



Meeting the challenge

Greater Wellington Regional Council

Multi Criteria Analysis Summary Document

Boulcott / Hutt Stopbank Feasibility Study

15 September 2006



Quality Assurance Statement	
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Greater Wellington Regional Council

Boulcott / Hutt Stopbank Feasibility Study

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1. Introduction

The Boulcott/Hutt Stopbank Feasibility Study is considering the stopbank alignment options available between Kennedy Good bridge and Mills Street. A multi criteria analysis (MCA) technique has been used by the technical team to take account of a wide range of factors that are important to the community and stakeholders in selecting the best alignment options. Three alignments between Kennedy Good Bridge and Mills St were initially proposed for consideration – Red (nearest to Harcourt Werry Drive), Green (Through both golf courses) and Blue (near to the property boundary of the golf course and residential dwellings). The technical team divided the total alignment length into three sub-sections – Hutt Golf Course, Boulcott Golf Course and past Safeway Storage. Each sub-section was assessed in three ways. 27 possible alignment combinations were then able to be ranked as shown in the following tables.

2. Costings

Costings are based on a stopbank cross section that merges into the two golf courses in a manner that allows golf to be played over the surface of the stopbank embankment. Features of this “golf-friendly” stopbank include wide crests, shoulder slopes of 1 vertical to 6 horizontal, tees and greens located on top of the crest, landscaping in keeping with a golf course environment. This stopbank scenario is identified below as the “golf-friendly” option.

The layout of Boulcott Golf Course presents fundamental difficulties with merging the stopbank because the proposed alignments cross at right angles to many of the fairways, causing unsatisfactory playing conditions. The costs of constructing stopbanks only to meet the required engineering standards are shown below as ‘Engineering’ costs. These costs exclude the costs of mitigation measures necessary to make stopbanks ‘golf friendly’ or to protect golf courses from frequent flooding.

The “Golf –friendly” Option enables the Boulcott Golf Course to remain a viable golf course following the construction of flood protection where as the “Engineering” Option assumes stopbanks and reinstatement through the Boulcott Golf Course are to the minimum requirements necessary to meet design standards for the Hutt River flood protection scheme. The contrasting Options are presented to demonstrate the worth of purchasing the Boulcott Golf Course as part of the overall stopbank construction project.

Colour Code Legend:

Hred,Hgreen,Hblue	Hutt Golf Course
Bred,Bgreen,Bblue	Boulcott Golf Course
Sred, Sgreen, Sblue	Past Safeway Storage

Sub-section Costs

Alignment Sub-section Costs	"Golf-friendly" Option \$ million	"Engineering" Option \$ million
Hred	8.3	8.3
Hblue	6.1	4.8
Hgreen	8.0	8.0
Bred	7.6	4.9
Bblue	8.0	8.0
Bgreen	8.0	5.6
Sred	4.6	4.6
Sblue	6.1	6.1
Sgreen	5.3	5.3

3. MCA (Multi Criteria Analysis)

The MCA methodology provides an open and traceable method of weighing up the advantages and disadvantages of the different options taking account of both tangible and intangible issues. Issues were canvassed from all quarters including stakeholders and the general public. The issues were grouped together into ten or less attributes and given an importance weighting by the technical team in a group discussion forum.

Each attribute was then considered against the alignment options in each sub-section and given a score to show how favourable they were. Finally, a matrix of outcomes was prepared to rank the overall alignment from most favourable to least favourable.

The MCA methodology is considered to be a transparent tool that can guide decision making where many different issues are involved but it is not supposed to provide the final outcome on its own.

