Environment Southland

Waituna Lagoon

Visual assessment of drain cleaning activities

prepared by

Ryder Consulting

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environment + planning + project management

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Dean Olsen, B.Sc.(Hons.), Ph.D.

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Ryder Consulting Limited
PO Box 1023
Dunedin
New Zealand
Ph: 03 477 2119
Fax: 03 477 3119

Table of Contents

1. Introduction

1.1 Background

A visual assessment of drain clearing activities was conducted in the catchment of Waituna Creek. Visual inspections of drains previously cleaned were conducted in Mahers Tributary, Taylors Tributary, Henderson Tributary and the Waituna Creek in the vicinity of Mahers and Taylors Tributaries (*Figure 1*). In addition, active drain cleaning was observed in Taylors Tributary and Henderson Tributary.

Best management practices for drain cleaning developed by the Waikato Regional Council (formerly Environment Waikato) (Environment Waikato 2007) were used in these assessments.

1.2 Report objectives

The purpose of this report was to:

1. Document the drain cleaning practices observed on 23 February 2012.
2. Comment on whether the drain cleaning practices observed comply with the BMPs developed by Waikato Regional Council and suggest ways of reducing potential environmental effects.
3. Comment on the likely consequences of drain cleaning for fish habitat and other potential environmental effects.

These assessments are focussed solely on the environmental effects of these activities and engineering/farm management considerations are not assessed.

