacted.

11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

9. Operating and maintenance costs.

of life (compared to existing situation). 12. Protection is implemented in the near term.

regulations.

5

4

7

10

3

Desired Outcomes Score:

Category	Criteria
Mandatory	Ensure flood control infrastructure can be designed and built in a suitable location. Ensure nor structural options can be implemented.
Conditions	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).



Legend

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

		Str	uctı	ural Options																	
	Mandatory Conditions	Wet	Dam		Dr	ry Dan	1	Le	evee /	Dyke	Ву	-Pass	s Channel	Erc	sion	Protection	lm	prove Conveyance	S	edime	ent/Debris Control
	Scoring Scheme			Comment			Comment			Comment			Comment			Comment		Comment	L		Comment
	1 = cannot be met 4 = can be met	1				1			4			4		4	ļ		4	Hood creek and other highwa crossings	y	4	
	1 = cannot be met 4 = can be met	4				4			4			4		4	ļ		4	4		4	
	Test Result:	Fa	il		F	ail		Pa	ass		Pa	ass		Pa	ss		Pa	ss	Р	ass]
ting rio = :C	Scoring System	Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score	Score	Weighted Score	
	1 = negative outcome 4 =positive outcome		0			0		2	18		2	18		3	27		3	27	3	27	
	1 = negative outcome 4 =positive outcome		0			0		2	16		2	16		3	24		4	32	4	32	
	1 = low benefit 4 = high benefit		0			0		3	15		3	15		4	20		4	20	4	20	
	1 = low benefit 4 = high benefit		0			0		1	8		1	8		3	24		4	32	4	32	
	1 = low benefit 4 = high benefit		0			0		4	32		4	32		3	24		3	24	3	24	
	1 = low benefit 4 = hiah benefit		0			0		4	16		4	16		4	16		4	16	4	16	
	1 = low benefit 4 = high benefit		0			0		1	4		1	4		1	4		1	4	1	4	
	1 = high cost 4 = low cost		0			0		2	12		2	12		3	18		2	12	3	18	
	1 = high cost 4 = low cost		0			0		3	21		3	21		3	21		4	28	2	14	
	1 = negative outcome 4 =positive outcome		0			0		1	7		1	7		2	14		2	14	2	14	
	1 = high risk 4 =low risk		0			0		3	30		3	30		4	40		4	40	4	40	
	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years		0			0		4	12		4	12		4	12		4	12	4	12	
	1 = meets few/none 2 = meets some 3 = meets most 4 = meets all		0			0		3	12		3	12		3	12		3	12	3	12	
sired	Outcomes Score:	0				0		2	03		2	03		25	6		27	73	2	265]

CW2174_Flood Mitigation Options -Apr_1_2014_Protected.xlsb AMEC Environment & Infrastructure

Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure Project No. CW2174

April 1, 2014

Scenario ID: 1

Basin Bow River Area Kananaskis Country

Definition

Desired Outcomes

1 = Low Importance to 10 = High Importance

Weighting Scenario x Scoring System Result = Weighted Score

1. Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.

2. Increase property protection for residents, business, and First Nations (note: business includes

agriculture and irrigation, as well as provincial and municinal infrastructure)
3. Protection of designated natural areas (traditional use, recreation, historical resources).
4. Ensure access to life-line services (fire, police, hospital, water & wastewater etc.) for all residents

within the basin.

5. Provide adequate protection for at least the 1% annual exceedance probability event.

6. Provide adequate protection for the largest historical flood of record.

7. Be designed and operated to meet multi-purpose

objectives (e.g., manage water resources for both

10. Ensure species (fish, wildlife, vegetation, etc.) are

not adverselv impacted.

11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

8. Development and construction costs.

9. Operating and maintenance costs.

of life (compared to existing situation). 12. Protection is implemented in the near term.

floods and droughts).

Category Criteria Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non-Mandatory structural options can be implemented. Conditions 2. Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).



Legend

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

Score		Non-S	Structural Options	;													
	Mandatory Conditions	Manage	ed Retreat	Warnii Manag	ng / Forecasting / ement			oning (Restricted pment)	Вι	uy-Ou	ts	Fle	ood I	Proofing	Вι	ıilding	Code Changes
	Scoring Scheme		Comment		Comment			Comment			Comment			Comment			Comment
	1 = cannot be met 4 = can be met	4		4			4			4			1			4	
	1 = cannot be met 4 = can be met	4		4			4			4			4			4	
	Test Result:	Pass] [Pass		Pa	ISS		Pa	ass		F	ail		Pa	ass	
Veighting cenario = AMEC	Scoring System	Score Weighted Score		Score Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score	
9	1 = negative outcome 4 =positive outcome	3 27		3 27		3	27		3	27			0		3	27	
8	1 = negative outcome 4 =positive outcome	3 24		3 24		3	24		3	24			0		3	24	
5	1 = low benefit 4 = high benefit	1 5		2 10		2	10		2	10			0		1	5	
8	1 = low benefit 4 = high benefit	1 8		2 16		1	8		1	8			0		1	8	
8	1 = low benefit 4 = high benefit	4 32		2 16		1	8		4	32			0		1	8	
4	1 = low benefit 4 = hiah benefit	4 16		2 8		1	4		4	16			0		1	4	
4	1 = low benefit 4 = high benefit	1 4		1 4		1	4		1	4			0		1	4	
6	1 = high cost 4 = low cost	2 12		3 18		4	24		2	12			0		4	24	
7	1 = high cost 4 = low cost	4 28		3 21		4	28		4	28			0		4	28	
7	1 = negative outcome 4 =positive outcome	4 28		3 21		3	21		4	28			0		3	21	
10	1 = high risk 4 = low risk	4 40		4 40		4	40		4	40			0		4	40	
3	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years	2 6		3 9		3	9		2	6			0		3	9	
4	1 = meets few/none 2 = meets some 3= meets most 4 =meets all	3 12		3 12		3	12		3	12			0		3	12	
Desired	Outcomes Score:	242]	226		2	19]	2	247			0]	2	14	

Assessment of Flood Mitigation Options
Prepared by AMEC Environment & Infrastructure
Project No. CW2174
April 1, 2014

Scenario ID: 1

Basin Oldman River Basin
Area Lethbridge

Definition

Veighting 1 = Low Importance to 10 = High Importance

Score

Desired

Outcomes

Weighting Scenario x Scoring System Result = Weighted Score

Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.
 Increase property protection for residents, business, and First Nations (note: business includes agriculture and irrigation, as well as provincial and municipal infrastructure).
 Protection of designated natural areas (traditional use, recreation, historical resources).

4. Ensure access to life-line services (fire, police,

hospital, water & wastewater etc.) for all residents within the basin.

5. Provide adequate protection for at least the 1% annual exceedance probability event.

6. Provide adequate protection for the largest historical flood of record.

7. Be designed and operated to meet multi-purpose

objectives (e.g., manage water resources for both floods and droughts).

10. Ensure species (fish, wildlife, vegetation, etc.) are not adversely impacted.
 11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

8. Development and construction costs.

9. Operating and maintenance costs.

of life (compared to existing situation).

12. Protection is implemented in the near term.

regulations.

5 8

4

6

7

10

3

Desired Outcomes Score: 199

Category	Criteria
Mandatory	Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non structural options can be implemented.
Conditions	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).



