REPORT

Irongate Industrial Plan Change
Assessment of Effects on Irongate Stream

Prepared for Hastings District Council

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QUALITY ASSURANCE STATEMENT

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HASTINGS DISTRICT COUNCIL

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1 Introduction

1.1 Background

MWH New Zealand Ltd has been commissioned by the Hastings District Council to prepare a plan change to the Hastings District Plan (the proposed plan change). This involves the rezoning of an area of land surrounding Maraekakaho Road and Irongate Road from 'Plains' to 'Industrial 2', which would open up this land for future industrial expansion. The proposed rezoning will provide for this area of land to be fully utilised for industrial activities.

The Irongate area is located south of Flaxmere and west of Hastings on the Heretaunga Plains. As indicated in Figure 1-1 below, the proposed new industrial area will be in close proximity to the Irongate Stream, raising the possibility that future industrial activities could affect water quality or stream habitat.

1.2 Purpose of this report

The purpose of this report is to detail:

- The known ecological values associated with the aquatic environment of the Irongate Stream.
- The extent of possible impacts from future industrial development on the aquatic environment of the Irongate Stream.
- The options available to avoid, remedy or mitigate any potential for adverse effects including any requirements for developing standards that may need to be applied to future subdivision and development for industrial purposes.
- The costs and benefits of any suggested mitigation options (where this is possible).

1.3 Information sources

The main sources of information used during the preparation of this report were:

- MWH New Zealand Ltd (2008): Irongate Plan Change: Stream Ecological Valuation Assessment.
- Stansfield (2004): Aquatic ecology and water quality: Karamu Stream.
- HBRC (2004): Te Karamu: catchment review and options for enhancement. Unpublished technical report. Hawke's Bay Regional Council.