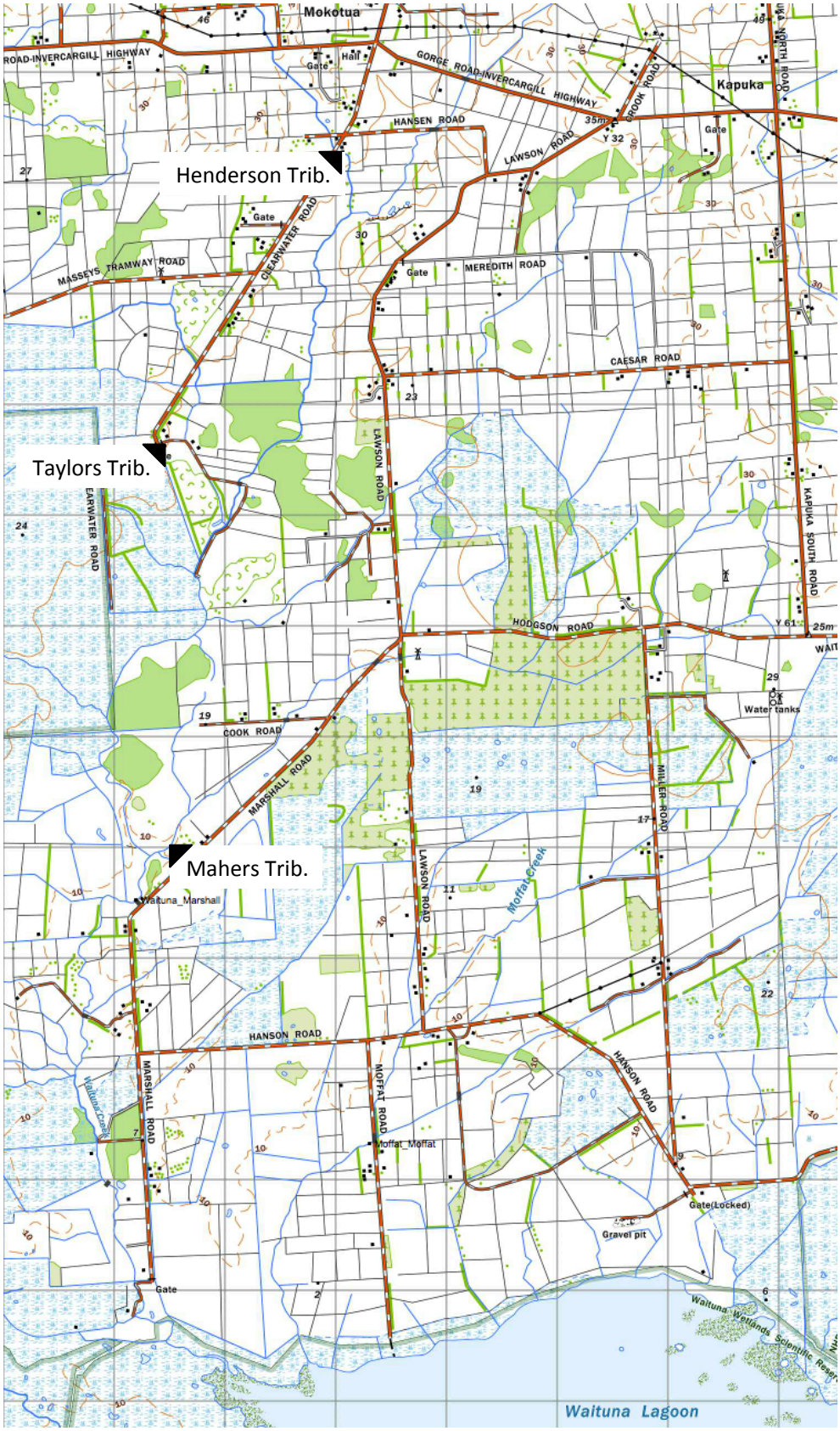

Figure 1 *Locations where drain cleaning was observed on 23 February 2012.*

2. Drain cleaning observed on 23 February 2012

2.1 Waituna Creek near Mahers Tributary

Waituna Creek near Mahers Tributary, has a moderate-sized channel with a bed predominantly of gravels and fine material. The section visited had been cleaned prior to the site inspection. Generally, there was relatively limited damage to the banks observed during the site visit, with some areas of localised disturbance evident (*Figure 2*, *Figure 3*, *Figure 5*). However, there were some exceptions to this where extensive bank remodelling had been undertaken (*e.g. Figure 6*).

Figure 2 *Waituna Creek near Mahers Tributary showing an area where a gravel bar has been removed, a submerged patch of watercress, and some localised bank disturbance.*

Figure 3 *Waituna Creek near Mahers Tributary showing an area of localised bank disturbance.*

Figure 4 *Waituna Creek near Mahers Tributary showing a recently cleaned section.*

Figure 5 *Waituna Creek near Mahers Tributary showing an area of localised bank disturbance caused by drain cleaning and an unstable and eroding bank.*

Figure 6 *Waituna Creek near Mahers Tributary showing an area of extensive earth works.*

2.2 Mahers Tributary

Mahers Tributary was a small channel (>2 m width) that was cleaned prior to the site visit. After cleaning, the channel was relatively uniformly U-shaped with some muddy edges and fine substrate bed and the full channel width was wetted, although overhanging bankside vegetation is likely to provide cover for some fish (*Figure 7*, *Figure 8*).

Figure 7 *Mahers Tributary showing a recently cleaned section.*

Figure 8 *Mahers Tributary showing a recently cleaned section.*

2.3 Taylors Tributary

Taylors Tributary was a small drain (>1 m width) that was being cleaned during the site visit. The uncleaned section of channel was extensively infested with grass with no visible surface water (*Figure 9*). After cleaning, the channel was relatively uniformly U-shaped with some muddy edges and fine substrate bed and the full channel width was wetted and water clarity was very low (*Figure 10*). In some areas there was substantial disturbance to the bank (*Figure 11*).

Figure 9 *Taylors Tributary showing an uncleaned and cleaned section.*

Figure 10 *Taylors Tributary showing the same section as Figure 9 after further cleaning.*

Figure 11 *Taylors Tributary showing a cleaned section of channel with bank disturbance.*

2.4 Henderson Tributary

Henderson Tributary is a small channel (>1 m width) that was being cleaned during the site visit. The uncleaned section of channel was extensively infested with grass with no visible surface water (*Figure 12*, *Figure 13*). After cleaning, the channel was relatively uniformly U-shaped with some gravel deposits, muddy edges and gravel or fine substrate bed and the full channel width was wetted and water clarity very low (*Figure 13*, *Figure 14*). It should be noted that the disturbance to the grass on the bank on the same side of the channel as the digger evident in *Figure 13* was caused by the digger driver flattening the grass with the back of the weed rake to give a clear view of the section of channel being cleaned.

Figure 12 *Henderson Tributary showing an uncleaned section of channel, showing lack of open surface water.*

Figure 13 *Henderson Tributary showing a section of channel being cleaned. Cleaned channel in foreground and uncleaned channel beyond digger. Note extensive grass cover in uncleaned section of drain.*

Figure 14 *Henderson Tributary showing a section of channel after being cleaned.*

2.5 Waituna Creek near Taylors Tributary

A recently cleaned section of Waituna Creek was viewed near Taylors Tributary (*Figure 15*) as well as an adjoining section that had not been cleaned (*Figure 16*, *Figure 17*).