Legend

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

		Str	ucti	ural Options																	
	Mandatory Conditions	Wet	Dam		D	ry Dan	1	Le	evee /	Dyke	В	/-Pas	s Channel	Er	osion	Protection	Impro	ve Conveyance	Se	dime	nt/Debris Control
	Scoring Scheme			Comment			Comment			Comment			Comment			Comment		Comment			Comment
	1 = cannot be met 4 = can be met	4				4			4			1			4		1			4	
	1 = cannot be met 4 = can be met	4				4			4						4					4	
	Test Result:	Pas	ss		Р	ass		P	ass		F	ail		Pa	ass		Fail		Pa	iss	
nting rio = EC	Scoring System	Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score Weighted Score		Score	Weighted Score	
	1 = negative outcome 4 =positive outcome	3	27		3	27		3	27			0		3	27		C		3	27	
	1 = negative outcome 4 =positive outcome	3	24		3	24		3	24			0		3	24		C		3	24	
	1 = low benefit 4 = high benefit	3	15		3	15		2	10			0		2	10		C		1	5	
	1 = low benefit 4 = high benefit	4	32		4	32		2	16			0		1	8		C		2	16	
	1 = low benefit 4 = high benefit	2	16		2	16		3	24			0		3	24		C		1	8	
	1 = low benefit 4 = hiah benefit	2	8		2	8		2	8			0		3	12		C		2	8	
	1 = low benefit 4 = high benefit	4	16		1	4		1	4			0		1	4		C		1	4	
	1 = high cost 4 = low cost	1	6		1	6		2	12			0		2	12		C		4	24	
	1 = high cost 4 = low cost	1	7		1	7		3	21			0		3	21		C		2	14	
	1 = negative outcome 4 = positive outcome	1	7		1	7		2	14			0		2	14		C		2	14	
)	1 = high risk 4 = low risk 1 = 10+ years	3	30		3	30		3	30			0		4	40		C		4	40	
	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years	1	3		1	3		3	9			0		3	9		0		3	9	
	1 = meets few/none 2 = meets some 3= meets most 4 = meets all	2	8		2	8		3	12			0		3	12		C		3	12	

0

217

0

205

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211

Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure Project No. CW2174

April 1, 2014

Scenario ID: 1

Basin Oldman River Basin Area Lethbridge

Definition

Desired

Outcomes

Weighting	1 = Low Importance to 10 = High Importance

Weighting Scenario x Scoring System Result = Weighted Score

1. Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both upstream and downstream.

2. Increase property protection for residents, business, and First Nations (note: business includes agriculture and irrigation, as well as provincial and municinal infrastructure)
3. Protection of designated natural areas (traditional use, recreation, historical resources).
4. Ensure access to life-line services (fire, police, hospital, water & wastewater etc.) for all residents within the basin.
5. Provide adequate protection for at least the 1% annual exceedance probability event.

6. Provide adequate protection for the largest historical flood of record.

7. Be designed and operated to meet multi-purpose objectives (e.g., manage water resources for both floods and droughts).

10. Ensure species (fish, wildlife, vegetation, etc.) are not adversely impacted.

11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

8. Development and construction costs. 9. Operating and maintenance costs.

of life (compared to existing situation). 12. Protection is implemented in the near term.

regulations.

Category	Criteria
Mandatory	Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non-structural options can be implemented.
Conditions	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).



Legend

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

Score		No	n-Structural Optio	ns																	
	Mandatory Conditions	Man	aged Retreat		arning anage	g / Forecasting / ment			oning (Restricted oment)	Вι	ıy-Ou	ts	Flo	od Pr	oofing	0			Bu	iildin	g Code Changes
	Scoring Scheme		Comment			Comment			Comment			Comment			Comment			Comment			Comment
	1 = cannot be met 4 = can be met																0				
	1 = cannot be met 4 = can be met																0				
	Test Result:	Pas	s	Pa	ass		Pa	ss		Pa	ass		Pa	ss		0			Pa	iss	
Weighting Scenario = AMEC	Scoring System	Score	Weighted Score	Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score					Score	Weighted Score	
9	1 = negative outcome 4 =positive outcome	3	27	3	27		3	27		3	27		3	27			0		3	27	
8	1 = negative outcome 4 =positive outcome	3	24	3	24		3	24		3	24		3	24			0		3	24	
5	1 = low benefit 4 = high benefit	1	5	1	5		1	5		1	5		1	5			0		1	5	
8	1 = low benefit 4 = high benefit	3 2	24	1	8		1	8		1	8		2	16			0		1	8	
8	1 = low benefit 4 = high benefit		32	1	8		3	24		1	8		1	8			0		1	8	
4	1 = low benefit 4 = high benefit		16	1	4		3	12		1	4		1	4			0		1	4	
4	1 = low benefit 4 = high benefit	1	4	3	12		1	4		1	4		1	4			0		1	4	
6	1 = high cost 4 = low cost 1 = high cost		6	3	18		4	24		2	12			12			0		4	24	
7	4 = low cost 1 = negative outcome		28 21	3	21		3	28		3	28			21			0		3	28	
10	4 =positive outcome 1 = high risk		40	3	21 40		4	40		1	10			40			0		4	40	
3	4 = low risk 1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years		3	4	12		3	9		1	3		4	12			0		3	9	
4	1 = meets few/none 2 = meets some 3 = meets most 4 =meets all	3	12	3	12	Includes reservoir management	3	12		1	4		4	16			0		3	12	
Desired	Outcomes Score:	242	!	2	12		23	38		1	58		21	0		0			2	14	

Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure Project No. CW2174 April 1, 2014

Scenario ID: 1

Basin Oldman River Basin Area First Nations (Pikani)

Definition

Desired

Outcomes

1 = Low Importance to 10 = High Importance Weighting Scenario x Scoring System Result = Weighted Score

Category	Criteria
Mandatory	Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non- structural options can be implemented.
Conditions	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).

1. Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.

2. Increase property protection for residents, business, and First Nations (note: business includes agriculture and irrigation, as well as provincial and municipal infrastructure).
3. Protection of designated natural areas (traditional use, recreation, historical resources).
4. Ensure access to life-line services (fire, police,

hospital, water & wastewater etc.) for all residents within the basin.
5. Provide adequate protection for at least the 1% annual exceedance probability event.

6. Provide adequate protection for the largest historical flood of record.

7. Be designed and operated to meet multi-purpose

objectives (e.g., manage water resources for both floods and droughts). 8. Development and construction costs. 9. Operating and maintenance costs.

10. Ensure species (fish, wildlife, vegetation, etc.) are not adversely impacted.

11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

of life (compared to existing situation). 12. Protection is implemented in the near term.

regulations.

5 8

4

10

3

4 =meets all

0

Desired Outcomes Score:



0

Legend

1	4	Strongly Positive
ı	3	Positive
ı	2	Negative
ı	1	Strongly Negative

		Structural Options																			
	Mandatory Conditions	Wet Dam Dry Dam					Le	evee /	Dyke	В	/-Pas	s Channel	Eros	ion Protection	lm	prov	e Conveyance	Sediment/Debris Control			
	Scoring Scheme			Comment			Comment			Comment			Comment		Comment			Comment			Comment
	1 = cannot be met 4 = can be met																				
	1 = cannot be met 4 = can be met																				
	Test Result:	Pa	ss		P	ass		Pa	ass		P	ass		Pas	i	Pass			Pass		
ng 0 =	Scoring System	Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score		Score	Weighted Score		Score	Weighted Score	
	1 = negative outcome 4 =positive outcome		0			0			0			0)		0			0	
	1 = negative outcome 4 =positive outcome		0			0			0			0)		0			0	
	1 = low benefit 4 = high benefit		0			0			0			0)		0			0	
	1 = low benefit 4 = high benefit		0			0			0			0					0		П	0	
	1 = low benefit 4 = high benefit		0			0			0			0)		0			0	
	1 = low benefit 4 = high benefit		0			0			0			0)		0			0	
	1 = low benefit 4 = high benefit		0			0			0			0)		0			0	
	1 = high cost 4 = low cost		0			0			0			0)		0			0	
	1 = high cost 4 = low cost		0			0			0			0)		0			0	
	1 = negative outcome 4 =positive outcome		0			0			0			0)		0			0	
	1 = high risk 4 =low risk		0			0			0			0)		0			0	
	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years		0			0			0			0)		0			0	
	1 = meets few/none 2 = meets some 3= meets most		0			0			0			0)		0			0	

0

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Assessment of Flood Mitigation Options
Prepared by AMEC Environment & Infrastructure
Project No. CW2174

April 1, 2014

Scenario ID: 1

Basin Oldman River Basin
Area First Nations (Pikani)

Definition

Weighting	1 = Low Imp
Worghang	. – 2011

= Low Importance to 10 = High Importance

Score

Desired Outcomes Weighting Scenario x Scoring System Result = Weighted Score

Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both ubstream and downstream.
 Increase property protection for residents, business, and First Nations (note: business includes)

agriculture and irrigation, as well as provincial and municinal infrastructure)
3. Protection of designated natural areas (traditional use, recreation, historical resources).
4. Ensure access to life-line services (fire, police,

hospital, water & wastewater etc.) for all residents

within the basin.

