

## 8.1 Methodology

## 8.2 Options Assessment

With respect to the objectives outlined above, and the requirements for local government to incorporate quadruple bottom line assessment of options (environmental, social, cultural and economic comparisons), the indicators presented in Table 8-1 have been identified as appropriate for Stanmore Bay. Some of the indicators will be adjusted subject to consultation with the RDC, ARC, community and other stakeholders. A number of additional options, and variations of the options were also modelled, but not included in the options evaluation due to a lack of effectiveness to alleviate flooding. The Modelling report (Appendix C) explores these options. The scores for each option have been developed using either qualitative or quantitative information. For example, the scores for flooding related criteria have been developed from the modelling exercise. A number of scores (such as the community acceptance and iwi acceptance criteria) are indicative only, and are expected to change following consultation of this document.

Table 8-1: Option Assessment Indicators for Stanmore Bay

General Category	Objectives	Assessment Method	Indicator	Comment / Explanation	Weighting
Environment	To avoid, remedy or mitigate the adverse effects of stormwater discharges on the environment.	Quantitative	Whether natural flow pattern is replicated	Score based on comparison of existing and MPD development hydrograph ( peak flows, time of concentration and volume): 5-Highest degree 4-Replicates or better for events up to the 10 year RP event 3-Replicates or better for events up to the 2 year RP event 1 =Minimal attenuation, 0 = not applicable	0.08
Environment		Quantitative	Amount of contaminants to receiving environment / Effectiveness of stormwater treatment	Estimate change in contaminant discharge potential (post-pre option) and score as follows: 5- less than 30% increase or >=75% removal 3-less than 60% increase or between 50% and 75% removal, local erosion control 2 - between 30 and 50% removal 1-more than 60% increase or <30% removal, minor erosion control 0- no removal	0.1
Environment / Amenity		Qualitative	Incorporates habitat restoration and/or protection	Evaluate habitat potential and score as follows: 5- maximises potential / minimises erosion 3-some habitat development/protection 2 - minimal effect 1-No change 0- negative effect	0.1
Cost	To provide cost effective solutions	Quantitative	Capital Cost	Group costs for each option. 1 -High cost 4- Low cost 5- No cost	0.12
Cost			Land Cost	Score as above	0.05
Community	Meet the social needs of the district population including	Qualitative	Considers planned future growth	How flexible is this option ? 5 - totally flexible, can adjust for growth beyond dp, 3 - flexible for dp growth and/or can be staged	0.06

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General Category	Objectives	Assessment Method	Indicator	Comment / Explanation	Weighting
	growth			1 - not very flexible 0 - constrained	
Community	Incorporate Amenity into Design	Qualitative	Incorporate Amenity into Design	5 - design has strong amenity component 4 - design can be easily adjusted to allow amenity 3 - additional cost to increase amenity 1- no amenity value 0 - negative amenity effect	0.06
Community	To protect the health and safety of the public by controlling or mitigating the adverse impacts of flooding where practical.	Quantitative	No habitable floors predicted to be flooded in 100 year	Estimate habitable floors flooded and score as follows: 5- 100% mitigation 3 - most 2-Some 0-No mitigation	0.08
Community			No habitable floors predicted to be flooded in 10 year	Rank the option vis no houses flooded, score 5 = 100%, then grade down to 0	0.06
Cultural		Qualitative	Temporary indication of cultural acceptability (to be confirmed in consultation)	5 - low risk of rejection by iwi 3 - medium risk of rejection by iwi 1-high risk of rejection by iwi	0.05
Risk	Minimise risk to council and the community	Qualitative	Risk of Cost Escalation due to construction unknowns	5 - low risk 3 - medium risk 1-high risk	0.05
			Risk of protracted consent process with authorities	5 - low risk 3 - medium risk 1-high risk	0.05
			Risk of operational failure	5 - low risk 3 - medium risk 1-high risk	0.08
			Risk of land availability (negotiation breakdowns, increase in land cost etc)	5 - low risk 3 - medium risk 1-high risk	0.05

### 8.3 Results of Options Evaluation

The following table summarises the options considered for each issue in the catchment where a number of options were investigated, and allocates an evaluation score and rank for each option, based on the weighted indicators described above. Note that a number of the options have not been compared – these are predominantly small projects with a localised effect, rather than catchment-wide benefits.