4. Attributes to Compare Alignment Options

4.1 List of Issues

These issues were suggested at the Workshop 2 white board exercise and in public consultation:

- a) Residual risk of stop bank failure
- b) Hydraulics of river and floodplain zone (including knock-on effects)

- c) Costs (disruption, construction, maintenance)
- d) Economic benefit (flood protection benefit) – future landuse
- e) Visual impact (security, loss of privacy)
- f) Constructability (including time and staging)
- g) Owner compensation/land purchase
- h) Consenting issues/public acceptance – due process
- i) Loss of amenity
- j) Environmental impacts – short and long term effects
- k) Social issues (impact) – access, amenity, etc
- l) Cultural impacts – (e.g. Possible heritage issues, Maori traditions and beliefs)
- m) Benefits to landowners (golf course)
- n) Timeframe to complete works
- o) Sustainability/opportunity cost
- p) Interests of Wellington region

Issue suggested at public meeting (24/05/06):

- q) Decline of house value due to proximity of the stopbank.

Additional issue

- r) Landscape

4.2 Definitions of Issues

Input from public meeting feedback is incorporated into the following definitions of the issues. GWRC consultation summary from public meeting (24/05/06) is included in Appendix A.

- a) Residual risk of stop bank failure – stopbank failure is related to flow velocities and erosion forces so where velocities are high more reliance is placed upon protective armouring and ongoing maintenance. For low velocities, erosion forces are less therefore the risk of failure is reduced during the stopbank's lifetime. Ability to increase the level of protection in the future. All stopbank options have crest levels designed to the same annual exceedence probability flood event.
- b) Hydraulic impacts upstream and downstream of the proposed stopbanks – floodplain hydraulics is based on conveyance, water levels, and storage and these are influenced by bed levels and channel width. Improved conveyance may increase downstream water levels. Reduced conveyance may increase water levels upstream. Reduced floodplain may increase water levels upstream and downstream.
- c) Costs (disruption, construction, maintenance) – disruption costs relate to the extent and time that normal golfing conditions are affected by construction activity such as machinery and noise, stockpiles and exposed fill batters without grass, reinstatement processes and greens reconstruction. Construction costs relate to earthworks, landscaping, walls, tree working, drainage, compaction, survey, utilities, stormwater pumps, etc. Maintenance costs relate to long term maintenance procedures such as lawn mowing, erosion protection inspections, post-flood inspections and cleanup.
- d) Economic impact from flood protection and future landuse options – benefits include flood protection on land that was prone to flooding, reduced cleanup, reduced erosion, reduced damage to fences, greens, tees, buildings, reduced days lost to golf per event. Land value will increase when flood protection is applied, opportunities for land zone change and resale for purposes other than recreation. Increased value of houses now protected against flood.

- e) Visual Impact (security, loss of privacy) – negative impacts from higher stopbanks include loss of scenery, loss of privacy from people on high ground, loss of security, increased spying from potential wrong doers, poor outlook on to back side of a stopbank.
- f) Construction difficulty (including staging and duration) – workability to build stopbank while satisfying conditions specified by golf courses, residents, resource consents. Ease of operation, good working conditions, good access, good materials, speed of construction, good foundation stability, resistance to water ingress.
- g) Owner compensation/land purchase – compensation to the landowners in order to site proposed stopbank in the desired position.
- h) Consenting issues/public acceptance – due process – the difficulty of mitigating effects of construction and the impacts on the wider community (road closure) and the perception of fairness to affected parties and to wider community who is funding the works. Perception of a fair deal with no party unduly disadvantaged or advantaged. Likelihood of achieving consent.
- i) Loss of amenity – impacts on recreational use of river and river bank (fishing, dog walking, etc.) reduction in sense of wellbeing living, working or playing nearby the stopbank, potential for land use change to affect existing well-being. Currently the stopbank provides children with a safe access route to and from Boulcott School, and Boulcott School uses the stopbank as a safe access route to and from the Hutt River for field trips
- j) Environmental impacts – dust, noise, pollution during short term construction period, effects on bed formation in Hutt River on opposite bank. Short and long term effects on river ecology, sediment movements and deposition.
- k) Social issues/impacts – perceptions of value for money, sense of enhancing a community asset, increased feelings of security from flooding, increased perception of property value, improving traffic and carparking conditions next to Boulcott Golf Course, increased recreational value.
- l) Cultural issues - undue impact on a particular societal group, Forest and Bird's views, Heritage issues, Iwi issues and the right to exercise kaitiakitanga.
- m) Impacts on landowners (Golf courses) - can the stopbank improve the function of the golf club, improve golfing experience, attract membership, reduce maintenance costs, improve clubhouse facilities, increase in value of the land afforded the protection of the stopbank against flood, new options for land use and development, benefits to businesses and residents of improved flood protection.
- n) Timeframe – the shorter the construction duration the better, less disruption to golf clubs, earlier protection to wider Hutt Valley.
- o) Sustainability/opportunity cost – does the option allow flexibility to GWRC in the long term if river circumstances change, does loss of floodplain limit “room to move” and reduce options for future flood protection schemes, will erosion costs become too great to maintain.
- p) Interests of Wellington region – value for money for the work done, saved damage costs in long term, local golf course facilities maintained and enhanced for public, enhanced feelings of flood security, transparent process, solution seen to be consistent with the wider community priorities.
- q) Impacts on neighbouring house values (due to proximity of the stopbank) – perception of a change to existing visual surroundings and outlook over floodplain, with corresponding reduction in sale price of house.
- r) Impacts on Landscape – potential impacts on existing natural character and the perceived naturalness of the neighbourhood.