5. Provide adequate protection for at least the 1% annual exceedance probability event.

6. Provide adequate protection for the largest historical flood of record.

7. Be designed and operated to meet multi-purpose

objectives (e.g., manage water resources for both

10. Ensure species (fish, wildlife, vegetation, etc.) are

not adverselv impacted.

11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

8. Development and construction costs.

9. Operating and maintenance costs.

of life (compared to existing situation).

12. Protection is implemented in the near term.

floods and droughts).

8

8

4

6

7

7

10

3

Desired Outcomes Score:

0

Category	Criteria
Mandatory	1. Ensure flood control infrastructure can be designed and built in a suitable location. Ensure no structural options can be implemented.
Conditions	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).



Legend

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

		Ν	on-S	Structural Option	S																
	Mandatory Conditions			ed Retreat	W		g / Forecasting / ement	La De	nd Zo	oning (Restricted oment)	Ві	uy-Ou	ts	Flo	ood F	Proofing	Bu	ildinç	g Code Changes		
	Scoring Scheme			Comment			Comment			Comment			Comment			Comment			Comment		
	1 = cannot be met 4 = can be met																				
	1 = cannot be met 4 = can be met																				
	Test Result:	Pa	ass		Pa	ass		Pa	ass		P	ass		Pa	iss		Pa	ISS			
ng) =	Scoring System	Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score			
	1 = negative outcome 4 =positive outcome		0			0			0			0			0			0			
	1 = negative outcome 4 =positive outcome		0			0			0			0			0			0			
	1 = low benefit 4 = high benefit		0			0			0			0			0			0			
	1 = low benefit 4 = high benefit		0			0			0			0			0			0			
	1 = low benefit 4 = high benefit		0			0			0			0			0		П	0			
	1 = low benefit 4 = high benefit		0			0			0			0			0			0			
	1 = low benefit 4 = high benefit		0			0			0			0			0			0			
	1 = high cost 4 = low cost		0			0			0			0			0			0			
	1 = high cost 4 = low cost		0			0			0			0			0			0			
	1 = negative outcome 4 =positive outcome		0			0			0			0			0			0			
	1 = high risk 4 =low risk		0			0			0			0			0			0			
	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years		0			0			0			0			0			0			
	1 = meets few/none 2 = meets some 3= meets most 4 =meets all		0			0			0			0			0			0			

0

0

0

0

CW2174_Flood Mitigation Options -Apr_1_2014_Protected.xlsb

Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure Project No. CW2174

April 1, 2014

Scenario ID: 1

Basin Oldman River Basin Area Pincher Creek

Definition

Desired

Outcomes

1 = Low Importance to 10 = High Importance Weighting Scenario x Scoring System Result = Weighted Score

Category	Criteria
Mandatory	Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non-structural options can be implemented.
Conditions	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).

1. Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.

2. Increase property protection for residents, business, and First Nations (note: business includes agriculture and irrigation, as well as provincial and municipal infrastructure).
3. Protection of designated natural areas (traditional use, recreation, historical resources).
4. Ensure access to life-line services (fire, police,

hospital, water & wastewater etc.) for all residents within the basin.
5. Provide adequate protection for at least the 1% annual exceedance probability event.

6. Provide adequate protection for the largest historical flood of record.

7. Be designed and operated to meet multi-purpose

objectives (e.g., manage water resources for both floods and droughts). 8. Development and construction costs. 9. Operating and maintenance costs.

10. Ensure species (fish, wildlife, vegetation, etc.) are not adversely impacted.

11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

of life (compared to existing situation). 12. Protection is implemented in the near term.

regulations.

5

4

10

3

Desired Outcomes Score: 196



Legend

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

		St	ruct	ural Options																	
	Mandatory Conditions	Wet Dam			D	ry Dan	n	L	evee /	Dyke	В	/-Pass	s Channel	Eros	ion Protection	In	nprov	e Conveyance	Se	dimen	nt/Debris Control
	Scoring Scheme			Comment			Comment			Comment			Comment		Comment			Comment			Comment
	1 = cannot be met 4 = can be met		4			4			4			1		4			4		4	4	
	1 = cannot be met 4 = can be met		4			4			4			4		4			4		4	4	
,	Test Result:	Pa	ıss		P	ass		Р	ass		F	ail		Pass	<u> </u>	Р	ass		Pa	iss	
ing o = C	Scoring System	Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score		Score	Weighted Score		Score	Weighted Score	
	1 = negative outcome 4 =positive outcome	4	36		4	36		4	36			0		3 2	7	3	27		3	27	
	1 = negative outcome 4 =positive outcome	4	32		4	32		4	32			0		3 2	4	3	24		4	32	
	1 = low benefit 4 = high benefit	1	5		1	5		1	5			0		1	5	1	5		1	5	
	1 = low benefit 4 = high benefit	1	8		1	8		1	8			0		1 :	3	1	8		1	8	
	1 = low benefit 4 = high benefit	4	32		4	32		4	32			0		1	3	2	16		3	24	
	1 = low benefit 4 = hiah benefit	4	16		4	16		3	12			0		1 .	1	2	8		3	12	
	1 = low benefit 4 = high benefit	4	16		1	4		1	4			0		1 4	1	1	4		1	4	
	1 = high cost 4 = low cost	1	6		1	6		3	18			0		4 2	4	2	12		4	24	
	1 = high cost 4 = low cost	1	7		1	7		4	28			0		4 2	8	4	28		3	21	
	1 = negative outcome 4 =positive outcome	1	7		1	7		2	14			0		2 1	4	3	21		2	14	
	1 = high risk 4 =low risk	2	20		2	20		2	20			0		4 4	0	4	40		4	40	
	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years	1	3		2	6		4	12			0		4 1	2	3	9		4	12	
	1 = meets few/none 2 = meets some 3= meets most 4 = meets all	2	8		2	8		3	12			0		3 1	2	3	12		3	12	
sired	Outcomes Score:	19	96		1	187		2	233			0		210		2	214]	23	35	

Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure Project No. CW2174

April 1, 2014

Scenario ID: 1

Basin Oldman River Basin Area Pincher Creek

Definition

Weighting

Desired Outcomes 1 = Low Importance to 10 = High Importance

Weighting Scenario x Scoring System Result = Weighted Score

1. Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.

2. Increase property protection for residents, business, and First Nations (note: business includes

agriculture and irrigation, as well as provincial and municinal infrastructure)
3. Protection of designated natural areas (traditional

use, recreation, historical resources).
4. Ensure access to life-line services (fire, police,

hospital, water & wastewater etc.) for all residents

nospital, water & wastewater etc.) for all residents within the basin.