It should also be noted that for a number of issues, such as potential future flooding, a number of different options may be implemented in parallel. The display of these options in this table is in these examples for information purposes, to assess how each option meets the criteria set for Stanmore Bay.

Appendix F contains the full scores and ranking for all options.

**Table 8-2: Options Evaluation Results**

<b>Issue</b>	<b>Option</b>	<b>Weighted Score</b>	<b>Rank (weighted)</b>
Current Flooding in Vipond Stream Catchments	V2 Increase diversion weir to max storage	2.53	1
	V1 Purchase houses	2.17	5
	V3 WQ ponds	2.29	4
	V4 Widen channel	1.94	6
	V6 retrofit on site mgmt	2.38	3
	V7 wingwalls on Langton Rd culvert	2.59	Not ranked – localised flooding options
	V8 bund on D'oyly rd	3.1	
	V5 Upgrade Kauri culvert	2.36	
	V9 Small capital improvements	n/a	
Current Flooding in Stanmore Stream Catchments	S1a on line storage	2.28	2
	S1b off line storage	2.72	1
	S2 Diversion	1.55	4
	S3 On site mgmt	2.26	3
	S4 stopbank Rata and Rimu Rds	3.02	not ranked – localized flooding options
	S5 Small capital works	2.6	
Current Flooding in Brightside Stream Catchments	B1 in line storage	2.44	1
	B2 parallel diversion	1.68	7
	B3 divert catchment 4 upper	1.94	5
	B4 enclose Brightside drain	1.7	6
	B5 purchase houses	2.11	3

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	B6 on site management	2.34	2
	B7 Line Brightside drain	2.08	4
	B8 Small capital works	2.6	n/a

<b>Issue</b>	<b>Option</b>	<b>Weighted Score</b>	<b>Rank (weighted)</b>
Erosion protection	EP1 new culvert	1.84	2
	EP2 line channel	1.55	3
	EP3 localised erosion Protection	2.36	1
Point source contamination	PS1 divert stormwater reticulation	1.82	2
	PS2 landfill mgmt plan	2.96	1
Potential future flooding	FF1 2ndry flow path required	2.76	7
	FF2 flood hazard design	2.84	6
	FF3 limit imperviousness	2.86	4
	FF4 hydrological neutrality	3.4	1
	FF5 LID	3.22	2
	FF6 2ndry flow path design	2.76	7
	FF7 on site storage	2.61	10
	FF8 catchment based storage	2.75	9
	FF8S offline storage/ treatment	2.91	3
	FF8B offline storage/ treatment	2.85	5
Erosion and stability	E1 sediment and erosion control plans	3.02	n/a
	E2 limit soil exposure	3.01	n/a
Diffuse contaminants - existing	DE1 enhance existing treatment	2.24	3
	DE2 incorporate treatment into cap works	3.08	1
	DE3 Retrofit	2.44	2
Diffuse contaminants - future	DF1 at source treatment	2.93	1
	DF2 - catchment based treatment	2.9	2
Stream mgmt and protection	SP1 riparian margins	2.7	n/a
	SP2 prohibit dams	3.34	
	SP3 remove fish barriers	2.85	
	SP4 stream maintenance	3.28	

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## 8.4 Discussion

### ***Brightside and Vipond Catchments***

Table 8-2 above provides information on the scores generated by each of the options compared. One of the strong themes that is apparent is that on-site management of stormwater is an option that generates high scores during the evaluation. These options are effective in reducing contaminant loading at-source, however would be difficult to implement catchment-wide in Stanmore Bay due to the steepness of the terrain. Risks relating to maintenance of the devices and cost escalation are also relatively high.

