Auckland Regional Council
TE RAUHĪTANGA TAIAO

CHEMICAL TREATMENT GUIDELINE

June 2008

Earthworks in the Auckland Region

It is estimated that approximately 800ha of consented earthworks are undertaken in the Auckland region each year. In addition, it is estimated that another 800ha of non consented earthworks (i.e. permitted activities) are also undertaken in a calendar year.

Most of the earthworks are undertaken within the urban area of Auckland and in particular within "Greenfield" areas. A large percentage of these areas discharge to small streams that in turn discharge to low energy marine environments.

The performance of sediment retention ponds constructed to TP90 standards is generally good, but there are a number of situations where the addition of a chemical coagulant will provide enhanced sediment removal from stormwater. The main situations where chemical treatment provides substantial improvement over an untreated pond situation are:

- where there is a high percentage of clay material;
- where cumulative effects of a number of earthworks stormwater discharges should be considered;
- where receiving environments are sensitive to sediment deposition; and
- where good treatment is required for a large storm event, in particular the storm event that overflows the primary spillway.

ARC monitoring staff with considerable experience of working with earthworks sites in the Auckland Region have identified that clays are difficult to settle out in conventional sediment retention ponds. Typically the discharge from sites with clays results in very high turbidity (NTU) and suspended solids entering receiving environments. The TP90 pond design relies on a slow decant rate (or draw down of the pond) to optimise settling times, but, if the suspended sediment has not settled, discharge through the decants can result in the discharge of highly turbid water over a protracted period.

Sampling results from chemically treated sediment retention ponds during ALPURT Sector B1 works showed pond treatment efficiencies ranging from 78% through to 99%. Further trials of a chemically treatment pond recently undertaken by NIWA have produced results that generally support the earlier studies and indicating pond treatment efficiencies ranging from 48% through to 92%.

High treatment efficiencies of ponds without chemical treatment are generally associated with smaller rainfall events where the pond design is similar to, or exceeds, the design standards of

TP90. During smaller rainfall events the percentage efficiency improvement gained by chemical treatment can be minor. In larger storms, and particularly storms with high rainfall intensity, the percentage efficiencies for both treated and untreated ponds can reduce significantly, but it is during these larger events the percentage efficiency improvement between an untreated and a treated pond is generally at its greatest as supported by the NIWA trials.

It is noted that the chemical treatment trials (and workshops) undertaken by the ARC to date have focused on use of polyaluminium chloride (PAC) as a chemical coagulant. This has transpired as PAC (and the rainfall activated system developed around the chemical) has generally been regarded as relatively easy to use and has provided proven treatment gains under Auckland conditions.

However, chemical treatment systems can fail if not properly constructed, inspected and maintained. Chemical treatment systems should be rigorously inspected prior to forecast rain events to ensure they will fully function throughout the event and in particular the heavier events when they provide the greatest benefit.

Why use chemical treatment?

Chemical treatment is used to treat sediment laden runoff from Land Disturbing Activities to a greater extent than standard sediment control practices. This ultimately reduces the quantity of sediment discharged to a receiving environment such as a freshwater stream, or marine environment. This helps to protect downstream environments from excessive sediment deposition and water quality degradation.

Chemical treatment has been proven to be a cost effective means of increasing sediment pond treatment efficiencies as opposed to enlarging ponds to achieve similar percentage efficiencies. There are often cost and physical limitations to increasing pond sizing beyond TP90. Studies have shown that increases in pond volume beyond TP90 provide progressively smaller increases in benefit of sediment removal (treatment efficiencies).

How does chemical treatment work?

Chemical treatment is a method of enhancing the removal of sediment-laden runoff from a Land Disturbing Activity. Liquid coagulant is usually added to the stormwater inflow to a sediment retention pond via a rainfall-activated system, although batch dosing by hand may be used under some circumstances.

The coagulant neutralises electrical charges that cause particles to repel each other, thereby accelerating the aggregation and settlement of particles that may otherwise be discharged from a sediment retention pond.

The application and design of the flocculation units are detailed in Auckland Regional Council's Chemical Treatment Guidelines Technical Publication 227 (TP227).

ARC chemical treatment policy

An objective of the ARPSC is "*To minimise sediment discharge to the receiving environment*". The ARPSC anticipates that with "*the implementation of the Regional Plan, improvements in*

water quality in water bodies and coastal water are expected due to the following: …increased efficiency and effectiveness of sediment control measures… "

The use of chemical treatment has significantly improved the pond treatment efficiencies and is now accepted as a best practicable option throughout the earthworks industry rather than an innovative practice. Many earthworks sites now have chemical treatment management plans which cover both rainfall activated chemical treatment devices attached to sediment retention ponds and the management of batch dosing associated with other activities for example pumping or associated with wheel wash facilities.

Auckland has mostly estuarine and/or harbour receiving environments and given that earthworks are often concentrated with "pockets" throughout the Auckland region as zone changes "free up" land for development, the need for improved efficiencies in sediment control is ongoing. The ARC considers chemical treatment as a key tool to minimising the effects of Land Disturbing Activities on the receiving environment.

Chemical treatment guideline

In order to provide a level of consistency and certainty to resource consent applicants and those preparing erosion and sediment control plans, we have adopted the following criteria:

Chemical treatment will be required for any site that produces more than **1.5 tonnes of (net) sediment** as determined by a Universal Soil Loss Equation[1] (USLE) calculation. Sites which exceed this threshold will require chemical treatment in accordance with a site chemical treatment management plan. This plan shall be submitted as a part of the resource consent application.

Exceptions to the guideline are:

- If a particular device is to be operational for less than one month, then chemical treatment may not be warranted.
- Sites within granular volcanic soils (generally found around the Pukekohe and Mangere Mountain areas) and the sand areas (such as Omaha and Muriwai) may not require chemical treatment.
- Sites which operate under specific discharge standards may not require chemical treatment (i.e. quarries).

If during the chemical treatment bench testing it is determined that chemical treatment will provide no benefit (improvement) to the efficiency of the sediment control devices, then chemical treatment may not be required.

[1] It is recognised that the USLE is a relatively simple model that whilst it is appropriate to estimate gross sediment yields, it is very much dependant on a range of assumptions regarding slope angles, soil conditions, and construction methodologies. The overall estimate is indicative of the magnitude of sediment likely to be discharged from the assessed site. It is noted that a USLE assessment should not be used to determine the environmental effects of an earthworks activity.