5. Provide adequate protection for at least the 1% annual exceedance probability event.

6. Provide adequate protection for the largest historical flood of record.

7. Be designed and operated to meet multi-purpose

objectives (e.g., manage water resources for both

10. Ensure species (fish, wildlife, vegetation, etc.) are

13. Meets existing federal and provincial policies and

not adverselv impacted.

11. Must not increase potential for flood-related loss

12. Protection is implemented in the near term.

8. Development and construction costs.

9. Operating and maintenance costs.

of life (compared to existing situation).

floods and droughts).

Category Criteria Ensure flood control infrastructure can be designed and built in a suitable location. Ensure nonstructural options can be implemented. Mandatory Conditions 2. Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).



Legend

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

Score		N	on-S	Structural Option	s													
	Mandatory Conditions	Ма	ınage	d Retreat			g / Forecasting / ement			oning (Restricted oment)	В	uy-Ou	ts	Flo	ood Proofing	Вι	ıildin	g Code Changes
	Scoring Scheme			Comment			Comment			Comment			Comment	_	Comment			Comment
	1 = cannot be met 4 = can be met	,	4		4	ļ			4			4			4		4	
	1 = cannot be met 4 = can be met		4		4	1			4			4			4		4	
	Test Result:	Pa	ISS		Pa	ss		P	ass		P	ass		Pa	ss	Pa	ass	
Veighting Scenario = AMEC	Scoring System	Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score	Score	Weighted Score	
9	1 = negative outcome 4 =positive outcome	3	27		4	36		3	27		3	27		3	27	3	27	
8	1 = negative outcome 4 =positive outcome	3	24		3	24		3	24		3	24		3	24	3	24	
5	1 = low benefit 4 = high benefit	1	5		1	5		1	5		1	5		1	5	1	5	
8	1 = low benefit 4 = high benefit	1	8		1	8		1	8		1	8		1	8	1	8	
8	1 = low benefit 4 = high benefit	1	8		1	8		2	16		1	8		2	16	1	8	
4	1 = low benefit 4 = hiah benefit	2	8		2	8		2	8		1	4		2	8	1	4	
4	1 = low benefit 4 = high benefit	1	4		1	4		1	4		1	4		1	4	1	4	
6	1 = high cost 4 = low cost	4	24		3	18		4	24		3	18		3	18	4	24	
7	1 = high cost 4 = low cost	4	28		2	14		4	28		4	28		4	28	4	28	
7	1 = negative outcome 4 =positive outcome	3	21		3	21		3	21		3	21		3	21	3	21	
10	1 = high risk 4 =low risk	4	40		4	40		4	40		4	40		4	40	4	40	
3	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years	1	3		3	9		4	12		3	9		4	12	3	9	
4	1 = meets few/none 2 = meets some 3= meets most 4 = meets all	4	16		4	16		3	12		4	16		4	16	3	12	
Desired	Desired Outcomes Score:		16		21	1		2	29		2	12		2	27	214		

Assessment of Flood Mitigation Options
Prepared by AMEC Environment & Infrastructure
Project No. CW2174

April 1, 2014

Scenario ID: 1

Basin Bow River

Area Priddis

Definition

Weighting 1 = Low Importance to 10 = High Importance

Score

Desired

Outcomes

Weighting Scenario x Scoring System Result = Weighted Score

Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.
 Increase property protection for residents, business, and First Nations (note: business includes agriculture and irrigation, as well as provincial and municipal infrastructure).
 Protection of designated natural areas (traditional use, recreation, historical resources).

4. Ensure access to life-line services (fire, police,

hospital, water & wastewater etc.) for all residents within the basin.

5. Provide adequate protection for at least the 1% annual exceedance probability event.

6. Provide adequate protection for the largest historical flood of record.

Be designed and operated to meet multi-purpose

10. Ensure species (fish, wildlife, vegetation, etc.) are not adversely impacted.
 11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

objectives (e.g., manage water resources for both floods and droughts).

8. Development and construction costs.

9. Operating and maintenance costs.

of life (compared to existing situation).

12. Protection is implemented in the near term.

regulations.

Category	Criteria
Mandatory	Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non structural options can be implemented.
Conditions	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).



Legend

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

Score		Struc	ctural Options																	
	Mandatory Conditions	Wet Dam		Dry	y Dan	1	Lev	e / Dyke	Ву	/-Pas	s Channel	Er	osior	Protection	lm	prov	e Conveyance	Se	dime	nt/Debris Control
	Scoring Scheme		Comment			Comment		Comment			Comment			Comment			Comment			Comment
	1 = cannot be met 4 = can be met	4		4	4		4			4			4			4		4	4	
	1 = cannot be met 4 = can be met	4		4	4		4			4			4			4		4	4	
	Test Result:	Pass		Pa	ISS		Pas	3	Pa	ass		Pa	ass		Pa	ass]	Pa	ISS	
Weighting Scenario = AMEC	Scoring System	Score Weighted Score		Score	Weighted Score		Score	aroco paulifica	Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score	
9	1 = negative outcome 4 =positive outcome	4 36	3	4	36		4	16	3	27		3	27		3	27		3	27	
8	1 = negative outcome 4 =positive outcome	4 32	2	4	32		4	32	3	24		3	24		3	24		3	24	
5	1 = low benefit 4 = high benefit	1 5		1	5		1	5	1	5		1	5		1	5		1	5	
8	1 = low benefit 4 = high benefit	3 24		3	24		3	24	2	16		1	8		1	8		1	8	
8	1 = low benefit 4 = high benefit 1 = low benefit	4 32		4	32		_	2	2	16		1	8		1	8		1	8	
4	4 = high benefit 1 = low benefit 4 = high benefit	3 12 4 16		1	12			4	1	4		1	4		1	4		1	4	
6	1 = high cost 4 = low cost	1 6		1	6		3	8	2	12		4	24		3	18		4	24	
7	1 = high cost 4 = low cost 1 = negative outcome	1 7		1	7			28	4	28		4	28		3	21		4	28	
7 10	4 =positive outcome 1 = high risk	1 7 2 20		3	7 30		_	4	3	30		2	14 40		2	14 40		2	14 40	
3	4 = low risk 1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years	1 3		1	3			9	2	6		4	12		3	9		4	12	
4	1 = meets few/none 2 = meets some 3 = meets most 4 = meets all	2 8		2	8		3	2	3	12		3	12		2	8		3	12	
Desired Outcomes Score:		208		20	06		260		2	02]	2	10		1	90]	21	10	

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Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure Project No. CW2174

April 1, 2014

Scenario ID: 1

Basin Bow River Area Priddis

Definition

1 = Low Importance to 10 = High Importance

Desired

Outcomes

Weighting Scenario x Scoring System Result = Weighted Score

1. Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.

2. Increase property protection for residents, business, and First Nations (note: business includes

agriculture and irrigation, as well as provincial and municinal infrastructure)
3. Protection of designated natural areas (traditional

use, recreation, historical resources).
4. Ensure access to life-line services (fire, police,

hospital, water & wastewater etc.) for all residents

within the basin.

5. Provide adequate protection for at least the 1% annual exceedance probability event.

6. Provide adequate protection for the largest historical flood of record.

7. Be designed and operated to meet multi-purpose

objectives (e.g., manage water resources for both

10. Ensure species (fish, wildlife, vegetation, etc.) are not adverselv impacted.

11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

8. Development and construction costs.

9. Operating and maintenance costs.

of life (compared to existing situation). 12. Protection is implemented in the near term.

floods and droughts).

Category	Criteria
- July	
Mandatory	Ensure flood control infrastructure can be designed and built in a suitable location. Ensure nor structural options can be implemented.
Conditions	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).