Because of the interactive nature of the three stream catchments in Stanmore Bay, implementing a solution in one catchment can also have an impact on another stream catchment. Considering the options in isolation can therefore lead to an underestimate of the effect of the option, assuming that works will also be implemented in other stream catchments.

For this reason, combinations of options were investigated during the modelling component of this project, with particular emphasis given to the Brightside and Vipond catchment interactions (due to most of the house flooding being near the confluence of these streams).

It can be seen from Table 8-3 below that the number of houses with habitable floor flooding during a 10 year event in the two catchments can be reduced from 6 to 4 (with a further 4 having their freeboard increased) by raising the weir in the D'Oyly reserve and spending approximately \$300,000. To reduce the number of flooded houses by a further 2, \$1.7m would need to be spent. To reduce to 1 house at risk, \$5m+ would be required.

It should be noted that the modelled options have concentrated on alleviating flooding in the catchment. These options, when compared using the evaluation matrix, also had the impacts on water quality and community perception evaluated, and therefore did not score as highly as at-source options which included amenity value and enhanced stormwater treatment components.

### ***Brightside Stream Catchment***

Additional storage in the upper part of the Brightside stream catchment would cost approximately \$1m, and would be council owned and maintained. Conversely, on-site stormwater management in the entire Brightside catchment would cost approximately \$4m. When considering which option to pursue, council budgets and timeframes would also become a factor.

The in-line storage suggested in the catchment would be designed to link with the Penlink stormwater management in the catchment. Storage could also potentially be located off-line, depending on the stream management objectives established, in conjunction with the already consented Penlink project.

Limited retrofit of stormwater detention tanks and swales in the catchment would cost approximately \$1.4-\$2m. This option would need to be hydraulically modelled to determine the impact of these devices

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on flooding during both high and low frequency storms. Careful management of the devices once installed would also be essential, due to high risks.

### ***Stanmore Stream Catchment***

Issues in the Stanmore stream catchment are not as focused on current flooding as in the other two catchments, therefore current flooding problems can be addressed by the construction of a stopbank near the affected houses (Rata/Rimu Roads). However, future development controls in this catchment are particularly important, as there are a number of areas yet to be developed. Hydrological neutrality has been identified as the single best solution for preventing future flooding in this area, while at the same time providing contaminant removal. Low impact design methods can be utilised to provide hydrological neutrality, rather than catchment-based controls (lowest scoring option), however an additional key issue in the catchment is the landfill site – the storage currently available upstream of the landfill site may be relocated further up the catchment, or the need for storage eliminated by diverting flows around the landfill via a larger capacity pipe. A landfill management plan is required to determine what option for reducing potential leachate discharge would be appropriate. The implementation of these options would need to be assessed in terms of the down-stream effect in on of erosion issues on the lower side of Whangaparaoa Road.

The catchment stream also has a high amenity potential near the bottom of the catchment. Opportunities for enhancing this area are being investigated by RDC.

### ***All Catchments***

For future development, the evaluation matrix has clearly indicated that at-source stormwater management (hydrological neutrality, Low Impact Design) is preferable to catchment-based treatment. This is most easily addressed by development rules, and allows for flexibility in design of subdivisions and commercial areas. It is important in this catchment that future development and in-fill does not exacerbate the problems that already exist in the lower catchment.

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Table 8-3: Modelled Option Combinations

Option	Houses at Risk			Option Combinations					Cost
	Habitable Floor	Freeboard < 200mm	Freeboard < 500mm	Do Nothing	V2 – Raise D'Oyly Weir	B1 – 20,000m <sup>3</sup> storage in Upper Brightside	B4 / B7 enclose or line Brightside drain along Brightside Road	B3 Divert Catchment 4A	
<b>10 Year Rainfall Event</b>									
Existing Development	5	11	21						Nil
Max future development	6	11	21						Nil
F1	4	7	17						\$300K
F2	5	13	19						\$1m
F3	6	11	21						\$350k
F4	6	10	19				3*1m box		\$3.7m
F5	3	7	17						\$1.3m
F6	2	5	16						\$1.7m
F7	5	9	17				3m wide Lined Channel		\$1m

