



# **Tauranga Harbour Sediment Management Review**

**Prepared for Bay of Plenty Regional Council**



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Bay of Plenty Regional Council

Prepared By

.....  
Roger MacGibbon  
Principal Ecologist,

Opus International Consultants Limited  
Environmental  
Opus House, Princes Street  
Private Bag 3057, Waikato Mail Centre,  
Hamilton 3240, New Zealand

.....  
Keith Hamill  
Principal Environmental Scientist

Telephone: +64 7 838 9344  
Facsimile: +64 7 838 9324

.....  
Alistair Muirhead  
Planning Manager/Principal Planner/Associate

Reviewed By

.....  
Clive Tozer and Jack McConchie

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## Executive Summary

In 2006 Bay of Plenty Regional Council produced the Tauranga Harbour Integrated Management Strategy (THIMS). That strategy identified sedimentation as the most significant issue for the communities living around Tauranga Harbour. Problems such as loss of many inner harbour sandy beaches and infilling of channels limiting boat navigation were highlighted. Subsequently concerns have been expressed about the accumulating evidence from environmental monitoring that sediment discharges are resulting in serious degradation of some major aquatic ecosystems and marine communities.

Opus International Consultants were contracted to undertake a review of the Bay of Plenty Regional Council approach to managing sediment loss from rural land. Our objectives were:

1. To determine what is known about the principal sediment sources, causes and effects, and the relevant erosion and transport mechanisms within the Tauranga Harbour Catchment, with particular focus on the NIWA series of reports;
2. To identify planning and policy mechanisms (statutory and non-statutory) that could increase the focus on sediment management and improve the effectiveness of riparian and sediment management programmes;
3. Make recommendations that would lead to more targeted, effective and efficient management of sediment sources; and
4. Recommend monitoring approaches that will enable the effectiveness of the sediment management initiatives to be measured and to enable the establishment of realistic KPI's.

Our key conclusions and recommendations are:

1. *The NIWA THSS study and GLEAMS model:*

The NIWA GLEAMS model provides catchment scale estimates of likely suspended sediment yields but it does not identify the principal sediment sources. Likewise, it only considers one element of the catchment sediment budget since it does not consider land-sliding, stream bank and channel changes or harbour margin erosion. These sediment inputs, while episodic, can be significant.

Consequently, the results from GLEAMS do not focus attention on key areas, problems, or initiatives. Likewise the model does not identify how to most effectively and efficiently reduce erosion, sediment transport, and sedimentation in the harbour, nor does it indicate where resources should be directed to have the greatest effect.

In summary, there is insufficient information contained within the NIWA reports, and from available Tauranga Harbour related information sources, to develop a reasonable understanding of the dynamics of sediment storage and transport, including stream bank erosion, within the catchment stream and river channels. While the models from the THSS can be refined, we believe it will be considerably more helpful to develop a field-focused

understanding of the principal sources of sediment at a scale that can be used to better focus remedial efforts, and provide a more complete understanding of the mechanisms by which this sediment enters the stream network and is transported downstream to the harbour. Consequently, we recommend:

- The next step should involve the selection of one high priority catchment – preferably one of those with the highest specific sediment yields - for detailed mapping of potential and actual sources of sediment and sediment flux. Having identified the source of the sediment, and how it is moving through the stream network, it will then be possible to develop appropriate policies, targeted mitigation tools, and measurable and realistic KPI's.
- We recommend the following additional monitoring is undertaken in the harbour itself to establish the extent of the sedimentation problem:
  - Using sediment cores from sub-estuaries identified as having higher sedimentation rates to identify changes in the rate of sedimentation over time (and particularly fine sediment sedimentation). This will provide a reference as to the natural rate of sedimentation and help set realistic expectations.
  - Ongoing measurement of the current sedimentation rates in the inner estuaries using (for example) replicate sedimentation plates in strategic locations. This would provide an objective measure of the effectiveness of measures implemented to reduce sedimentation rates.

## *2. Statutory and non-statutory mechanisms:*

The current BOPRC approach to managing the harbour sedimentation problem is a voluntary one that relies on the provision of free technical support and a low level of financial support to encourage landowners to adopt sediment and water quality management practices on their land. The current approach does not provide the Council with the means to ensure that most effort occurs within high priority areas.

Consequently, we have recommended that BOPRC:

- Include in the Proposed Regional Policy Statement, a suite of objectives and policies for the Tauranga Harbour Catchment to identify key sediment sources such as farming activities, intensive lifestyle property development or marginal uses of steep erodible hill country. The objectives and policies would specify the type and mix of statutory and non statutory mechanisms to be employed to mitigate or avoid sediment discharge from the identified activities in the Tauranga Catchment.
- Investigate the cumulative effects of permitted activities to determine if in fact those effects are minor, or more significant. This could be achieved by undertaking a study or studies of activities that have the potential to generate sediment and are permitted under the BOPRC Water and Land Plan. Targeted monitoring of potential sediment source sites such as cultivated land and intensive rural lifestyle development would enable a clearer picture of their relative contribution to the harbour sediment load to be developed. The results of this study could be used to assess the need for any rule changes.

- Monitor more vigorously the earthworks and cultivation activity that falls within permitted activity status under the Water and Land Plan to gauge compliance and evaluate the cumulative effects of multiple adjacent permitted earthworks.
- Investigate the implementation of a sediment-focused financial support system that has two additional funding tiers to encourage sediment erosion remedial works:
  1. Provision of grant funding as high as 75% for sites located in areas rated as having the highest risk of sediment erosion AND where remedial works can be expected to generate substantial improvements. The purpose of this increased level of support would be to provide real incentive to “reluctant” landowners and greater leverage for BOPRC land managers to have remedial work done in the high priority areas. It is suggested that financial support over 50% and up to 75% should be considered on a case-by-case basis only and offered entirely at the discretion of the Council land managers.
  2. Creation of a separate pool of funding to be used by BOPRC to undertake sediment erosion remedial works in high priority areas where medium to large scale works at one location may be a cost-effective way of managing the sediment loads generated by several properties. An example would be the construction of sediment retention ponds mid catchment to intercept and trap the sediment in a stream carrying high sediment loads. The works would be owned by BOPRC and may be on land purchased or leased by Council or offered by a supporting landowner. BOPRC have been involved in the construction of sediment retention ponds in the Rotorua area for a similar purpose.

These proposed new financial support tiers could be funded by redistributing existing funding or by increased investment in sediment management.

### 3. *Mitigation tools and practices*

The successful reduction of sediment loads within streams running through rural land requires a comprehensive understanding of the sources and causes of sediment erosion within each sub-catchment. Until this is known, it is impossible to direct remediation efforts in any targeted or prioritised way.

The riparian management recipe for effective management of sediment generated by surface erosion on farmland is different to that for the management of nitrogen, faecal pathogens and riparian biodiversity, and will vary considerably in a spatial sense over the landscape. Sediment extraction from runoff can be achieved very effectively (functionally and financially) when remediation is focused on areas where runoff collects.

Measurable reductions in sediment loads in waterways can only be achieved with the cooperation of all or most landowners in each sub-catchment. A voluntary programme with low levels of financial support and no additional support for landowners in high priority areas is less likely to be successful.

Consequently, we recommend:

- As stated above, that a comprehensive field based assessment be undertaken of one of the major sediment yielding harbour catchments to develop a more accurate understanding of the principal sources and causes of sediment generation, and a better knowledge of the sediment movement pathways from source to harbour. Until this is done, remediation cannot be targeted.
- That in areas identified as major sources of sediment the primary focus of riparian management should be to reduce sediment loads to streams. Investment in other riparian targets such as biodiversity enhancement and nutrient management should be secondary to achieving better sediment management.
- Also as stated above, that BOPRC investigate introducing two additional tiers of financial support for sediment management work in areas designated to be high risk for sediment erosion and high priority for sediment management. The purpose of these additional tiers of funding would be to assist BOPRC to better direct effort and resources into high risk areas where remediation activity will generate the greatest return for every dollar spent. Funding could either be obtained by redistributing existing budgets or by investing additional funding for sediment focused activities.
- That BOPRC test and measure the effectiveness of specific, targeted, mitigation options for erosion prone and high risk areas by monitoring their effects upstream and downstream, before and after application of the particular method.
- That BOPRC upskill all of their land management advisers who need it in the latest techniques for the maximisation of sediment extraction, including the use of sediment retention ponds. Information about the most effective sediment management techniques should then be conveyed to landowners, especially those in high priority catchments, using workshops, field days and demonstration sites.
- That BOPRC undertake further field-based investigations to determine the significance of stream bank erosion as a source of sediment to Tauranga Harbour.
- That an assessment of the importance of mass movement and slip erosion as a source of sediment on the steeper farmland in the catchment be undertaken. This could be included as part of the field-based assessment of catchment sediment sources and causes recommended above.

#### *4. Monitoring and measurement*

Continued support of a voluntary programme requires on-going evidence of success. Currently, BOPRC is not reporting the extent and nature of the remedial work being undertaken that is contributing directly to the management of sediment especially in high priority areas, nor the effectiveness of remedial works as expressed by measured reductions in sediment loads. Furthermore, there is no catchment wide monitoring programme to measure changes in stream and river water quality. There is a wish to set 10

year sediment-focused KPI's but this cannot be done without the means to measure responses.

Consequently we recommend:

- That Council investigate establishing permanent monitoring stations on key waterways.
- Thought be given to initiating up-and down-stream monitoring on priority stream reaches to measure the effectiveness of sediment focused remedial works (and also to monitor the impact of storm events).
- That a more comprehensive system of recording and documenting fenced and planted riparian margins be implemented to include a measure of its potential to manage sediment effectively. This would need to include the land area protected inside the fencing, the type of vegetation growing in the fenced areas, and the capacity of those areas to intercept runoff and filter our sediment. This will provide valuable information to Council land management staff as to where increased coordination of effort might generate better results, especially when correlated with areas designated as high risk and high priority areas for sediment.



# **1 Introduction**

## **1.1 Background**

Tauranga Harbour is considered to be a significant cultural, social, ecological and economic asset to the western region of the Bay of Plenty. The harbour is fed by 28 sub-catchments that drain from the Kaimai-Mamuku Ranges through a mix of native forest, pine plantation, livestock farms, horticultural land, lifestyle blocks and urban areas.

In 2006 Bay of Plenty Regional Council produced the Tauranga Harbour Integrated Management Strategy (THIMS). That strategy identified sedimentation as the most significant issue for the communities living around the harbour. Problems such as loss of many inner harbour sandy beaches and infilling of channels limiting boat navigation were highlighted. Subsequently concerns have been expressed about the accumulating evidence from environmental monitoring that sediment discharges are resulting in serious degradation of some major aquatic ecosystems and marine communities.

Much of the sedimentation in Tauranga Harbour has been driven by historical events, nevertheless there is increasing public concern about sedimentation and in response to this growing concern about the impact of sediment within the harbour, the THIMS recommended a review of the drivers and consequences of sedimentation and its cumulative effects on the harbour. NIWA were commissioned to undertake a Tauranga Harbour Sediment Study (THSS) to look at sedimentation in the southern part of Tauranga Harbour. Earlier work has indicated that the northern part of the harbour probably received little sediment from streams, instead most was brought in from outside the harbour by littoral drift (Smale 1993).

Opus International Consultants were contracted to undertake a review of the Bay of Plenty Regional Council approach to managing sediment loss from rural land. This will include:

1. A review of what is known about the origin, causes and transport mechanisms of sediment that is subsequently deposited within Tauranga Harbour, and to identify any gaps in knowledge;
2. A review of the current statutory and non-statutory mechanisms available to develop an integrated approach to the management of sediment from rural properties within the Tauranga Harbour catchment that recognises and provides for the sustainable management of natural and physical resources;
3. Provision of recommendations that will enable Bay of Plenty Regional Council to improve the effectiveness, efficiency, and catchment-wide integration of the management of sediment generation, waterway contamination and harbour sedimentation.

## **1.2 Our approach to the review**

Our approach to this project has been to utilise our collective expertise and experience across a wide range of disciplines. These include soil erosion, hydrology, riparian management, sustainable land management practice, freshwater, terrestrial and estuarine ecology, sediment fluxes and sedimentation, river and drainage system assessment, and environmental management planning and auditing. The aims are to:

- Objectively evaluate and review the interpretation and recommendations of technical reports prepared by other parties.
- Identify the gaps in technical knowledge and data, especially those relating to the specific sources, causes and processes of erosion and sediment transport that lead to elevated sedimentation within the harbour. This will include making comparisons to other regions of NZ where appropriate, and developing recommendations as to how the identified information gaps could be filled.
- Scrutinise the policies and mechanisms outlined in all relevant statutory documents and apply our nation-wide experience to assess the efficiency and effectiveness of the mechanisms, whether they have the correct emphasis and whether they are likely to deliver the desired results. Where the current mechanisms are thought to be less than optimal, provide experience-based recommendations as to what changes should be made to develop an integrated catchment-wide approach that is efficient, effective and avoids unnecessary duplication of effort.
- Give consideration to the effectiveness of the non-statutory mechanisms used currently to manage sediment contamination of Tauranga Harbour catchment and make recommendations, based on reported performance and our project team experiences in other regions, as to how these could be improved.
- Evaluate the state of knowledge of the effectiveness of sediment erosion management practices (including the management of stream bank erosion); identify knowledge gaps; and where necessary recommend appropriate changes in practice or emphasis in managing sediment loss from rural properties.
- Provide a brief commentary on how current and recommended sediment management mechanisms may perform under altered climatic conditions.

In summary, our primary focus has been to provide recommendations and direction that will lead quickly to:

- the determination of principal sediment sources and causes, and the relevant erosion and transport mechanisms;
- more targeted, effective and efficient management of sediment sources;
- improved uptake of remediation measures by landowners in high-priority areas;
- enable changes in sediment loads and the effectiveness of remediation actions to be assessed, monitored and recorded;
- the identification of policy and planning mechanisms that could increase the focus and emphasis on sediment management and provide support to the field based remedial and mitigation activities.

## 2 Causes of sedimentation

### 2.1 Sources and causes of sediment in waterways

Sedimentation, or the deposition of sediment (especially fine sediment) on the floors of water bodies such as wetlands, lakes, estuaries and harbours, occurs when the sediment load received from the freshwater catchment exceeds the capacity of the wetland, lake, estuary or harbour to flush the sediment out. Increased sediment loads in feeding streams can lead to increased sedimentation which can have a significant negative effect on the ecology of these water bodies.

All rivers and streams have a natural sediment load which relates to the resistance of the material forming the bed, banks and catchment and the erosion potential of the flow. Increased sediment loads in streams and rivers can occur as a result of a variety of causes and processes. Most processes, except mass movement, wind erosion and the actions of livestock on stream banks, require surface water runoff to carry the sediment to the stream and river. The most predominant causes of increased sediment loads are:

1. *Mass movement erosion*: where the unconsolidated regolith on slopes or sections of hillsides slump or slip usually as a result of heavy rain or earthquakes, and most commonly on steep slopes (steeper than 15 degrees). This is the most common form of erosion in NZ hill country (Hicks and Anthony, 2001). A key factor determining the significance of such activity to downstream sedimentation rates is the connectivity of the failure and debris with the stream network.
2. *Gully erosion*: the formation of distinct channels carved into a hill slope or valley bottom by surface water runoff. Gully erosion is more likely on steeper slopes, on less cohesive and poorly compacted soils (eg. pumice).
3. *Sheet and rill erosion*: can occur on almost any land where there is sufficient slope for water to accumulate and then move across the ground surface as a result of gravity. The moving water may dislodge and carry soil particles with it. The loss of sediment to waterways as sheet erosion is most prevalent in areas subject to intense rainfall; soils with low infiltration capacity, and on soil types such as sands and silts, that are more easily transported by low volume and low velocity flowing water. Sheet erosion will develop into rill erosion (narrow miniature channels) where there are depressions or steeper sections where an increased volume of water collects or runoff velocity is greater.
4. *Streambank erosion*: accentuated by the removal of the soil anchoring effects of natural riparian vegetation, and where livestock, especially cattle, have access to stream margins.
5. *Human induced ground disturbance*, eg.. earthworks, forestry harvesting and cultivation.

Sediment loss from the land (and, consequently, increased sediment loads in streams and rivers) will increase in the following situations: (collated from MfE 2001, Hicks and Anthony 2001, Parkyn 2004):

- Land without a forest or bush canopy – intact forest canopies buffer the impact of heavy rain by reducing the intensity of the rainfall hitting the ground, by

anchoring erosion prone soils with their root systems, and by providing increased water infiltration (by utilising water from the soil and by providing a water-absorbing organic layer to the soil);

- Steep slopes (especially land steeper than 15 degrees, Class 6, 7 and 8 land) – the steeper the slope the greater the eroding power of surface water runoff.
- Land with heavily grazed vegetation cover (ie. grazed pasture) – the shorter and less dense the vegetation cover, the greater the velocity of surface runoff and the greater the erosion power.
- Soil types with poor water infiltration capacity (including soils compacted by livestock – pugging, or vehicles – roads and tracks) – less ability to absorb water means more water to run across the land surface;
- Saturated soils – more rainfall is forced to run across the land surface more quickly;
- Land where soil is exposed (eg. cultivated land; over-grazed pasture) – more soil is exposed to the eroding power of surface runoff;
- Land that receives intensive rainfall events - the greater the volume of water the greater its eroding power.

Obviously, the reverse change in one or more of these factors can also reduce sediment loss and reduce the amount of sediment reaching streams and rivers.

Erosion is a natural process and occurs on all land, however, the activities of humans on the land can accelerate the rate of erosion and sediment loss. Deforestation has had the greatest impact of all land use changes on sediment loads in streams. Research has shown that suspended sediment levels are generally two to five times higher in streams draining pasture than those draining native forests (Quinn et al, 1998). International estimates of soil loss suggest that, on average, six tonnes of soil per hectare are lost annually from pastureland, six times greater than the average rate of soil formation (MfE 2000; Pimental et al 1995).

Ultimately, the re-establishment of an intact native forest canopy would reduce accelerated erosion and sediment loss to the lowest achievable levels, however, it would still not be reduced to zero. Some erosion and sedimentation has always occurred and will continue to do so despite any intervention. Reafforestation may prove to be necessary on the steepest and most erosion prone land. Where this is not possible for a range of reasons other tools and practices are required to minimise accelerated erosion.

## 2.2 Stream channel sediment dynamics

Stream and river channels are dynamic systems that can accumulate, convey or lose sediment over time and space. At any one time the sediment inputs to a stream or river channel are unlikely to match its outputs into estuaries, harbours or the sea. Stream channels can accumulate and store considerable quantities of sediment on the inside of stream meanders, and on stream banks and flood plains that lie adjacent to the main channel. Much of this sediment is deposited during flood events but floods can also be when sediment is remobilised and carried further down the channel.

The variable capacity of streams to accumulate sediment within their channels means that sediment being discharged into harbours may be a reflection of past land use practices or past environmental processes rather than contemporary activities.

Knowledge of the current sources and causes of sediment inputs to waterways and an understanding of the sediment transport dynamics within the stream channel, including rates of deposition, stream bank erosion and channel erosion, are necessary if sediment management efforts are to be most effectively targeted.

### 3 Sources of sediment entering Tauranga Harbour.

#### 3.1 Introduction

This section describes and discusses the results of the Tauranga Harbour Sediment Study (THSS). Prior to the THSS, investigations of sediment sources to Tauranga Harbour (and in particular sources from rural land) were limited.

- The NERMN had monthly sediment monitoring within Tauranga Harbour, and river water quality monitoring (including 10 waterways within the Tauranga Harbour catchment) (Taylor 2001).
- Surman et al. (1999) assessed sediment origins in the Tauranga catchments and made some very rough estimates of the loads from different catchments. The focus of the survey was assessing debris in streams that may contribute to stream bank erosion. The study noted that in many cases stock grazing was obvious right up to the water's edge leaving exposed banks or causing direct erosion. The authors concluded that the sediment load to streams could be reduced by improved riparian management.
- Investigations have occurred on the influence of previous landslides and biotic influences on landslide occurrence in the Kaimai Range (Jane and Green 1983a, Jane and Green 1983b). The authors examined historical aerial photographs and found clear evidence of increased erosion, since 1943. This appeared to be associated with areas of poor vegetation rather than a particular slope, aspect, soil type, or geology. Browsing animals may increase the risk of further erosion following a landslide by slowing revegetation of exposed soils.
- Wildlands (2010) provided a state of environment report for the Kaimai Range and northern Mamaku plateau. This described the vegetation and land use in sub-catchments of the Tauranga Harbour. The report analysed the land cover and soil types in the catchment using the Land Use Classification but referred to the THSS for more detailed analysis of sediment sources. The report noted that the steep uplifted nature of the Kaimai Range and the steeply-incised character of streams draining the Range means that the forested headwaters have very high values for water and soil conservation.

#### 3.2 Tauranga Harbour Sediment Study (THSS)

The THSS study developed models to assess the relative contributions of various sediment sources from the Tauranga Harbour catchment and to investigate the fate of sediments deposited in Tauranga Harbour south of Matahui Point.