Legend

4		Strongly Positive
3		Positive
2		Negative
1		Strongly Negative
	_	

Score		N	on-S	Structural Option	ıs																
	Mandatory Conditions	Managed Retreat			Wa	Warning / Forecasting / Management				oning (Restricted pment)	Вι	ıy-Ou	ts	Flood Proofing				Building Code Changes			
	Scoring Scheme			Comment			Comment			Comment			Comment			Comment			Comment		
	1 = cannot be met 4 = can be met	4	4		4	1			4			4			4			4			
	1 = cannot be met 4 = can be met	4	4		4	1			4			4			4			4			
	Test Result:	Pa	ISS		Pa	ss		Pa	ass		Pa	ass		Pa	ass		P	ass			
Veighting cenario = AMEC	Scoring System	Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score			
9	1 = negative outcome 4 =positive outcome	4	36		3	27		4	36		3	27		3	27		3	27			
8	1 = negative outcome 4 =positive outcome	4	32		3	24		4	32		3	24		3	24		3	24			
5	1 = low benefit 4 = high benefit	1	5		1	5		1	5		1	5		1	5		1	5			
8	1 = low benefit 4 = high benefit	1	8		2	16		1	8		1	8		1	8		1	8			
8	1 = low benefit 4 = high benefit	2	16		2	16		1	8		1	8		1	8		1	8			
4	1 = low benefit 4 = hiah benefit	2	8		2	8		1	4		1	4		1	4		1	4			
4	1 = low benefit 4 = high benefit	1	4		1	4		1	4		1	4		1	4		1	4			
6	1 = high cost 4 = low cost	2	12		3	18		4	24		2	12		4	24		4	24			
7	1 = high cost 4 = low cost	4	28		3	21		4	28		4	28		4	28		4	28			
7	1 = negative outcome 4 =positive outcome 1 = high risk	4	28		3	21		3	21		3	21		3	21		3	21			
10	4 = low risk 1 = 10+ years	4	40		4	40		4	40		4	40		4	40		4	40			
3	2 = 5-10 years 3 = 2-5 years 4 = <2 years	1	3		3	9		3	9		1	3		4	12		3	9			
4	1 = meets few/none 2 = meets some 3= meets most 4 =meets all		0		3	12		3	12		3	12		3	12		3	12			
Desired Outcomes Score:		: 220			22	21		2	31]	1	96]	217				214			

Assessment of Flood Mitigation Options
Prepared by AMEC Environment & Infrastructure
Project No. CW2174

April 1, 2014

Scenario ID: 1

Basin Bow River
Area First Nations (Siksika)

Definition

Desired

Outcomes

Weighting 1 = Low Importance to 10 = High Importance

Score Weighting Scenario x Scoring System Result = Weighted Score

Category	Criteria
Mandatory	Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non structural options can be implemented.
Conditions	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).

Inmprove existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.
 Increase property protection for residents, business, and First Nations (note: business includes agriculture and irrigation, as well as provincial and municipal infrastructure)
 Trotection of designated natural areas (traditional use, recreation, historical resources).
 Ensure access to life-line services (fire, police, hospital, water & wastewater etc.) for all residents within the basin.
 Provide adequate protection for at least the 1% annual exceedance probability event.
 Forvide adequate protection for the largest historical flood of record.

7. Be designed and operated to meet multi-purpose

objectives (e.g., manage water resources for both

10. Ensure species (fish, wildlife, vegetation, etc.) are not adverselv impacted.
 11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

Development and construction costs.
 Operating and maintenance costs.

of life (compared to existing situation).

12. Protection is implemented in the near term.

floods and droughts).

4

6

10

Desired Outcomes Score:



Legend

208

219

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

		St	ructi	ural Options																
	Mandatory Conditions	ns		Dry	Dam	Le	evee /	Dyke	В	y-Pas	s Channel	Erosi	on Protection	lm	prove	e Conveyance	Sed	dimer	nt/Debris Control	
	Scoring Scheme			Comment		Comment			Comment			Comment		Comment			Comment			Comment
	1 = cannot be met 4 = can be met	4	4	Dam to be built between Calgary and reserve	4	Dam to be built bet Calgary and rese		4			1		4			4		4	1	
	1 = cannot be met 4 = can be met	4	4		4			4					4			4		4	1	
	Test Result:	Pa	ıss		Pas	s	P	ass		F	ail		Pass		Pa	ass		Pa	ss	
ing io = C	Scoring System	Score	Weighted Score		Score	Weighted Score	Score	Weighted Score		Score	Weighted Score		Score Weighted Score		Score	Weighted Score		Score	Weighted Score	
	1 = negative outcome 4 =positive outcome	4	36		4	36	4	36	Would need to be localized		0		3 27	,	3	27		3	27	
	1 = negative outcome 4 =positive outcome	3	24		4	32	4	32			0		3 24		3	24		3	24	
	1 = low benefit 4 = high benefit	1	5		2	10	1	5			0		1 5		1	5		1	5	
	1 = low benefit 4 = high benefit	4	32		4	32	4	32			0		1 8		4	32		1	8	
	1 = low benefit 4 = high benefit	4	32		4	32	4	32			0		1 8		2	16			8	
	1 = low benefit 4 = high benefit	3	12		3	12	4	16			0		1 4		1	4		1	4	
	1 = low benefit 4 = high benefit	4	16		1	4	1	4			0		1 4		1	4		1	4	
	1 = high cost 4 = low cost	1	6		1	6	4	24			0		3 18	3	2	12		4	24	
	1 = high cost 4 = low cost	1	7		2	14	4	28			0		3 21		4	28		4	28	
	1 = negative outcome 4 =positive outcome	1	7		1	7	2	14		L	0		2 14	1	2	14		2	14	
	1 = high risk 4 =low risk	2	20		2	20	1	10			0		4 40)	4	40		4	40	
	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years	1	3		2	6	4	12			0		4 12	2	3	9		4	12	
	1 = meets few/none 2 = meets some 3 = meets most 4 =meets all	2	8		2	8	3	12			0		3 12	2	3	12		3	12	

0

197

227

210

CW2174_Flood Mitigation Options -Apr_1_2014_Protected.xlsb

Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure Project No. CW2174

April 1, 2014

Scenario ID: 1

Basin Bow River Area First Nations (Siksika)

Definition

Weighting	1 = Low Importar

ance to 10 = High Importance

1. Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.

2. Increase property protection for residents, business, and First Nations (note: business includes agriculture and irrigation, as well as provincial and municinal infrastructure)
3. Protection of designated natural areas (traditional use, recreation, historical resources).
4. Ensure access to life-line services (fire, police, hospital, water & wastewater etc.) for all residents within the basin.

5. Provide adequate protection for at least the 1% annual exceedance probability event.

6. Provide adequate protection for the largest historical flood of record.

7. Be designed and operated to meet multi-purpose

10. Ensure species (fish, wildlife, vegetation, etc.) are not adverselv impacted.

11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

objectives (e.g., manage water resources for both

8. Development and construction costs. 9. Operating and maintenance costs.

of life (compared to existing situation). 12. Protection is implemented in the near term.

floods and droughts).

Desired

Outcomes

Weighting Scenario x Scoring System Result = Weighted Score

Category	Criteria
Mandatory	Ensure flood control infrastructure can be designed and built in a suitable location. Ensure no structural options can be implemented.
Conditions	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).