Figure 15 *Waituna Creek showing a cleaned section with bank damage.*

Figure 16 *Waituna Creek showing an uncleaned section with extensive bank erosion.*

Figure 17 *Waituna Creek showing an uncleaned section of channel with bankside cover and watercress.*

3. Drain cleaning best management practices (BMPs)

3.1 Waikato BMPs

The Waikato Regional Council has produced best management practices for drain cleaning that are aimed at reducing the environmental effects of this activity (Environment Waikato 2007). This report makes the following recommendations:

- Minimise the need for drain cleaning by having effective sediment and erosion control.
- Use filterstrips (a strip of grass on the margins of the drain) to reduce the amount of sediment entering the drain (minimum width 3 m).
- Exclude stock from the banks to drains to prevent stock damage and reduce erosion.
- Consider the installation of a sediment trap.
- Reduce weed growth through nutrient management.
- Use of herbicide sprays to reduce the cover and biomass of vegetation in drains.

3.1.1 Objectives of drain cleaning

This report goes on to identify the following objectives of drain cleaning:

a) To re-establish the drainage depth required for the drain and its feeder drains (e.g. side drains and field tiles) by removing only the bed obstructions. The channel should not be enlarged or deepened below its original depth.
b) Provide the required outfall and water-table levels for agricultural productivity and access.
c) Minimise disturbance, avoid sensitive areas (e.g. patches of native vegetation), and rehabilitate disturbed land (e.g. smooth spoil heaps; reseed exposed soil) particularly if erosion is likely to occur.
d) Maintain existing bends in the channel.

3.1.2 Drain cleaning procedures

To achieve these objectives, the Waikato BMPs report identifies the following procedures:

a) Inspect the drain with the digger driver beforehand and identify any areas that shouldn't be disturbed (riffles, pools) and mark these with aerosol paint or pegs.
b) Only excavate material from the bed, avoid disturbing the banks.
c) Work from one bank if possible to minimise land disturbance. If there is a choice of banks, use the side that will have the least disturbance and maximise preservation of drain bank vegetation. Try and retain vegetation for erosion protection and preserve native vegetation.
d) Do not over-dig the bed of the drain.
e) Drains do not have to be perfectly flat bottomed and even edged. Small imperfections will have little effect on hydraulic efficiency and will provide some habitat diversity. Create 'V' shaped drains with a gradual slope rather than wide, flat bottomed ones with steep sides as they will erode less and require less long term maintenance.
f) In some highly sensitive situations it may be necessary to control the flow of dirty water downstream. Filter fabrics or straw bales could be used. A good idea is to leave a buffer of weed at the lower end of the drain to trap silt and clean this area last.
g) To minimise soil compaction the use of wide tracked equipment is preferred over the use of rubber tyred vehicles.

h) Materials excavated from the drain should not be placed in wetlands or boggy areas.
i) Clean spoil can be used to build a working platform along the drain, but this should not stop drainage or cause ponding of water. Excess spoil should be incorporated into fields or taken from the site.
j) Exposed soils that are prone to surface wash erosion and channel erosion should be seeded or planted.
k) Use a digger with a weed-rake or a stream-cleaning bucket because this allows water and some stream life to escape back into the drain

Of these procedures, a, b, c, d, f, g, h, j and k are relevant to the activities observed in the Waituna drains. In the Waituna Creek catchment, e) is not relevant, as these are established drains/waterways. Point i) is not relevant to these assessments, as the use of spoil to create platforms for the digger was not observed.

3.2 Compliance with the Waikato drain cleaning BMPs

During observations made on 23 February 2012, it was not possible to assess point a), as it was not relevant to the drains that were being cleared. However, this may be relevant to activities in the Waituna Creek mainstem. During observations it was evident that work was being conducted from one bank (point c), the channels were not being over-dug (point d), the excavators being used were wide tracked (point g) and a weed rake was being used at Henderson Tributary, while a stream-cleaning bucket was being used at Taylors Tributary (point k).

It was evident during the visit that banks were disturbed in some areas in Waituna Creek and Taylors Tributary (point b), although the extent of this disturbance was relatively limited. Such disturbance may be unavoidable in some circumstances or may be done to restabilise eroding banks. However there was no evidence of rehabilitation of these areas (point j), although landowners are encouraged to re-sow disturbed areas with grass seed, where practical (J. Chisholm, Environment Southland, *Pers. comm.*).

During activities observed in Taylors Tributary and Henderson Tributary,

substantial water discolouration was evident. Given current concerns regarding water quality in Waituna Lagoon the situation is likely to fit the description of a "highly sensitive situation". Thus, it is recommended that methods be investigated to reduce the flow of sediment from activities that potentially generate high concentrations of suspended sediment.

4. Potential effects of drain cleaning on fish habitat and other environmental considerations

4.1 Fish

Nine species of fish have been recorded from the Waituna Creek catchment (records from New Zealand Freshwater Fish Database, downloaded 28 December 2011): Shortfin eel, longfin eel, giant kokopu, inanga, common bully, redfin bully, common smelt, black flounder and brown trout. Of these, eight are indigenous and one (brown trout) is introduced.