Catchment sediment modelling was done using the GLEAMS model. The model had limited calibration and validation. The validation that was done used historical sediment monitoring data and storm-flow sampling from three catchments and found a reasonable agreement over the long term (Parshotham et al. 2009). This empirical sampling only considered suspended sediment and not dissolved or bedload material. The model tended to over predict the sediment load with a ratio of modelled load to measured load of 1.27, 1.16 and 1.51 for the Waipapa, Kopurererua and Waimapu Streams respectively.

The fate of sediments in the harbour itself was modelled using DHI FM hydrodynamic sediment model, the SWAN wave model and the USC-3 sedimentation model (Green 2009, Prichard and Gorman 2009). These models were validated using harbour bed sediment mapping and measurements of tides, waves and sedimentation rates in the harbour. Hancock et al (2009) measured sedimentation rates from cores in 10 sub-estuaries and these were used to calibrate the USC-3 model. Overall the calibration was considered to be satisfactory (Green 2009) although there appeared to be a tendency to overestimate sedimentation rates in several sub-estuaries (i.e. measured sedimentation rates on the tidal flats in the sub-estuaries ranged from 0.75 - 1.57 mm/yr over a period of 23-90 years, while the hindcast of fine sedimentation rates in the same areas ranged from 0.8 - 2.6 mm/yr).

Overall, the various models tended to over-estimate sediment transport and deposition rates. They also tended to produce average values across wide areas and did not identify specific sources of sediment, or the mechanisms of its erosion and transport. Therefore, while the models suggested a problem of greater magnitude than may actually exist they also did not provide any detail which can be used to define focused, efficient and effective management of the potential problem.

### **3.2.1 Catchment sediment sources**

The predicted total sediment load (t/yr) to the stream network is shown in Table 3.1 and the relative yield from different land uses for a common slope, rainfall and soil is shown in Table 3.2. The catchment model predicted the highest sediment yields to occur for pasture areas, steep slopes and soils which were less well-drained. There was an estimated band of high sediment yields between the coast and ranges as a result of pasture land use on moderate slopes (Elliot et al 2010). It is suggested that these general conclusions are potentially influenced by the choice of erosion and sediment transport drivers used within the models. Without detailed calibration and field evidence it is not possible to confirm whether these drivers, and their magnitude, are appropriate for the Tauranga catchments. It is possible that a measure of the mismatch between model results and the limited empirical data is a result of inappropriate drivers.

Pasture was estimated to make the largest contribution to sediment load to streams (62.5%) because it covered a third of the catchment area and the yield (t/ha/yr) from pasture was higher than other main land uses in the catchment. Bush, scrub and native forest cover 44% of the catchment but contributed only 27.3% of the sediment load despite being on steeper, and supposedly more erosion prone land. This apparent anomaly is partly explained by the nature and thresholds relating to different forms of sediment transport and erosion.

**Table 3.1:** Sediment load and sediment yield of various land uses for the current climate and distribution of the land use (from Elliot et al. 2010).

Land use	Total load (t/yr)	Fraction of total load (%)	Total area (ha)	Fraction of total area (%)	Yield (t/ha/yr)
Pasture	119696	62.5	33262	33.7	3.6
Bush, scrub and native forest	52291	27.3	43595	43.9	1.2
Exotic forest	9079	4.7	10098	10.2	0.9
Other bare earth	3227	3.5	121	0.1	26.66
Urban earthworks	992	0.5	189	0.2	5.33
Urban and roads	2162	1.1	6416	6.5	0.34
Orchard and cropland	579	0.3	4963	5.0	0.12

**Table 3.2:** Sediment yields to streams from various land uses relative to pasture for a 10.5 degree slope, soil type Ka, and rainfall region RR1 (from Elliot et al. (2010).

Land use	Yields relative to pasture yield
Open canopy pine	0.02
Indigenous forest	0.03
Closed canopy pine	0.04
Bush and scrub	0.05
Orchard and cropland	0.05
Harvested forest	0.19
Urban grassland	0.41
Afforestation	1
Pasture	1
Quarry with treatment pond	3.2
Agricultural bare earth	8.6
Urban earthworks with seasonal control and treatment pond	0.86
Urban earthworks with seasonal control and no treatment pond	9.1
Urban earthworks with no seasonal control and treatment pond	43.3
Bare earth and land slips	47.8

The GLEAMS model only considers what might be argued to be ‘continuous’ erosion and sediment transport. Hillcountry erosion, however, is episodic with large amounts of erosion and sediment transport occurring only during infrequent extreme events. Much of this sediment is subsequently deposited on the lower and flatter slopes within the catchment. Over a longer timeframe it is likely the at least some of this apparent difference in erosion and sediment transport rates would disappear.



Uncontrolled earthworks resulted in estimates of very high sediment yields but this could be reduced dramatically by erosion and sediment control. Even if erosion and sediment controls were not in place the contribution of urban earthworks to the overall sediment load would be reasonably small (2.4%) because of the small area exposed to erosion processes compared to other land uses.

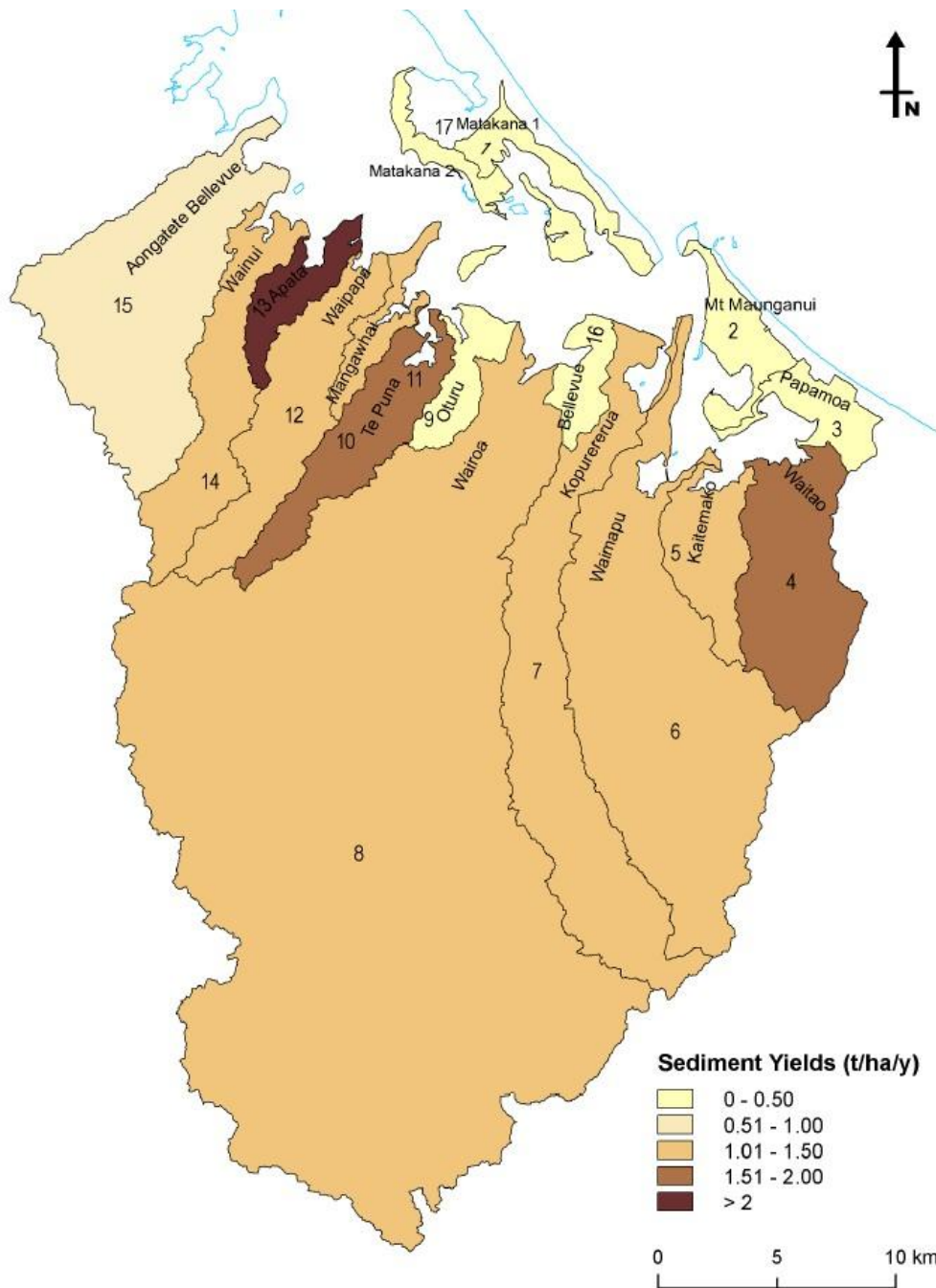
### 3.2.2 Sediment load and yield from sub-catchments

The models suggested that the overall sediment loading to the harbour was primarily driven by the size of the sub-catchment. This is logical since larger catchments only exist because they have lost more material i.e., more land has been eroded away to form the bigger catchment. Thus most of the sediment entering the harbour comes from the Wairoa sub-catchment (45.6% of the total load to the southern harbour). However, most (95%) of this sediment from the Wairoa sub-catchment is transported directly to the ocean and therefore has no impact on sedimentation rates within the harbour. The highest sediment yields (load/ha) to the harbour were from the Apata, Waitao and Te Puna sub-catchments. The sediment load and yield to the harbour from each sub-catchment is shown in Table 3.3 and Figure 3.1.

**Table 3.3:** Sediment load to Tauranga Harbour and yield from each sub-catchment (from Elliot et al. 2010). Highlights show the sub-catchments with the highest sediment yields.

Outlet ID	Name	Area (ha)	Load (t y <sup>-1</sup> )	Fraction of total load (%)	Yield (t ha <sup>-1</sup> y <sup>-1</sup> )	SDR (%)
1	Matakana 1	1409	62	0.1	0.04	85
2	Mt Maunganui	1299	393	0.4	0.30	83
3	Papamoa	1182	318	0.3	0.27	59
4	Waitao	4332	8078	7.4	1.86	64
5	Kaitemako	1989	2045	1.9	1.03	66
6	Waimapu	11824	16262	15.0	1.38	61
7	Kopurererua	7879	8113	7.5	1.03	60
8	Wairoa	46534	49641	45.6	1.07	54
9	Oturu	1158	453	0.4	0.39	60
10	Te Puna	2799	4274	3.9	1.53	57
11	Mangawhai	957	1251	1.2	1.31	75
12	Waipapa	3680	4722	4.3	1.28	55
13	Apata	1240	2955	2.7	2.38	67
14	Wainui	3523	4891	4.5	1.39	54
15	Aongatete Bellevue	7854	4717	4.3	0.60	50
16	Bellevue	950	267	0.2	0.28	80
17	Matakana 2	755	316	0.3	0.42	87
<b>Total</b>		<b>99366</b>	<b>108758</b>	<b>100</b>		
<b>Average</b>					<b>1.09</b>	<b>57</b>

The model estimated that overall about 57% of the sediment generated within the catchment was delivered to the estuary. The estimates of Sediment Delivery Ratio (SDR) were based on catchment size, particle size and stream slope, and imply a considerable degree of deposition within the stream network.



**Figure 3.1:** Sediment yield (t/ha/yr) to from Tauranga Harbour sub-catchments (source: Elliot et al. 2010). Hume et al. (2010) identified Waitao, Kaitemako and Waimapu as sub-catchments with the highest priority for mitigation based on effects and potential for mitigation.

The interesting feature here is that if this is the case then there must be significant river bed aggradation within the drainage network. This suggests either that the sediment supply indicated by the GLEAMS model is too high (which is also suggested by the field calibration), or that there is a significantly increasing flood risk as a result of rising river beds and reduced channel capacity. This issue requires further investigation and clarification.

### 3.2.3 Sedimentation within Tauranga Harbour

Sedimentation within Tauranga Harbour is complex. Substantial amounts of sediment can by-pass the harbour and be discharged directly to the ocean. In other cases sediment can be transported to sub-estuaries, or re-suspended by wind and waves following initial deposition and transported to other sub-estuaries. Modelling in Tauranga Harbour found that current sedimentation rates were elevated where sediment was trapped along the fringes of larger embayments (e.g. Welcome Bay), in sheltered embayments at river mouths (e.g. Pahoia and Wainui), and where flushing is obstructed by causeways (e.g. Te Puna inner) (Green 2010; Hume et al. 2010).

Fine sediment loss to the ocean was found to be greatest from sub-catchments that discharged close to the mouth of the harbour. For example, nearly all (95%) of the fine sediment discharge from the Wairoa River is lost to the ocean (Green 2010).

Green (2010) found that the estuaries with the highest sedimentation rates under a climate change scenario were: Te Puna inner (8 mm/yr), Waipapa River mouth (4.5mm/yr), Pahoia Beach Road (3.7 mm/y), Wainui River mouth (3.2 mm/yr), Welcome Bay (3.2 mm/y), and Mangawhai Bay inner (2.9 mm/yr).

Green (2010) also identified sub-estuaries with a high potential for adverse ecological effects. High risk of potential adverse effects was defined as where high fine-sediment sedimentation rates combined with already low seabed mud content. The result of this analysis is shown in Figure 3.2.

The modelled sedimentation rates estimated within Tauranga Harbour are low to moderate when compared to other estuaries on the east coast Auckland, Firth of Thames, and Wellington (Hancock et al 2009; Swales et al. 2002). Wriggle Coastal Management has recently revised a Sedimentation Rate Condition Rating for New Zealand estuaries which defines sedimentation rates as very low (pre-European) <1 mm/yr; low, 0.5-1mm/yr; moderate 1-2mm/y; high 2-5mm/yr and very high >5mm/yr (e.g. Robertson and Stevens 2010; L. Stevens pers comm. 2011). Compared to this rating system the inner estuaries of Tauranga Harbour would be described as having 'high' sedimentation rates.

There is a body of evidence suggesting sedimentation is a problem for the harbour including:

- Anecdotal reports of mud accumulation over previously sandy inner estuary beaches;
- A reduction in the abundance of the sea grass (an overall 34% loss between 1959 and 1996) that correlated with the relative sediment loading to sub-estuaries (Park 1999);
- Changes in the distribution of cockle and pipi shells buried in now muddy estuaries (e.g. Wainui estuary) (S. Parks pers. com. 2011);
- An increasing trend in suspended solids in some parts of the Harbour (Scholes 2005).

However, there remains a shortage of scientific data to determine whether the current sedimentation rates are having a significant ecological effect; whether the rate of sedimentation is accelerating or declining; and what proportion of the sediment load is natural as opposed to human induced.

Sediment cores taken during the harbour modelling study were adequate for validating the model but did not establish changes in the rate of sedimentation between different time periods, so could not provide a reliable reference as to the rate of sedimentation prior to large scale land disturbance.

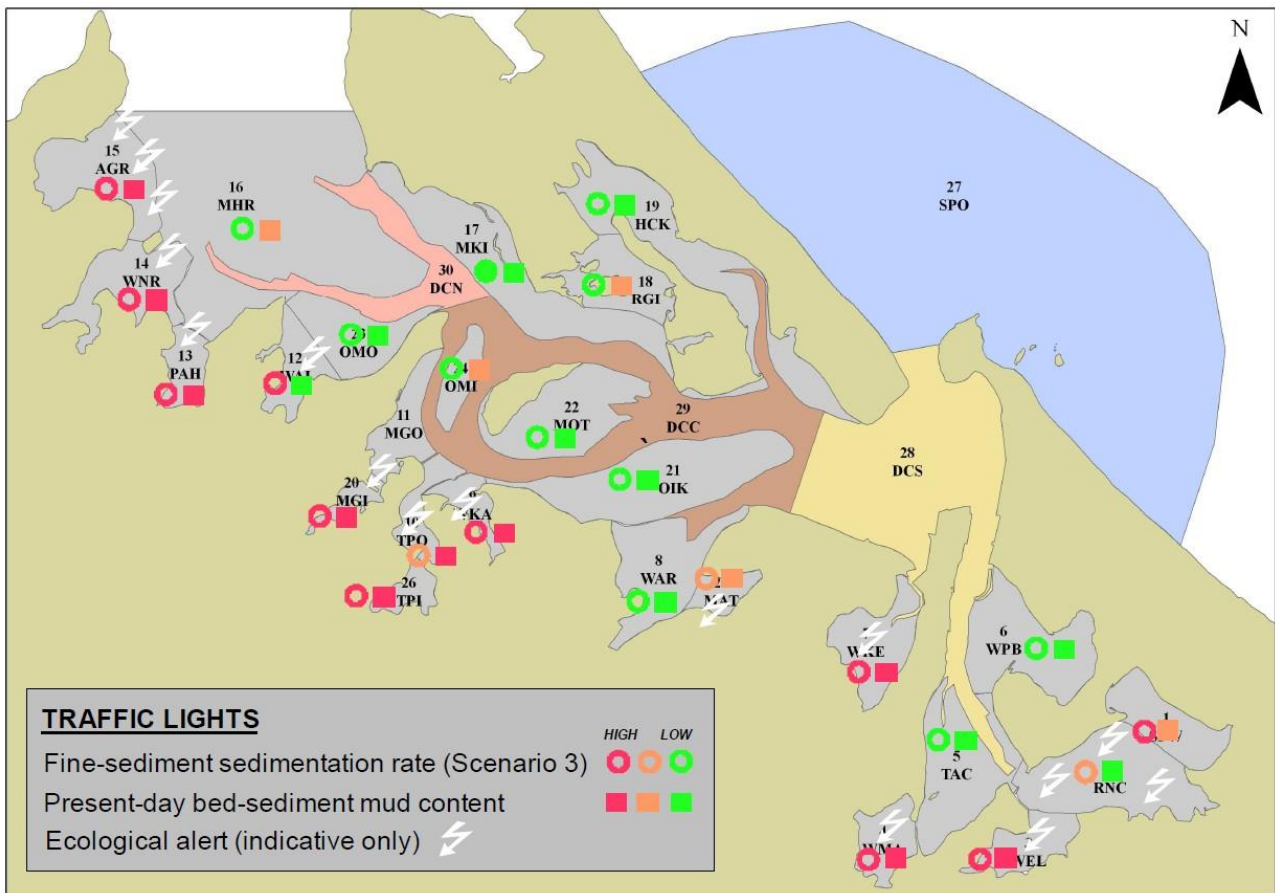
### **3.2.4 Urbanisation and climate change**

The catchment model predicted ongoing urbanisation to fractionally reduce the sedimentation within the harbour. In contrast, future climate change was predicted to increase the sediment load to the harbour by 42.8% by 2051, and by 19.4% when averaged over the period from present until 2051. The pattern was the same for all sub-catchments. This large increase in overall sediment load was due to both an increase in rainfall and the increased frequency of large rainfall events used in this model. The predictions were also high because they assumed a 'wettest' climate model (Elliot et al 2010).

Increases in catchment sediment runoff were predicted to cause even larger increases in sedimentation rates in most sub-estuaries because the increased sediment runoff would overwhelm the 'self-cleaning' processes in the harbour (Hume et al. 2010, Green 2010).

The analysis of the potential impact of predicted climate change is however very simplistic. For example, it only considered increases in rainfall and temperature. The model did not consider increases in evapo-transpiration as a result of increases in temperature. It also did not consider changes in vegetation type and cover and land-use practices which may result from any change in climate. Finally, it did not consider the impact of rises in sea level on water depths and the bathymetry of the harbour. The effects of rising sea levels on the sedimentation processes in the lower reaches of stream channels and estuaries are likely to be significantly greater than the effects of climate on sediment erosion and transport.

Another key issue underpinning the entire analysis is that the soil resource is infinite i.e., no consideration is given to the fact that soil can only be eroded once from the land surface. For example, once the soft, friable easily erodible material has been eroded the remaining surface will have increased resistance. Likewise, once a slope has experienced a landslide all the loose material has been removed leaving hard resistant bedrock; hence the presence of the ranges and hills.



**Figure 3.2:** Sedimentation rates of fine sediment assuming climate change scenario; classified as ‘high’ (>1.0 mm/yr), ‘medium’ (0.30-1.0) and ‘low’ (<0.3 mm/yr). Current mud content classified as ‘high’ (>20%), ‘medium’ (10-20%) and ‘low’ (<10%) (source Green 2010).

### 3.2.5 Constraints on the model results

The GLEAMS modelling provides a holistic assessment of the expected rates of soil erosion from the various sub-catchments and as such provides a useful tool for identifying which sub-catchments are likely to exhibit the highest sediment yields, and consequently have the greatest potential impact on sedimentation within Tauranga Harbour.

However, the model has not been calibrated to a robust level and provides only a measure of the potential for continuous, on-going soil loss. The model does not consider infrequent but usually severe erosion events which can result in large inputs of material into the stream network i.e. bank erosion, changes in channel form, and landslip erosion. These events potentially result in greater amounts of sediment mobilisation and subsequent deposition than more continual suspended sediment transport.

While the model provides an overall measure of erosion, sediment transport and deposition it does not identify the principal sources of material or the actual mobilisation mechanisms. Effective and efficient mitigation measures require targeting of interventions. This targeting of specific actions is not well supported by the results of the GLEAMS modelling.