# Options Evaluation

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Option	Houses at Risk			Option Combinations					Cost
	Habitable Floor	Freeboard < 200mm	Freeboard < 500mm	Do Nothing	V2 – Raise D'Oyly Weir	B1 – 20,000m <sup>3</sup> storage in Upper Brightside	B4 / B7 enclose or line Brightside drain along Brightside Road	B3 Divert Catchment 4A	
F8	6	10	17				Twin 1.8m Culverts		Not costed
F9	1	4	14				3*1m box		\$5m
F10	1	4	12				3*1m box		\$5.4m

100 year event									
X-X	26	45	69	Do nothing					
X-MPD	20	37	64	Do nothing					
F11	13	17	49				3*1m box		\$5.4m
F12	9	18	47	Impact of raising the weir further	Weir at RL7.6				
F1	4	7	64						

## 9.1 Auckland Regional Council

Site visits and extensive discussions have been undertaken with the Auckland Regional Council as part of the catchment management planning development. On-going discussions with ARC have occurred during the development of the management plan, and analysis of options. The ARC have provided review of the plan, and their comments have been incorporated into the final document.

ARC comments and section 92 requests have been incorporated into this plan.

## 9.2 Iwi

Iwi consultation is expected to progress in parallel with the submission of a draft ICMP to the ARC and community.

## 9.3 Community

As identified in Section 5.1.1, stormwater questionnaires were delivered to the community in the catchment. There were a large number of responses, and a number of residents have been visited by council staff to discuss flooding issues in the catchment. The Stanmore Bay community has also been consulted extensively with respect to the Hibiscus Coast Sewerage Strategy.

Further consultation with all parties is anticipated when the network consent application is notified.

### 10.1 Recommendations – Capital Works

The options analysis and evaluation of capital works for the catchment has been extensive. The options for the reduction of flooding in Stanmore Bay are expensive, and are also limited in their amenity and contaminant removal value. The following programme of works is proposed to provide progressive improvement to stormwater quantity and quality issues in the catchment, and also includes some further investigative studies to ensure that money is being spent wisely.

**Table 10-1: Recommended Capital Works**

<b>Priority</b>	<b>Works</b>	<b>Option No.</b>	<b>Est. Cost</b>	<b>Comments/Timing</b>
1	Bund in D'Oyly Reserve raised to 6.8m	V2	\$300k	Improves flood control, maximises storage, incorporates landscaping of D'Oyly reserve and minor quality treatment. On-site retrofit prohibitively expensive. Completed in 2006.
2	Bund on Rata/Rimu Roads	S3	<\$70k	Bunding during redevelopment to fully protect properties.
3, 4	Minor capital works – Vipond Stream: <ul style="list-style-type: none"> <li>- Erosion protection/planting near Langton;</li> <li>- Relocate cable blocking culvert;</li> <li>- Improve Langton culvert entry;</li> <li>- Minor diversion of local Knott and Langton drainage into diversion pipeline; and,</li> <li>- Reticulation extension.</li> </ul>	V7, V8, V9, S5, B8	<\$70k \$50k p/a	Annual cost for small works. To be prioritised based on questionnaire information, development proposals and requests for service.
5	Ongoing stream maintenance plan, incorporating management/removal of fish barriers.	SP4	<\$100k	Liaise with ARC, RDC has stream-clearing consent, requires monitoring.
6	Localised erosion protection in Stanmore Stream (654a Whangaparaoa Rd)	EP3	\$150k	Undertaken in 2006.