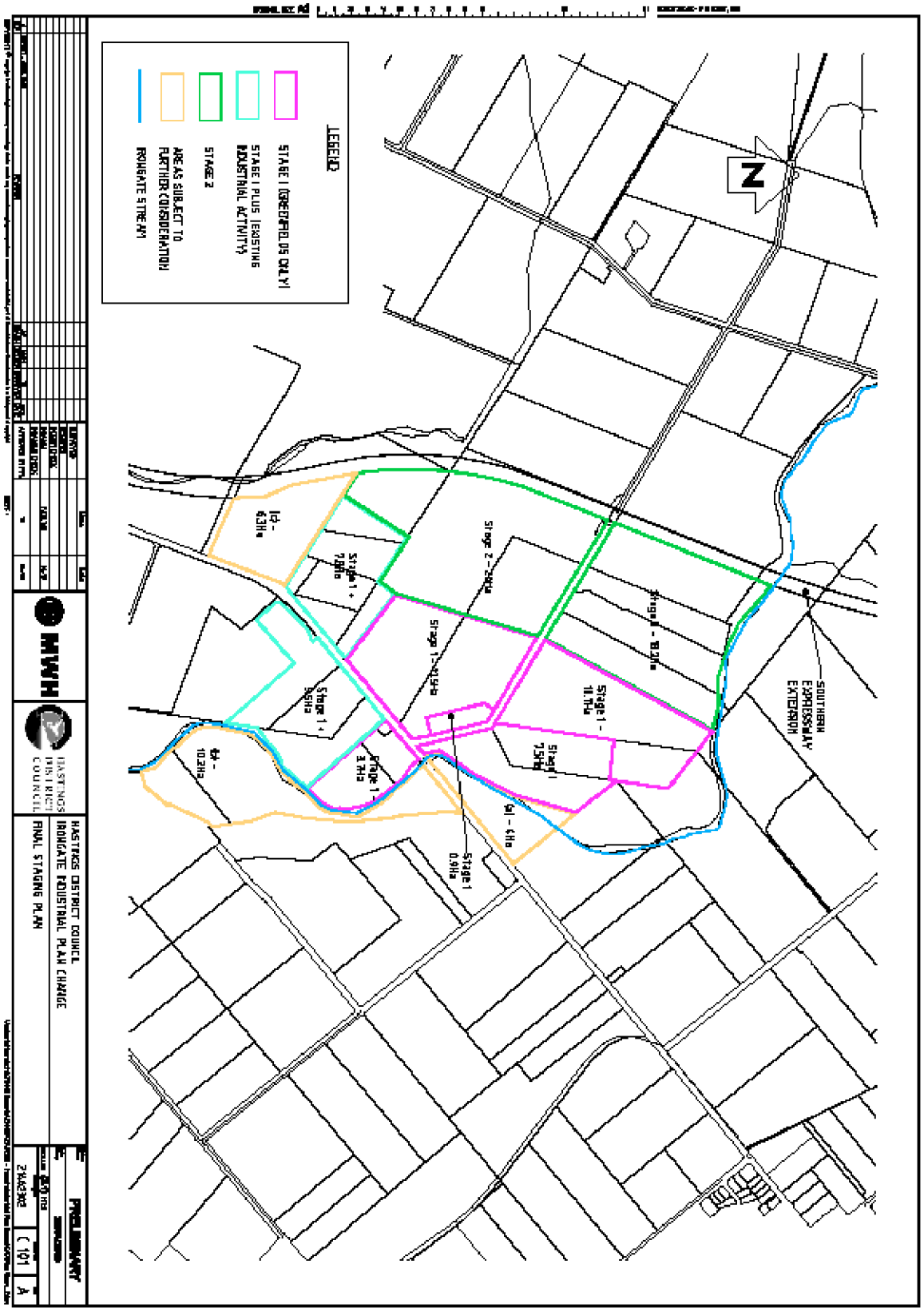

Figure 1-1: Irongate Stream and the area proposed for rezoning

2 Stream characteristics

2.1 Location

The Irongate Stream is a 3rd order tributary of the Karamu Stream which is a major tributary of the Clive River, which in turn joins the Waitangi Estuary at Clive (refer Figure 2-1). The Waitangi Estuary has been classified as a nationally important fisheries habitat supporting an important whitebait fishery and many estuarine fish (HBRC Regional Coastal Plan 1999).