The conservation status of New Zealand's freshwater fish fauna was recently reviewed by a panel of experts (Allibone *et al.* 2010) using the most recent threat classification system developed by the Department of Conservation (Townsend *et al.* 2008). Longfin eels, giant kokopu, inanga and redfin bullies were classified as 'declining' (Allibone *et al*. 2010) indicating that the populations of these species are predicted to decline due to existing threats (which include habitat loss and degradation). The remainder of the fish species identified are not currently classified as at risk or threatened.

The excavation of weed and fine sediment from stream or drain channels is likely to affect habitat for fish in these waterways. Many native fish, including eels and giant kokopu, are nocturnal and spend daylight hours in cover, such as weed, undercut banks, boulders or logs. Such structures may be disturbed during drain cleaning, which may reduce their suitability as cover. In addition, fish may be excavated along with weed and fine sediment during cleaning, although the use of weed rakes will allow some fish to escape. However, the two drains where excavation was observed were heavily infested with grass, to the point where little open water was evident. In such situations, the removal of vegetation may improve habitat quality for some fish, especially once some of the areas disturbed during cleaning have recolonized providing some cover for

fish.

Few studies on the effects of drain cleaning on fish have been conducted in New Zealand. Ryder (1997) directly observed galaxiids in the spoil from drain cleaning in Clear Creek near Seaward Downs in the Mataura catchment but did not detect an adverse effect on fish abundance, and highlighted the difficulties in comparing pre- and post-cleaning electric fishing data. Goldsmith (2000) found no changes in species richness or density six weeks after mechanical or chemical macrophyte removal in four small streams in Southland. Goldsmith (2000) identified the difficulty in quantifying the effects of drain cleaning, including differences in the capture efficiency of sampling tecniques between cleaned and uncleaned drains. Young *et al*. (2004) assessed the effects of drain cleaning in spring-fed drains in Marlborough. They observed the removal of shortfin eels (estimated at 0.3-0.4 eels per metre of drain length cleaned).

4.2 Other considerations

Young *et al.* (2004) estimated that invertebrate densities immediately after cleaning were about half of those observed prior to cleaning but had recovered within one month. Ryder (1997) found that the macroinvertebrate community was quite resilient to weed clearing activities, with only the mayfly *Deleatidium* being adversely affected.

Young *et al.* (2004) observed a large increase in suspended sediment and organic matter during cleaning, which is consistent with observations made during these observations in the Waituna Creek catchment. They also report short-term increases in ammoniacal nitrogen and dissolved reactive phosphorus concentrations and prolonged elevation of total phosphorus following drain cleaning and attribute these effects to reduced uptake by aquatic plants (macrophytes and/or periphyton) and/or the effects of physical disturbance by the excavator mobilising phosphorus-rich sediments. It is also possible that the prolonged increase in total phosphorus may also have resulted from decreased groundwater input to this drain.

There are currently concerns regarding the water quality in Waituna Lagoon, and the prospect of the lagoon 'flipping' from a clear water state to a turbid state. It has been suggested that the removal of sediment and organic matter will reduce

loadings to the lagoon during flood events, although the net effect of drain cleaning on sediment loads is currently unclear. Given the concerns regarding water quality in the Lagoon, the findings of Young *et al*. (2004) provide some cause for concern and warrant further investigation on the effects of drain cleaning on sediment and nutrient loadings to the lagoon.

5. Conclusions and recommendations

Generally, the works observed during the visit on 23 February 2012 were conducted in a manner consistent with the Waikato Regional Council guidelines (Environment Waikato 2007). Cleaning was being conducted from one bank, the channels were not being over-dug, the excavators being used were wide tracked and a weed rake or stream-cleaning bucket was being used. No stranded fish were observed during this visit, although the sites being cleaned during the visit were small, grass-choked channels that offered habitat of limited suitability for most fish. The use of weed rakes is likely to reduce the likelihood of fish stranding, as the open structure of the rake is likely to provide greater opportunity for fish to escape back into the water than if a solid bucket is used.

It was evident during the visit that banks were disturbed in some areas. While such disturbance may be unavoidable in some circumstances, there was no evidence of rehabilitation of these areas having been undertaken. This is recommended to reduce the likelihood of erosion and sedimentation.

Substantial water discolouration was evident during cleaning. Given current concerns regarding the water quality in Waituna Lagoon, and the prospect of the lagoon 'flipping' from a clear water state to a turbid state and the possibility of drain cleaning activities liberating nutrients (particularly phosphorus, Young *et al*. 2004), it is recommended that steps be taken to reduce suspended sediment concentration during drain cleaning, where possible.

6. Acknowledgements

Joe Chisholm (Environment Southland) showed me around the locations observed.

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