4.3 Definitions of Proposed Attributes

The Issues above were amalgamated into the following attributes.

1. Project Costs (c,g,m) [Economic]

Construction costs of stopbank including land purchase, compensation costs (net of commercial benefits) to commercial stakeholders (golf clubs, Safeway Storage Ltd, Transpower) for disruption and impacts to activities and general business. Maintenance costs in the future.

2. River Environment Impacts (j) [Environmental]

Long term effects on river ecology, sediment movements, and river morphology.

3a. Permanent Impacts on Property Adjoining Stopbank (e,q) [Economic]

Impacts due to proximity of the stopbank such as loss of scenery, loss of privacy, loss of security, poor outlook onto rear of stopbank. Potential impacts on property values next to stopbank.

3b. Permanent Impacts on Property Upstream/Downstream of Stopbank (b) [Economic]

Impact on top water levels for any given flood flow due to stopbank. Increased flood levels upstream or downstream, or increased velocities and scour. Costs to maintain existing levels of flood protection upstream and increased river protection works downstream of the stopbank.

4. Impacts on Local Community Amenity (i) [Social]

Impacts on recreational use of river, riverbank or channel (fishing, walking dogs, picnics, fitness walks). Impacts on sense of well being living, working, travelling or playing nearby the stopbank. Children's safety to and from local schools and to the river bank for educational visits.

5. Temporary Effects of Construction, Timing and Staging (f,n) [Economic]

Net costs associated with constructability (ease of construction and timeframe) while satisfying conditions specified by stakeholders and resource consents. This includes access to and from site, sourcing materials, reinstatement, and staging of construction. Short term effects of noise, dust, air pollution during construction.

6. Regional Impacts (d,h,k,p) [Social]

Increased areas of flood protection for the Hutt Valley. Reduced burden on ratepayers for post-flood clean-up and social disruption. Regional impact on property values resulting from the level of flood protection, including opportunities for land use change. Perception of fairness to affected parties. Perception of a solution that is value for money, that preserves sporting assets, enhances the community's feelings of protection from flood, increased recreational value.

7. Cultural, Iwi and Heritage (l) [Cultural]

Impacts on a particular societal group, Forest and Bird Society's views or any other advocacy organisation's views. Heritage values. Iwi rights to exercise kaitiakitanga.

8. Sustainable River and Flood Management (a,o,r) [Environmental]

Residual risk of stopbank failure. Capacity to increase level of protection in the future, flexibility of future response if river dynamics change. Manageable levels of sustainable river maintenance as part of ongoing flood plain management. Impact of stopbank on the natural character and landscape of the flood plain and river environment.

