ENVIRONMENT WAIKATO

Memorandum

File C 609601A

DATE 4 October 1994

TO M Brockelsby

FROM N Selvarajah

SUBJECT **Environmental impact assessment of the proposed sewage effluent treatment systems by Hamilton City Council**

Report 1 - Hamilton sewage and the Waikato River

1. Volume of sewage

The report estimated that the per capita flow of effluent is 330 litres/day. This flow is substantially greater than the average flow usually considered which is 200 litres/day. According to the report the higher per capita flow in Hamilton City is due mainly to storm water intrusion. Approximately an extra daily influent volume of 13500 m^3 could be avoided if storm water intrusion is avoided or stopped.

Moreover, HCC should actively campaign to minimise domestic water use, which will reduce the waste water volume substantially. New dwellings should install dual flush systems in the toilet. If necessary water meters should be installed (charging above a certain volume of water use).

2. Table 3.1

The mass loading of BOD and SS do not correspond with the respective concentrations.

3. Treatment of faecal coliforms

It is misleading to report faecal coliform treatment efficiency using percentage values.

4. Dilution

On many occasions the report refers to the Waikato River possessing a greater capacity to dilute high strength waste water. If 'dilution is the solution', most environmental problems can be solved without any cost! There has been no consideration given to mass loading of waste water constituents into the environment, including river outflow to the sea. For example the total sewage nitrogen that is discharged by HCC into the Waikato River is approximately 1.4 tonnes which is about a 15% increase in total nitrogen upstream of the discharge. Similarly, 0.87 tonnes of ammoniacal nitrogen added through HCC sewage effluent discharge causes an 88% increase in the ammoniacal nitrogen discharged upstream.

To improve Waikato River water quality, non-point and point sources of pollution should be reduced. Point sources of pollution caused by farming activities (e.g. oxidation pond discharges) have been substantially reduced due to Environment Waikato's move to make land application of farm effluent a permitted activity. Approximately 50% of the farms in the Waikato are currently using land treatment system. There is an increasing trend towards land treatment of farm waste water due also to the high fertiliser value the farm waste water provides to the dairy farmer.

As for non-point sources of pollution, Environment Waikato is currently involved with farmers and researchers in developing guidelines for good grazing practices. Most of the non-point source pollution problem will be solved through continuous consultation and technological transfer. However, if required rules will be introduced through the General Regional Plan to minimise non-point source pollution caused by major industries, including the farming sector. Since the enactment of the RMA environmental issues have been given greater consideration by the wider community. Stringent standards of discharge of waste water to land or surface water are imposed by Environment Waikato and many other regional councils. For example, about 10 years ago dairy companies were allowed to discharge waste water at 1500 kg N/ha/year. The current average N loading rate that has been applied is 300 kg/ha/year.

The applicant must consider that the stringent standards imposed on other resource users are also applicable to the HCC.

Report 2 - Options for waste water treatment and disposal

The report extensively assessed the available options to treat or dispose waste water. A good system should have the following characteristics:

a. Environmentally sustainable.
b. Reliable with little or no uncertainty.
c. Affordable.
d. Low energy requirements.
e. Culturally acceptable.
f. Possible to install and run within the given time frame (maximum of 2 years).

1. Status quo

It is clear that the existing primary treatment quality is unacceptable due to relatively high loadings of nutrients into the Waikato River. Although the report advises that due to high dilution available in the Waikato River the discharge from primary treated effluent is unlikely to cause any adverse effects. However, Report 1 also argues "...addition of secondary treatment would result in a significant increase in the effluent quality. This could potentially have several important benefits to the Waikato River in terms of effluent toxicity and impact upon aquatic biota...". Since the discharge is one of the major point sources of pollution in the region, the applicant should take every effort to improve the quality of the effluent discharged. If there is uncertainty whether the existing discharge quality in unlikely to affect the receiving environment (including sea), the applicant should carry out extensive studies to show that the discharge will not cause adverse effects.

2. Land treatment systems

(a) Nutrient loading

According to the report it has been estimated that using the existing primary treatment system a land area of 1360 ha is required (without buffer zone) at the 500 kg N/ha/year loading rate. Presumably this figure has been obtained considering the possible population increase. This is because using a daily plant output of total nitrogen of 1400 kg N, the required land area is 1022 ha.