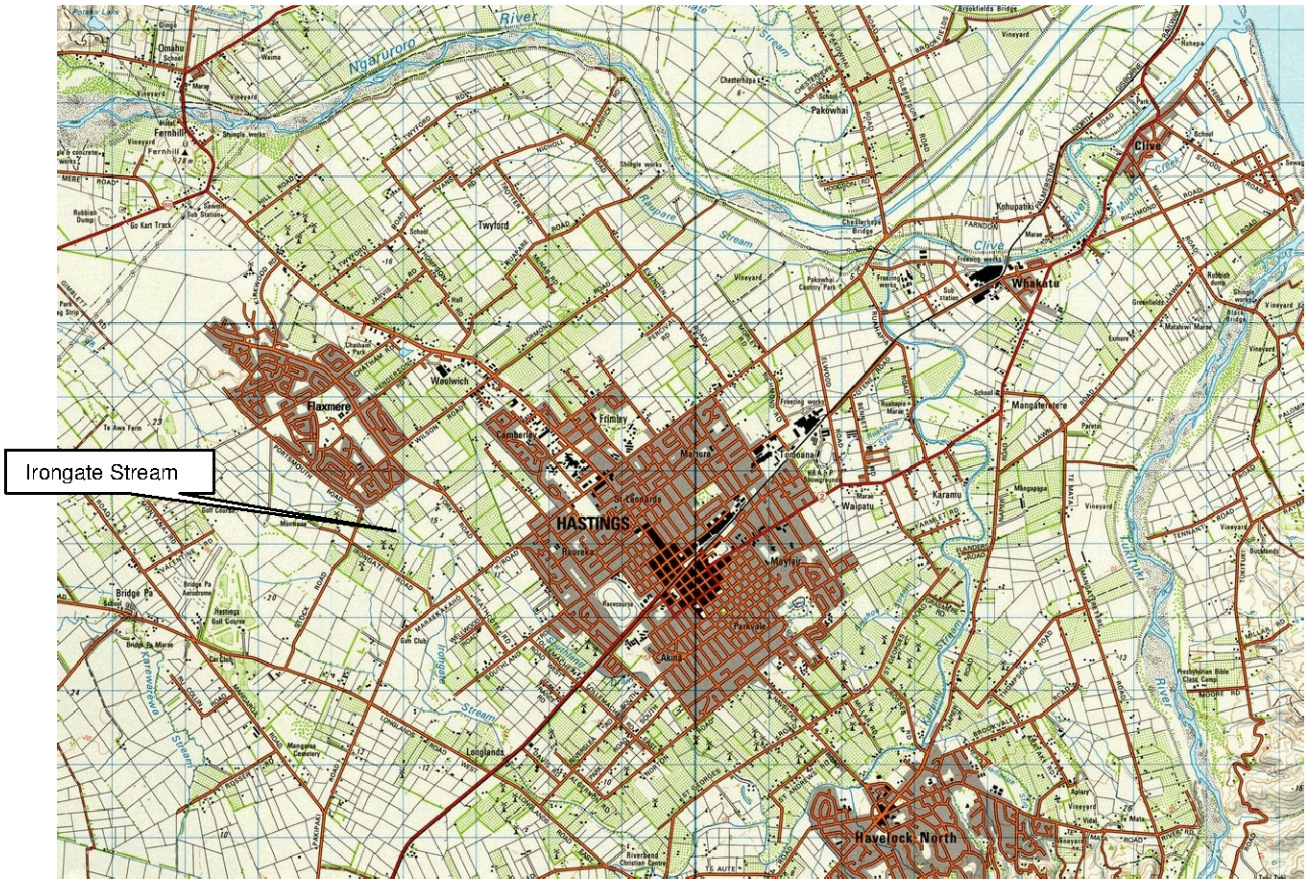

Figure 2-1: Location of Irongate Stream in relation to Karamu Stream and the Clive River

2.2 Land use

Land use in the Irongate Stream catchment comprises existing industrial use (i.e. existing industrial sites on Maraekakaho Road and within the Omahu Road industrial zones), residential use (i.e. the suburbs of Flaxmere, Raureka and Camberley) and horticultural / agricultural uses (i.e. short rotation cropping, grazing, orcharding).

2.3 Topography

The Irongate Stream is a spring fed watercourse which, within the proposed plan change area, is approximately 30 km inland from the sea, at an elevation of 15m above sea level, and has a catchment area of some 44 square kilometres. It flows across the alluvial gravels of the Heretaunga Plains. The local landform is a flat plain, draining generally to the east. The plain features small scale localised down-

cutting, caused by fluvial erosion (stream channels), and a relict river bed (the former Ngaruroro River alignment).

2.4 Management Regime

The Irongate Stream channel between Portsmouth Road and State Highway 2 was enlarged and straightened during the 1960s with the development of the suburb of Flaxmere. Further channel upgrading was undertaken in 2002. A HBRC flow gauging weir (Clark's Weir) is located on the stream immediately upstream of the Upper Southland Drain outlet upstream of Maraekakaho Road.

The management regime for the stream has a strong 'flood control' focus. This includes periodic mechanical removal of aquatic weeks for drainage enhancement.

2.5 Riparian conditions

Land development has heavily modified the riparian state of the Irongate Stream. Adjacent industrial or horticultural / agricultural activities frequently occur within the riparian zone. In some cases Industrial and productive land uses are operating as close as 6 metres to the wetted stream channel (MWH 2008).

Typically, riparian vegetation is dominated by exotic grasses within 20 metres either side of the wetted stream channel. Occasional exotic trees and shrubs are also present.

2.6 Channel form and substrate size

The Irongate Stream channel has been extensively 'channalised', both through straightening and through formation of uniform 'batter slopes'. Stream reaches are typically long and natural floodplains have been replaced with batter slopes. Some minor floodplain development (terracing) has occurred locally on the batter slope surfaces.

The stream typically has a mean depth of 0.5 metres and a mid stream depth of 0.9 metres. The wetted channel width is typically 5.6 metres.

The channel straightening has probably eliminated much of the variation in flow dynamics that might otherwise have occurred and has produced an almost uniform "run", with little in the way of riffle or pool habitat. This lack of variation in flow dynamics limits the range of habitats available for benthic biota, with a consequent reduction in biodiversity.

MWH (2008) found that the underlying stream bed is largely comprised of medium to large gravels but that the gravels were buried under a layer of fine sediments. The rate of sediment deposition is likely to have been accelerated by removal of the forest cover and land use development.

2.7 Aquatic fauna

A fish survey was undertaken in the Irongate Stream during October 2008 as part of the Stream Ecological Valuation Survey (MWH 2008). Four native fish species and two exotic species were found downstream of Clark's Weir. These were the shortfin eel, longfin eel, inanga and common bully, as well as the exotic goldfish and mosquito fish. Upstream of the weir only the native shortfin eel and koura (freshwater crayfish) and the exotic mosquito fish were reported. Earlier surveys, including Anderson (2000) have also recorded common smelt and rainbow trout in Irongate Steam.

Clark's Weir probably impedes the upstream passage of the non-climbing native species such as inanga and common bully.

