

Appendix F

Case Study: Scouring Events in IWL Inflow Waters

The MacIntyre Creek system has been canalized and altered by YECL during the 1950s to collect and divert water to its turbines, numbers 1 & 2, on Fish Lake Rd. YECL has a water use license to allow it to use this water.

A scour occurs when the water flow cuts into the bed or banks of the system and collects sediment. The local geology of this area contains apatite, a mineral rich in TP and used as an agricultural fertilizer. Sediment analysis confirms the sediment contains TP, being measured at 1,086,000 ug/kg sediment. MacIntyre creek scours will naturally overflow the creek banks above Turbine no 1 and run into the Porter Creek headwaters.

Heavy rain, thaw, sudden decreases in air temperature in winter, beaver activity, changes in water flow to maximize electrical generation efficiency, and other unknown reasons all cause scouring effects on this system. The net effect is to mobilize large amounts of TP-rich sediment from above IWL, moving it down into IWL and MacIntyre Marsh, where the slowing of the water velocity in IWL and the marsh allows the sediment to drop out of the water column. The mobilized sediment is known as suspended solids ("SS").

Scouring occurrences are a frequent, continual fact of life at IWL. They occur regularly, necessitating a cessation of feeding whilst the fish are stressed by sediment irritating the gills. Yet, during these episodes, incoming TP and SS levels can be significantly above IWL WUL outflow limits.

Scouring events are so regular IWL does not, and cannot afford to, sample every one. Some begin overnight, and are not sampled until they are in decline the following morning. Others are sampled as they start, but they can continue for days and IWL cannot afford to do daily samples. Still others can occur on regular sampling days. However, for over 93% of the samples taken over almost four years, the natural environment pours more sediment into IWL than IWL discharges.

IWL's tanks and ponds act as a giant settling facility, filtering and removing great surges of sediment that would otherwise pour into MacIntyre marsh, smothering invertebrate and macrophytic life. The sediment deposited in the tanks is re-suspended in the course of operations, but this is in small volumes spread over a long time. Some will then settle in the settlement ponds, some pass out to MacIntyre marsh, highly diluted compared to when it flowed in. The effect for IWL is the settlement ponds are filling faster than predicted, but more seriously that the TP contained in the re-suspended solids will be measured as if produced by IWL.

There is little any monitoring regime can do to differentiate this "re-suspended TP" from that produced by IWL's operations. IWL understands this, but asks the Water Board to bear this in mind whilst deliberating the Water Use License amendment.

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Perhaps the significance of scouring events can be shown by one example: July 14/15th 2008.

The evening of July 14th, 2008 saw heavy downpours around IWL. Some time during the night, a flash flood literally tore down from YECL head pond no1, over spilling into the Porter Creek headwaters, flowing into IWL, as well as into MacIntyre Marsh at PS3.

The photos and sampling took place on the morning of the 15th July.



IWL Supply Water

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Samples of IWL Inflow and Outflow Waters during July 2008 Scouring Event
Bottles in order of appearance: PS-3 MacIntyre Creek Inflow, PS-5 MacIntyre Creek Outflow, Site B Porter Creek Inflow, PS-2b Porter Creek Outflow

The TP sample results for this scour event appear in Appendix E's dataset.

By 8 am on the 16th, the water was back to normal and clear. It can be assumed the scour lasted at least 24 hours. Calculations of flow rate and sample analysis reveal that in this one 24 hour period on MacIntyre Creek:

- IWL removed **131.7 tonnes** of sediment,
- IWL removed **153.4 kg** of Total Phosphorous carried in the removed sediment

And on Porter Creek:

- IWL removed **14.5 tonnes** of sediment,
- IWL removed **19.6 kg** of Total Phosphorous carried in the removed sediment.

To put this in the context of an aquaculture operation, the TP IWL removed from the MacIntyre Creek system is the approximate equivalent of that produced when feeding 38 tonnes of fish feed. This is equivalent to approximately 27% of Icy Waters Ltd's *annual* feed volume on MacIntyre Creek water. *This was in the natural system in one 24 hour period.* This calculation does not include the quantity of sediment and TP that was directly moved into MacIntyre Marsh via PS3.

To conclude, background sediment and background TP levels are significant in these systems. IWL has no control over them; these background levels provide a surplus of nutrients for these systems whether IWL exists or not. Thus, IWL TP and suspended solids license Limits must be "above background".

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