**Table 3.4:** The scale of ecological effects in each sub-estuary and the potential for mitigation in each sub-catchment. The numbers in the body show the relative contribution of each sub-catchment to the sedimentation rate of fine sediment in each sub-estuary. Dark green cells indicate the highest priority for mitigation. (source Hume et al. 2010).

	Potential for mitigation in subcatchments	Subestuaries																									
		1- SPW Speedway	2 - RNC Rangataua Bay	3 - WEL Welcome Bay	4 - WMA Waimapu	5 - TAC Tauranga City foreshore	6 WPB Waipu Bay	7 - WKE Waikareao	8 WAR Mouth of Wairoa River	9 - WKA Wakaraka	10 - TPO Te Puna (outer)	11 - MGO Mangawhai Bay (outer)	12 - WAI Mouth of Waipapa River	13 - PAH Pahoa Beach Road	14 - WNR Mouth of Wainui River	15 - AGR Mouth of Aongatete River	16 - MHR Middle-harbour sandbanks	17 - MKI Matakana Island	18 - RGI Rangiwaia Island	19 - HCK Hunters Creek	20 - MGI Mangawhai Bay (inner)	21 - OIK Oikimoke Point	22 - MOT - Sandbank E. of Motuhua Is	23 - OMO W of Omokoroa Peninsula	24 - OMI Sandbank E of Omokoroa Pen	25 - MAT Matua	26 - TPI Te Puna (inner)
<b>Scale of adverse effects in subestuaries</b>		H	H	H	H	L	L	H	L	H	H	M	H	M	M	M	L	L	L	L	L	L	L	M	L	L	L
101 - MKE Matakana Is.	L																										
102 - MMI Mount Maunganui	L						10																				
103 - PAP Papamoa	M	12																									
104 - WTO Waitao	H	47	79	21			5																				
105 - KMK Kaitemako	H			47																							
106 - WMP Waimapu	H	31	16	26	99		26																				
107 - KOP Kopurererua	M						7	82											5								
108 - WAR Wairoa	L	7		5			48	18	20	59									65	80	19					72	
109 - OUT Oturu	M																										
110 - TPU Te Puna	M								5	98																	98
111 - MGW Mangawhai	M										24																
112 - WAI Waipapa	M											99							5								
113 - APA Apata	M												98														
114 - WNR Wainui	M													95													
115 - AGR Aongatete	M														97												
116 - MAT Matua	L																										
117 - MTW Matakana 2	L																										

### 3.2.6 Priority sub-catchments for mitigation

The THSS used expert panel workshops to assess options for mitigation (Hume et al 2009). Sub-catchments with the highest priority for targeting mitigation efforts were identified by intersecting the assessment of ecological risk in sub-estuaries with sub-catchments where the workshop identified high/medium opportunity for mitigation (i.e. high potential for adverse effects in the harbour + opportunity to mitigate). The results of this analysis are shown in Table 3.4 with the highest priority sub-catchments shaded in dark green. The numbers in the table show the relative contribution of each sub-catchment to the sedimentation rate of fine sediment in each sub-estuary.

The highest priority sub-catchments were: Waitao (WTO), Kaitemako (KMK), and Waimapu (WMP). These were identified as affecting sub-estuaries with high ecological effects and having high potential for mitigation. The next highest priority sub-catchments were: Kopurererua (KOP), Oturu (OUT), Te Puna (TPU) and Waipapa (WAI). It is not clear why Apata sub-catchment was not also included in this priority list because its receiving environment (Pahoia Beach Road (PAH)) was also identified as having a high potential for adverse ecological effects (see Figure 3.2), it was assessed as having medium potential for mitigation and it had by far the highest sediment yield of all catchments to the harbour (see Table 3.3).

### 3.2.7 Mitigation options from the THSS workshop

The THSS used expert panel workshops to assess options for mitigation (Hume et al 2009). Sediment runoff mitigation in the catchment was considered preferable to reversal methods in the harbour such as removal of mangroves or dredging. The key step however before any mitigation opportunities can be developed and promoted is the identification of the primary sediment source areas. Only once this has been done can the appropriate measures be selected, can they be applied to the right areas, and can the effect of these measures be quantified. Without such targeting of remediation and mitigation limited resources will have to be dispersed over wide areas. This will likely lead to the inefficient use of limited resources, poor results, and a poor uptake of mitigation measures. The current model does not assist in identifying these priority areas.

The key generic mitigation opportunities identified for the sub-catchments were:

- Retirement of steeper pasture areas or establishment of pine plantations on steep slopes was expected to reduce sediment yields from these areas by 5 to 10 times. Opportunities were identified for land retirement and/or pine plantations in several sub-catchments<sup>1</sup>. It was not thought practical to solely target steep slopes for forestry because the distribution of steep areas is patchy (see Hume et al. 2010).
- Enhanced floodplain deposition in the Waitao, Omanawa (in Wairoa catchment) and Waiorohi (Waimapu sub-catchment). But this could potentially conflict with other land uses and could impact on flood protection measures and both the flood hazard and risk.
- Riparian planting in pasture areas of several sub-catchments (Waitao, Waimapu, Kopurererua, Omanawa Stream in Wairoa, Mangawhai, Waipapa, and Apata). Riparian planting can act as a filter strip and /or provide protection from bank erosion. It is interesting that the GLEAM model did not consider either bank erosion or landsliding. This recommendation does not therefore appear to be derived from the work presented. Hume et al. (2010) focused on the use of riparian strips as protection from stream bank erosion. They noted

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<sup>1</sup> Opportunities for land retirement were identified in: Papamoa, Waitao, Kaitemako, Waimapu, Kopurererua, Wairoa, Te Puna, Mangawhai, Waipapa, Apata, Wainui, and Aongatete. Opportunities for pine plantations were identified in: Waitao, Kaitemako, Waimapu, Kopurererua, Wairoa, Te Puna, Mangawhai, Waipapa, Apata, Wainui, and Aongatete.

that there was uncertainty about the contribution of bank erosion to sedimentation. Actively meandering streams erode banks on the outside of bends and deposit material on the inside of bends resulting in little net change. On the other hand it was noted that unstable alluvial channels can be a significant source of sediment during storms. Overall stream channel erosion was estimated to contribute 10% of the sediment load. It is not apparent how this estimate was derived, especially since this process was not considered by the GLEAMS model. In fact, given the mismatch between the model and empirical results the rate of stream erosion must be significantly higher.

- Some minor opportunities where improved forestry control would be beneficial. Hume et al (2010) roughly estimated that harvesting may contribute 3.7% of the sediment load from forestry and introducing additional controls may reduce this contribution to 1.8%. Additional controls could have particular benefit in the Waitao catchment where forestry covers 17.5% of the catchment.
- Maintain current earthwork controls, but enhanced earthwork controls were considered to give little benefit because they occupy a small proportion of the catchment.

There appeared to be little attention given to the potential for focused riparian planting to act as filter strips. This is discussed later in this report.

Despite the recommendation of a range of mitigation options no advice has been provided as to where these resources and mitigation measures should be focused, or whether all measures were appropriate for all catchments and situations. This is the critical first step.

### 3.2.8 Information gaps

The GLEAMS catchment model did not account for:

- Mass erosion events such as landslides which could increase with more intense rainfall from climate change. These were excluded from the model based on observations that the catchment was generally stable. Given the significant landsliding episodes which have affected this area in the past the conclusion that the catchment is generally stable seems inconsistent. This is likely to reflect the nature of the erosion considered in the study, essentially continuous suspended sediment movement. Episodic landsliding is likely to have a significant impact especially when the debris has direct access to a stream channel.
- Stream bank erosion from urban or rural streams. The stream network was assumed to be purely depositional and remobilisation of deposited material or movement of bed load was not addressed by the model. If this is the case then there has been a significant change in the nature of the processes operating. Originally the channels were at least partly erosional which led to their incised character. If the streams are now depositional what has led to this change and what are the implications for future management?
- Land management activities that might reduce sediment load to streams such as riparian filter strips.



- The effects of bare earth such as building platforms or farm tracks that were permitted activities. Large areas of exposed bare earth and metal roads were identified from aerial photographs but this did not extend to fine detail of building platforms from permitted activities.
- The contribution of harbour margin erosion. If there are significant sea level changes as a result of climate change then harbour margin erosion may become an increasing source of sediment to the harbour, however, the current contribution of harbour erosion to sediment loads is unknown. A study undertaken by students for Bay of Plenty Regional Council during the summer of 2007/8 identified areas around the harbour margin where sediment erosion is occurring but the study did not address the severity of the problem nor, in any objective way, the causes. Any study undertaken to evaluate the importance of harbour margin erosion should include an evaluation of harbour margin land use to develop an understanding of whether the supply of this source of sediment is accelerating or declining.

The THSS and associated workshop acknowledged limitations to the modelling and identified further monitoring and investigation that would help improve understanding of sediment loads (Hume 2010; Elliot et al. 2010). These included:

- Assessment of stream bank erosion rates. Stream bank erosion can be high (e.g. 6000 g/m<sup>2</sup>/yr for urban streams in Auckland (Timperley and Reed 2008 in Parshotham et al. (2009)). While it can be difficult to get overall rates of bank erosion site-specific measurements are relatively quick, easy and cheap. Placing these measurements in the wider context requires multiple measurements. Stream bank erosion also needs to be considered in conjunction with stream deposition. At the present time there is limited knowledge of stream bank erosion and changes in bed elevation. Furthermore, little is known of either the temporal or spatial variation in these rates. This is an area where considerably more work is required.
- Continue long term monitoring of sediment loads to better characterise the distribution of event sediment loads and the relationship between rainfall and loads.
- Comparison between predicted and measured stream sediment loads and in particular validation of stream transport components of the model.
- Assessment of current and future prevalence of slips in the catchment. There are two key elements to consider with regard to landslip activity and downstream sedimentation. The first is the episodic but often extreme nature of landsliding events. The second is the connectivity of any landslide to the stream network i.e., how much of the material and what is the character of the material available for incorporation into the downstream sediment cascade?
- More detailed monitoring related to the effects of land use to refine estimates of the effects of various land uses.
- Assessing the feasibility and effectiveness of enhanced floodplain deposition in the Waitao and Waimapu sub-catchment.

The THSS model outputs have: indicated broad land uses and catchments which are potentially contributing to sediment to Tauranga harbour, an understanding of sediment dynamics within the harbour, and identified priority sub-catchments for focusing mitigation efforts and predicting some possible future scenarios. However, it is possible that the

results of GLEAMS were partly determined by the model drivers and not necessarily the actual physical environmental processes operating. What is required now is field calibration and validation of the model results. This would include specifically: identifying the sources of the sediment; how the sediment gets into the stream network; and how the sediment is transported through the system. The model for example does not distinguish land management or mitigation measures (with the exception of earthwork sediment controls) that could be used to reduce erosion, sediment transport and sedimentation in the harbour. This is not surprising because the catchment model simply quantifies on a catchment basis what is already known from the literature and there was no actual calibration and limited validation. Consequently the catchment model is a blunt instrument for identifying and mitigating sources of sediment and transport mechanisms up the catchment.

### **Recommendations**

This report builds on the THSS to discuss causes of sedimentation and potential mitigation measures with a particular focus on rural and pastoral areas. It is essential, however, that effort and resources should be directed where: the problem exists in a form, and at a scale, where some effect is likely; the potential benefits of any interventions will be maximised; and where any effects of these interventions can be quantified.

There is insufficient information contained within the NIWA reports, and from available Tauranga Harbour related information sources, to develop a reasonable understanding of the dynamics of sediment storage and transport, including stream bank erosion, within the catchment stream and river channels. While the models from the THSS can be refined, we believe it will be considerably more helpful to develop a field-focused understanding of the principal sources of sediment at a scale that can be used to better focus remedial efforts, and provide a more complete understanding of the mechanisms by which this sediment enters the stream network and is transported downstream to the harbour. The monitoring is intended to be integrated with management efforts to identify key sources. We recommend:

- Choosing one of the priority catchments for detailed identification of sediment sources for focussing management efforts.. We suggest these should include the highest priority catchments (i.e. Waitao, Kaitemako and Waimapu) or Apata catchment because they have the highest sediment yields.
- Undertaking detailed mapping of sediment sources and sediment flux within these study catchments. This should identify the principal sediment sources (i.e. bare ground, stream banks, stream bed, landslides etc.) and how the erosion of sediment could be controlled (see section on mitigation options). The mapping should extend the full length of the stream network to include drains and seeps which can transport sediment further down a catchment. Work following the 2004 rainstorms in the Manawatu region showed that while sediment was mobilized over a wide area, the bulk of the sediment in the river systems came from a few small isolated locations (Hancox and Wright 2005a and b). The mapping should draw upon information in the model regarding land use, slopes etc. where appropriate. Such an exercise would also help to provide the necessary input data to refine and better calibrate the model drivers .
- For completeness, the mapping of sediment sources should build upon existing work looking at the extent of bare earth from permitted activities in the catchment such as building platforms and tracks on farms and lifestyle blocks. We do not

expect this to be a significant source of sediment on a catchment basis. A rough desktop assessment of the sediment derived from house building estimated that it would contribute less than 1%, and this was based on very conservative assumptions.<sup>2</sup>

- If stream bed and banks are a major source of sediment then simple erosion pins could be used to estimate the rates of material loss and how this is impacted by various land use, remediation, and mitigation options. This monitoring should be supported by terrestrial photography of key sites and subsequent digital image processing.
- Regular sampling of settleable sediments in the stream. This should be done longitudinally down the catchment and at sufficient spatial resolution to distinguish the effects of sediment sources and any subsequent mitigation. We recommend using simple time integrated sediment traps with multiple replicates per site. The main variable to test is mm of settled sediment measured using an Imhoff cone. Suspended sediment transport is highly episodic in nature. This creates a problem when interpreting the results of grab samples. This method accounts for some of this variability and is very cost effective.
- That Council investigate establishing permanent monitoring stations on key waterways. There is no catchment wide monitoring programme to measure changes in stream and river water quality, nor any monitoring to determine the effectiveness of riparian activity. There is a wish to set 10 year sediment-focused KPI's but this cannot be done without the means to measure responses.
- Trial specific, targeted, mitigation options for erosion prone and high risk areas by monitoring their effects upstream and downstream, before and after application of the particular method.
- Undertake targeted monitoring to evaluate the impact of severe weather events on sediment loads in the catchment.
- Assessing the feasibility and effectiveness of enhanced floodplain deposition in the Waitao and Waimapu sub-catchment.

A holistic, field-based assessment of erosion, sediment transport, and sedimentation within each sub-catchment will help to identify the source and scale of any problem, and how it might best be remedied. It will also help determining whether streambank erosion is a significant contributor to harbour sedimentation. There is unlikely to be a single cause of all erosion and sedimentation and thus there is unlikely to be a single solution. Instead there must be targeted solutions for targeted problems to achieve the greatest return on any investment of resources. The NIWA model, as it is currently, does not provide information at the sub-catchment and farm property level sufficient to identify priority sediment sources and focus remedial efforts.

Detailed mapping of sources and past and present mitigation measures undertaken can provide high level Key Performance Indicators (KPIs) – measuring the extent of remedial

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<sup>2</sup> Based on an average of about 3000 building consents per year in Tauranga and Western Bay (the proportion in the Tauranga catchment will be much less than this), and a 300m<sup>2</sup> of exposed earth per house, exposed for 6 months per year = ~45 ha exposed earth. Uncontrolled urban earth works have a sediment yield 26.7 tonnes /ha/yr which corresponds to potential yield 1201 tonnes per year. This corresponds to about 0.6% of the total sediment load.

actions implemented. Instream monitoring will provide second level KPIs – measuring the effect of the actions in terms of percentage reduction of settleable sediments. To quantitatively link this to sediment loads entering the estuary as estimated by the model will require additional monitoring of suspended sediments and/or modelling. In our view this is a lower priority.

### **Recommendation**

We recommend the following additional monitoring is undertaken in the harbour itself to establish the extent of the sedimentation problem:

- Using sediment cores from sub-estuaries identified as having higher sedimentation rates to identify changes in the rate of sedimentation over time (and particularly fine sediment sedimentation). This will provide a reference as to the natural rate of sedimentation and help set realistic expectations.
- Ongoing measurement of the current sedimentation rates in the inner estuaries using (for example) replicate sedimentation plates in strategic locations. This would provide an objective measure of the effectiveness of measures implemented to reduce sedimentation rates.
- Identification of historical sedimentation rates in conjunction with measurement of current sedimentation rates could be used to set objective and justified targets for fine-sediment sedimentation within the harbour based on historical rates.
- Consideration of ecological field measurements in the estuary itself to confirm the risk assessment and the actual extent of problems due to current sedimentation.
- The assessment of priority sub-catchments identified in Hume et al. (2010) and Green et al. (2010) were described by the authors as a 'very rough'. This prioritisation should be considered flexible and as different management opportunities are identified for each sub-catchment then the priority sub-catchments should be reassessed. Consideration should be given to elevating the priority of Pahoia Beach Road (PAH) and Wainui River mouth (WNR) because of their relatively high sedimentation rates (2.4mm/yr) compared to other sub-estuaries. (This would also occur if there was a higher cut-off (e.g. 2 mm/yr) to distinguish 'high' from 'moderate' sedimentation rates.

## **4 Statutory and non-statutory planning mechanisms for sediment control**

### **4.1 Introduction**

There are a number of statutory and non-statutory planning mechanisms that relate to the management of sediment generation in the Tauranga Harbour catchment.

A detailed analysis of these mechanisms is included in Appendix 1 of this report. The analysis includes, where applicable, objectives, policies, rules, methods of implementation, effectiveness and recommendations for future actions.

This section of the report summarises the Appendix analysis in, with a focus on the effectiveness of the mechanisms, information gaps, and recommendations for future actions.

### **4.2 Statutory Planning Instruments**

#### **4.2.1 Bay of Plenty Regional Policy Statement (RPS)**

The RPS provides a global overview of significant resource management issues for the region.<sup>3</sup> It sets out objectives, policies, methods for their implementation but does not contain rules.<sup>4</sup> The implementation of the provisions of the RPS includes the provision of services, information, incentives, imposing levies and promoting rules through regional and district plans.<sup>5</sup> The RPS sets the direction for Regional Plans and Tauranga City and Western Bay of Plenty District Plans which must give effect to the RPS.<sup>6</sup>

The effectiveness of the RPS could be improved by the inclusion of specific objectives or policies which target the issue of and outcomes sought for soil conservation as it relates to the Tauranga Harbour catchment and in particular the rural area of the catchment.

A change to the RPS is not recommended due to the BOPRC having released a Proposed Regional Policy Statement in 2010.

#### **4.2.2 Proposed Bay of Plenty Regional Policy Statement (PRPS)**

Confidence in the direction and content of the PRPS is limited due to the potential changes to the content and structure of the PRPS which can arise from the statutory process to which the PRPS is subject.

Changes and challenges to the notified PRPS can arise from:

1. The Bay of Plenty Regional Council decisions on submissions and further submissions.

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<sup>3</sup> Section 62(1) Resource Management Act 1991 (RMA)

<sup>4</sup> Section 62(1)(d) RMA

<sup>5</sup> Page 83 Bay of Plenty Regional Policy Statement (RPS)

<sup>6</sup> Sections 65(6) and 75(3)(c) RMA

2. Environment Court hearings and decisions on appeals to BOPRC decisions on submissions.

The ability to alter the contents of the PRPS while it is still open to change in the current statutory process could enable the strengthening or improving the effectiveness of the PRPS by inclusion of specific or targeted objective and policies to address the Tauranga catchment specific issues to reinforce the adverse effects that significant sediment loads are having within the catchment and on the adjacent coastal receiving environment.

### **Recommendations**

The Proposed Regional Policy Statement would be the appropriate statutory document to include objectives and policies that highlight and target the need for a reduction of the sediment load entering Tauranga Harbour and the management of sediment generated in the harbour catchment. New sediment related objectives and policies, added by way of variation or plan change, would identify the targeted sediment sources, such as but not limited to farming activities, intensive lifestyle development and marginal use of steep erodible hill country, and specify the type and mix of statutory and non statutory mechanisms to be employed.

The change or variation requires support from a review of existing technical reports and any additional investigations to decide if the evidence supported the insertion of targeted objectives and policies for the Tauranga Catchment is justified.

#### **4.2.3 Bay of Plenty Regional Water and Land Plan (RWLP)**

The RWLP encompasses a wide range of activities and specifies when that activity does or does not require resource consent.

The implementation of the RWLP's provisions is reliant upon those undertaking activities to comply with the relevant provisions or obtain resource consents.

The RWLP makes it clear when the environmental effects of an activity require resource consent to be obtained, and the matters that must be addressed in such applications throughout the region.

#### **Permitted Activities**

If not already done, an assessment of the cumulative effect of permitted activities on the environment is a matter that should be addressed to ascertain if in fact those effects are minor. The enforceability of permitted activity rules would appear to be problematic. The high number of lifestyle blocks in the catchment means that there may be many permitted activities being carried out e.g. construction of farm tracks and building pads which cumulatively may have a significant effect.

The 'passive' use of land, i.e. retention of open pasture and stock access to streams or non treatment of eroded stream banks which may contribute to sediment loads in the Tauranga catchment, only requires consent in the RWLP if observable adverse effects are identified i.e. a point source discharge of contaminants or significant discolouration of waterbodies.