A survey of the benthic invertebrates, also undertaken as part of the SEV assessment, produced a Macroinvertebrate Community Index (MCI) score of 42. This low score indicates poor in-stream conditions and reflects the lack of a hard stony substrate and an abundance of softy sediment. Hawke's

Bay Regional Council monitoring has previously recorded an MCI score of 65 for Irongate Stream, also indicating degraded in-stream conditions (Stansfield 2004).

2.8 Aquatic flora

Six exotic and one native macrophyte species have been observed in the Irongate Stream (Stansfield 2004). The native species was duckweed (*Lemna minor*). The exotic species were fennel leaved pond weed (*Potamogeton pectinatus*), curled pond weed (*Potamogeton cripus*), elodea (*Elodea canadensis*), water celery (*Apium nodiflorum*), swamp willow weed (*Persicaria decipiens*), and water cress (*Nasturium officinale*).

2.9 Water Quality

Water quality investigations carried out by HBRC (Stansfield 2004) showed that the stream is moderately well oxygenated but, like most small streams with reduced riparian vegetation, it probably experiences high water temperatures in summer. In the context of the Karamu catchment, the Irongate Stream has low dissolved reactive phosphorous (DRP) and elevated soluble inorganic nitrogen (SIN) and ammonia concentrations.

While water clarity is generally high in the upper reaches, the inflow of the Upper Southland Drain stormwater outfall, which carries a high suspended sediment load, causes a marked decline in water clarity (Stansfield 2004). This stormwater discharge enters the Irongate Stream approximately 500m upstream of Maraekakaho Road, adjacent to the proposed new industrial zone.

The Te Karamu Catchment Review (HBRC 2004) noted that "*There has been an apparent decline in water clarity in recent years. Stock access, with associated habitat disturbance, and industrial development, has resulted in downstream siltation contributing to the loss of good quality habitat and trout spawning substrate.*"

3 Stream Ecological Valuation

The Auckland Regional Council Stream Ecological Valuation method (SEV) (Rowe et al., 2008) has been applied at the Irongate Stream to quantify the current integrity of associated aquatic ecological functions and to establish a benchmark measure of ecosystem function against which future land use changes can be measured.

This assessment method focuses on measurement of hydraulic, biogeochemical, habitat provision and biotic ecological functions of a given stream reach. The methodology and results are reported in full in MWH (2008), and are summarised here.

A 100 metre long reach of the Irongate Stream at the downstream end of the area affected by the proposed plan change was surveyed. The overall finding of the survey was that the ecological value of the stream is significantly degraded when compared against a pristine (undeveloped) reference site (SEV score of 0.481 compared with the reference site score of 0.914). The key factors contributing to its degraded state are:

(i) More than 25% of the catchment area upstream of the study site is covered in impervious surfaces,

(ii) Extensive channel modification resulting in uniform flow dynamics and loss of connectivity to flood plains,

(iii) Heavily modified riparian zone with almost no riparian shading or organic matter inputs to the stream, and

(iv) Increased rates of sediment deposition.

These factors have lead to reduced habitat quality, reduced habitat diversity and loss of biodiversity.

4 Potential effects of future industrial development

4.1 Increased impervious surface

Currently more than 25% of the catchment upstream of the study area is covered in impervious surfaces (roof of buildings, sealed roads, car parks, etc). Future development will further increase the area of impervious surfaces within the catchment, potentially increasing the rate at which stormwater runs off the catchment and reducing opportunities for rainwater replenishment of the groundwater resource. An increasing proportion of impervious surfaces can lead to higher wet weather peak flows and lower dry weather base flows. This combination of effects can significantly reduce the quality and diversity of habitats for the benthic ecology and fish.

The plan change is being formulated on the basis that any future industrial activities in the Irongate Stream sub-catchment (i.e. those properties within the plan change area that currently drain to the Irongate Stream) will be required to develop their own on site solutions for the management of stormwater, which could include the discharge stormwater directly to the Irongate Stream. However, it is understood that there will be a requirement for future industrial activities to dispose of roof (non contaminated) runoff to ground, thereby moderating to a degree the potential for significant increases in peak stormwater flows.

As such, the effect of the proposed plan change may be relatively minor on its own, depending on the stormwater management solutions ultimately adopted for future industrial activities, but the cumulative effects of development throughout the catchment have probably already modified the natural flow regime to a significant extent.

4.2 Increased contaminant loads

Industrial expansion and an associated increased area of impervious surface is generally correlated with increased heavy metal and persistent organic contaminant loads carried to the watercourse by stormwater runoff. The principal contaminants of concern are those associated with runoff from road surfaces and roofs, such as zinc, copper, lead and PAHs. Depending on the type of industry that develops in the area, suspended solids, nutrients and other contaminants may also be of concern.

