VSAP Stormwater Project:

‘Minimisation of the impact of unsealed roads on stormwater quality’

Technical Report

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Completed by:

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For

CARDINIA

City of Casey

MORNINGTON PENINSULA Shire

COMMITTED TO A SUSTAINABLE PENINSULA

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Executive Summary

This Technical Report is a product of the project 'Minimisation of the impact of unsealed roads on stormwater quality', hereafter called the Unsealed Roads Stormwater Project. With funding by EPA Victoria as part of the Victorian Stormwater Action Program (VSAP), the municipalities of Cardinia, Casey and Mornington Peninsula initiated the project in an effort to protect stormwater quality in the Westernport catchment.

The information contained in the Technical Report was collected from field trials, experiments, literature searches and industry liaison, and is a comprehensive report detailing project activities for the twelve-month period. Accompanying this Technical Report are the following documents:

- *Handbook*: An instructional handbook on the best practice unsealed road maintenance measures to control sediment and improve stormwater quality. (40 pages)

- *Field Guide & Video:* An on-site guide outlining simple steps for protecting water quality along unsealed roads. (4 pages)

Background

The municipalities of Mornington Peninsula, Casey and Cardinia identified unsealed roads in their Stormwater Management Plans as a significant source of sediment and other associated pollutants to stormwater runoff.

Photo 1: Mangroves in Westernport Bay.

Stormwater from the Mornington Peninsula Shire, City of Casey and Cardinia Shire flows into the catchment of Westernport Bay. This area has significant environmental values, including seagrass beds, saltmarsh and mangrove communities, Ramsar listed wetlands and habitat for protected species of migratory birds.

Consequently, management of sediment from unsealed roads was identified as a priority risk issue for the region. In an effort to protect stormwater quality in the Westernport catchment, the three councils formed a partnership and were successful in their application to the VSAP program to investigate this environmental issue.

Literature Review

As a first step in the Unsealed Roads Stormwater Project, a desk-top study reviewed past studies and literature relating to unsealed roads and stormwater quality. As detailed in Chapter Two, a number of factors can influence sediment runoff from an unsealed road. These factors can be separated into two main focus areas; sediment production and sediment delivery.

Sediment Production

An unsealed road pavement has the potential to produce large amounts of sediment runoff. Experiments were undertaken to compare the effectiveness of various road surfacing techniques for minimising sediment runoff from an unsealed pavement. Treatments were constructed on a road in Mornington Peninsula Shire Council. Simulated rainfall was used as the method of collecting water quality data from specially constructed plots. The experimental design is detailed in Chapter Three.


Photos 2 & 3: Rainfall simulation trials conducted at Boes Rd, Hastings.

The data collected indicates that road surface treatments provide minimal benefits to stormwater quality. Neither wet compaction, dry compaction nor an additional surface layer resulted in a reduction in sediment runoff. As a result, efforts should be focused on improved maintenance of roadside drainage structures and the treatment of drainage water prior to discharge. Increased attention to these matters will provide maximum benefits for the environment for any resources invested.

Analysis of the road runoff found that unsealed roads generate a large proportion of fine sediment particles. Approximately 60% of the sediment collected in runoff was very fine silt and a further 30-40% was silt.

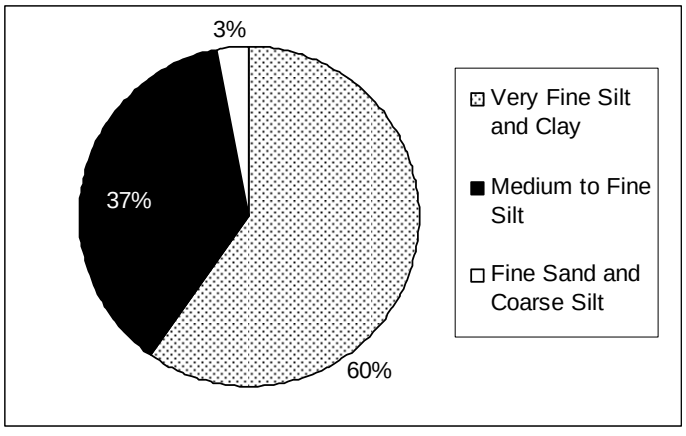

Figure 1: Particle Size Distribution of Sediment Runoff from an Unsealed Road Pavement in Hastings, Victoria.