4.4 Summary of MCA Attributes

The Four Fundamental Attributes are represented in the list of MCA attributes for Boulcott / Hutt Stopbank Feasibility analysis in the following manner:

- Economic – 1, 3a, 3b, 5
- Social – 4, 6
- Environmental – 2, 8
- Cultural issues – 7.

5. Scoring the Attribute against the Alignment Sections

Alignment Section Scores – “Golf-friendly” Development Option

(stopbanks and reinstatement that enables the Boulcott Golf Course to remain a viable golf course following the construction of flood protection)

Attribute Label	Project costs (Compensation, Construction, Net GC costs)	River environmental impacts	Permanent impacts on adjoining property	Permanent impacts upstream/down stream	Impacts on local community amenity	Temporary construction & timing effects	Regional impacts	Cultural, Iwi, heritage	Sustainable river and flood management
Hred	1	2	5	3	3	3	2	4	2
HBlue	5	4	3	5	5	4	4	4	4
HGreen	2	3	5	5	5	2	3	4	3
Bred	1	3	5	5	3	3	3	4	2
BBlue	1	3	1	5	2	1	4	4	4
BGreen	1	3	5	5	5	2	2	4	2
Sred	4	3	4	5	2	2	2	2	2
SBlue	1	3	2	5	5	1	3	5	4
SGreen	3	3	3	5	5	2	4	5	4

Alignment Section Scores – “Hard” Development Option

(stopbanks and reinstatement through the Boulcott Golf Course to the minimum requirements necessary to meet design standards for the Hutt River flood protection scheme)

Attribute Label	Project costs (Compensation, Construction, Net GC costs)	River environmental impacts	Permanent Construction impacts on adjoining property	Permanent impacts upstream/down stream	Impacts on local community amenity	Temporary construction & timing effects	Regional impacts	Cultural, lwi, heritage	Sustainable river and flood management
Hred	1	2	5	3	3	3	2	4	2
HBlue	5	4	3	5	5	4	4	4	4
HGreen	1	3	5	5	5	2	3	4	3
Bred	5	3	5	5	3	3	3	4	2
BBlue	1	3	1	5	2	1	4	4	4
BGreen	4	3	5	5	5	2	2	4	2
Sred	4	3	4	5	2	2	2	2	2
SBlue	1	3	2	5	5	1	3	5	4
SGreen	3	3	3	5	5	2	4	5	4

Notes

“High score is Good” ie preferable.

6. Weighting the Significance of the Attributes

Attribute Weights – Technical Team, Group Viewpoint

Attribute (short label)	Team weightings
1. Project Cost	15%
2. River Impact	11%
3a. Adjoining property Effects	9%
3b. U/D Impacts	13%
4. Amenity Impacts	11%
5. Short term Construction Impacts	6%
6. Regional Impacts	7%
7. Cultural Impacts	11%
8. Sustainability Issues	17%
TOTAL	100%