All of these contaminants have the potential to degrade water quality, and many are potentially toxic to aquatic organisms if threshold concentrations in receiving waters or sediments are exceeded.

The majority of heavy metals and PAHs in stormwater absorb to particles which can be removed from stormwater relatively effectively by filtering or settling processes. This may occur in the future through the use of onsite treatment and ground disposal and trench or swale solutions for the management of stormwater in the new industrial areas.

The Hastings District Plan currently requires, for any activity involving the use or storage of hazardous substances, that stormwater originating on or collected from the activity site is prevented from contaminating any groundwater or water. These District Wide provisions will continue to apply to the proposed plan change area. As such, any future industrial activity that stores or uses hazardous substances will be required to implement a stormwater management solution that is likely to involve some form of filtering or settling process prior to discharge to the Irongate Stream or to ground.

4.3 Loss of riparian vegetation

Industrial expansion probably will not result in further degradation of the riparian zone as it is already heavily modified to the extent that a range of ecological functions are significantly impaired. These include:

(i) Reduced shading (leading to increase water temperatures, increased light intensity on the streambed, increased primary production and wider diurnal variations in pH and dissolved oxygen).

(ii) Reduced organic energy supply (inputs of leaf litter and other organic material from the riparian zone is a key source of energy and invertebrate food supply).

(iii) Reduced bank stability and increased erosion (often leading to bank protection works).

(iv) Buffering of the aquatic environment (buffering of water quality from influences of surrounding land use activities, including contaminant load in stormwater and shallow groundwater, litter and other inputs).

The proposed plan change does however provide an opportunity for riparian enhancement to restore some of these functions. This is discussed further below.

4.4 Channel modification and loss of connectivity to the floodplain

The extensive channel straightening and replacement of natural floodplains with uniformly sloped stream banks that has already taken place has created relatively homogenous flow conditions, and reduced the diversity and quality of habitat for benthic biota and fish.

It is unlikely that development of the sites that adjoin the Irongate Stream for industrial purposes in the future will result in further channel modification or further loss of connectivity to the floodplain.

5 Options to mitigate or enhance

5.1 Options to mitigate potential effects of industrial expansion

The preceding discussion suggests that the principal risks of industrial expansion with regard to the Irongate Stream are:

(i) the cumulative impact of increased impervious surface in the catchment, and

(ii) increased contaminant loads discharged to the watercourse in stormwater runoff.

An increase in impervious surface would be an inevitable consequence of industrial expansion in the Irongate area. Nevertheless, the effects of that increase can be mitigated by a stormwater management regime that incorporates low impact design techniques to reduce the rate of stormwater runoff to the stream and promote the infiltration of stormwater into the ground.

A stormwater management approach that is based around disposal to land would provide an effective means of minimising the discharge of contaminants to the stream, for instance by a combination of vegetated swales and infiltration strips. Through these mechanisms particulate material and associated contaminants carried by stormwater are retained in the surface soils, significantly reducing the contaminant loads entering groundwater and eventually surface waters of the Karamu catchment.

The proposed new industrial area is particularly suitable for such an approach, indeed current stormwater practices are to ground soakage. A recent preliminarily geotechnical investigation found that the area proposed to be rezoned is underlain by extensive alluvial sediments consisting predominantly of greywacke derived gravels, sands and silts, and that the near surface soils generally drain very rapidly (MWH 2008a).

It is understood that the avoidance or mitigation of the potential effects associated with the discharge of stormwater to surface water streams will continue to be managed through the provisions of the Hawke's Bay Regional Resource Management Plan. Resource consents would be required in the future for any diversion and discharge of stormwater to the Irongate Stream from future industrial sites where:

- the site exceeds 2 hectares in area; or
- the site is used for the storage of hazardous substances; or
- the discharge causes a permanent reduction in the ability of the receiving channel to convey flood flows; or
- the discharge causes permanent bed scouring or bank erosion of the receiving channel; or
- the discharge causes the production of conscious oil or grease films, scums or foams, or floatable or suspended materials in the receiving waters after reasonable mixing.

These regulatory requirements provide some encouragement for a stormwater management regime that reduces the rate of stormwater runoff to the stream and promotes the infiltration of stormwater into the ground. It is noted that the imminent review of the Hawke's Bay Regional Resource Management Plan provides an opportunity to strengthen incentives for low impact design techniques in stormwater management.