Legend

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

Score		n-Structural Option	s																
	Mandatory Conditions	Mana	ged Retreat		ng / Forecasting / Jement			oning (Restricted pment)	В	uy-Ou	ts	Flo	ood F	roofing	Вι	ıilding	Code Changes		
	Scoring Scheme		Comment		Comment			Comment			Comment			Comment			Comment		
	1 = cannot be met 4 = can be met	4		4			4			4	Relates to relocation of residences	4				4			
	1 = cannot be met 4 = can be met	4	Assume that this could be administered by the Band Council.	4			4	Assume that this could be administered by the Band Council.	4		Assume that this could be administered by the Band Council.	4		Assume that this could be administered by the Band Council.		4	Assume that this could be administered by the Band Council.		
	Test Result:	Pass	=	Pass		Pa	ass]	P	ass		Pa	ass		Pass				
Veighting cenario = AMEC	Scoring System	Score Weighted Score		Score Weighted Score		Score	Weighted Score		Score Weighted Score			Score Weighted Score				Weighted Score			
9	1 = negative outcome 4 =positive outcome	4 3	6	4 36		4	36		4	36		3	27		3	27			
8	1 = negative outcome 4 =positive outcome	3 2	4	3 24		3	24		3	24		3	24		3	24			
5	1 = low benefit 4 = high benefit	1 5	i i	1 5		1	5		1	5		1	5		1	5			
8	1 = low benefit 4 = high benefit	2 1	6	3 24		1	8		2	16		2	16	Includes self-access to things like power & water	1	8			
8	1 = low benefit 4 = high benefit	3 2	4	1 8		1	8		4	32		3	24		1	8			
4	1 = low benefit 4 = hiah benefit	2 8	3	1 4		1	4		4	16		2	8		1	4			
4	1 = low benefit 4 = high benefit	1 4		1 4		1	4		1	4		1	4		1	4			
6	1 = high cost 4 = low cost	4 2	Assumes houses destroyed in 2013 are rebuilt in current locations.	3 18		4	24		3	18		4	24		4	24			
7	1 = high cost 4 = low cost	4 2	8	2 14	Includes management	4	28		4	28		4	28		4	28			
7	1 = negative outcome 4 =positive outcome	3 2	1	3 21		3	21		3	21		3	21		3	21			
10	1 = high risk 4 =low risk	4 4	0	4 40		4	40		4	40		4	40		4	40			
3	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years	1 3	Assumes houses destroyed in 2013 are rebuilt in current locations.	3 9		2	6		3	9	Assumes people currently without housing would be relocated now, rather than after rebuilding	3	9		3	9			
4	1 = meets few/none 2 = meets some 3 = meets most 4 - meets all	4 1	6	3 12		3	12		4	16		4	16		3	12			
Desired	Desired Outcomes Score:			219		2	20]	2	265		246				214			

Assessment of Flood Mitigation Options
Prepared by AMEC Environment & Infrastructure
Project No. CW2174
April 1, 2014

Scenario ID: 1

Basin Bow River

Area First Nations (Stoney/Nakoda)

Definition

Desired

Outcomes

Weighting 1 = Low Importance to 10 = High Importance

Score Weighting Scenario x Scoring System Result = Weighted Score

Category

Criteria

1. Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non-structural options can be implemented.

2. Must meet existing transboundary legal commitments (i.e., downstream volumes to other

Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.

 Increase property protection for residents, business, and First Nations (note: business includes agriculture and irrigation, as well as provincial and municinal infrastructure)
 Trotection of designated natural areas (traditional use, recreation, historical resources).

 Ensure access to life-line services (fire, police, hospital, water & wastewater etc.) for all residents within the basin.
 Provide adequate protection for at least the 1% annual exceedance probability event.
 Forvide adequate protection for the largest historical flood of record.

7. Be designed and operated to meet multi-purpose

objectives (e.g., manage water resources for both

10. Ensure species (fish, wildlife, vegetation, etc.) are not adversely impacted.
 11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

Development and construction costs.
 Operating and maintenance costs.

of life (compared to existing situation).

12. Protection is implemented in the near term.

floods and droughts).

regulations.

4

10

3

4 =meets all

0

0

Desired Outcomes Score:



0

Legend

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

		Structural Options Wet Dam Dry Dam Levee / Dyke By-Pass Channel Erosion Protection Improve Conveyance Sediment/Debris Co																			
	Mandatory Conditions	We	t Dam		Di	ry Dar	n	Le	evee /	Dyke	В	/-Pas	s Channel	Eros	ion Protection	Improve Conveyance				dime	nt/Debris Control
	Scoring Scheme			Comment			Comment			Comment			Comment		Comment			Comment			Comment
	1 = cannot be met 4 = can be met																				
	1 = cannot be met 4 = can be met																				
	Test Result:	ult: Pass Pass		Pa	ass		P	ass		Pas	i	Pass			Pass						
ng 0 =	Scoring System	Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score		Score	Weighted Score		Score	Weighted Score	
	1 = negative outcome 4 =positive outcome		0			0			0			0)		0			0	
	1 = negative outcome 4 =positive outcome		0			0			0			0)		0			0	
	1 = low benefit 4 = high benefit		0			0			0			0)		0			0	
	1 = low benefit 4 = high benefit		0			0			0			0					0		П	0	
	1 = low benefit 4 = high benefit		0			0			0			0)		0			0	
	1 = low benefit 4 = high benefit		0			0			0			0)		0			0	
	1 = low benefit 4 = high benefit		0			0			0			0)		0			0	
	1 = high cost 4 = low cost		0			0			0			0)		0			0	
	1 = high cost 4 = low cost		0			0			0			0)		0			0	
	1 = negative outcome 4 =positive outcome		0			0			0			0)		0			0	
	1 = high risk 4 =low risk		0			0			0			0)		0			0	
	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years		0			0			0			0)		0			0	
	1 = meets few/none 2 = meets some 3= meets most		0			0			0			0)		0			0	

0

0

0

AMEC Environment & Infrastructure

Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure Project No. CW2174

April 1, 2014

Scenario ID: 1

Basin Bow River Area First Nations (Stoney/Nakoda)

Definition

Desired

Outcomes

Weighting	1 = Low Importance to 10 = High Importance

Weighting Scenario x Scoring System Result = Weighted Score

1. Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.

2. Increase property protection for residents, business, and First Nations (note: business includes

agriculture and irrigation, as well as provincial and municinal infrastructure)
3. Protection of designated natural areas (traditional

use, recreation, historical resources).
4. Ensure access to life-line services (fire, police, hospital, water & wastewater etc.) for all residents

nospital, water & wastewater etc.) for all residents within the basin.

5. Provide adequate protection for at least the 1% annual exceedance probability event.

6. Provide adequate protection for the largest historical flood of record.

7. Be designed and operated to meet multi-purpose

objectives (e.g., manage water resources for both

10. Ensure species (fish, wildlife, vegetation, etc.) are

not adverselv impacted.

11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

8. Development and construction costs.

9. Operating and maintenance costs.

of life (compared to existing situation). 12. Protection is implemented in the near term.

floods and droughts).

Category	Criteria
Mandatory	Ensure flood control infrastructure can be designed and built in a suitable location. Ensure no structural options can be implemented.
Conditions	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).