7. Outcomes of Multi Criteria Analysis

Route Number	Hutt Section	Boulcott Section	Safeway Section	Team Viewpoint	Rank	"Golf-friendly" Cost \$Millions	Team Viewpoint	Rank	"Engineering" Cost \$Millions
Route 23	Hblue	Bgreen	Sgreen	11.37	1	19.4	11.81	2	15.7
Route 14	Hblue	Bred	Sgreen	11.28	2	19.0	11.87	1	15.0
Route13	Hblue	Bblue	Sgreen	11.09	3	19.4	11.09	5	18.1
Route 12	Hblue	Bgreen	Sblue	10.85	4	20.2	11.30	4	16.5
Route 10	Hblue	Bred	Sblue	10.76	5	19.8	11.35	3	15.8
Route 3	Hgreen	Bgreen	Sgreen	10.65	6	21.3	10.94	8	18.9
Route 2	Hblue	Bblue	Sblue	10.57	7	20.2	10.57	10	18.9
Route 16	Hgreen	Bred	Sgreen	10.56	8	20.9	11.00	6	18.2
Route 15	Hblue	Bgreen	Sred	10.46	9	18.7	10.91	9	15.0
Route 18	Hgreen	Bblue	Sgreen	10.37	10	21.3	10.22	14	21.3
Route 22	HBlue	Bred	Sred	10.37	10	18.3	10.96	7	14.3
Route 11	Hblue	Bblue	Sred	10.19	12	18.7	10.19	15	17.4
Route 19	Hgreen	Bgreen	Sblue	10.13	13	22.1	10.43	12	19.7
Route 20	Hgreen	Bred	Sblue	10.04	14	21.7	10.48	11	19.0
Route 24	Hgreen	Bblue	Sblue	9.85	15	22.1	9.70	19	22.1
Route 17	Hgreen	Bgreen	Sred	9.74	16	20.6	10.04	18	18.2
Route 26	Hred	Bgreen	Sgreen	9.72	17	21.6	10.17	16	19.2
Route 25	Hgreen	Bred	Sred	9.65	18	20.5	10.09	17	17.8
Route 7	Hred	Bred	Sgreen	9.63	19	21.2	10.22	13	18.5
Route 21	Hgreen	Bblue	Sred	9.46	20	20.6	9.31	23	20.6
Route 8	Hred	Bblue	Sgreen	9.44	21	21.6	9.44	22	21.6
Route 9	Hred	Bgreen	Sblue	9.20	22	22.4	9.65	21	22.4
Route 5	Hred	Bred	Sblue	9.11	23	22.0	9.70	19	19.3
Route 27	Hred	Bblue	Sblue	8.93	24	22.4	8.93	26	22.4
Route 6	Hred	Bgreen	Sred	8.81	25	20.9	9.26	25	20.9
Route 1	Hred	Bred	Sred	8.72	26	20.5	9.31	23	17.8
Route 4	Hred	Bblue	Sred	8.54	27	20.5	8.54	27	20.9