### **Consented Activities**

Where an activity is consented, it appears that a combination of compliance with the consent conditions by the holder and monitoring by BOPRC staff is very effective in controlling sediment loss to the harbour. The Tauranga Harbour Sediment Study identifies that by controlling earthworks, the sediment yield from earthworks sites is markedly reduced.

### **Region Wide Rules**

The rules in the RWLP are general or region wide with some area specific rules for activities in the Rotorua lakes or other significant water bodies. There are no specific rules designed to set limits for sediment generation within the Tauranga Harbour Catchment

### **Recommendations**

#### **(i) Permitted Activities**

If not already done, investigate the cumulative effects of permitted activities to determine if in fact those effects are minor, or more significant. This could be achieved by undertaking a study or studies of activities that have the potential to generate sediment and are permitted under the BOPRC Water and Land Plan. Targeted monitoring of potential sediment source sites such as cultivated land and intensive rural lifestyle development would enable a clearer picture of their relative contribution to the harbour sediment load to be developed. The results of this study could be used to assess the need for any rule changes.

Review education and awareness campaigns for permitted activity standards to help ensure permitted activity rules are complied with.

Review the effectiveness of BOPRC permitted activity condition compliance monitoring and take action if significant non compliance is found.

#### **(ii) Region Wide Rules**

The Tauranga Catchment could benefit from a specific suite of rules to address sediment generation and mitigation issues in that catchment. However such rules could only be justified if robust data and information demonstrated that such rules would significantly reduce the adverse effects of sedimentation on the Harbour or sub estuaries. It is questionable whether such robust supporting information exists.

### **Other Regions**

A review of the Waikato Regional Plan shows that management of activities that have the potential to release sediment is similar to the BOPRC

A review of the Gisborne District Council Proposed Combined Regional Land and District Plan shows however that a different approach to management has been adopted. Gisborne District Council has divided the region into three land overlays, which broadly reflect the land's varying susceptibility to erosion. The rules relating to activities have sub-headings for each land overlay, and within these are various thresholds of environmental effects for particular activities.

### **Physical works within a riparian zone, stream channel or wetland**

In order to optimise the effectiveness of sediment management techniques it may be necessary to undertake works within a stream channel or wetland (see Section 5: Mitigation tools and practices). Utilisation of these techniques would be more likely if resource consents were not required.

In relation to undertaking physical works associated with implementing riparian protection plans, Rules 68, 69 and 66B enable exotic weed removal and planting of indigenous plants to be undertaken as a permitted activity.

The existing RWLP rules do facilitate in-stream restoration works where the permitted activity rule provisions are complied with.

Also, in relation to Riparian Management Plans which include works in a wetland, the RWLP permits planting of indigenous plants, and the modification of a wetland for the purposes of wetland maintenance or enhancement where there is a Biodiversity or Riparian Management Plan that specifically includes the wetlands works (refer Policy 135 of RWLP).

#### **4.2.4 Bay of Plenty Regional Coastal Environment Plan (CEP)**

The rules of the CEP apply to the Coastal Marine Area (CMA). The CMA is defined in the RMA as "... the foreshore, seabed, and coastal water, and the air space above the water". The CEP refers to the coastal receiving environment and its rules do not have a direct effect on landward practices which are responsible for the sediment being discharged into the CMA.

#### ***Recommendation***

No changes are made to the CEP.

#### **4.2.5 Proposed Western Bay of Plenty District Plan (PDP)**

The PDP is required by the RMA to address effects of the use of land, noise emissions, effects of surface water activities and any other functions specified in the RMA<sup>7</sup>

The WBOPDC PDP has limited effect or focus on rural land use controls relating to sediment generation within the Tauranga Catchment due to the activity focus of the planning provisions.

#### ***Recommendation***

No proposed changes to the WBOPDC PDP.

#### **4.2.6 Tauranga District Plan and the Proposed Tauranga City Plan (PTCP)**

The PTCP is required by the RMA to address effects of the use of land, noise emissions, effects of surface water activities and any other functions specified in the RMA<sup>8</sup>.

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<sup>7</sup> Sections 31(1)(b)(i) to 31(1)(b)(iii), 31(1)(d) and 31(e)



The PTCP is sufficiently advanced in a number of areas where the provisions relating to subdivision and land use are unchallenged.

The TDP and PTCP have limited effect or focus on rural land use controls relating to sediment generation within the Tauranga Catchment due to the urban focus of the planning provisions.

**Recommendation**

No proposed changes to the TCC PTCP.

### 4.3 Non Statutory Instruments

#### 4.3.1 Bay of Plenty Regional Council's Policy on Partnerships with the Private Sector (PPS)

The PPS involves the BOPRC supporting, by way of funds, technical inputs and technical advice, three environmental protection programmes:

- Biodiversity Protection Programmes
- Environmental Enhancement Fund (EEF)
- Riparian Management Plans

**Effectiveness of the voluntary programmes/plans to reduce sediment generation:**

This is not well understood, and quantitative data collection needs to be undertaken to measure sediment load of waterways with and without works installed in accordance with programmes funded by the PPS.

Determination of the effectiveness of the PPS is also being undertaken as part of the proposed wider BOPRC phone survey of rural landowners regarding sedimentation concerns to ascertain their awareness, responsibilities and use of the funding opportunities from the PPS.

Method 78 of the RWLP promotes monitoring of (a) The effectiveness of riparian management and plantings on water quality and in stream biota using a programme that is consistent with national guidelines and (b) Sites protected under covenants which are part of Environment Bay of Plenty Farm Plans, Environmental Plans and Environmental Programmes, as a means to implement the objectives and policies relating to the Integrated Management of Land and Water.

**Recommendation**

Measure quantitatively the effectiveness of the PPS mechanisms in reducing sediment generation.

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<sup>8</sup> Sections 31(1)(b)(i) to 31(1)(b)(iii),31(1)(d) and 31(e)

### **Funding support**

#### 1. Environmental Enhancement Fund (EEF)

EEF projects have a broad range of objectives and targeting sediment reduction in the Tauranga Harbour Catchment is unlikely to be the driving imperative for EEF projects.

#### 2. Riparian management and biodiversity activities

BOPRC Grant funding at up to 25% of the cost of approved Riparian Management Plan works is available and between 25-75% grant funding is available for approved Biodiversity Management Plan works/activities.

If sediment management is the highest priority it would be more appropriate for BOPRC to provide negotiated grant funding assistance based on scale/priority/'return on investment' (similar to what Hawkes Bay Regional Council is doing – refer to section 4.4 below). It is well recognised that taking care of sedimentation issues also significantly reduces nutrient loss and benefits water quality.

Another tool available to landowners is a Wetland Management Agreement, which is similar to a Riparian Management Plan, but specifically for wetlands. Provision is made for these in the RWLP – the existence of a Wetland Management Agreement permits specified works in a wetland.

### **4.3.2 Bay of Plenty Regional Council's Erosion and Sediment Guidelines for Land Disturbing Activities 2010/10 (ESCG)**

The ESCG is a non statutory document which outlines the erosion and sediment control practices to be implemented when undertaking development.

Provisions of the ESCG become a requirement when applying for and implementing resource consents to undertake land disturbing activities in the region.

The ESCG is an effective tool for providing practical guidance on how erosion and sediment control options can be utilised when undertaking land disturbing activities, and therefore in controlling sediment discharge to the harbour.

However, when resource consents are not sought or not required, adherence to the relevant provisions of the ESCG to minimise sediment discharge is much less likely to occur.

### ***Recommendation***

Discussions with BOPRC policy and consent staff should be initiated to ascertain if it is practicable to incorporate the provisions of the ESCG into the permitted activity rules of the RWLP.

### 4.3.3 Sub - Catchment Action Plans

Tauranga Harbour Restoration – Sediment Action Plan 25 January 2010 – this DRAFT plan sets out existing and planned policy and operational work to address sedimentation issues within Tauranga Harbour. It includes an outline of the catchment management approach to stream management, sediment control and biodiversity protection across the whole Tauranga Harbour catchment.

There are 28 sub catchments around Tauranga Harbour. These have been grouped into 17 working areas. The plan is to develop Sub Catchment Action Plans for all 17 working areas. These plans will form the basis of prioritising action within each of the catchments.

These plans are in the early stages of preparation and implementation. It is critical that quantitative data is collected to determine their effectiveness.

#### **Recommendation**

Complete the preparation of all 17 sub catchment plans.

### 4.3.4 Community Care Groups Support Programmes e.g. stream, estuary, and land care groups

Care Groups are organised community groups which work to protect and enhance a local area of environmental importance.

Each year, BOPRC supports Care Groups with funding, as well as offering technical advice and support. Eligibility for funding and advice is based on the groups having sound environmental objectives.

Care Groups can operate on public and private land.

#### **Recommendation**

If not already in place, implement a monitoring programme to be used to understand the extent and effectiveness of the community programmes. In particular, this monitoring should record:

- the location of the work done so that the percentage of community work occurring in high priority sediment management areas can be evaluated, and
- the nature of the work done so that its contribution to the management of sediment can be quantified.

This is discussed in more detail in a later section.

### 4.3.5 District Council non-statutory discretionary programmes

The WBOPDC 's Annual Plan 2010/2011 and Draft Annual Plan 2011/2012 makes provision for fencing grants which are in addition to the BOPRC EEF under the Natural Environment section of the Annual Plan. The WBOPDC 's Annual Plan 2010/2011 and Draft Annual Plan 2011/2012 makes provision for fencing grants which are in addition to the BOPRC EEF under the Natural Environment section of the Annual Plan.

\$97,000 was allocated to fencing grants in the year ending June 2011 which exceeded the Long Term Community Plan 2010-2019 estimate by \$29,907.00<sup>9</sup>. \$104,000 has been allocated to fencing grants in the year ending June 2012.<sup>10</sup>

The purpose of the funding is detailed in the Natural Environment section of the Annual Plan. Fencing works subject to this grant can be undertaken for pest control purposes, demarcation of stands of indigenous vegetation as well as riparian margin enhancement.

### **Recommendation**

Request from the WBOPDC the location and extent of riparian and protection works funded by WBOPDC to ascertain where the funded works have been undertaken in the District and if the works complement that undertaken by the BOPRC in the Tauranga Harbour Catchment.

## **4.4 Non-statutory mechanisms adopted by other selected regional councils**

A phone survey of six regional councils was undertaken to gain an understanding of the voluntary mechanisms they are using to manage sediment erosion and waterway contamination. In each council land management officers, or their equivalent, were spoken to. The six regional councils contacted were Waikato, Hawkes Bay, Taranaki, Northland, Horizons, and Gisborne District Council. The details of this phone survey can be found in Appendix 2.

### **4.4.1 Financial support**

All councils except Gisborne provided financial support for fencing to exclude livestock from riparian areas. The percentage of funding supplied ranged between 30% and 90% of the cost of materials and labour, with most providing support at levels less than 50%.

Hawkes Bay provided the highest level of support (90%) only for those properties in high priority catchment areas. They apply a sliding scale of financial support depending on the level of priority of the area. The level of support is determined on a case-by-case basis and the decision is made by council land management staff.

Taranaki provides discounted native plants whereas Waikato provides 30% of the cost of native plants for riparian areas. Other areas sometimes support planting but this is not their priority. Gisborne does not provide financial support for riparian planting.

As expected, the regions most prone to erosion (Gisborne, Taranaki, Hawkes Bay and Horizons) provide significant funding support for erosion control planting, including poplar planting and the establishment of forestry. All offered funding for over 50% of the costs when applications were received from high priority areas.

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<sup>9</sup> Pages 51 and 52 Western Bay of Plenty District Council Annual Plan 2010/2011.

<sup>10</sup> Page 47 52 Western Bay of Plenty District Council Annual Draft Plan 2011/2012

All officers interviewed agreed that increased levels of financial support increased landowner involvement but they also agreed that higher levels of support often produced problems with landowners who were not prepared to manage the protected areas. The Hawkes Bay attitude was, however, that greater levels of financial support were essential to improve landowner uptake and management effectiveness in high priority erosion-prone land. The cost of increased maintenance input was far less than the benefits of an increase in protection works.

#### 4.4.2 Technical support

All regions provided some level of free advisory and technical support to landowners for riparian and erosion control works. Waikato, Taranaki, Northland and Horizons all provide free environment / riparian management plan support. Taranaki (in some situations) and Horizons both require that such plans are produced before financial support is granted.

#### *Recommendations*

It is our recommendation that BOPRC investigate the introduction of two additional approaches to the funding of sediment erosion remedial works:

1. Provision of grant funding as high as 75% for sites located in areas rated as having the highest risk of sediment erosion AND where remedial works can be expected to generate substantial improvements. The purpose of this increased level of support would be to provide real incentive to “reluctant” landowners and greater leverage for BOPRC land managers to have remedial work done in the high priority areas. It is suggested that financial support over 50% and up to 75% should be considered on a case-by-case basis only and offered entirely at the discretion of the Council land managers.
2. Creation of a separate pool of funding to be used by BOPRC to undertake sediment erosion remedial works in high priority areas where medium to large scale works at one location may be a cost-effective way of managing the sediment loads generated by several properties. An example would be the construction of sediment retention ponds mid catchment to intercept and trap the sediment in a stream carrying high sediment loads. The works would be owned by BOPRC and may be on land purchased or leased by Council or offered by a supporting landowner. BOPRC have been involved in the construction of sediment retention ponds in the Rotorua area for a similar purpose.

The intention would be for both of these new approaches to be operated alongside the existing community riparian initiatives, and need not require increased financial contributions from Council. Instead funding could be redistributed so that a portion of the existing funding pool is put aside for directed high priority works. This would lower the amount available to the existing low level riparian management grant pool but would increase BOPRC's ability to focus on priority areas and increase the environmental return for every dollar invested.

## 5 Mitigation tools and practices

### 5.1 Guiding principles

Once sediment enters a stream opportunities to extract the sediment before it is deposited in lakes, estuaries and harbours are limited. Consequently, the management and control of sediment needs to be focused “upslope” from waterways.

Often the best return for effort will be achieved when resources are directed at managing the land closest to where the rainfall makes contact with the ground, ie. at the principal source of sediment, before the volume and velocity of runoff increases substantially. More sustainable cultivation, grazing and stock management practices can reduce accelerated sediment erosion significantly. However, pastoral farming invariably generates increased levels of sediment even when more sustainable land management practices are adopted. Because of this additional measures are required to intercept and filter mobilised sediment before it reaches the stream channel.

The fencing and planting of waterway margins (referred to generally as riparian management) has become the primary tool for the management of all farm induced freshwater contaminants (nitrogen, phosphorus, faecal pathogens and sediment). When designed specifically and knowledgeably to intercept and extract single priority contaminants riparian management can be very effective. However, often a generic fencing and planting formula is used as a “cure-all” for all contaminants. In these cases the effectiveness of effort can be mediocre.

### 5.2 Determining the sources and causes of sediment erosion

As discussed in previous sections of this report, sediment can arise from different sources, be generated by a range of causes, and be transported via a range of processes. The sources of sediment and causes of its mobilisation will vary across the wider landscape, within a catchment and even within the bounds of a single farm property. The prescription for minimising the amount of sediment reaching natural waterways will therefore also have to vary greatly. It is therefore a fundamental necessity that before any remedial action is planned or implemented a clear understanding of the sources and the nature/causes of the sediment erosion is gained. A great amount of wasted expense can be avoided if riparian and sediment management effort is located where it will intercept the most critical runoff and in a form that has the greatest chance of retaining or trapping the most sediment.

#### *Information gaps and recommendations*

The NIWA model does not clearly identify the primary sources and causes of sediment erosion on rural land within the harbour catchment. A reasonable level of knowledge of the main sources of sediment within each catchment is necessary if limited sediment management resources are to be utilised in the most cost-effective way and if priority areas for sediment management are to be identified.

It is our recommendation that a comprehensive field based assessment be undertaken of one of the major sediment yielding harbour catchments to develop a more accurate understanding of the principal sources and causes of sediment generation, and a better knowledge of the sediment movement pathways from source to harbour. Such a field-based assessment can be undertaken using relatively low cost methods but will generate a substantial amount of information that can be used to focus the sediment management effort and prioritise areas where greatest attention is needed and/or where greatest return for investment will be achieved.

It is also our recommendation that, once the field-based assessment is completed and a more comprehensive understanding of sediment sources and causes developed, work should be undertaken to delineate areas within the catchment that are the principal generators of sediment and these should then become high priority areas for sediment management effort and, potentially, eligible for a higher level of financial support.

### **5.3 Landowner participation**

The success of any voluntary or non-statutory mechanism rests very much on the extent to which landowners decide to participate. With a site-specific problem such as erosion or sedimentation, success also depends on where landowner participation occurs. Increased landowner participation may be achieved by:

- Education of landowners of the reason and need for the mitigation;
- Provision of information and technical help to assist with implementation;
- Financial support to reduce the cost of the works; and
- Threat of the imposition of binding rules if the voluntary approach does not work.

It is acknowledged that BOPRC has been using these tools to varying degrees for many years. These tools will usually result in greatest uptake from landowners with an interest in the environment and/ or the financial resources to contribute to the work. They will be scattered across the landscape and not necessarily located in the priority areas where most improvement can be achieved for every dollar spent.

High levels of financial assistance (over 50%) for fencing and planting have been shown to increase landowner participation (MfE 2000; C. Stace pers comm.). However, this approach also tends to lead to an attitude of reduced responsibility for on-going management. The predecessor to BOPRC offered fencing and planting subsidies as high as 87% in the 1980's in the Rotorua area (MfE 2000). This induced very high participation rates but many landowners passed the responsibility of management of the retired riparian areas back to Council. The result was a large area of poorly managed stream margins.

Council field staff spoken to as part of our phone survey (see section 4.4 and Appendix 2) generally agreed that a financial support of 25 to 30% encouraged more landowners to participate than if no assistance was offered. Such a level of assistance also conveyed the message that responsibility for management of the protected land remained with the landowner.

Hawkes Bay Regional Council has a policy of a sliding scale of subsidy up to 90% depending on where the property is located and the priority of the area for management.

The Council land management staff determine the level of subsidy on a case by case basis. This enables them to direct limited resources to where greatest improvements for every dollar spent can be achieved.

### **Information gaps and recommendations**

It is our recommendation that BOPRC:

- Continue to encourage and support community based, riparian focused initiatives such as stream care and land care groups. While the activities of these groups may not always be focused on sediment management and will often not be located in the high priority areas for sediment management, they do act as an incentive and example to other landowners to undertake similar works.
- Continue to supply the existing levels of financial support (25%) to landowners who voluntarily choose to produce and implement a riparian management plan in areas not designated as high priority for sediment management, or in high priority sediment areas where the proposed works are not sediment focused or are not likely to contribute to a significant reduction in sediment reaching waterways.
- Investigate introducing two additional tiers of financial support for sediment management work in areas designated to be high risk for sediment erosion and high priority for sediment management. These tiers are described in section 4.4.2 above. The purpose of these additional tiers of funding is to assist BOPRC to better direct effort and resources into high risk areas where remediation activity will generate the greatest return for every dollar spent. Both proposed additional tiers are likely to lead to increased ownership of works by BOPRC and thus an increased commitment to maintenance, however, the increased effectiveness of works (as measured by reduced sedimentation in Tauranga Harbour) undertaken in high priority areas should be sufficient to justify increased maintenance costs.

The third recommendation requires that good knowledge exists of the location of high risk / priority sediment erosion areas. Consequently, our recommendation (stated in the section above) that a comprehensive field based assessment of sediment sources and causes in one major catchment be undertaken will need to be actioned before such a system can be imposed.

## **5.4 Sediment mitigation tools**

### **5.4.1 Sustainable farming practices**

The implementation of cultivation, grazing and livestock management practices to minimise soil loss can significantly reduce, but not eliminate, accelerated soil erosion. This is especially the case on land that is prone to surface or sheet erosion rather than mass slip erosion.

Practices that can reduce soil erosion include (MfE 2000):

- Reduce pasture damage by avoiding over grazing and keeping stock off wet and saturated areas where treading and pugging damage can occur.



- Minimise and slow down surface runoff by allowing pastures to grow longer during the wet season on areas where runoff is more likely to occur, and by creating temporary or permanent filter strips on more level sections of the hill where runoff occurs.
- Provide frequent cut-offs along farm tracks and roads to capture surface runoff and channel this water through gently sloping ungrazed grass swales or into detention ponds to allow sediments to be captured or to settle before the water flows on to natural waterways.
- Use minimum or zero tillage for land with a high risk of surface erosion.
- Cultivate across the slopes on steeper land rather than up and down the slope.
- Avoid cultivating gullies and depressions that carry runoff.

### **Information gaps and recommendations**

The utilisation of these land management techniques by landowners is voluntary and uptake depends very much on the will of each landowner. It is our recommendation that continued efforts by regional council staff to educate landowners and farm advisers about sustainable and low-sediment yielding land management best-practices should be encouraged. However, increased adoption of these practices alone is unlikely to generate significant reductions in sediment loads in streams.