5.2 Stream enhancement options

The Steam Ecological Valuation methodology (Rowe 2008) uses two criteria to determine if a site is a suitable candidate for on-site restoration:

- an SEV score between 0.4 and 0.8 indicates on-site remediation is likely to be beneficial, and
- if the amount of impervious area caused by urban development above the site is > 25% then it is likely that the potential for restoration of ecological functions will be low (and off-site remediation should be considered).

The SEV assessment undertaken at Irongate Stream gave a score of 0.48 but also found that >25% of catchment above the site is covered in impervious surface. Our interpretation of these results is that while this site is not an ideal candidate for on-site restoration, some consideration of restoration options is warranted given the opportunity presented by the plan change process.

The options available to enhance the existing ecological value of the stream are:

(i) Reinstate meanders (so as to encourage development of riffles and pools).

(ii) Reinstate natural flood plains (enhances the stream's ability to accommodate flood flows).

(iii) Reduce area of impervious surface in catchment (restore more natural flow regime).

(iv) Reduce sediment inputs from the catchment (restore stony or cobble bed).

(v) Enhancement of riparian zone (restores a range of ecological functions).

Within the context of the proposed plan change, Option (v) above (the enhancement of the riparian zone) stands out as being the most realistic, practical and economic restoration option for improving the current ecological value of the Irongate Stream.

Enhancement of the riparian zone by planting can potentially restore a range of ecological functions (see Section 4.3 above) within the restoration area. It is also noted that the Hawke's Bay Regional Council's Te Karamu Catchment Review (HBRC 2004) considered that riparian planting is a logical enhancement step on Regional Council owned land from the Irongate/Awanui/Karamu confluence to Riverslea Road South, and on land within the Irongate Stream floodway as far as SH2, which will potentially be owned by Regional Council in the future.

That report indicated that probably a more pressing issue was the need to exclude stock from the stream and implement land use practices directed at reducing sediment inputs to the stream from the wider catchment (Option (iv) above). Without that step, and a reinstatement of the original stony streambed, other enhancement options are unlikely to improve the invertebrate community structure, as reflected by the MCI values. This is a wider catchment management issue, outside of the scope of this assessment, and the plan change process.

Enhancement of Riparian Zone

An appropriate riparian zone stream enhancement option would consist of a 15m wide riparian buffer area established along those parts of the proposed new industrial zone that abut the Irongate Stream. This would include a 15m x 440m buffer area along the northern perimeter (true left bank only), a 15m x 416m buffer area along the eastern perimeter (true left and true right banks), and a 15m x 400m buffer area where the stream abuts the southern extent of the proposed new zone. Collectively these areas comprise a total riparian buffer area of approximately 2.508 hectares.

The Regional Council has indicated that a 6m wide access strip would be required along the length of all riparian buffers areas, to allow periodic vehicle access for drainage maintenance purposes. On that basis, a 6m wide access corridor should be provided for, landward from the top of the bank of the stream.

In order to accommodate flood flows and maintenance requirements, while still maximising the ecological benefits of the riparian buffer areas, it is recommended that a riparian planting 'zone' approach be used. The proposed 'zones' are shown on Figure 5-1 below.