Legend

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

Score		N	on-S	Structural Option	s															
	Mandatory Conditions	Ma	anage	d Retreat			g / Forecasting / ement	La De	ind Zo evelop	oning (Restricted oment)	Вι	ıy-Out	ts	FI	ood F	Proofing	Buildin		Code Changes	
	Scoring Scheme			Comment			Comment			Comment			Comment			Comment			Comment	
	1 = cannot be met 4 = can be met																			
	1 = cannot be met 4 = can be met																			
	Test Result:	Pa	iss		Pa	ss		Pa	ass		Pa	ass		Р	ass]	Pa	iss		
Weighting Scenario = AMEC	Scoring System	Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		
9	1 = negative outcome 4 =positive outcome		0			0			0			0			0			0		
8	1 = negative outcome 4 =positive outcome		0			0			0			0			0			0		
5	1 = low benefit 4 = high benefit		0			0			0			0			0			0		
8	1 = low benefit 4 = high benefit		0			0			0			0			0			0		
8	1 = low benefit 4 = high benefit		0			0			0			0			0			0		
4	1 = low benefit 4 = hiah benefit		0		Ш	0		Ш	0		Ш	0			0		Ш	0		
4	1 = low benefit 4 = high benefit		0			0			0			0			0			0		
6	1 = high cost 4 = low cost		0			0		Ш	0		Ш	0			0			0		
7	1 = high cost 4 = low cost		0		Ш	0		Ш	0		Ш	0		L	0		Ш	0		
7	1 = negative outcome 4 =positive outcome		0		Ш	0		Ш	0		Ш	0		L	0		Ш	0		
10	1 = high risk 4 =low risk		0		Ш	0		Ш	0		Ш	0		L	0		Ш	0		
3	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years		0			0			0			0			0			0		
4	1 = meets few/none 2 = meets some 3= meets most 4 =meets all		0			0			0			0			0			0		
Desired	Desired Outcomes Score:		0		0				0			0		0				0		

Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure Project No. CW2174 April 1, 2014

Scenario ID: 1

Basin Elbow River Area First Nations (Tsuu Tina)

Definition

Desired

Outcomes

1 = Low Importance to 10 = High Importance Weighting Scenario x Scoring System Result = Weighted Score

Category	Criteria
Mandatory	Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non-structural options can be implemented.
Conditions	Must meet existing transboundary legal commitments (i.e., downstream volumes to other

1. Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.

2. Increase property protection for residents, business, and First Nations (note: business includes agriculture and irrigation, as well as provincial and municipal infrastructure).
3. Protection of designated natural areas (traditional use, recreation, historical resources).
4. Ensure access to life-line services (fire, police,

hospital, water & wastewater etc.) for all residents within the basin.
5. Provide adequate protection for at least the 1% annual exceedance probability event.

6. Provide adequate protection for the largest historical flood of record.

7. Be designed and operated to meet multi-purpose

objectives (e.g., manage water resources for both floods and droughts). 8. Development and construction costs. 9. Operating and maintenance costs.

10. Ensure species (fish, wildlife, vegetation, etc.) are not adversely impacted.

11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

of life (compared to existing situation). 12. Protection is implemented in the near term.

regulations.

5 8

4

10

3

4 =meets all

0

Desired Outcomes Score:



0

Legend

П	4	Strongly Positive
	3	Positive
	2	Negative
	1	Strongly Negative
_		

		Structural Options																							
	Mandatory Conditions		t Dam		Dı	ry Dar	n	Le	Levee / Dyke				s Channel	Eros	on Protection	Improve Conveyance				edime	nt/Debris Control				
	Scoring Scheme			Comment			Comment			Comment			Comment		Comment			Comment			Comment				
	1 = cannot be met 4 = can be met																								
	1 = cannot be met 4 = can be met																								
	Test Result:	Pa	ıss		P	ass		Pa	ass]	Pa	ass		Pass		Pa	ıss		Pa	ass					
ng o = ;	Scoring System	Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score		Score	Weighted Score		Score	Weighted Score					
	1 = negative outcome 4 =positive outcome		0			0			0			0			1		0			0					
	1 = negative outcome 4 =positive outcome		0			0			0			0		(,		0			0					
	1 = low benefit 4 = high benefit		0			0			0			0		(0			0					
	1 = low benefit 4 = high benefit		0			0			0			0					0			0					
	1 = low benefit 4 = high benefit		0		Г	0			0			0		()		0			0					
	1 = low benefit 4 = hiah benefit		0			0			0			0		(0			0					
	1 = low benefit 4 = high benefit		0			0			0			0		(0			0					
	1 = high cost 4 = low cost		0			0		П	0			0		(1		0		П	0					
	1 = high cost 4 = low cost		0			0			0			0		(0		П	0					
	1 = negative outcome 4 =positive outcome		0			0			0			0		(0		П	0					
	1 = high risk 4 =low risk		0			0			0			0		()		0			0					
	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years		0			0			0			0		(0			0					
	1 = meets few/none 2 = meets some 3= meets most		0			0			0			0		(0			0					

0

0

0

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0

Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure Project No. CW2174

April 1, 2014

Scenario ID: 1

Basin Elbow River Area First Nations (Tsuu Tina)

Definition

Desired Outcomes

Weighting	1 = Low Importance to 10 = High Importance
Weighting	1 = Low Importance to 10 = High Importance

Weighting Scenario x Scoring System Result = Weighted Score

1. Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.

2. Increase property protection for residents, business, and First Nations (note: business includes

agriculture and irrigation, as well as provincial and municinal infrastructure)
3. Protection of designated natural areas (traditional

use, recreation, historical resources).
4. Ensure access to life-line services (fire, police,

hospital, water & wastewater etc.) for all residents

nospital, water & wastewater etc.) for all residents within the basin.

5. Provide adequate protection for at least the 1% annual exceedance probability event.

6. Provide adequate protection for the largest historical flood of record.

7. Be designed and operated to meet multi-purpose

objectives (e.g., manage water resources for both

10. Ensure species (fish, wildlife, vegetation, etc.) are

not adverselv impacted.

11. Must not increase potential for flood-related loss

13. Meets existing federal and provincial policies and

8. Development and construction costs.

9. Operating and maintenance costs.

of life (compared to existing situation). 12. Protection is implemented in the near term.

floods and droughts).

8

5

8

4

6

7

7

10

3

Desired Outcomes Score: 0

Category Criteria Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non-Mandatory structural options can be implemented. Conditions 2. Must meet existing transboundary legal commitments (i.e., downstream volumes to other



Legend

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

		Non-Structural Options Warning / Forecasting / Land Zoning (Restricted)																	
	Mandatory Conditions	Ma	anage	d Retreat		arninç anage	g / Forecasting / ment			oning (Restricted oment)	Ві	uy-Ou	ts	Flo	od F	Proofing	Bu	iildinç	g Code Changes
	Scoring Scheme			Comment			Comment			Comment			Comment			Comment			Comment
	1 = cannot be met 4 = can be met																		
	1 = cannot be met 4 = can be met																		
	Test Result:	Pa	ass		Pa	ass		Pa	ss		P	ass		Pass]	Pa	iss	
nting rio = EC	Scoring System	Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score	
	1 = negative outcome 4 =positive outcome		0			0			0			0			0			0	
	1 = negative outcome 4 =positive outcome		0			0			0			0			0			0	
	1 = low benefit 4 = high benefit		0			0			0			0			0			0	
	1 = low benefit 4 = high benefit		0			0			0			0			0			0	
	1 = low benefit 4 = high benefit		0			0			0			0			0			0	
	1 = low benefit 4 = high benefit		0			0			0			0			0			0	
	1 = low benefit 4 = high benefit		0			0			0			0			0			0	
	1 = high cost 4 = low cost	Ш	0			0		Ш	0			0			0		Ш	0	
	1 = high cost 4 = low cost	Ш	0			0		Ш	0			0			0		Ш	0	
	1 = negative outcome 4 =positive outcome	Ш	0			0		Ш	0			0			0		Ш	0	
)	1 = high risk 4 =low risk	Ш	0			0		Ш	0			0			0		Ш	0	
	1 = 10+ years 2 = 5-10 years 3 = 2-5 years		0			0			0			0			0			0	
	4 = <2 years 1 = meets few/none 2 = meets some 3 = meets most 4 = meets all		0			0			0			0			0			0	

0

0

0

0

CW2174_Flood Mitigation Options -Apr_1_2014_Protected.xlsb AMEC Environment & Infrastructure

Assessment of Flood Mitigation Options
Prepared by AMEC Environment & Infrastructure
Project No. CW2174
April 1, 2014

Scenario ID: 1

Basin Elbow River

Area Upstream of Glenmore Dam

Definition

Weighting 1 = Low Importance to 10 = High Importance

Weighting Scenario x Scoring System Result = Weighted Scor

Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both upstream and downstream.
 Increase property protection for residents, business, and First Nations (note: business includes agriculture and irrigation, as well as provincial and municinal infrastructure).
 Protection of designated natural areas (traditional use, recreation, historical resources).
 Ensure access to life-line services (fire, police, hospital, water & wastewater etc.) for all residents

Provide adequate protection for at least the 1% annual exceedance probability event.
 Provide adequate protection for the largest

historical flood of record.