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Priority	Works	Option No.	Est. Cost	Comments/Timing
7	Brightside catchment – Pond in upper catchment	B1	\$1m	In-line storage, further storage/treatment in conjunction with Penlink.
8	Landfill Investigation and management plan implementation.	PS2	>\$50k	Evaluate condition of stormwater pipe through landfill. Undertaken in 2006.
9	Stanmore catchment – Upstream storage	S1	\$900k	May be undertaken in conjunction with development/ pipe diversion projects.
10	Raise / Purchase of houses not protected by programme of works.	V1, B5	Not costed	Depends on effect of implemented works. Likely to include up to 11 houses.
11	Retrofit of stormwater treatment in catchment	DE3	Not costed	Depends on the extent to which treatment is incorporated into capital works above.

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Figure 10-1: Proposed Works

### 10.2 Recommendations – Future Development

Recommended rules for future development and re-development are provided below, based on the evaluation undertaken of options for future development issues such as flooding and contaminant loading.

It is recommended that the following rules be utilised in Stanmore Bay to control the stormwater effects from future development. These rules apply to the subdivision and development of residential and industrial land:

#### 10.2.1 Residential Subdivision Land Use

1. Pre-development flow regime is to be retained on all sites for storm events up to a 1 in 100 year ARI storm in the Brightside and Vipond stream catchments. 1 in 2 and 1 in 10 year pre-development flows are to be replicated in the Stanmore catchment. This is to be achieved through a combination of small capital works, localised works, ongoing stream maintenance and development controls.
2. Secondary flow paths are to be provided where primary flows exceed 200 l/s. Flow paths shall be located in roads and reserves where practicable. Drainage easements shall be provided for flow paths through private property.
3. Stormwater management design details and maintenance plans are to be submitted with all consent applications.
4. Stormwater runoff from all new impervious surfaces >1,000 m<sup>2</sup> must be treated to the equivalent of 75% removal of Total Suspended Solids on an annualised basis.
5. Stormwater management in the catchment is to be undertaken in coordination with wastewater and water supply planning where practicable.
6. Fully integrated Low impact design (i.e. not solely on-site storage) or offline storage is preferred to control stormwater in new developments to achieve hydrological neutrality.
7. Site imperviousness is not to exceed 60%.
8. Direct discharge of stormwater to ground is prohibited.

#### Streams

9. Piping of perennial catchment streams identified in Figure 2-6 is prohibited (except for road crossings).
10. Direct private piped discharges into streams are to be avoided where practicable. Where unavoidable, erosion protection shall be provided for any piped discharge of stormwater into catchment watercourses, and stormwater retention for erosion protection purposes shall be provided in accordance with ARC TP10.

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11. A riparian margin of 10m on each side of all perennial catchment streams identified in Figure 2-6 is to be established as new or re-development occurs (note that the riparian planting in these buffers should aim to be weed resistant).
  12. Enhancement of stream amenity values is to be maximised in category 3 and 4 streams (lower Stanmore and Vipond streams).

### Construction

13. All new development must comply with ARC Technical Publication 90 (ARC, 1999c), Erosion and Sediment Control Guidelines for Land Disturbing Activities.
14. No structures are to be placed within the 100 year flood plain identified in Figure 5-2. Where development is proposed in areas within 50m of the flood plains identified in this plan, developers are to undertake additional modelling to confirm the levels of the flood plain in that area.
15. Habitable floors minimum level shall be the greater of the value specified in the District Plan, 500mm above the 1 in 100 year ARI flood plain level, or 200mm above the sea level inundation level (3.7m RL). Properties within 50m of the coastline require a site specific determination of habitable floor levels and building/engineering controls to protect the structure and/or land from inundation.
16. No fill is to be placed within the 100 year flood plain identified in Figure 5-2.

### Wastewater

17. The flow rate from all bathroom basin taps, kitchen taps and showers should not exceed 9 litres/minute.
18. All toilet suites to be 6\*3 litre dual flush.
19. All properties are to include a shower.