#### **5.4.2 Riparian management techniques for sediment**

##### **General principles**

The generic formula for riparian management, adopted by streamcare, landcare and other community groups throughout the country, has been to fence all stream margins and establish a 5 to 10 metre wide area between fence and stream in native trees and shrubs. This has often been “sold” as an effective “cure-all” for the reduction of all farming sourced water contaminants. However, the native tree and shrub portion of this formula may contribute little to the removal of sediment from runoff. In some cases it may even lead to increased sediment loads in streams because of increased bank erosion induced by higher levels of shade.

The formula for the optimisation of sediment extraction and the minimisation of sediment entering streams in runoff can often be quite different to that for the management of nitrogen, faecal pathogens and the enhancement of riparian biodiversity. In contrast, the formula for the extraction of sediment from farm runoff will also be quite effective at reducing phosphorus contamination of streams because phosphorus readily binds to sediment particles. Much of the phosphorus not utilised by plants is carried to waterways with sediment.

##### **Fencing**

The construction of stock-proof fencing along all stream margins is essential for the improvement of water quality in streams, rivers, lakes and wetlands. Livestock, especially cattle, entering stream channels drag sediment with them from farm tracks, disturb and mobilise sediment on the stream bottom, and trample and erode stream banks, particularly

those that are steep sided and composed of unconsolidated alluvial material (Trimble 1994).

Fencing should also be erected around all permanent wetlands (including seepage/ spring-fed wetlands) and 1<sup>st</sup> order streams and drains.

While the proportion of stream margins that are fenced in the harbour catchment seems to be relatively high (eg. 86% of the streams in the Te Manaia catchment [BOPRC 18 May 2011 powerpoint presentation]), there appears to be no accurate measure across the catchment of the effectiveness of this fencing, especially with regard to sediment management. For example, if only one side of a stream channel is fenced then the value of the fencing is minimal; or, if lower reaches of streams are fenced but the steeper upper reaches are not then the effectiveness overall can be judged as low. Furthermore, the value of fencing as a tool for the management of sediment is best measured by the volume of land removed from grazing and its capacity to intercept sediment laden runoff, rather than just a lineal measure of fencing constructed.

### **Information gaps and recommendations**

We strongly recommend that permanent fencing of all waterways continues to be encouraged throughout the catchment. Landowners should be encouraged to fence wetlands, large springs and seeps, and 1<sup>st</sup> order streams and drains as well as larger streams and rivers.

It is our recommendation that every effort should be directed at increasing the percentage of effectively fenced waterway margins in high priority / high sediment yielding areas. Efforts should be made to coordinate the fencing to achieve greatest sediment management effect. This should include the encouragement of fencing on any particular farm block where it will generate the greatest reduction of sediment flow into streams, and may need to be supported by an increased level of financial support (as discussed in sections above).

It is also our recommendation that a more comprehensive system of recording and documenting fenced and planted riparian margins be implemented to include a measure of the effectiveness of remedial work in managing each factor that affects water quality (i.e. sediment, phosphorus, nitrogen, faecal pathogens, and biodiversity). For sediment, this would need to include the land area protected inside the fencing, the type of vegetation growing in the fenced areas, and the capacity of those areas to intercept runoff and filter our sediment. This will provide valuable information to Council land management staff as to where increased coordination of effort might generate better results, especially when correlated with areas designated as high risk and high priority areas for sediment. It will also provide useful measures of effort for senior management and councillors.

### **Filter strips and beds**

#### **1. Stream margins**

Only those sections of stream margin that receive surface runoff can function to filter and trap sediment generated from farmland. Surface water runoff generally enters streams along localised channels, rills or depressions even on relatively flat farmland. Sheet runoff

may enter riparian margins along a wide, contiguous front after very heavy rain on flat country. This does not commonly occur on hill country except on more level flood deltas.

Consequently, the cost-effectiveness of planting for sediment management can be greatly increased by only planting where surface runoff is most likely to occur.

Sedges and grasses, including pasture grasses, are considerably more effective at filtering, trapping and holding sediment than are trees and shrubs (whether native or exotic). The dense ground level growth of grasses reduces the velocity and sediment transport capacity of surface runoff and enhances sediment deposition. Effective sediment filter strips can be established by allowing pasture grasses to grow thus reducing the cost of establishment to that of constructing a stock proof fence. Ungrazed grass swards can lose vigour over a number of years so the ability to mow these strips occasionally or graze them lightly with sheep can be advantageous.

The optimum width of the grass filter strip for sediment extraction depends very much on the steepness of the surrounding slopes, the volume of runoff and the concentration of sediment in the runoff. In one New Zealand study, Smith (1989) found that retired pasture buffers of 10 – 13 metres were capable of reducing suspended sediment by over 80%. But in another student study in the Waikato a well grassed buffer of 50 metres was not sufficient to prevent a noticeable proportion of fine sediment reaching the stream from moderately steep slope on a deer farm.

## 2. Runoff channel filter beds

The effectiveness of grasses and sedges at filtering out sediment in runoff increases on more gently sloping land and in proportion to the volume of vegetation that the runoff intercepts. The amount of sediment especially fine sediment that settles out increases as the flow velocity decreases, and the area available for sediment storage increases. Consequently filter strips or beds that are established along the rills, depressions and channels that concentrate runoff are more likely to be effective than narrow filter strips on the stream margin.

## 3. Existing seepage areas and wetlands

Seepage areas, wetlands and swampy areas are obvious locations for sediment management because they are generally located in areas of gentle slope that receive runoff, and they are populated by grasses and sedges.

### ***Information gaps and recommendations***

The mechanics of filter beds and strips as a tool for the management of sediment are well understood scientifically but ineffectively practised. There is a need for an increased level of education of landowners and advisers to enable them to refine the utilisation of riparian management techniques, especially the use of sediment filter strips, to achieve better results on the ground.

It is our recommendation that BOPRC upskill all of their land management advisers who need it in the latest techniques for the maximisation of sediment extraction, including the use of sediment retention ponds. Information about the most effective sediment

management techniques should then be conveyed to landowners, especially those in high priority catchments, using workshops and field days. The establishment of demonstration sites, where sediment focused best management practices have been installed, would be the most effective method of conveying the techniques to landowners.

It is also our recommendation that in areas identified as major sources of sediment the primary focus of riparian management should be to reduce sediment loads to streams. Investment in other riparian targets such as biodiversity enhancement and nutrient management should be secondary to achieving better sediment management.

### **Sediment retention ponds**

On steeper land the velocity and volume of runoff can overwhelm filter strips or beds during heavy rainstorm events, or when soils are saturated. In areas with high levels of soil erosion, filter beds and wetlands can exceed their sediment storage capacity after prolonged wet periods. They then become sources rather than traps of sediment.

The construction of sediment retention ponds along runoff channels in erosion prone catchments can greatly reduce sediment reaching streams. These ponds serve to capture sediment laden runoff, and by slowing the velocity of water flow sediment will settle to the bottom before excess water flows through the elevated outflow culvert. The accumulated sediment can be excavated from the ponds periodically and disposed of off-site. The appropriate number and size of ponds can be determined to manage anticipated flood events. BOPRC has installed two such retention ponds in the Lake Okaro catchment and these seem to be performing well (J. Pattison, pers comm.).

### ***Information gaps and recommendations***

Sediment retention ponds can be very effective tools for the reduction of sediment discharge into natural waterways. However, they must be built to acceptable design specifications and be designed to accommodate the volumes of water typically received during 5 or 10 year ARI flood events.

It is our recommendation that sediment retention pond design information, standards, and specifications be either obtained or developed. The utilisation of this technology should be encouraged amongst landowners in the high priority sediment generating areas.

### **Management of streambank erosion**

Little appears to be known about the contribution of streambank erosion to the sediment load entering Tauranga Harbour. The NIWA reports do not address this in any detail.

Streambank erosion can be significant in some catchments and minimal in others. One Canadian study (Culley and Bolton in Parkyn 2004) found that streambank erosion contributed to 32% of the sediment discharge from streams. A USA study (Line et al. 2000) demonstrated that the removal of dairy cattle from streambanks lead to a 82% reduction in suspended sediment loads along the stream.

The planting of native riparian tree species can eventually stabilise streambanks if the bank height is less than the depth of the tree root systems. Unfortunately, most of our indigenous

riparian tree species are relatively shallow rooting which means that they are prone to undercutting on entrenched stream channels. Furthermore, the planting of trees and shrubs on stream margins can increase streambank erosion by shading out the grasses and sedges that provide some surface cover. This in turn exposes the bank sediment to erosion by water.

Mechanical bank reshaping is a technique that should be utilised more frequently in catchments where streambank erosion is a significant issue. The removal of unconsolidated sediment from steep streambanks and the establishment of a more stable bank contour means that riparian margin planting can be undertaken with less risk of inducing accelerated bank erosion.

#### ***Information gaps and recommendations***

It is our recommendation that BOPRC undertake further field-based investigations to determine the significance of streambank erosion as a source of sediment to Tauranga Harbour. This work could be incorporated into the recommended catchment field assessment of sediment sources and causes (as stated in section 3.3).

#### **5.4.3 Managing mass movement and land retirement**

Sediment generated by mass movement and slip erosion requires considerably different remediation from that for surface erosion. Severe and large scale slip erosion on steep hill country, as occurs on much of the North Island East Coast, can only be effectively managed by retirement of the land from grazing and reforestation with fast growing exotic tree species or natives. The establishment of an intact forest canopy has been shown to be the key ingredient in reducing sediment outputs from these areas (M. Marden pers comm.). While it is often difficult to establish full vegetation cover on the landslide scar, planting of the toe and depositional zone can lead to disproportionate reductions in sediment being discharged into the adjacent stream or river.

In areas where mass movement is less severe the establishment of fast-growing deep-rooting willow and poplar species can be used effectively to stabilise slopes and enable pastoral farming to continue.

Mass movement is most likely to occur on steeper Class 6, 7 and 8 land. It is likely to contribute to sediment loads in the upper reaches of the Tauranga Harbour catchment. However, the NIWA study has not clearly identified the proportion or significance of the sediment arising from mass movement on farmland in the catchment. The need for improved remediation cannot therefore be assessed.

#### ***Information gaps and recommendations***

It is our recommendation that an assessment of the importance of mass movement and slip erosion as a source of sediment on the steeper farmland in the catchment be undertaken. This could be included as part of the field-based assessment of catchment sediment sources and causes recommended above.

It is also recommended that consideration be given to the sediment yield arising from indigenous forest land in the Kaimai Range, and also the pine plantations in this area. The

NIWA model suggests that the yield is low but anecdotal information from some landowners and others counters this view. This may reflect the use of inappropriate drivers in the GLEAMS model as suggested earlier.

## 6 Summary of information gaps, conclusions and recommendations

We have undertaken this Tauranga Harbour Sediment Management Review with the following objectives:

1. To determine what is known about the principal sediment sources, causes and effects, and the relevant erosion and transport mechanisms within the Tauranga Harbour Catchment, with particular focus on the NIWA series of reports;
2. To identify planning and policy mechanisms (statutory and non-statutory) that could increase the focus on sediment management and improve the effectiveness of riparian and sediment management programmes;
3. Make recommendations that would lead to more targeted, effective and efficient management of sediment sources; and
4. Recommend monitoring approaches that will enable the effectiveness of the sediment management initiatives to be measured and to enable the establishment of realistic KPI's.

Our key conclusions and recommendations are as follows:

### *1. The NIWA THSS study and GLEAMS model:*

The NIWA GLEAMS model provides catchment scale estimates of likely suspended sediment yields but it does not identify the principal sediment sources. Likewise, it only considers one element of the catchment sediment budget since it does not consider land-sliding, stream bank and channel changes or harbour margin erosion. These sediment inputs, while episodic, can be significant.

Consequently, the results from GLEAMS do not focus attention on key areas, problems, or initiatives. Likewise the model does not identify how to most effectively and efficiently reduce erosion, sediment transport, and sedimentation in the harbour, nor does it indicate where resources should be directed to have the most effect.

The calibration of the model does not appear to be robust; it significantly over-estimates sediment input to the harbour when compared to those empirical measurements that are available.

The model also seems to essentially identify only the material which is transported within the channel system. Since the bulk of erosion and sediment transport is likely to occur under high flow conditions, with considerable overbank flow, much of the sediment will not even reach the harbour but be deposited across the extensive lower flood plains.

In summary, there is insufficient information contained within the NIWA reports, and from available Tauranga Harbour related information sources, to develop a reasonable understanding of the dynamics of sediment storage and transport, including stream bank erosion, within the catchment stream and river channels. While the models from the THSS

can be refined, we believe it will be considerably more helpful to develop a field-focused understanding of the principal sources of sediment at a scale that can be used to better focus remedial efforts, and provide a more complete understanding of the mechanisms by which this sediment enters the stream network and is transported downstream to the harbour. Consequently, we recommend:

- The next step should involve the selection of one high priority catchment – preferably one of those with the highest specific sediment yields - for detailed mapping of potential and actual sources of sediment and sediment flux. Having identified the source of the sediment, and how it is moving through the stream network, it will then be possible to develop appropriate policies, targeted mitigation tools, and measurable and realistic KPI's..
- We recommend the following additional monitoring is undertaken in the harbour itself to establish the extent of the sedimentation problem:
  - Using sediment cores from sub-estuaries identified as having higher sedimentation rates to identify changes in the rate of sedimentation over time (and particularly fine sediment sedimentation). This will provide a reference as to the natural rate of sedimentation and help set realistic expectations.
  - Ongoing measurement of the current sedimentation rates in the inner estuaries using (for example) replicate sedimentation plates in strategic locations. This would provide an objective measure of the effectiveness of measures implemented to reduce sedimentation rates.

## 2. Statutory and non-statutory mechanisms:

The current BOPRC approach to managing the harbour sedimentation problem is a voluntary one that relies on the provision of free technical support and a low level of financial support to encourage landowners to adopt sediment and water quality management practices on their land. The current approach does not provide the Council with the means to ensure that most effort occurs within high priority areas.

Council rules and policies do not focus on, or prioritise, sediment management either. The permitted activity clauses in the Regional Water and Land Plan are such that the cumulative effects of multiple adjacent compliant activities could result in significant sediment discharge to waterways. In summary, Council currently has only limited ability to control and improve current levels of sediment contamination of waterways.

Consequently, we have recommended that BOPRC:

- Include in the Proposed Regional Policy Statement, a suite of objectives and policies for the Tauranga Harbour Catchment to identify key sediment sources such as farming activities, intensive lifestyle property development or marginal uses of steep erodible hill country. The objectives and policies would specify the type and mix of statutory and non statutory mechanisms to be employed to mitigate or avoid sediment discharge from the identified activities in the Tauranga Catchment.



- Investigate the cumulative effects of permitted activities to determine if in fact those effects are minor, or more significant. This could be achieved by undertaking a study or studies of activities that have the potential to generate sediment and are permitted under the BOPRC Water and Land Plan. Targeted monitoring of potential sediment source sites such as cultivated land and intensive rural lifestyle development would enable a clearer picture of their relative contribution to the harbour sediment load to be developed. The results of this study could be used to assess the need for any rule changes.
- Monitor more vigorously the earthworks and cultivation activity that falls within permitted activity status under the Water and Land Plan to gauge compliance and evaluate the cumulative effects of multiple adjacent permitted earthworks.
- Investigate the implementation of a sediment-focused financial support system that has two additional funding tiers to encourage sediment erosion remedial works:
  1. Provision of grant funding as high as 75% for sites located in areas rated as having the highest risk of sediment erosion AND where remedial works can be expected to generate substantial improvements. The purpose of this increased level of support would be to provide real incentive to “reluctant” landowners and greater leverage for BOPRC land managers to have remedial work done in the high priority areas. It is suggested that financial support over 50% and up to 75% should be considered on a case-by-case basis only and offered entirely at the discretion of the Council land managers.
  2. Creation of a separate pool of funding to be used by BOPRC to undertake sediment erosion remedial works in high priority areas where medium to large scale works at one location may be a cost-effective way of managing the sediment loads generated by several properties. An example would be the construction of sediment retention ponds mid catchment to intercept and trap the sediment in a stream carrying high sediment loads. The works would be owned by BOPRC and may be on land purchased or leased by Council or offered by a supporting landowner. BOPRC have been involved in the construction of sediment retention ponds in the Rotorua area for a similar purpose.

These proposed new financial support tiers could be funded by redistributing existing funding or increased investment in sediment management.

### 3. *Mitigation tools and practices*

The successful reduction of sediment loads within streams running through rural land requires a comprehensive understanding of the sources and causes of sediment erosion within each sub-catchment. Until this is known, it is impossible to direct remediation efforts in any targeted or prioritised way.

The riparian management recipe for effective management of sediment generated by surface erosion on farmland is different to that for the management of nitrogen, faecal pathogens and riparian biodiversity, and will vary considerably in a spatial sense over the

landscape. Sediment extraction from runoff can be achieved very effectively (functionally and financially) when remediation is focused on areas where runoff collects.

Measurable reductions in sediment loads in waterways can only be achieved with the cooperation of all or most landowners in each subcatchment. A voluntary programme with low levels of financial support and no additional support for landowners in high priority areas is less likely to be successful.

Consequently, we recommend:

- That in areas identified as major sources of sediment the primary focus of riparian management should be to reduce sediment loads to streams. Investment in other riparian targets such as biodiversity enhancement and nutrient management should be secondary to achieving better sediment management.
- As stated above, that a comprehensive field based assessment be undertaken of one of the major sediment yielding harbour catchments to develop a more accurate understanding of the principal sources and causes of sediment generation, and a better knowledge of the sediment movement pathways from source to harbour. Until this is done, remediation cannot be targeted.
- Also as stated above, that BOPRC investigate introducing two additional tiers of financial support for sediment management work in areas designated to be high risk for sediment erosion and high priority for sediment management. The purpose of these additional tiers of funding would be to assist BOPRC to better direct effort and resources into high risk areas where remediation activity will generate the greatest return for every dollar spent. Funding could either be obtained by redistributing existing budgets or by investing additional funding for sediment focused activities.
- That BOPRC test and measure the effectiveness of specific, targeted, mitigation options for erosion prone and high risk areas by monitoring their effects upstream and downstream, before and after application of the particular method.
- That BOPRC upskill all of their land management advisers who need it in the latest techniques for the maximisation of sediment extraction, including the use of sediment retention ponds. Information about the most effective sediment management techniques should then be conveyed to landowners, especially those in high priority catchments, using workshops, field days and demonstration sites.
- That BOPRC undertake further field-based investigations to determine the significance of stream bank erosion as a source of sediment to Tauranga Harbour.
- That an assessment of the importance of mass movement and slip erosion as a source of sediment on the steeper farmland in the catchment be undertaken. This could be included as part of the field-based assessment of catchment sediment sources and causes recommended above.

#### *4. Monitoring and measurement*

Continued support of a voluntary programme requires on-going evidence of success. Currently, BOPRC is not reporting the extent and nature of the remedial work being undertaken that is contributing directly to the management of sediment especially in high priority areas, nor the effectiveness of remedial works as expressed by measured

reductions in sediment loads. Furthermore, there is no catchment wide monitoring programme to measure changes in stream and river water quality. There is a wish to set 10 year sediment-focused KPI's but this cannot be done without the means to measure responses.

Consequently we recommend:

- That Council investigate establishing permanent monitoring stations on key waterways.
- Thought be given to initiating up-and down-stream monitoring on priority stream reaches to measure the effectiveness of sediment focused remedial works (and also to monitor the impact of storm events).
- That a more comprehensive system of recording and documenting fenced and planted riparian margins be implemented to include a measure of its potential to manage sediment effectively. This would need to include the land area protected inside the fencing, the type of vegetation growing in the fenced areas, and the capacity of those areas to intercept runoff and filter our sediment. This will provide valuable information to Council land management staff as to where increased coordination of effort might generate better results, especially when correlated with areas designated as high risk and high priority areas for sediment.

#### *5. Other considerations:*

We also suggest:

- That consideration be given to the sediment yield arising from indigenous forest land in the Kaimai Range, and also the pine plantations in this area.