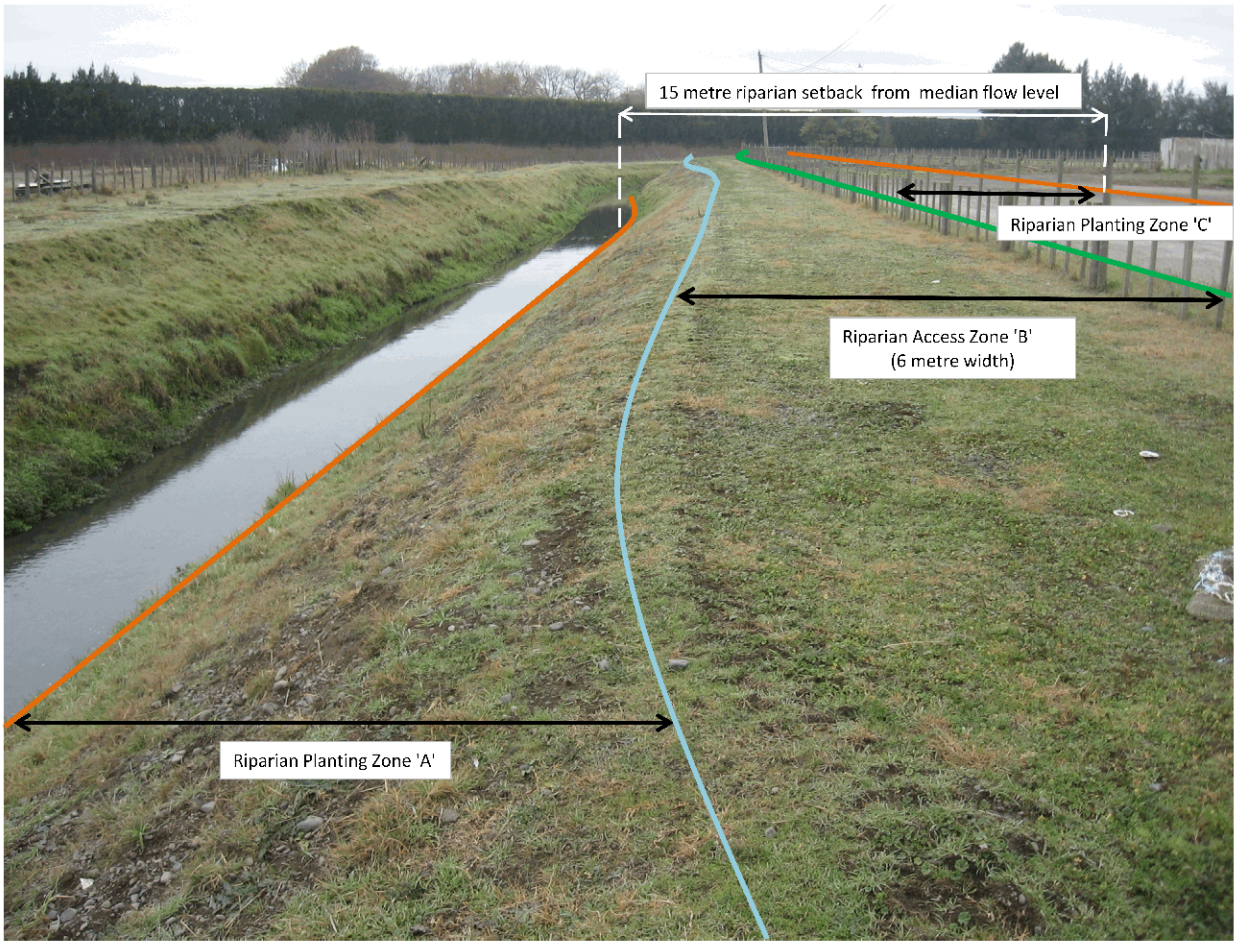

Figure 5-1: Schematic showing proposed riparian planting 'zones' (not to scale)

- **Zone 'A'** – this 'zone' refers to the plantings between median water level and the top of the bank, and comprises grasses and shrubs. Plantings have been recommended for this area (refer to planting schedule contained in Appendix A), which would minimise roughness and minimise constraints to physical access to the stream channel (e.g. access by excavator from access strip for regarding works).

- **Zone 'B'** – this 'zone' comprises a 6 m wide access strip, measured from the top of bank landward. This zone is not proposed to be planted.

- **Zone 'C'** – this 'zone' comprises shrub and forest species (refer to planting schedule contained in Appendix A), and aims to provide shading and organic matter inputs (leaf litter, woody debris) to the stream.

The newly established riparian buffer areas would require maintenance for the first four years from establishment. Weed control would need to commence with the placement of a 60mm deep cover of organic mulch over the plantings established in zones 'A' and 'C'. Periodic weed control would then continue for the first four years from planting. During the first two years, plantings would require irrigation during dry periods.

A summary of the rough order costs for the implementation of the riparian buffer areas are contained in Appendix A. Overall, the rough order cost (-/+ 30%) for the establishment and maintenance of the riparian buffer areas in accordance with the recommended planting schedule contained in Appendix A is $90,630.00 to $168,300.00 (excluding GST). The rough order cost for the purchase of the land contained within the 15m wide riparian buffer area is $1,254,000.00 based on a land purchase cost of $50.00 / m2.

6 Conclusions

Potentially significant adverse effects associated with the proposed industrial rezoning include the cumulative effects of increased impervious surfaces in the catchment and increased contaminant loads discharged to the watercourse in stormwater runoff. Both of these effects could be effectively mitigated by a stormwater management regime that encourages low impact design techniques such as reduction of the rates of stormwater runoff to the stream, use of vegetated swales for conveyance and infiltration to ground for the disposal of stormwater.