Appendix A

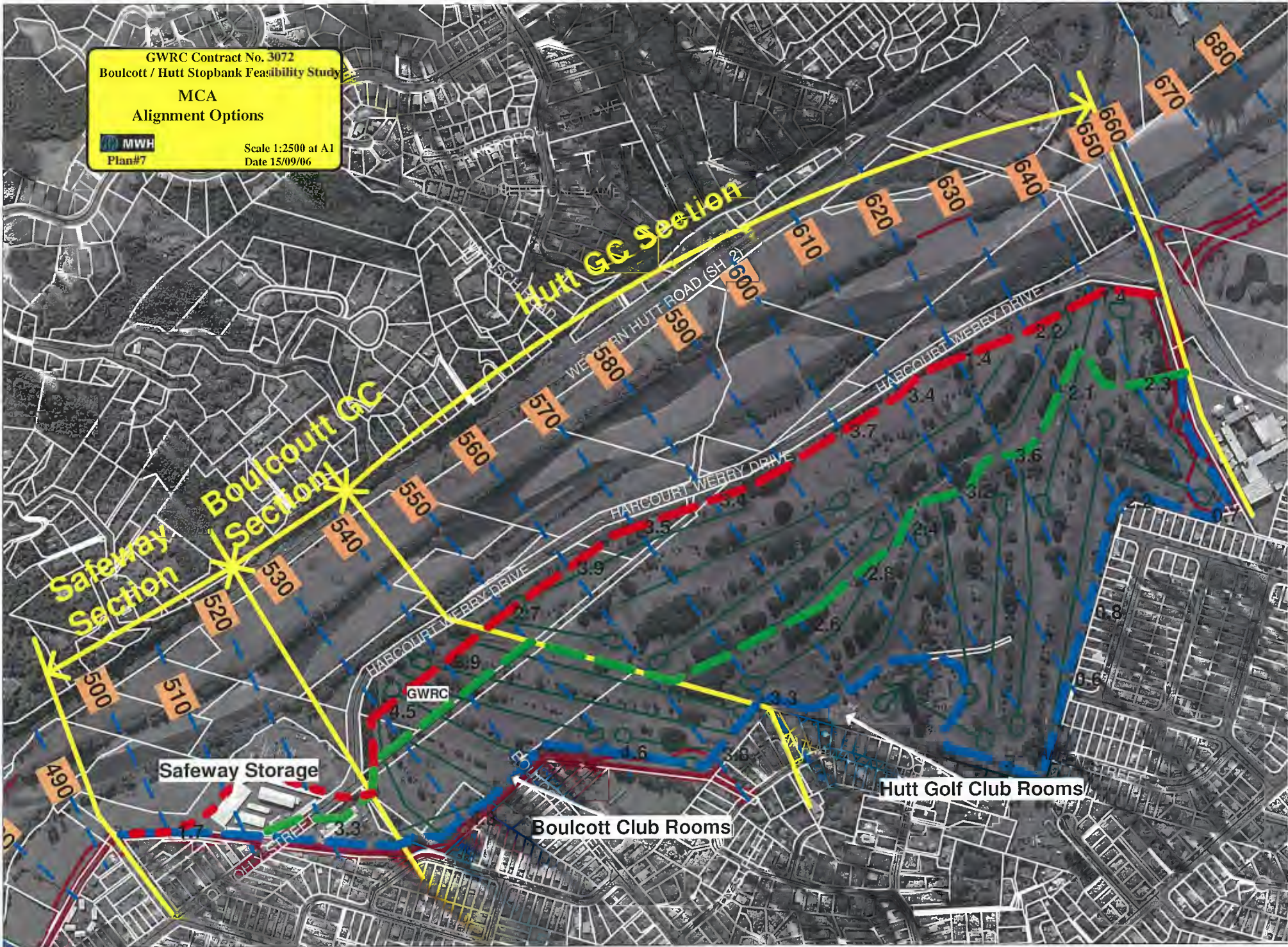
Plan #7 Plan of Alignment Options and Subsections

GWRC Contract No. 3072
Boulcott / Hutt Stopbank Feasibility Study

MCA
Alignment Options



Scale 1:2500 at A1
Date 15/09/06



Addendum

Sensitivity of Outcomes to Various Weightings

Boulcott Hutt Stopbank Feasibility Study

Date: 18 Septeber 2006

Sensitivity - Alternative Weightings

Attribute Label	Project costs (Compensation, Construction, Net GC costs)	River environmental impacts	Permanent impacts on adjoining property	Permanent impacts upstream/down stream	Impacts on local community amenity	Temporary construction & timing effects	Regional impacts	Cultural, lwi, heritage	Sustainable river and flood management
Weightings - Team	0.15	0.11	0.09	0.13	0.11	0.06	0.07	0.11	0.17
Weightings - Local	0.038	0.132	0.19	0.09	0.15	0.17	0.04	0.06	0.13
Weightings - Golf	0.025	0.1	0.075	0.075	0.075	0.25	0.15	0.075	0.175
HRed	1	2	5	3	3	3	2	4	2
HBlue	5	4	3	5	5	4	4	4	4
HGreen	2	3	5	5	5	2	3	4	3
BRed	1	3	5	5	3	3	3	4	2
BBlue	1	3	1	5	2	1	4	4	4
BGreen	1	3	5	5	5	2	2	4	2
SRed	4	3	4	5	2	2	2	2	2
SBlue	1	3	2	5	5	1	3	5	4
SGreen	3	3	3	5	5	2	4	5	4

	Team Weighting	Local Area Weighting	Golfing weighting
HRed	2.64	3.062	2.75
HBlue	4.3	4.088	4.1
HGreen	3.56	3.712	3.25
BRed	3.08	3.414	3.15
BBlue	2.9	2.464	2.775
BGreen	3.17	3.504	2.9
SRed	2.98	2.858	2.525
SBlue	3.36	3.124	3
SGreen	3.88	3.6	3.525