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**Appendix 1: Tauranga Harbour Sediment Summary Table**

STATUTORY PLANNING INSTRUMENT	MECHANISMS FOR CONTROL OF SEDIMENT GENERATION AND SEDIMENTATION OF TAURANGA HARBOUR	SUPPORT MECHANISMS	EFFECTIVENESS	COMMENT
<p><b>Bay of Plenty Regional Policy Statement ( RPS)</b></p> <p>Operative 1 December 1999 - subject to three plan changes</p> <p>2008 – Significance criteria added.</p> <p>October 2009 - Growth Management provisions and boundaries inserted to reflect Smartgrowth provisions in the Bay of Plenty.</p> <p>March 2010 - Additions to Omokoroa Stage 1 Growth Area</p> <p>Provides global overview of significant resource management issues for the region.<sup>11</sup></p> <p>Sets out objectives, policies, methods for their implementation but does not contain rules.<sup>12</sup></p> <p>Implementation of RPS provisions includes the provision of services,</p>	<p>Section 6.2 Land Issues, recognises at 6.2.4 that soil conservation issues in the region link to water quality and quantity issues for example:</p> <p>Section 6.2.5 - high sediment and nutrient loads resulting from inappropriate land use practices can adversely affect water quality and use, and aquatic species and habitats.</p> <p>Section 6.2.6 – inappropriate land use can adversely affect riparian margins and wetlands, and adversely affects water quality.</p> <p>Section 9 The Coastal Environment, follows a similar format and recognises these relevant issues:</p> <p><i>‘Inappropriate land use practices and discharges to rivers are adversely affecting coastal water quality.’</i></p> <p><i>‘Estuarine areas have been significantly modified and reduced in area and quality by reclamations, drainage, river diversion, grazing and other activities’.</i><sup>15</sup></p> <p>Implementation methods for sections 6 and 9 include: encourage land management agreements<sup>16</sup> with landowners and agencies, use of education, fund riparian margin protection programmes, work with district councils to ensure district plans reflect key issues, and develop rules <sup>17</sup>through the Bay of Plenty Regional Water and Land Plan and the Bay of Plenty Regional Coastal Environment Plan.</p>	<p><b>Regional Plan Rules</b></p> <p>Provisions of the Bay of Plenty Regional Water and Land Plan and Regional Coastal Environment Plan specify when activities do and do not require resource consent.</p> <p><b>Education</b></p> <p>Technical publications - Erosion and Sediment Guidelines for Land Disturbing Activities 2010/10</p> <p><b>Financial Support and Advice</b></p> <p>Refer to Bay of Plenty Regional Council’s Policy on Partnerships with the Private Sector – Riparian Protection Plans, Biodiversity Protection Programmes, and Environmental Enhancement Fund</p>	<p>The effectiveness is limited by the fact that there is no specific objective or policy which identifies the issue of soil conservation as it relates to the Tauranga Harbour catchment and in particular the rural area of the catchment.</p> <p>The RPS provides a global region wide overview of relevant environmental issues, with the exception of the Growth Management provisions included in October 2009, which specified areas where urban growth would and would not be permitted in the Bay of Plenty.</p>	<p><b>Recommendation</b></p> <p>A mechanism to produce targeted objectives and policies for the Tauranga Catchment in the RPS, which would strengthen or improve the effectiveness of the RPS (by addressing catchment specific issues to reinforce the adverse effects that significant sediment loads are having within the catchment and on the adjacent coastal receiving environment), is a change to the RPS which is <b>not</b> recommended.</p> <p>This is because BOPRC has released a Proposed Regional Policy Statement in 2010 which would be the appropriate statutory document to amend by way of a variation or change.</p>

<sup>11</sup> Section 62(1) Resource Management Act 1991 ( RMA)

<sup>12</sup> Section 62(1)(d) RMA

<sup>15</sup> Page 120 Section 9.2 RPS

<sup>16</sup> Page 98 section 6.3.1(c) i), (vii), (ix) and page 1124 section 9.1.3( c) (ii)

<sup>17</sup> Page 98 section 6.3.1(c) ii), (iii)(x), and (xx)Page 124 section 9.3( c) (v)



STATUTORY PLANNING INSTRUMENT	MECHANISMS FOR CONTROL OF SEDIMENT GENERATION AND SEDIMENTATION OF TAURANGA HARBOUR	SUPPORT MECHANISMS	EFFECTIVENESS	COMMENT
<p>information, incentives, imposing levies and making rules<sup>13</sup></p> <p>Sets direction for Regional Plans and Tauranga City and Western Bay of Plenty District Plans which must give effect to the RPS.<sup>14</sup></p>	<p>The Growth Management provisions included in October 2009 in section 17<sup>18</sup> of the RPS specified areas where urban growth would and would not be permitted in the Bay of Plenty. Section 17 focused on the sequencing of urban development in the Bay of Plenty.</p>			
<p><b>Proposed Bay of Plenty Regional Policy Statement (PRPS)</b></p> <p>The PRPS was publicly notified on 9 November 2010.</p> <p>One hundred and eighty three submissions were lodged during the submission period which closed on 8 February 2011.</p> <p>The further submission period closed on 19 May 2011.</p>	<p>The weight given to the provisions of the PRPS is limited due to the potential changes to the content and structure of the PRPS which can arise from the statutory process to which the PRPS is subject.</p> <p>Changes and challenges to the notified PRPS can arise from:</p> <ol style="list-style-type: none"> <li>1. The Bay of Plenty Regional Council decisions on submissions and further submissions.</li> <li>2. Environment Court hearings and decisions on appeals to BOPRC decisions on submissions.</li> </ol>		<p>Strengthening or improving the effectiveness of the PRPS by inclusion of specific or targeted objective and policies to address the Tauranga catchment specific issues to reinforce the adverse effects that significant sediment loads are having within the catchment and on the adjacent coastal receiving environment.</p>	<p><b>Recommendation</b></p> <p>The Proposed Regional Policy Statement would be the appropriate statutory document to amend by way of a variation or change.</p> <p>Review existing technical reports and undertake any additional investigations to decide if the insertion of targeted objectives and policies for the Tauranga Catchment is justified.</p> <p>Need to justify the statutory intervention to satisfy section 32 of the RMA.</p>
<p><b>Bay of Plenty Regional Water and Land Plan (RWLP)</b></p> <p>The RWLP was operative on 1 December 2008</p> <p>March 2010 - Plan Changes to address rule dealing with groundwater bores and flooding effects was completed.</p> <p>The RWLP encompasses a wide</p>	<p><b>Relevant Permitted Activities</b></p> <p>The RWLP has a number of permitted activity provisions i.e. where compliance with the limits or levels specified in the relevant rule means no resource consent is required for the activity to occur. Where the activity cannot comply with all the permitted activity conditions, then resource consent is required.</p> <p><b>(i) Earthworks</b></p> <p>Specified volumes of earthworks are permitted, depending upon the distance from riparian areas, the slope of the land, and whether they can meet a number of conditions. Those conditions of relevance are: avoiding discharging untreated stormwater to vegetation or watercourses, managing storm water to avoid areas of exposed soil, avoiding causing erosion, and avoiding damage to wetlands.</p>	<p><b>Enforcement Action</b></p> <p>Where activities are undertaken without a consent being obtained, BOPRC enforce the provisions of the RWLP.</p> <p><b>Monitoring of Consented Activities</b></p> <p>Where resource consents are required, monitoring of conditions is undertaken by BOPRC staff.</p> <p><b>Financial Support and Free Advice</b></p> <p>Refer to Bay of Plenty Regional</p>	<p><b>Permitted Activities</b></p> <p>The cumulative effect of permitted activities on the environment is a matter that should be addressed to ascertain if in fact those effects are minor. The enforceability of permitted activity rules would appear to be extremely problematic. The high number of lifestyle blocks in the catchment means that there can be many permitted activities be carried out e.g farm tracks, building pads which cumulatively may have a</p>	<p><b>Recommendations</b></p> <p><b>(i) Permitted Activities</b></p> <p>Investigate the cumulative effects of permitted activities to determine if in fact those effects are minor, or more significant.</p> <p>Implement increased education and awareness campaigns for permitted activity standards.</p> <p><b>(ii) Region Wide Rules</b></p> <p>The Tauranga Catchment would benefit from a specific suite of rules to address sediment</p>

<sup>13</sup> Page 83 Bay of Plenty Regional Policy Statement ( RPS)

<sup>14</sup> Sections 65(6) and 75(3)(c) RMA

<sup>18</sup> Page 189 to 206 RPS

STATUTORY PLANNING INSTRUMENT	MECHANISMS FOR CONTROL OF SEDIMENT GENERATION AND SEDIMENTATION OF TAURANGA HARBOUR	SUPPORT MECHANISMS	EFFECTIVENESS	COMMENT
<p>range of activities and specifies when that activity does or does not require resource consent.</p> <p>The implementation of the RWLP's provisions is reliant upon those undertaking activities to comply with the relevant provisions or obtain resource consents.</p> <p>The RWLP makes it clear when the environmental effects of an activity require resource consent to be obtained, and the matters that must be addressed in such applications throughout the region.</p>	<p><b>(ii) Disturbance of Soil through Removal of Vegetation</b> The disturbance of land and soil through removal of vegetation is permitted, as long as certain criteria are met, including land slope, vulnerability of the soils to erosion, proximity to the coast, proximity to riparian margin, and whether they can meet a number of conditions. Those conditions of relevance are: avoiding discharging untreated stormwater to vegetation or watercourses, managing storm water to avoid areas of exposed soil, avoiding causing erosion, and avoiding damage to wetlands.</p> <p><b>(iii) Forest Harvesting and Forestry Earthworks</b> Any vegetation disturbance as a result of forest harvesting undertaken by Accredited Forestry Operators is permitted, as long as it can meet a number of conditions. All earthworks associated with forestry operations undertaken by Accredited Forestry Operators are permitted outside of riparian margins and sand dune country, as long as it can meet a number of conditions.</p> <p><b>(iv) Cultivation</b> Land disturbance due to cultivation is permitted as long as it is not undertaken on slopes over 25 degrees, on land subject to a high risk of erosion, on the coastal margin, and within the riparian margins of streams, rivers and wetlands, and as long as it complies with a number of conditions. Those conditions of relevance are: avoiding discharging untreated stormwater to vegetation or watercourses, managing storm water to avoid areas of exposed soil, avoiding causing erosion, and avoiding damage to wetlands, and that cultivation shall be undertaken across the contour of the land.</p> <p><b>(v) Stock Crossings of Waterways</b> Stock are permitted to cross water ways as long as either a Riparian Protection Plan or Biodiversity Management Plan is in place for a property, and the landowner is complying with that plan, or a number of other conditions are met.</p> <p><b>(vi) Stock in the Bed of a River or Stream</b> Stock are permitted in the bed of a river or stream as long as either a Riparian Protection Plan or Biodiversity Management Plan is in place for a property, and the landowner is complying with that plan, or a number of other conditions are met.</p> <p><b>(vii) Grazing of Land</b> The disturbance of land, soil and ephemeral flow paths and artificial watercourses by the grazing of stock is a permitted activity as long as either a Riparian Protection Plan or Biodiversity Management Plan is in place for a property, and the landowner is complying with that plan, or a number of other conditions are met.</p>	<p>Council's Policy on Partnerships with the Private Sector – Riparian Protection Plans, Biodiversity Protection Programmes, and Environmental Enhancement Fund.</p> <p><b>Education</b></p> <ul style="list-style-type: none"> <li>• Technical publications – Erosion and Sediment Guidelines for Land Disturbing Activities 2010/10</li> <li>• Land Management fact sheets<sup>19</sup>.</li> <li>• Tauranga Harbour Fact sheets<sup>20</sup></li> </ul>	<p>significant effect.</p> <p>The 'passive' use of land, i.e. retention of open pasture or retention of eroded stream banks which may contribute to sediment loads in the Tauranga catchment, only requires consent in the RWLP if observable adverse effects are identified i.e. a point source discharge of contaminants or significant discolouration of waterbodies.</p> <p><b>Consented Activities</b> Where an activity is consented, it appears that a combination of compliance with the consent by the holder and monitoring by BOPRC staff is very effective controlling sediment deposition in the harbour. The Tauranga Harbour Sediment Study identifies that by controlling earthworks, the sediment yield is markedly reduced.</p> <p><b>Region Wide Rules</b> The rules in the RWLP are general or region wide with some area specific rules for activities in the Rotorua lakes or other significant water bodies. There are no specific rules</p>	<p>generation and mitigation issues in that catchment.</p> <p>Undertake background research to decide if specific Tauranga Catchment rules in the RWLP are required.</p> <p>Based on the investigations, prepare specific rules for inclusion in the RWLP by way of a plan change.</p> <p>A review of the Waikato Regional Plan shows that management of activities that have the potential to release sediment is similar to the BOPRC.</p> <p>A review of the Gisborne District Council Proposed Combined Regional Land and District Plan shows however that a different approach to management is adopted.</p> <p>Gisborne District Council has divided the region into three land overlays, which broadly reflect the land's varying susceptibility to erosion. The rules relating to activities have sub-headings for each land overlay, and within these are various thresholds of environmental effects for particular activities.</p>

<sup>19</sup> <http://www.boprc.govt.nz/knowledge-centre/fact-sheets/land-management-fact-sheets.aspx>

<sup>20</sup> <http://www.boprc.govt.nz/knowledge-centre/fact-sheets/tauranga-harbour-fact-sheets.aspx>

STATUTORY PLANNING INSTRUMENT	MECHANISMS FOR CONTROL OF SEDIMENT GENERATION AND SEDIMENTATION OF TAURANGA HARBOUR	SUPPORT MECHANISMS	EFFECTIVENESS	COMMENT
	<p><b>(viii) Temporary Damming of Water in a Drain</b>                      This is permitted for a period of less than 6 months as long as it complies with a number of conditions, and of relevance, the activity shall not cause or induce erosion to the bed or banks of any surface water body or to land.</p> <p><b>(ix) Damming of Water in a River or Stream</b>                      This is permitted as long as it complies with a number of conditions, and of relevance, the activity shall not cause or induce erosion to the bed or banks of any surface water body or to land.</p> <p><b>(x) Discharge Structures in Waterbodies</b>                      The installation and use of discharge structures into rivers and streams is permitted subject to complying with a number of conditions, those of relevance being: the activity shall not disturb vegetation in a wetland, or change the water flow or quantity, or water quality in a wetland; all practicable steps shall be taken to avoid, remedy or mitigate the release of sediment during construction of the structure, and no clearly discernable change in the visual clarity of the water shall occur beyond a distance of 100 metres downstream of the activity site; the activity shall not cause or induce erosion of the bed or banks of any surface water body.</p> <p><b>(xi) Culverts in Waterbodies</b>                      The installation and use of culverts are permitted where the adjacent land slope is less than 35 degrees and they are not in a wetland, as long as a number of conditions are met, including that the construction, installation and ongoing presence of the culvert shall not cause or induce erosion of the bed or banks of any surface water body.</p> <p><b>(xii) Single Span Bridges</b>                      The installation and use of single span bridges are permitted where the adjacent land slope is less than 35 degrees and they are not in a wetland, as long as a number of conditions are met, including that the construction, installation and ongoing presence of the culvert shall not cause or induce erosion of the bed or banks of any surface water body.</p> <p><b>(xiii) Introduction of Plants to a Waterbody</b>                      The introduction of indigenous plants and associated bed disturbance is permitted as long as a number of conditions are met, including that the installation of the plants shall not cause or induce erosion of the bed or banks of any surface water body.</p> <p><b>(xiv) Removal of Plants from a Waterbody</b>                      The removal of exotic plants from a waterbody and associated bed disturbance is permitted as long as a number of conditions are met, including that the installation</p>			

STATUTORY PLANNING INSTRUMENT	MECHANISMS FOR CONTROL OF SEDIMENT GENERATION AND SEDIMENTATION OF TAURANGA HARBOUR	SUPPORT MECHANISMS	EFFECTIVENESS	COMMENT
	<p>of the plants shall not cause or induce erosion of the bed or banks of any surface water body.</p> <p><b>(xv) Maintenance of Identified Streams and Rivers (including modified watercourses)</b> Disturbance of the bed of a stream or river (including modified watercourses) that is listed in the RWLP Table 44, where the activity is necessary for the purposes of maintaining the land drainage function of the stream or river, is a permitted activity subject to a number of conditions, including that the activity shall not cause or induce erosion of the bed or banks of any surface water body.</p> <p>Not covered in the plan is maintenance of farm drains – as these are not rivers in the RMA. Therefore, no controls on the works undertaken in a farm drain, however, the discharge from them to other watercourses are controlled.</p> <p><b>(xvi) Maintenance or Enhancement of a Wetland</b> This activity is permitted if it is undertaken under a Riparian Protection Plan, Biodiversity Management Plan or Wetland Management Agreement, subject to certain other conditions.</p> <p><b>Prohibited Activities</b> Stock are prohibited from grazing in the Rotorua Lakes and the beds of Natural State Rivers (per BOPRC Water Quality Classification Maps).</p> <p><b>Financial Contributions</b> Part IV of the RWLP sets out the circumstances in which financial contributions or environmental works may be required as conditions of resource consents.</p>			
<p><b>Bay of Plenty Regional Coastal Environment Plan (CEP)</b></p> <p>Operative 1 July 2003</p> <p>22 March 2011 - change to give effect to policy 29 of the New Zealand Coastal Policy Statement 2010</p> <p>The rules of the CEP apply to the</p>	<p>Sediment discharge to the CMA is permitted by Rule 9.2.4(a) <i>“with a suspended solids concentration of the water being discharged being limited to 150 g.m-3, the water being substantially free of grease, oil, scums and foam and the maximum discharge does not exceed 80 litres per second for a 20% AEP”</i><sup>22</sup>.</p> <p>Disturbance and deposition on the foreshore and seabed is addressed at a policy level in section 14 of the CEP and 'stock grazing and trampling is identified as an activity which is prohibited in the Coastal Marine Area (All Zones by Rule 14.2.4(k)).<sup>23</sup></p>	<p><b>Enforcement Action</b> Where activities are undertaken without a consent being obtained, BOPRC enforce the provisions of the CEP.</p> <p><b>Monitoring of Consented Activities</b> Where resource consents are required, monitoring of conditions is undertaken by BOPRC staff.</p>	<p>The rules do not have a direct effect on land ward practices which are responsible for the sediment being discharged into the CMA.</p>	<p><b>Recommendation</b> No proposed changes to the CEP.</p>

<sup>22</sup> Page 51 Bay of Plenty Regional Coastal Environment Plan ( CEP)

<sup>23</sup> Page 93 CEP

STATUTORY PLANNING INSTRUMENT	MECHANISMS FOR CONTROL OF SEDIMENT GENERATION AND SEDIMENTATION OF TAURANGA HARBOUR	SUPPORT MECHANISMS	EFFECTIVENESS	COMMENT
<p>Coastal Marine Area (CMA) which is defined in the RMA as  <i>“coastal marine area means [the foreshore, seabed, and coastal water, and the air space above the water]—</i>                      (a) <i>Of which the seaward boundary is the outer limits of the territorial sea:</i>                      (b) <i>Of which the landward boundary is the line of mean high water springs, except that where that line crosses a river, the landward boundary at that point shall be whichever is the lesser of—</i>                          (i) <i>One kilometre upstream from the mouth of the river; or</i>                          (ii) <i>The point upstream that is calculated by multiplying the width of the river mouth by 5<sup>21</sup>”.</i></p> <p>The CEP covers the end of the catchment i.e. the coastal receiving environment and has limited, if any, control on the landward margins.</p>				
<p><b>Proposed Western Bay of Plenty District Plan ( PDP)</b>                      The PDP was notified in March 2009 and the PDP has reached the stage where appeals to the Western Bay of Plenty District Council’s (WBOPDC) decision on submissions have been lodged and are being resolved. Parts of the PDP are now beyond challenge by appeal and in effect</p>	<p>The zoning of land for specific categories of activities and imposing rules for specific zone-based activities or district-wide rules is the key to the land use regime in place in the PDP. The main zones are Rural 1 and Rural 2.</p> <p>The Rural 1 (Farming Production Lot),’ generally comprises land of moderate productive capacity and which is used principally for pastoral farming or forestry. The area extends from the lowlands into the higher country. The higher country generally has a lower standard of infrastructure servicing.<sup>25</sup> The Rural 2 (General Farming) Zone) covers the area of the District that has been identified as having highly productive soils suitable for more intensive primary production land uses. The</p>	<p><b>Enforcement Action</b>                      Where activities are undertaken without a consent being obtained, WBOPDC enforce the provisions of the PDP.</p> <p><b>Monitoring of Consented Activities</b>                      Where resource consents are required, monitoring of conditions is undertaken by WBOPDC staff.</p>	<p>The WBOPDC PDP has limited effect or focus on rural land use controls relating to sediment generation within the Tauranga Catchment due to the activity focus of the planning provisions.</p>	<p><b>Recommendation</b>                      No proposed changes to the WBOPDC PDP.</p>

<sup>21</sup> Section 2(1) Interpretations Resource Management Act 1911

<sup>25</sup> Page 16.7 section 16.3.1 Proposed Western Bay of Plenty District Plan ( PDP)

STATUTORY PLANNING INSTRUMENT	MECHANISMS FOR CONTROL OF SEDIMENT GENERATION AND SEDIMENTATION OF TAURANGA HARBOUR	SUPPORT MECHANISMS	EFFECTIVENESS	COMMENT
<p>operative.</p> <p>The PDP is required by the RMA to address effects of the use of land, noise emissions, effects of surface water activities and any other functions specified in the RMA<sup>24</sup></p>	<p>focus of this zone is on providing for primary productive activities and ensuring that land is used in an effective and efficient way.<sup>26</sup></p> <p>Both the Rural 1 and Rural 2 zone have as permitted activities two key land uses being;</p> <p><b>“Farming” which is defined in the PDP as</b>  <i>“means and includes agriculture, including outdoor (extensive) pig farming (means the keeping of pigs in an extensive manner in paddocks where groundcover is maintained and where no fixed buildings are required), horticulture, floriculture, beekeeping, aquaculture, the keeping of not more than 25 poultry; and/or the keeping of not more than 12 weaned pigs when these are kept mainly within buildings or outdoors without groundcover being maintained.”<sup>27</sup></i></p> <p>and</p> <p><b>“Production Forestry” which is defined in the PDP as</b>  <i>“means the management of land for commercial wood production including the extraction of timber there from but does not include the milling or processing of timber.”<sup>28</sup></i></p> <p>Both definitions are in effect operative as neither has been subject to appeal.</p> <p>Both activities can be undertaken as permitted activities with the primary controls relating to the location, number and construction of buildings, limitation on noise levels, and /or the provision of buffer distances from property boundaries or non Rural Zone boundaries, the CMA, or areas of specific landscape or ecological significance.<sup>29</sup></p> <p>The application of buffer distances from the CMA boundary or areas subject to natural hazards is used in the Rural Zones.</p> <p><b>“Earthworks” is defined in the PDP as</b> <i>“the alteration of land contours on any site including, without limitation: (a) deposition, disturbance of land by moving, removing, placing or replacing soil by excavating, cutting, filling or backfilling (b) recompacting of existing ground.”</i></p> <p>The definition of earthworks is subject to appeal.</p>	<p><b>WBOP Development Code 2009</b></p> <p>Compliance with the development standards specified in the WBOPDC’s Development Code 2009 is linked with the subdivision and development standards of the PDP. The Development Code specifies minimum design requirements for such matters as stormwater, waste water, land stability and road formation.<sup>31</sup></p> <p><b>Structure Plans</b></p> <p>A number of structure plans for townships adjacent to the Tauranga Harbour such as Omokoroa, Waihi Beach, and Katikati are included in the PDP.<sup>32</sup> The Structure Plans specify the density of development and services required along with some recognition of environmental enhancement being undertaken in terms of screen planting. The Structure Plans focus on ensuring the services required for the projected development within the boundaries of the plans can be adequately serviced.</p>		