In order to achieve a low impact approach it is recommended that the Council ensure there are mechanisms available (such as rules contained in the Regional Resource Management Plan) that can limit the ability of stormwater from the new industrial zone to be discharged directly to surface water streams.

Riparian zone enhancement in those areas where the proposed new industrial zone abuts the Irongate Stream has the potential to restore some of the ecological functions of the stream within that reach, provided it is undertaken in concert with other restoration initiatives identified by the Regional Council, which apply to the lower stream and the wider catchment. On its own, riparian planting beside the proposed new industrial zone has limited potential for restoring ecological functions of the Irongate Stream, but would provide other benefits such as enhanced amenity values.

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Appendix A
Riparian Buffer Area

Riparian planting schedule for Irongate Industrial Plan Change

Irongate Stream riparian enhancement plant species list		
Zone 'A'	***Botanical name***	***Common name***
	Phormium tenax	lowland flax
	Phormium cookianum	coastal flax
	Poa cita	silver tussock
	Carex virgata	tussock sedge
	Coprosma crassifolia	
	Coprosma propinqua	mingimingi
	Corokia cotoneaster	korokio
	Cortaderia fulvida	toetoe
	Hebe stricta	koromiko
	Leucopogon fasciculatus	mingimingi

Zone 'C'	***Botanical name***	***Common name***
	Carpodetus serratus	putaputaweta
	Coprosma robusta	karamu
	Corokia cotoneaster	korokio
	Hoheria angustifolia	narrow-leaved lacebark
	Hoheria populnea	lacebark
	Knightia excelsa	rewarewa
	Kunzea ericoides	kanuka
	Myrsine australis	red matipo
	Pittosporum eugenioides	lemonwood
	Pittosporum tenuifolium	kohuhu
	Pseudopanax crassifolius	lancewood
	Podocarpus totara	totara
	Sophora tetraptera	kowhai

General notes:

All plantings shall be at a 1 metre spacing.

The 15 metre riparian planting zone is measured at right angles to, and away from, the Irongate Stream channel.
The 15 metre commences from the median flow level of the Irongate Stream.

Plantings shall be held under a 2 year establishment period, during which time plant losses shall be replaced.

Notes regarding Zone 'A':

Silver tussock (*Poa cita*) shall be planted in a sufficient quantity to achieve no less than 20% of the total Zone 'A' planting composition.
Coprosma crassifolia shall be planted in a sufficient quantity to achieve no less than 15% of the total Zone 'A' planting composition.

Flax species (*Phormium tenax*, *P. cookianum*) or toetoe (*Cortaderia fulvida*) shall be planted in quantities to achieve no more than 10%.
of the total Zone 'A' planting composition.

Notes regarding Zone 'C':

Kowhai (*Sophora tetraptera*) shall be planted in a sufficient quantity to achieve no less than 20% of the total Zone 'C' planting composition.
Totara (*Podocarpus totara*) shall be planted in a sufficient quantity to achieve no less than 15% of the total Zone 'C' planting composition.
The remaining 65% of plants for riparian planting within Zone 'C' shall comprise of a mix of any of the other riparian plant species listed in Zone 'C' of the planting schedule.

All plants used in riparian planting shall be eco-sourced (sourced from naturally occurring specimens within the Heretaunga Ecological District). Plant species that cannot be sourced from the Heretaunga Ecological District shall be sourced from the next nearest location (e.g. from adjacent ecological districts).

Rough Order Costs

Irongate Stream Riparian Enhancement - Rough Order Cost Estimate			
Plants for Zone 'A'	13,299		
Plants for Zone 'C'	25,381		
Contingency for lost plantings (15%)	5,643		
Planting	10,000		
Mulch	45,144		
Irrigation	10,000		
Weed control	20,000		
Land purchase (@ $50m2)	1,254,000		
	-30%	**Calculated**	**+30%**
Riparian enhancement sub-total (excluding land)	**$90,627**	**$129,467**	**$168,307**
Riparian enhancement sub-total (including land)	**$968,427**	**$1,383,467**	**$1,798,507**

Assumptions made in calculating rough order costs:

Mulch 60mm depth over Zones 'A' and 'C'.

1/3 of plants located within Zone 'A'; 2/3 of plants located within Zone 'C'.

Plant costs at 2009 rates for bulk orders.

Irrigation costs allow for 6 people at $12.50/hr over 12 - 8 hour working days, including equipment costs.

Planting costs allow for 10 people at $12.50/hr over 10 - 8 hour working days.

Weed control allows for 2 people at $20.00/hr over 10 - 8 hour working days, including material costs for the first four years.