7. Be designed and operated to meet multi-purpose

objectives (e.g., manage water resources for both

Section 10. Ensure species (fish, wildlife, vegetation, etc.) are not adversely impacted.
 Must not increase potential for flood-related loss.

13. Meets existing federal and provincial policies and

Development and construction costs.
 Operating and maintenance costs.

of life (compared to existing situation).

12. Protection is implemented in the near term.

Category

Criteria

1. Ensure flood control infrastructure can be designed and built in a suitable location. Ensure non-structural options can be implemented.

2. Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).

within the basin.

floods and droughts).

Desired

Outcomes



Legend

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

Score		Structural Options																		
	Mandatory Conditions	Wet Dam		Dry Dam			Le	vee /	Dyke	By-Pas	s Channel	Er	osion Protection	Improve Conveyance				Sediment/Debris Control		
	Scoring Scheme			Comment			Comment	$oxedsymbol{oxed}$		Comment		Comment		Comment			Comment			Comment
	1 = cannot be met 4 = can be met	4	4			4		4	4		1			4		1		1	1	
	1 = cannot be met 4 = can be met	4	4			4		4	4					4						
	Test Result:	Pa	iss		Pa	ass		Pa	ISS]	Fail]	Pa	ass	F	ail		Fa	ail	
Weighting Scenario = AMEC	Scoring System	Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score Weighted Score		Score	Weighted Score	Score	Weighted Score		Score	Weighted Score	
9	1 = negative outcome 4 =positive outcome	3	27		4	36		3	27		0		3	27		0			0	
8	1 = negative outcome 4 =positive outcome	3	24		4	32		3	24	Includes protection of Discovery Ridge in the flood fringe	0		3	24		0			0	
5	1 = low benefit 4 = high benefit	2	10		2	10		2	10		0		1	5		0			0	
8	1 = low benefit 4 = high benefit	2	16		2	16		1	8		0		1	8		0			0	
8	1 = low benefit 4 = high benefit	3	24		4	32		4	32		0		1	8		0			0	
4	1 = low benefit 4 = high benefit	3	12		4	16		4	16		0		1	4		0			0	
4	1 = low benefit 4 = high benefit	4	16		1	4		1	4		0		1	4		0			0	
6	1 = high cost 4 = low cost	1	6		1	6		3	18		0		3	18		0			0	
7	1 = high cost 4 = low cost	1	7		1	7		3	21		0		3	21	Ш	0			0	
7	1 = negative outcome 4 =positive outcome	1	7		1	7		2	14		0		2	14	Ш	0		Ш	0	
10	1 = high risk 4 = low risk	3	30	Less risk than upstream	3	30		3	30		0		4	40	Ш	0			0	
3	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years	1	3		2	6		3	9		0		4	12		0			0	
4	1 = meets few/none 2 = meets some 3 = meets most 4 = meets all	2	8		2	8		3	12		0		3	12		0			0	
Desired Outcomes Score:		e: 190		210		225			0			97	0				0			

CW2174_Flood Mitigation Options -Apr_1_2014_Protected.xlsb

Assessment of Flood Mitigation Options Prepared by AMEC Environment & Infrastructure Project No. CW2174

April 1, 2014

Scenario ID: 1

Basin Elbow River Area Upstream of Glenmore Dam

Definition

1 = Low Importance to 10 = High Importance

Weighting Scenario x Scoring System Result = Weighted Score

1. Improve existing shelter, sustenance and security for individuals within the basin (compared to current situation and not increase flood impacts to other users/basins both uostream and downstream.

2. Increase property protection for residents, business, and First Nations (note: business includes

agriculture and irrigation, as well as provincial and municinal infrastructure)
3. Protection of designated natural areas (traditional

use, recreation, historical resources).
4. Ensure access to life-line services (fire, police,

within the basin.

floods and droughts).

Desired

Outcomes

hospital, water & wastewater etc.) for all residents

5. Provide adequate protection for at least the 1% annual exceedance probability event. 6. Provide adequate protection for the largest

historical flood of record.

7. Be designed and operated to meet multi-purpose

objectives (e.g., manage water resources for both

10. Ensure species (fish, wildlife, vegetation, etc.) are

13. Meets existing federal and provincial policies and

not adverselv impacted.
11. Must not increase potential for flood-related loss

12. Protection is implemented in the near term.

8. Development and construction costs. 9. Operating and maintenance costs.

of life (compared to existing situation).

Category	Criteria
Mandatory	Survey flood control infrastructure can be designed and built in a suitable location. Ensure nor structural options can be implemented.
Conditions	Must meet existing transboundary legal commitments (i.e., downstream volumes to other users).



Legend

4	Strongly Positive
3	Positive
2	Negative
1	Strongly Negative

Score		N	on-Structural (Option	S															
	Mandatory Conditions	Managed Retreat			Warning / Forecasting / Management			Land Zoning (Restricted Development)			Buy-Outs			Flood Proofing			Building Code Changes			
	Scoring Scheme		Comme	nt		Comment			Comment			Comment			Comment			Comment		
	1 = cannot be met 4 = can be met		No infrastructure in the f Creek potentially affected (in the floodplain m	under review on	4			4			4			4			4			
	1 = cannot be met 4 = can be met		4		4			4			4			4			4			
	Test Result:	est Result: Pass			Pass		Pass		Pass		Pass]	Pass						
Weighting Scenario = AMEC	Scoring System	Score	Weighted Score		Score Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score		Score	Weighted Score			
9	1 = negative outcome 4 =positive outcome	3	27		4 36		4	36		3	27		4	36		3	27			
8	1 = negative outcome 4 =positive outcome	3	24		3 24		4	32		3	24		3	24		3	24			
5	1 = low benefit 4 = high benefit	1	5		1 5		3	15		1	5		1	5		1	5			
8	1 = low benefit 4 = high benefit	2	16		3 24		3	24		1	8		1	8		1	8			
8	1 = low benefit 4 = high benefit	4	32		2 16		3	24		1	8		3	24		1	8	Assuming that there are already stringent building codes in place for Lott Creek & Discovery Ridge		
4	1 = low benefit 4 = high benefit	4	16		2 8		3	12		1	4		2	8		1	4			
4	1 = low benefit 4 = high benefit	1	4		1 4		1	4		1	4		1	4		1	4			
6	1 = high cost 4 = low cost	2	12		3 18		4	24		2	12		4	24		4	24			
7	1 = high cost 4 = low cost	4	28		3 21		4	28		4	28		4	28		4	28			
7	1 = negative outcome 4 =positive outcome	3	21		3 21		4	28		3	21		3	21		3	21			
10	1 = high risk 4 =low risk	4	40		4 40		4	40		4	40		4	40		4	40			
3	1 = 10+ years 2 = 5-10 years 3 = 2-5 years 4 = <2 years	1	3		4 12		3	9		4	12		4	12		3	9			
4	1 = meets few/none 2 = meets some 3= meets most 4 =meets all	4	16		4 16		3	12		4	16		4	16		3	12			
Desired Outcomes Score:		: 244			245			288					250				214			