<sup>24</sup> Sections 31(1)(b)(i) to 31(1)(b)(iii),31(1)(d) and 31(e)

<sup>26</sup> Page 16.7 section 16.3.1 Proposed Western Bay of Plenty District Plan ( PDP)

<sup>27</sup> Page 3-11 Definitions section Proposed Western Bay of Plenty District Plan ( PDP)

<sup>28</sup> Page 3-11 Definitions section Proposed Western Bay of Plenty District Plan ( PDP)

<sup>29</sup> Page 16.10 Rule 16.5.1 ( c ) ( iii to v) Proposed Western Bay of Plenty District Plan ( PDP)

<sup>31</sup> Section design Standards WBOPDC Development Code 2009

<sup>32</sup> Appendix 0.7 Proposed Western Bay of Plenty District Plan ( PDP)

STATUTORY PLANNING INSTRUMENT	MECHANISMS FOR CONTROL OF SEDIMENT GENERATION AND SEDIMENTATION OF TAURANGA HARBOUR	SUPPORT MECHANISMS	EFFECTIVENESS	COMMENT
	<p>There are rules requiring activities which include earthworks to obtain consent in significant ecological and landscape areas.</p> <p>The PDP has incentives for the protection of significant natural features. The subdivision of land involving the protection of a significant natural or ecological feature can be undertaken subject to the area containing the significant natural and ecological feature being protected in perpetuity and being subject to an ongoing management plan.<sup>30</sup></p>			

<sup>30</sup> Page 16.15 to 16.18 Rule 16.5.2(f) Proposed Western Bay of Plenty District Plan ( PDP)

STATUTORY PLANNING INSTRUMENT	MECHANISMS FOR CONTROL OF SEDIMENT GENERATION AND SEDIMENTATION OF TAURANGA HARBOUR	SUPPORT MECHANISMS	EFFECTIVENESS	COMMENT
<p><b>Tauranga District Plan and the Proposed Tauranga City Plan (PTCP)</b></p> <p>The PTCP was notified in October 2009 and the decision on submissions to the PTCP was released in October 2010 for Section 5 Natural Environment and Section 7 Heritage, with the remainder of the decisions being released in March 2011.</p> <p>The PTCP is required by the RMA to address effects of the use of land, noise emissions, effects of surface water activities and any other functions specified in the RMA<sup>33</sup>.</p> <p>The PTCP is sufficiently advanced in a number of areas where the provisions relating to subdivision and land use have been unchallenged.</p>	<p>The type of land uses and matters subject to rules for activities undertaken in the Rural Zones or on the harbour, margins are similar in the TDP and the PTCP with some minor variances in the buffer distances applied. The setback from the Mean High Water Springs boundary in the TPD and the PTCP is 60m<sup>34</sup>.</p> <p>Primary production activities, forestry, and factory farming are permitted activities in the Rural Zone in the TDP and the PTCP.</p> <p>Primary production is defined in the PTCP and the TDP<sup>35</sup> as meaning:  <i>“Any of the following activities, whether singularly or in combination, for commercial gain or exchange:</i>  <i>a) The cultivation of land;</i>  <i>b) The keeping, maintenance and farming of animals and birds (including poultry) for the production of meat, fibre, or other animal-derived produce (including offspring);</i>  <i>c) Aquaculture (fish farming and hatcheries, shellfish farming, seaweed gathering and processing);</i>  <i>d) Horticulture (including all forms of fruit, vegetable, flower, seed, or grain crop farming).”</i></p> <p>The main controls on such activities include buffer distances and height and noise limits.</p> <p>Earthworks controls in the PTCP have been modified during the decision making process, such that volume controls in each zone have been removed<sup>36</sup>. Specific policy areas such as special ecological areas identified section 5 of the PTCP or the natural hazard areas adjacent to the coast or rivers have restrictive earthworks limits such as only 5m<sup>3</sup> removal of land within a 6 month period being a permitted activity<sup>37</sup> in the special ecological policy areas.</p> <p>The generic earthworks rule which applies to all zones are very limited in effect and use.</p>	<p><b>Enforcement Action</b>  Where activities are undertaken without a consent being obtained, TCC enforce the provisions of the PTCP..</p> <p><b>Monitoring of Consented Activities</b>  Where resource consents are required, monitoring of conditions is undertaken by TCC staff.</p>	<p>The TDP and PTCP have limited effect or focus on rural land use controls relating to sediment generation within the Tauranga Catchment due to the urban focus of the planning provisions.</p>	<p><b>Recommendation</b>  No proposed changes to the TCC PTCP.</p>

<sup>33</sup> Sections 31(1)(b)(i) to 31(1)(b)(iii), 31(1)(d) and 31(e)

<sup>34</sup> 60 metre setback from Mean High Water Springs in the Rural Zone is specified on page 5 of 18 Rule 21.2.2.1 (a) in the Tauranga District Plan and page 12 of 37 Rule 16A.8.4( c) of the Proposed Tauranga City Plan ( PTCP)

General Provisions

<sup>35</sup> Page 23 of 33 Section 3 Definitions Proposed Tauranga City Plan and Page 11 of 16 Section 10 Definitions of the Tauranga District Plan ( TDP)

<sup>36</sup> Factsheet released by Tauranga City with decisions on Section 4 of the Proposed Tauranga City Plan( PTCP)

<sup>37</sup> Page 15 and 16 Rules 4C.2.4 to 4C.2.6 and 4C.2.8 of the of the Proposed Tauranga City Plan( PTCP)



Non Statutory Instruments

NON STATUTORY INSTRUMENTS	MECHANISMS FOR CONTROL OF SEDIMENT GENERATION AND SEDIMENTATION OF TAURANGA HARBOUR	SUPPORT MECHANISMS	EFFECTIVENESS	COMMENT
<p><b><u>Bay of Plenty Regional Council's Policy on Partnerships with the Private Sector (PPS)</u></b></p> <p>The PPP involves the BOPRC supporting, by way of funds and technical inputs, three environmental protection programmes.</p>	<p><b>Biodiversity Protection Programmes</b> Development and implementation of Biodiversity Protection Programmes to protect remnants of native bush, wetlands and/or rare or endangered native plant and animals including use of covenants or encumbrances to be recorded against the land. The Biodiversity Protection Programme is a voluntary programme. It enables landowners and community groups to protect valuable sites of native biodiversity across the Bay of Plenty. BOPRC are able to offer assistance in 2 situations: sites with particularly high biodiversity values on private land across the region, and, sites that have not been identified as being of outstanding value but are of significance to those who own them. The Council assist the landowners to develop a management plan for the site. Financial support through grants from BOPRC is available, and varies, depending on the nature of the site and the type of work required, ranging from 25 percent to 75 percent of the total cost. Council monitor the works and staff report to Council. Council report to the public on the number of Biodiversity Protection Programmes in its 3 yearly report of progress towards the Regional Community Outcomes.</p> <p><b>Environmental Enhancement Fund (EEF)</b> <i>"EEFs project will have the primary purpose of directly promoting, enhancing or protecting 'The natural or historic (including cultural) character of; Public access to; and Public understanding of the Bay of Plenty's environment."</i><sup>38</sup></p> <p>The BOPRC website has a section dedicated to outlining how applications for monies from the EEF can be made to undertake environmental enhancement projects.<sup>39</sup></p> <p>Seven million dollars has been allocated to 400 environmental enhancement projects within the region since the fund's inception in 2000.<sup>40</sup></p> <p>The EEF Subcommittee of the BOPRC decides grants above \$5000.00. The EEF subcommittee is advised of delegated decisions made by staff on grants below \$5000.00.<sup>41</sup></p> <p>\$287,000 allocated to projects in the 2010/2011 financial year.<sup>42</sup> An additional \$370,000 is proposed to be spent in 2011. An additional \$20,000 has been allocated to</p>	<p><b>Financial Support and Advice</b> For Riparian Management Plans, up to 25% of the identified works are funded by BOPRC. BOPRC staff provide advice for free to prepare the plans. For Biodiversity Protection Programmes, up to 75% of the identified works are funded by BOPRC. BOPRC staff provide advice for free to prepare the programmes.</p> <p><b>Education</b> A number of pamphlets are available from BOPRC to assist in educating landowners about BOPRC's environmental protection programmes.</p> <p><b>RWLP</b> Objective 18 of the RWLP is to achieve the sustainable management of riparian margins in, amongst others, Tauranga Harbour. (i) Harbour margins – 100% by 2010, and (ii) Rivers and streams in the Tauranga Harbour catchment – 80% by 2020. The measures to implement Objective 18 in the RWLP are non-regulatory mechanisms, including voluntary action by landowners.</p> <p><b>Catchment Area Plan</b> Catchment Area Plans will provide guidance to these environmental protection programmes.</p>	<p><b>Effectiveness of the programmes/plans to reduce sediment generation:</b> This is not understood, and field surveys need to undertaken to measure load with and without the programmes.</p> <p><b>Effectiveness of BOPRC in terms of how well these voluntary programmes are promoted and how well they are received by landowners:</b> Determining the effectiveness of the PPS could be undertaken as part of the survey of a larger survey of rural landowners regarding sedimentation concerns to ascertain their awareness and use of the funding opportunities from the PPS.</p> <p><b>Effectiveness of the current type of Riparian Protection Plans that are being prepared:</b> BOPRC need to investigate if other methods of reducing sediment deposition are more effective i.e. rather than fence a 5m wide riparian margin, and plant within that to the stream edge (which appears to be the common practice), instead identify "seep points" (locations where water enters the streams), and manage these areas to reduce erosion, enhance their ability to trap sediment etc</p>	<p>Method 78 of the RWLP promotes monitoring of (a) The effectiveness of riparian management and plantings on water quality and instream biota using a programme that is consistent with national guidelines and (b) Sites protected under covenants which are part of Environment Bay of Plenty Farm Plans, Environmental Plans and Environmental Programmes, as a means to implement the objectives and policies relating to the Integrated Management of Land and Water.</p> <p><b>Recommendation</b> Undertake studies to better understand the effectiveness.</p> <p>Studies could include: Field work to measure quantitatively the effectiveness in reducing sediment generation.</p> <p>In relation to undertaking physical works associated with implementing riparian protection plans where the works may be in the bed of a watercourse, a review of the RWLP has identified the following relevant rules: Rule 68 - permits the planting of indigenous plants into the bed of a watercourse. Rule 69 – permits the removal of exotic plants from the bed of a watercourse.. Rule 66B – Permits the removal of any vegetation and bed disturbance where the activity is for scientific purposes.</p> <p>Therefore, if the implementation of Riparian Protection Plans where works takes place in the</p>

<sup>38</sup> Page 263 Bay of Plenty Regional Council's Policy on Partnerships with the Private Sector.

<sup>39</sup> <http://www.boprc.govt.nz/sustainable-communities/funding-and-awards/environmental-enhancement-fund.aspx>

<sup>40</sup> Page 11 Environmental Enhancement Fund Subcommittee report – Environmental Enhancement Fund Policy Review for dated 17 February 2011

<sup>41</sup> Terms of Reference for the EEF Subcommittee – Environmental Enhancement Fund Policy Review 17 February 2011

NON STATUTORY INSTRUMENTS	MECHANISMS FOR CONTROL OF SEDIMENT GENERATION AND SEDIMENTATION OF TAURANGA HARBOUR	SUPPORT MECHANISMS	EFFECTIVENESS	COMMENT
	<p>the He Matapuna Akoranga a Hawea Vercoe fund.<sup>43</sup></p> <p>All groups and organisations monitor progress of the project, provide annual written reports to Council, and a summary report when completed. Staff report to Council every year on the project progress. Council report to the public on the number and achievements of EEF community projects in its 3 yearly report of progress towards the Regional Community Outcomes.</p> <p><b>Riparian Protection Plans</b> Two types of assistance are available:</p> <ul style="list-style-type: none"> <li>• Land Use Induced Threats - fencing of a riparian margin to keep livestock out of the waterway.</li> <li>• Naturally occurring threats – where threats to estuaries, lakes, rivers, streams and their margins arise from matters beyond the reasonable control of the landowner and there is significant public good arising from the undertaking of the riparian protection.</li> </ul> <p>BOPRC provides assistance to landowners by preparing a Riparian Management Plan for their property that includes identification and mapping of relevant riparian areas, an assessment of erosion issues, in the riparian areas, a schedule of works with cost estimates, specifications for site preparation and fencing, specifications for ongoing maintenance, an implementation timetable, and identification of any works eligible for grants. The type of grant a landowner can receive will depend on the issues affecting the riparian areas. Max 30 fencing and native planting</p> <p>Council monitor the works and staff report to Council.</p>			<p>bed of a watercourse can comply with these permitted rules, then no consents will be required to implement them.</p> <p>Also, in relation to Riparian Protection Plans which include works in a wetland, the RWLP permits planting of indigenous plants, and the modification of a wetland for the purposes of wetland maintenance or enhancement where there is a Biodiversity or Riparian Protection Plan that specifically includes the wetlands works (per Policy 135 of RWLP).</p> <p>Another tool available to landowners is a Wetland Management Agreement, which is similar to a riparian Protection Plan, but specifically for wetlands. Provision is made for these in the RWLP – the existence of a Wetland Management Agreement permits specified works in a wetland.</p> <p><b>Recommendation</b> BOPRC need to target the priority areas and actively foster the uptake of the voluntary schemes to maximise the environmental benefits within the Tauranga Harbour Catchment. A review of the level of funding and targeting of such funding needs to be undertaken to ensure that the maximum level of benefit is achieved. It is apparent that the RRP works relate directly to the enhancement of water quality and sediment load reduction but is capped at a maximum contribution of 25 percent of works where as enhancement works undertaken as part of a BPRP achieve a potential 75 percent subsidy for such works</p>
<p><b><u>Bay of Plenty Regional Council's Erosion and Sediment Guidelines for Land Disturbing Activities 2010/10 (ESCG).</u></b></p>	<p>The ESCG is linked to the RWLP which specifies when resource consents are required to undertake land disturbing activities the region. Implementation of the provisions of the ESCG is undertaken through the provisions becoming a requirement when applying for and implementing resource consents to undertake land disturbing activities in the region.</p>	<p><b>Monitoring of Consented Activities</b> Inclusion of practices in resource consents conditions - adherence to the provisions of the ESCG is required when resource consents are required to</p>	<p>The ESCG is an effective tool for providing practical guidance on how erosion and sediment control options can be utilised when undertaking land disturbing activities, and therefore in</p>	<p><b>Recommendation</b> Include in the ESCG land management options in erosion prone land areas of the Tauranga Catchment.</p>

<sup>42</sup> Page 15 of Environmental Enhancement Fund Subcommittee Report – Environmental Enhancement Fund Policy Review 17 February 2011.

<sup>43</sup> Page 15 of Environmental Enhancement Fund Subcommittee Report – Environmental Enhancement Fund Policy Review 17 February 2011.

NON STATUTORY INSTRUMENTS	MECHANISMS FOR CONTROL OF SEDIMENT GENERATION AND SEDIMENTATION OF TAURANGA HARBOUR	SUPPORT MECHANISMS	EFFECTIVENESS	COMMENT
<p>The ESCG is a non statutory document which outlines the erosion and sediment control practices to be implemented when undertaking development.</p>	<p>The ESCG outlines examples of best practice with regard to erosion and sediment control.</p> <p>The ESCG also provides guidance on undertaking winter earthworks. Earthworks sites over this period are subject to a reduced earthwork scope and the inclusion of a water quality discharge standard.</p>	<p>undertake land disturbing activities.</p> <p>Where resource consents are required, monitoring of conditions is undertaken by BOPRC staff.</p>	<p>controlling sediment discharge to the harbour.</p> <p>However, when resource consents are not sought or not required, adherence to the relevant provisions of the ESCG to minimise sediment discharge is unlikely to occur.</p>	<p>Determine of the provisions of the ESCG can be built into the permitted activity rules of the RWLP.</p>
<p><b>Sub - Catchment Action Plans</b></p> <p>Tauranga Harbour Restoration – Sediment Action Plan 25 January 2010 – this DRAFT plan sets out existing and planned policy and operational work to address sedimentation issues within Tauranga Harbour. It includes an outline of the catchment management approach to stream management, sediment control and biodiversity protection across the whole Tauranga Harbour catchment.</p>	<p>There are 28 sub catchments around Tauranga Harbour. The plan is to develop Sub Catchment Action Plans for 17 of these sub catchments. These plans will form the basis of prioritising action within each of the catchments.</p> <p>At this time, only one has been developed, for the Waitekohe sub-catchment.</p>	<p><b>Biodiversity Protection Programmes</b> – the location and contents of these programmes will be consistent with the Catchment Action Plans</p> <p><b>Riparian Protection Plans</b> - the location and contents of these programmes will be consistent with the Catchment Action Plans.</p>	<p>These plans are in the early stages of preparation and implementation. It is unlikely that there will be any data to advise their effectiveness.</p>	<p><b>Recommendation</b></p> <p>Complete the preparation of all 17 sub catchment plans.</p>
<p><b>Community Care Groups Support Programmes</b> e.g. stream, estuary, and land care groups.</p> <p>Care Groups are organised community groups which work to protect and enhance a local area of environmental importance.</p> <p>Each year, BOPRC supports Care Groups with funding, as well as</p>	<p>There are approximately 24 Care Groups with a focus on Land Care. A full list is included at <b>Appendix 3</b><sup>44</sup>. Analysis of the location and objectives of the care groups included in the map and schedule identifies that 8 are in areas of high risk for sediment generation, and of these, only 2 have objectives including soil conservation.</p>	<p><b>Financial Support and Free Advice</b></p> <p>Refer to Bay of Plenty Regional Council's Policy on Partnerships with the Private Sector – Riparian Protection Plans, Biodiversity Protection Programmes, and Environmental Enhancement Fund.</p> <p><b>Education</b></p> <ul style="list-style-type: none"> <li>• Land Management fact sheets<sup>45</sup>.</li> <li>• Tauranga Harbour Fact sheets<sup>46</sup></li> </ul>	<p>No record of effectiveness.</p>	<p><b>Recommendation</b></p> <p>If not already in place, implement a monitoring programme to be able to understand the effectiveness of these programmes.</p>

<sup>44</sup> Wildlands Consultants 2010, Prepared for BOPRC, Contract Report No 2075

<sup>45</sup> <http://www.boprc.govt.nz/knowledge-centre/fact-sheets/land-management-fact-sheets.aspx>

<sup>46</sup> <http://www.boprc.govt.nz/knowledge-centre/fact-sheets/tauranga-harbour-fact-sheets.aspx>

NON STATUTORY INSTRUMENTS	MECHANISMS FOR CONTROL OF SEDIMENT GENERATION AND SEDIMENTATION OF TAURANGA HARBOUR	SUPPORT MECHANISMS	EFFECTIVENESS	COMMENT
<p>offering technical advice and support. Eligibility for funding and advice is based on the groups having sound environmental objectives.</p> <p>The land can be public or private land.</p>		<p><b>Catchment Area Plans</b> will provide guidance to these programmes.</p>		
<p><b><u>District Council non-statutory discretionary programmes</u></b></p>	<p>The WBOPDC 's Annual Plan 2010/2011 and Draft Annual Plan 2011/2012 makes provision for fencing grants which are in addition to the BOPRC EEF under the Natural Environment section of the Annual Plan.</p> <p>\$97,000 was allocated to fencing grants in the year ending June 2011 which exceeded the Long Term Community Plan 2010-2019 estimate by \$29,907.00<sup>47</sup>. \$104,000 has been allocated to fencing grants in the year ending June 2012.<sup>48</sup></p> <p>The purpose of the funding is detailed in the Natural Environment section of the Annual Plan. Fencing works subject to this grant can be undertaken for pest control purposes, demarcation of stands of indigenous vegetation as well as riparian margin enhancement.</p>		<p>No record of effectiveness.</p>	<p><b>Recommendation</b></p> <p>Request from the WBOPDC the location and extent of riparian n protection works undertaken which has received funding under this grant to ascertain if extent of works undertaken in the Tauranga Harbour Catchment.</p>

<sup>47</sup> Pages 51 and 52 Western Bay of Plenty District Council Annual Plan 2010/2011.