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### 10.2.2 Commercial and Industrial Land Use

#### Stormwater

20. Pre-development flow regime is to be retained on all sites for storm events up to a 1 in 100 year ARI storm. In the Brightside and Vipond stream catchments. 1 in 2 and 1 in 10 year pre-development flows are to be replicated in the Stanmore catchment. .
21. Secondary flow paths are to be provided for where primary flows exceed 200 l/s. Flow paths shall be located in roads and reserves where practicable. Drainage easements shall be provided for flow paths through private property.
22. Stormwater management design details and maintenance plans are to be submitted with all consent applications.
23. Stormwater runoff from all impervious surfaces must be treated to the equivalent of 75% removal of Total Suspended Solids on an annualised basis.
24. Low impact design or offline storage is preferred to control stormwater in new developments to achieve hydrological neutrality.
25. Stormwater management in the catchment is to be undertaken in coordination with wastewater and water supply planning where practicable.

#### Streams

26. Piping of catchment streams identified in Figure 2-6 is prohibited (except for road crossings).
27. Piped private discharges into streams are to be avoided where practicable. Where unavoidable, erosion protection shall be provided for any piped discharge of stormwater into catchment watercourses, and stormwater retention for erosion protection purposes shall be provided in accordance with ARC TP10.
28. A riparian margin of 10m on each side of all perennial catchment streams identified in Figure 2-6 is to be established as new development occurs. Note that the riparian planting shall be developed in accordance with ARC TP148 (ARC, 2001b).
29. Construction of in-stream dams in watercourses identified as perennial in Figure 2-6 is prohibited.

#### Construction

30. All new development must comply with ARC Technical Publication 90 (ARC, 1999c), Erosion and Sediment Control Guidelines for Land Disturbing Activities.
31. No structures or fill are to be placed within the 100 year flood plain identified in Figure 5-2. Where development is proposed in areas within 50m of the flood plains identified in this plan, developers are to undertake additional modelling to confirm the levels of the flood plain in that area.

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32. Habitable floors minimum level shall be the greater of the value specified in the District Plan, 500mm above the 1 in 100 year ARI flood plain level, or 200mm above the sea level inundation level (3.7m RL). Properties within 50m of the coastline require a site specific determination of habitable floor levels and building/engineering controls to protect the structure and/or land from inundation.

### Wastewater

33. All toilet suites to be 6\*3 litre dual flush.

## 10.3 Council Implementation of the ICMP

Rodney District Council will use the following methods to ensure that the recommendations of this ICMP and NMP are implemented:

- Development consenting: Council's standards for Engineering Design and Construction provide for early consultation with the developer. Section 401.10 of the Standard says:

*"The design shall comply with any approved Stormwater Discharge Consent;*

- Long term management of the asset will be covered under general council asset management plans, maintenance contracts and subject to the Long Term Council Community Plan.
- Network maintenance, as described in Section 2.3.
- Stormwater management systems are to be installed and commissioned prior to the commencement of any stormwater discharges from impervious surfaces.
- There shall be a maintenance period for new stormwater devices to ensure that planting is established, that there is no scour or erosion and that the device functions as intended (refer to Section 10.3.1 below).
- Information on recommended small site sediment and erosion controls shall be provided with building consents.

### 10.3.1 Maintenance Plans

A maintenance plan is essential in terms of ensuring the ongoing success and effectiveness of the stormwater management system. Different components of the stormwater 'treatment train' have different maintenance requirements. ARC TP10 provides maintenance guidelines and checklists to enable operators to maintain their devices in effective working order. A maintenance plan should be included with any subdivisional and/or development proposal requiring consent. Appendix I describes technical requirements of the maintenance contract, and relevant sections of RDC's Standards for Engineering Design and Construction.

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# Appendix A

## Stream Assessments

# **Appendix B**

## **Wastewater Pumping Station AEE**

# Appendix C

## Hydrological and Hydraulic Modelling

# Appendix D

## Flooding Questionnaire Results

# Appendix E

## Option Information

# Appendix F Option Evaluation

# **Appendix G**

## **Previous CMP Excerpts**

# Appendix H

## Landfill Consent

**Appendix I**  
**Technical Requirements of the**  
**Maintenance Contract and Selections of**  
**Relevant Sections of RDC's Standards for**  
**Engineering Design and Construction**