Scores

Sub-section Results

Boulcott Hutt Stopbank Feasibility Study

Sensitivity - Alternative Weightings

Route Number	Hutt Section	Boulcott Section	Safeway Section	Team Viewpoint	Rank	"Golf-friendly" Cost \$Millions	Team Viewpoint	Rank	"Engineering" Cost \$Millions	Local View	Rank	Golf View	Rank
Route 23	Hblue	Bgreen	Sgreen	11.37	1	19.4	11.81	2	15.7	11.192	1	10.525	2
Route 14	Hblue	Bred	Sgreen	11.28	2	19	11.87	1	15	11.102	2	10.775	1
Route 13	Hblue	Bblue	Sgreen	11.09	3	19.4	11.09	5	18.1	10.152	12	10.4	3
Route 12	Hblue	Bgreen	Sblue	10.85	4	20.2	11.3	4	16.5	10.716	5	10	5
Route 10	Hblue	Bred	Sblue	10.76	5	19.8	11.35	3	15.8	10.626	6	10.25	4
Route 3	Hgreen	Bgreen	Sgreen	10.65	6	21.3	10.94	8	18.9	10.816	3	9.675	9
Route 2	Hblue	Bblue	Sblue	10.57	7	20.2	10.57	10	18.9	9.676	18	9.875	7
Route 16	Hgreen	Bred	Sgreen	10.56	8	20.9	11	6	18.2	10.726	4	9.925	6
Route 15	Hblue	Bgreen	Sred	10.46	9	18.7	10.91	9	15	10.45	7	9.525	11
Route 18	Hgreen	Bblue	Sgreen	10.37	10	21.3	10.22	14	21.3	9.776	16	9.55	10
Route 22	Hblue	Bred	Sred	10.37	10	18.3	10.96	7	14.3	10.36	8	9.775	8
Route 11	Hblue	Bblue	Sred	10.19	12	18.7	10.19	15	17.4	9.41	21	9.4	13
Route 19	Hgreen	Bgreen	Sblue	10.13	13	22.1	10.43	12	19.7	10.34	9	9.15	16
Route 20	Hgreen	Bred	Sblue	10.04	14	21.7	10.48	11	19	10.25	10	9.4	14
Route 24	Hgreen	Bblue	Sblue	9.85	15	22.1	9.7	19	22.1	9.3	23	9.025	18
Route 17	Hgreen	Bgreen	Sred	9.74	16	20.6	10.04	18	18.2	10.074	14	8.675	21
Route 26	Hred	Bgreen	Sgreen	9.72	17	21.6	10.17	16	19.2	10.166	11	9.175	15
Route 25	Hgreen	Bred	Sred	9.65	18	20.5	10.09	17	17.8	9.984	15	8.925	19
Route 7	Hred	Bred	Sgreen	9.63	19	21.2	10.22	13	18.5	10.076	13	9.425	12
Route 21	Hgreen	Bblue	Sred	9.46	20	20.6	9.31	23	20.6	9.034	25	8.55	23
Route 8	Hred	Bblue	Sgreen	9.44	21	21.6	9.44	22	21.6	9.126	24	9.05	17
Route 9	Hred	Bgreen	Sblue	9.2	22	22.4	9.65	21	22.4	9.69	17	8.65	22
Route 5	Hred	Bred	Sblue	9.11	23	22	9.7	19	19.3	9.6	19	8.9	20
Route 27	Hred	Bblue	Sblue	8.93	24	22.4	8.93	26	22.4	8.65	26	8.525	24
Route 6	Hred	Bgreen	Sred	8.81	25	20.9	9.26	25	20.9	9.424	20	8.175	26
Route 1	Hred	Bred	Sred	8.72	26	20.5	9.31	23	17.8	9.334	22	8.425	25
Route 4	Hred	Bblue	Sred	8.54	27	20.5	8.54	27	20.9	8.384	27	8.05	27

Full Alignment Results