<sup>48</sup> Page 47 52 Western Bay of Plenty District Council Annual Draft Plan 2011/2012

## **Appendix 2: Riparian and erosion management support and subsidisation – policy and feedback from selected regional councils**

A phone survey of selected regional councils was undertaken to determine their current policies related to subsidisation of riparian retirement and erosion management practices on private land; the views of land management staff as to whether increased subsidy levels lead to increased landowner investment in riparian or erosion management; and the extent of technical support provided by councils to landowners.

### **1. Waikato Regional Council**

**Q1:** *What level of subsidy is there for fencing of riparian areas?*

**Q2:** *What level of subsidy is there for vegetation planting of riparian areas? Is it preferentially natives and/or exotics that are planted? Does the subsidy take the form of monetary payments or physical plants supplied?*

Subsidy level of 35% for both fencing and planting of riparian areas. Natives are preferentially planted. The subsidy level may vary according to different zones or areas (i.e. some zones may get less than 35% subsidy), which is determined and managed by a liaison sub-committee. Subsidy is provided in monetary form; however there are suppliers that can be used to provide plants as part of this subsidy.

**Q3:** *What level, if any, subsidy is there towards erosion plantings and/or forestry (i.e. plantation forests on erosion prone land)?*

For stream banks erosion control there is also a 35% subsidy for plantings

**Q4:** *Do you think that increased levels of subsidy would improve landowner uptake (improve riparian erosion and management)?*

There may be an increased level of uptake from landowners if the subsidy is increased but the trade off is that there may also be less commitment from landowners to manage personal environmental issues.

**Q5:** *Does the council provide free technical advice to landowners?*

**Q6:** *Does the council require landowners to have a management plan/ erosion plan/ riparian plan to qualify for subsidy?*

Free technical advice is provided for landowners if requested and there is a responsibility to work individually with landowners and document the management process on a case to case basis. No specific management plan is required for landowners to qualify for subsidy, as may be the case in Taranaki.

**Additional:** The regional policy statement is in the final stages of review (expected in 2014). There are changes expected with regard to controlling stock access in-conjunction with the rule requiring that all cattle be kept out of waterways.

## 2. Hawkes Bay Regional Council

**Q1:** *What level of subsidy is there for fencing of riparian areas?*

**Q2:** *What level of subsidy is there for vegetation planting of riparian areas? Is it preferentially natives and/or exotics that are planted? Does the subsidy take the form of monetary payments or physical plants supplied?*

There is a subsidy scheme for riparian management (mostly fencing and sometimes native plantings) which can be up to 50% (\$2,000 – 10,000); however each case is assessed individually and subsidies can be much higher (up to 90%) at priority catchment areas. Higher subsidy cases are managed by an Esplanade Strip Agreement and management plans are more typical for projects with higher subsidies. Cases of less than \$2,000 are not considered.

**Q3:** *What level, if any, subsidy is there towards erosion plantings and/or forestry (i.e. plantation forests on erosion prone land)?*

A similar scheme is adopted for erosion management through forestry planting (Poplar and Willow subsidies). This has recently been administered through the Forestation Grants Scheme. Again, cases of less than \$2,000 are not considered.

**Q4:** *Do you think that increased levels of subsidy would improve landowner uptake (improve riparian erosion and management)?*

There already appears to be a highly flexible and pragmatic approach to subsidy levels for landowner management initiatives.

**Q5:** *Does the council provide free technical advice to landowners?*

**Q6:** *Does the council require landowners to have a management plan/ erosion plan/ riparian plan to qualify for subsidy?*

Free technical advice is offered but management plans are not specifically part of the criteria for qualifying for subsidy.

## 3. Gisborne District Council

**Q1:** *What level of subsidy is there for fencing of riparian areas?*

**Q2:** *What level of subsidy is there for vegetation planting of riparian areas? Is it preferentially natives and/or exotics that are planted? Does the subsidy take the form of monetary payments or physical plants supplied?*

Currently there is no specific subsidy scheme for fencing or planting of riparian areas.

**Q3:** *What level, if any, subsidy is there towards erosion plantings and/or forestry (i.e. plantation forests on erosion prone land)?*

There is a fixed payment subsidy for forestry plantings for erosion control in erosion prone areas. This is administered by MAFF and takes on a monetary form that varies according to how far you

are from the port (i.e. erosion risk potential and subsequent environmental effects). Payments may range from \$2,800 to 14,000/ha based on distance from port.

**Q4:** *Do you think that increased levels of subsidy would improve landowner uptake (improve riparian erosion and management)?*

No comment

**Q5:** *Does the council provide free technical advice to landowners?*

**Q6:** *Does the council require landowners to have a management plan/ erosion plan/ riparian plan to qualify for subsidy?*

Yes free technical advice is provided but no management plan is currently required.

#### **4. Northland Regional Council**

**Q1:** *What level of subsidy is there for fencing of riparian areas?*

**Q2:** *What level of subsidy is there for vegetation planting of riparian areas? Is it preferentially natives and/or exotics that are planted? Does the subsidy take the form of monetary payments or physical plants supplied?*

Up to 50% subsidy is provided for fencing but planting is not a priority, although it occasionally can be subsidised in specific instances with reasonable justification.

**Q3:** *What level of subsidy, if any, is there for erosion plantings and/or forestry (i.e. plantation forests on erosion prone land)?*

A new erosion scheme seems to be underway in the region and the person on the phone was not clear about the details of this scheme. Subsidies do exist for poplar plantations of 100 or more plants.

**Q4:** *Do you think that increased levels of subsidy would improve landowner uptake (improve riparian erosion and management)?*

No comment

**Q5:** *Does the council provide free technical advice to landowners?*

**Q6:** *Does the council require landowners to have a management plan/ erosion plan/ riparian plan to qualify for subsidy?*

Yes free advice is offered and each case is assessed and a management plan formulated following specific assessments.

#### **5. Taranaki Regional Council**

**Q1:** *What level of subsidy is there for fencing of riparian areas?*

**Q2:** *What level of subsidy is there for vegetation planting of riparian areas? Is it preferentially natives and/or exotics that are planted? Does the subsidy take the form of monetary payments or physical plants supplied?*

Subsidised planting scheme – grows physical plants and can supply those at a cost to landowners. Landowners are mostly expected to apply for funding through the Tree Trust or STRESS (see below) Funding grants. Onus is very much up to the farmer to undertake works to manage riparian health. However, in catchment areas deemed of significant ecological value a consents-based funding scheme can see higher percentages of subsidy (e.g. 50% or more) granted. A case to case assessment is undertaken.

**Q3:** *What level, if any, subsidy is there towards erosion plantings and/or forestry (i.e. plantation forests on erosion prone land)?*

A complicated forestry subsidy scheme is underway in Taranaki for erosion control – Hill Country Erosion Fund. The details around this are involved and an email detailing this initiative has been provided.

### **South Taranaki Erosion Support Scheme (STRESS)**

If you are implementing any of the below works on class 6 and 7 land as identified by TRC farm plan, you can apply for STRESS funding. Waitotara catchment is identified as first priority, but STRESS will open up to the rest of the region from 1 December 2011. A brief summary of areas and funding available is provided below:

#### **Forestry – funding up to \$1500 per ha or 75%**

- No species limitation
- Minimum of 750 stems per hectare
- 8 wire post and batten (or an agreed alternate)
- Area must be under 5ha
- Must be replanted if harvested

#### **Retirement/Reversion fencing – funding up to \$8 per meter**

- 8 wire post and batten (or an agreed alternate)
- No stock grazing
- Can be existing native vegetation; manuka/kanuka; gorse if there is 10% native underneath.

#### **Poplar and willow poles – pole free**

- \$4.50 sleeve is the landowners cost, pole is free
- Poplar or willow poles/stakes

Please note that the landholder has to enter into one of the appropriate securities/agreements: TRC Memorandum of understanding, TRC Memorandum of encumbrance (over \$5000), QEII, ETS, and PFSI. If the scheme is over-subscribed the applications will be assessed via the ranking criteria.

**Q4:** *Do you think that increased levels of subsidy would improve landowner uptake (improve riparian erosion and management)?*



No comment obtained

**Q5:** *Does the council provide free technical advice to landowners?*

**Q6:** *Does the council require landowners to have a management plan/ erosion plan/ riparian plan to qualify for subsidy?*

Yes free technical advice is provided but a management plan is strictly required in order to qualify for any form of assistance and the regional council will prepare these plans for each case with close consultation with landowners (i.e. what they want and what is ecologically sound and most feasible).

## 6. Horizons Regional Council

**Q1:** *What level of subsidy is there for fencing of riparian areas?*

**Q2:** *What level of subsidy is there for vegetation planting of riparian areas? Is it preferentially natives and/or exotics that are planted? Does the subsidy take the form of monetary payments or physical plants supplied?*

There is a subsidy scheme for lowland dairy catchment areas held at 30% aimed at water quality management. This is particularly for fencing and not so much for planting. All subsidies are in a monetary form.

**Q3:** *What level, if any, subsidy is there towards erosion plantings and/or forestry (i.e. plantation forests on erosion prone land)?*

There is a Hill Country Erosion subsidy scheme which may vary from case to case but is typically held at 50-70%. Again this is mostly for fencing and is a monetary subsidy. Poplar plantation is commonly subsidised to control sedimentation and erosion.

**Q4:** *Do you think that increased levels of subsidy would improve landowner uptake (improve riparian erosion and management)?*

There is a likelihood of increased uptake if the subsidy level is increased from 50% however; the council prefers to keep landowners accountable for managing of their own land. Again, a trade off exists to maintain landowner incentive but ensure that there is a level of accountability. There is justification to have flexibility in the subsidy level and adjust that based on specific cases and assessment.

**Q5:** *Does the council provide free technical advice to landowners?*

**Q6:** *Does the council require landowners to have a management plan/ erosion plan/ riparian plan to qualify for subsidy?*

Free technical advice is provided to landowners, but landowners must have a management plan in order to qualify for subsidy.

## Appendix 3: Care Group Summary

### CARE GROUP SUMMARY

Care Group Name	No. of Members (approx)	Catchment	Main Activities
Aongatete Forest Restoration Trust		Aongatete	Objective - to restore the wildlife and plant life of a part of the Kaimai Forest Park. Activities - Sustained possum, rat, and stoat control over 200 ha of forest adjacent Aongatete lodge for biodiversity restoration.
Argyll Road Reserve		Waimapu	No information
Athenree Harbourcare		Waiau	Mangroves and Biodiversity
Castlewold Drive Reserve Care Group	9	Waimapu	Objective - Develop a walk way through the reserve, keep the reserve free of rubbish, get the public involved and encourage use of the reserve. Activities - weed control and removal, revegetation planting.
Forest and Bird Waihi		Waihi	Planting park beside recreation fields.
Forest and Bird Waihi		Waihi	Indigenous vegetation planting on riverbank of the Karangahake gorge.
Fraser Street Reserve Care Group	20	Waimapu	Objective - eradication of invasive pest species; especially pampas, wattle, gorse and blackberry. Activities - planting and weed removal.
Friends of Puketoki Scenic Reserve		Te Puna	Sustained possum, rat, and stoat control over 40 ha of Puketoki Reserve for maintenance and restoration of indigenous biodiversity.
HELP		Waihi	Planting and weed control in Karangahake Gorge
Johnson Reserve Care Group	15	Waimapu	Objective - to carry out pest plant control and revegetation planting within reserve to enhance indigenous habitat. Activities - Pest animal and plant control and indigenous revegetation planting. Improved access to reserve by pest plant removal.
Kaiate Falls Landcare		Otawa	Amenity
Kaimai Landcare		Wairoa	No information
Katikati Environmental Forum		Uretara	Objective - to lead community initiatives in improving the environment.
Lagoon Place Reserve	10	Waimapu	No information
Lund Road Pest Control Group	21	Aongatete	Objective - reduce possum infestation levels in tracts of indigenous forest. Possum control to assist indigenous vegetation recovery and increase indigenous fauna presence.
Matahoroa Gully Reserve	10	Waimapu	No information
Matua Estuary Care Group	17	Omanawa	Objective - maintain clean open water around Matua estuary. Activities - Mangrove control, bird monitoring, pest plant and pest animal control to enhance estuarine biodiversity by reducing sedimentation to encourage bird passage and recovery.
Mauao Reserve Care Group	70	Otawa	Objective - vegetation restoration. Activities - removing invasive weeds from the mount and replanting with indigenous species common to the area.



Care Group Name	No. of Members (approx)	Catchment	Main Activities
Mills-Maungatapu	12	Waimapu	Objective - protect indigenous birds by control of rodents on the Maungatapu Peninsula. Activities - Rodent control on a dozen properties to protect indigenous birds.
Moini Place Care Group	6	Waimapu	No information.
Morton/Prestidge Estuary Care Group	22	Aongatete	Objective - maintain clear open water in estuaries in vicinity of Morton/Prestidge Roads. Activities - Mangrove control in Wainui Estuary. Bird monitoring. Pest plant control to restore healthy estuarine habitat.
Nga Tahatai O Te Puna	20	Te Puna	Objective - To save coastal cliffs from eroding, to protect the Urupa on cliff-properties. Natural processes have been disrupted by forest clearance along the coastal headland, and by replanting some of that forest we seek to facilitate the return of natural processes. Activities - Planting of indigenous species, mainly pohutukawa, along the coastal cliffs. Planting started in 2008, and continued this year. 500-600 trees have been planted.
Ngamuwahine		Wairoa	Amenity.
Ngapeke Road Care Group	6	Otawa	Objective - stabilise steep banks, beautify area and control pest plants and animals. Activities - Trapping and poisoning pest animals to reduce erosion and enhance natural biodiversity. Pest plant control and indigenous plant revegetation to encourage indigenous bird presence.
Omokoroa Environmental Managers Incorporated	55	Te Puna	Objective - To restore and maintain the shoreline and estuaries surrounding the Omokoroa Peninsula as healthy and eco-friendly environments. Activities - Mangrove removal. Monitoring following the Waikaraka Estuary model.
Omokoroa Estuaries Restoration		Te Puna	Mangroves and biodiversity.
Osprey Reserve/ Te Auhi Pa	5	Otawa	No information.
Otanewainuku Kiwi Trust		Omanawa	Objective - to return to the Otanewainuku forest of 100 years ago, to build brown kiwi numbers and, later, to return kokako to the forest so their haunting call will again echo in the canopy. Activities - Monitoring, kiwi surveys and predator control - targeting stoats, rats, wild cats and possums.
Pest Free Omokoroa		Te Puna	Overall objectives of the group are to increase the indigenous bird populations of Omokoroa Peninsula, reduce the rat population, provide safer nesting habitat for bird life, facilitate the establishment of appropriate trees and shrubs to provide year round food supplies for birds and encourage indigenous regrowth, and to continue building support for the project through communication and engagement with the community. Activities - Bait station based rodent control. Bait station network currently 380+ distributed around peninsula. Trakka monitoring, bird counts.
Pirirakau Mahi Whenua Roopu		Te Puna	No information.
Rotary Park	5	Waimapu	No information.

Care Group Name	No. of Members (approx)	Catchment	Main Activities
Reserve			
Ruakaka Pest Management Group	15		Pest animal and plant control.
Rudolf Steiner School Wetland		Otawa	Objective - wetland restoration. Activities - planting and weed control.
Scantlebury Reserve Care Group	15	Waimapu	Objective - restore foreshore reserve. Activities - Pest plant control, extensive planting, rubbish removal and graffiti control to enhance reserve.
Taipari Street Gully	9	Waimapu	No information.
Tanners Point/Athenree Harbour Care Group	20	Waiau	Objective - maintain clear waters of Athenree/ Tanners Pt harbour. Activities - Mangrove removal, pest animal control to enhance estuarine biodiversity including indigenous bird recovery. Pest plant control and revegetation planting to restore indigenous habitat on Moutuhora Island.
Te Aroha Earthwatch		Te Aroha	Water quality and bush restoration. Te Aroha Earthwatch are an environmental group whose recent activities have included submissions on local authority plan changes, and efforts to restore degraded indigenous natural areas at the foot of Mt Te Aroha.
Te Kauri Point Wildlife Recovery Group	6	Tuapiro	Objectives - To restore the indigenous bird dawn chorus through pest control. Activities - Pest plant and pest animal control, riparian and coastal revegetation planting to enable indigenous bird recovery and enhance historic reserve.
Te Puna Estuary Management Group	11	Te Puna	Objective - To restore and enhance Te Puna Estuary by protecting and enhancing biodiversity and conservation values through including and involving the whole community. Activities - Weed removal and planting of indigenous species. Mangrove removal. Monitoring of sediment, birds and pests.
Te Puna Quarry Park		Te Puna	Objectives - Te Puna Quarry is a community development in environmental arts, which aims to provide an enjoyable environment for people to visit, and a forum for exhibitions of sculpture and other environmental art works. It also aims to cater for specialist plant group and other horticultural interests. Within the horticultural side, Te Puna Quarry aims to maintain a balance between the emphasis on indigenous and exotics, and has both an indigenous horticultural section, and 25 acres of indigenous forest on the south east of the quarry. Activities - Recreational and educational programs. Caters for walking groups and schools. Undertakes weed and goat control within the 25 acre bush block.
Team Kaitemako	27	Otawa	Objective - general habitat protection. Activities - weed removal, revegetation planting, pest control
Tuapiro Stream Enhancement Group	5	Tuapiro	Group does not exist anymore.
Uretara Estuary Managers	50	Uretara	Objective - integrated catchment management. Activities - protection of nesting birds, weed removal, pest control, mangrove control.
Waihi District Walkways Inc		Waihi	To create a series of walkways with riparian planting to enhance and restore biodiversity and to protect the social and cultural heritage values of the areas.

Care Group Name	No. of Members (approx)	Catchment	Main Activities
Waikaraka Estuary Managers	85	Te Puna	Objectives - To return mangroves to the extent they covered in 1986. The vision of Waikaraka Estuary Managers is that of an aesthetically pleasing environment of natural beauty, with the following desirable attributes: Open unpolluted water fed by clear and unpolluted streams; abundant estuarine marine life particularly fish and shellfish; healthy eelgrass beds; presence of indigenous bird species, especially those that are rare or endangered in estuarine habitats; reduced numbers of pests particularly rats and stoats; presence of indigenous trees and shrubs; healthy wetlands bordering the estuary; absence of rubbish and noxious weeds; absence of sources of agricultural and domestic pollution; absence of further significant inflows of silt. Activities - Mangrove removal; rat control around the estuary margins; weed removal; planting; monitoring.
Waikareao Estuary Care Group	21	Omanawa	Objective - integrated catchment management approach. Activities - mangrove management, weed control, promotion of good land management practices.
Waimapu Estuary Care Group	33	Waimapu	Objective - maintain clean open water in Waimapu Estuary. Activities - Mangrove control, bird, sediment and benthic monitoring, pest plant and pest animal control to improve water quality and enhance indigenous estuarine biodiversity through habitat improvement. Pest plant and indigenous vegetation planting to enhance riparian margins and public reserves to increase presence of indigenous fauna.
Waione Stream Managers		Wairoa	Objective - revegetate the Waione flood bunds. Group does not exist anymore.
Waitao Kaiate Environmental Group	20	Otawa	Objective - increase biodiversity and soil and water values. Growing own plants from locally sourced seed in established nursery. Activities - Fencing and planting streams, local parks and wetlands plus pest plant and pest animal control to enhance in-stream biodiversity and water quality.
Waitete Stream catchment care group		Waihi	Improve habitat around Waihi. Educate school children through hands-on involvement in growing and planting.
Welcome Bay Catchment Managers	80	Otawa	Objective - maintain clean open water around Welcome Bay. Mangrove removal to achieve sediment reduction and estuarine habitat and biodiversity restoration. Activities - Pest plant control and indigenous revegetation planting to enhance local reserves.
Whakamarama Community Incorporated		Te Puna	Objectives -To represent the residents of our district on issues of concern to them in accordance with our constitution; i.e. a. To promote awareness and discussion of matters of interest to the residents of Whakamarama. b. To represent the views of the residents of Whakamarama to the appropriate authorities. c. To acquire information that is likely to be of benefit to the residents of Whakamarama, [this includes historical records, photos and recorded information



Care Group Name	No. of Members (approx)	Catchment	Main Activities
			<p>from older residents, past and present.]</p> <p>d. To take any actions the Organisation may from time to time consider beneficial to its members and the district.</p> <p>e. To borrow or raise or give security for money in such manner as the Organisation sees fit.</p> <p>f. To invest and use funds of the Organisation in any manner as it deems fit.</p> <p>g. To do all such things as are incidental to the attainment of, or for the carrying into effect, the foregoing objectives.</p> <p>Activities - Environmental education and promotion; consult with, advise, submit opinion, request action and generally communicate with and lobby the local authorities and other NGOs; fundraising; hold meetings; support community initiatives i.e. Friends of Puketoki pest control programme; historical research, archiving and recording of heritage artefacts.</p>