The land area required could vary depending on the type of crop used and land management practices. For example, the land area required for a saw-log forest system will be 5100 ha (@100 kg N/ha/year) and for energy-wood or pulpwood will be 3400 ha (@150 kg N/ha/year). The land area required for energy-wood or pulpwood could be even greater considering the frequency of crop harvest. On the other hand, for grazed dairy pasture the land area required will be 2500 ha (@200 kg N/ha/year) and for a 'cut and carry' pasture system it will be up to 850 ha (@600 kg N/ha/year). The land areas referred to here are without the provision of appropriate buffer zones and are estimated for primary treated effluent.

With appropriate hydraulic and nitrogen loading rates and good management practices, land treatment systems are preferred to other treatment systems. Land treatment systems are consistent with the cultural requirements. Land treatment systems have been adopted by many industries to manage their waste water in New Zealand and overseas. However, when managed poorly land treatment systems can lead to death of crops, surface runoff of effluent, and nitrate leaching to ground water.

(b) Hydraulic loading

It could be argued that with proper secondary treatment mechanisms the nitrogen loading can be reduced substantially. Unfortunately, the high volume of waste water means that very large land area would still be required to spray irrigate the waste water. For example, if 25 mm of effluent is applied per day, to spray irrigate 35000 m^3 the required land area per day will be 140 ha. If a 14 day rotation is used the total area of land required excluding buffer zones will be approximately 2000 ha regardless of the type of crop and the management practice used. During wet weather the spray irrigation has to be either stopped or spread onto the total available land area. It is concluded that even if the nutrient loading is reduced through further treatment, the high volume of waste water is extremely difficult to manage from the land treatment view point.

Considering the large land area required to treat the HCC sewage effluent, land treatment is a very expensive option for waste water treatment. Such systems require a high capital cost and have a very high running cost.

3. Secondary treatment

It is out of scope of this memo to assess all the secondary treatment systems that are available to treat the HCC sewage effluent. This memo will assess the most practicable secondary treatment system which is currently available.

Sludge removal
In order to increase the efficiency of any secondary treatment, a major proportion of solids should be removed following primary treatment. This will enable substantial removal of phosphorus, BOD, heavy metals and organic nitrogen.

Dewatered and composted sludge can be given away as organic manure to the public, organic fertiliser companies or can be used by HCC for fertilising gardens and parks.

Activated sludge system
It is well known that the activated sludge system is one of the best known and reliable secondary treatment systems available to treat waste waters with high BOD and ammoniacal nitrogen. This system can also reduce suspended solids substantially. Following activated sludge treatment most of the ammoniacal nitrogen will be transformed into nitrate.

Nitrate produced from an activated sludge system should be removed by denitrification. Denitrification techniques currently available are very efficient and reliable. The only set back with this system is that phosphorus is not treatd in an activated sludge system. The best treatment option for phosphorus is either land treatment or binding phosphorus by the use of chemicals (e.g. aluminoferrous oxides).

4. Summary

a. Minimise or prevent storm water intrusion into sewage system.

b. Land treatment systems are not suitable for treating HCC sewage effluent. Such systems are very costly (capital and running) and require a substantial amount of energy to run.

c. Other systems such as constructed wetlands, oxidation ponds and fixed growth biological secondary treatment are not suitable either due to the large area of land required, high capital and running costs and high uncertainties related to treatment efficiency.

d. The most preferred system for HCC is a combination of primary treatment, sludge removal, activated sludge treatment, denitrification, disinfection through UV treatment and a rapid flow wetland system. The rapid flow wetland treatment system will be consistent with cultural requirements. The effluent should be treated to a quality that is acceptable as a discharge into the Waikato river and hence the land area required for the rapid flow wetland system will be very small (e.g. 5-10 ha).

e.g.
Primary treatment $\rightarrow$ sludge removal $\rightarrow$ activated sludge treatment $\rightarrow$ nitrification $\rightarrow$ denitrification $\rightarrow$ UV treatment $\rightarrow$ rapid flow wetland system $\rightarrow$ diffuser.