These small sized particles are generally hard to control due to the long detention times required for the particles to settle. A proportion of the material will be suspended indefinitely because the particles are too small to settle, even if detained prior to discharge. This finding is consistent with the Westernport Sediment Study

(2003), which found that a proportion of fine sediment found in the bay is sourced from unsealed roads. During large storms a higher proportion of coarse sediment is produced, most probably because the increased volume and velocity of the stormwater has the capacity to pick-up and transport larger road particles. Therefore, during large storm events coarse material may be transported to waterways and contribute to stream bedload.

Dust suppression is regularly used by councils to control the amount of dust generated from unsealed roads, and as such these treatments were included in the field experiments. The results indicated that dust suppressants have the potential to adversely affect stormwater quality. The lignosulphonate treatment produced greater amounts of sediment, calcium and organic carbon than when compared to an untreated gravel pavement. Runoff from the bitumen treatment also showed greater amounts of calcium and organic carbon than runoff from the gravel pavement. These findings indicate that environmental factors should be considered when using dust suppression.

Sediment Delivery

Roadside drainage has the potential to collect and transport sediment and other pollutants away from the road and 'deliver' runoff into local waterways. To investigate measures for reducing sediment delivery, a variety of erosion and sediment control techniques were trialed at six locations within Cardinia Shire Council and the City of Casey. The results of the trials are detailed in Chapter Four.

Any measures used to minimise sediment runoff and improve water quality from unsealed roads should be site specific and take into account the characteristics of the local area. There is a variety of erosion and sediment control measures available for use on unsealed roads, and these technologies are continuously developing. Any sediment control measures will need to be periodically cleaned and maintained. This is an important requirement to ensure treatment efficiency is maintained and should be included in costs and long-term resource allocation.

Photo 4: Runoff from an unsealed road flowing directly into Cockatoo Creek.

An unsealed road network may contribute disproportionate amounts of sediment to the catchment. Only some road sections may have the necessary characteristics to potentially impact on water quality of receiving waters. Identifying these areas is an important step in ensuring cost effective sediment control measures that result in the maximum benefits to the environment. This strategic management approach provides a long-term solution to stormwater impacts from unsealed roads. A process for the assessment of an unsealed road network is detailed in Chapter Four.

Dust Suppression

Dust suppression products have the potential to affect the surrounding environment. The challenge is to find a balance between minimising the effects of dust against the effects of application. Application guidelines are detailed in Chapter Five, which provide some direction for manufacturers, suppliers and users of dust suppression chemicals for minimising environment impacts. Increased regulation and possible certification of commercially available dust suppression products may be an effective way of managing the environmental effects of dust suppression in the long-term.

Further study is required to fully investigate the short-term and long-term effects of dust suppression. The likelihood of any adverse environmental effects of dust suppressants would be best determined by a systematic study and detailed analysis of soil and water samples along roadsides and surrounding waterways where such materials are regularly applied. In particular, more information is needed on the chemical composition and environmental impacts of bitumen derived dust suppressants, as little information was found on these products in Australia.

Conclusions

Unsealed road pavements have the potential to produce large amounts of sediment, with turbidity of runoff water in excess of 1000 NTU. These sediment levels are up to 40 times the objectives set for the Western Port catchment in the State Environment Protection Policy (Waters of Victoria). The sediment produced from unsealed roads is typically very fine, with up to 60% of particles in runoff being very fine silt and clay. This type of sediment has the potential to be suspended in stormwater for long periods of time, carried long distances and cause environmental harm once reaching waterways. As a result, unsealed roads are a significant source of sediment and can potentially cause environmental damage.

Management of roadside drainage is the most effective way of controlling sediment runoff from unsealed roads. Experiments conducted as part of the Unsealed Roads Stormwater Project found that no single surfacing technique produces significant benefits to sediment runoff. Focusing on the maintenance of roadside drainage structures and the treatment of drainage water prior to discharge will provide maximum benefits for the environment for any resources invested. Due to the proximity of the road at a stream crossing, these sections are inherently the highest risk to water quality. Priority management of these high risk sites through identifying and assessing risks and implementing sediment control measures accordingly is an effective way to improve water quality at the catchment scale.

Photo 5: A table drain along an unsealed road following rainfall.

Victorian councils have a legal responsibility to manage unsealed roads so as to minimise erosion, sediment and pollutant transport. Council staff need to be aware of the environmental risks associated with unsealed roads and adopt good environmental practices when working along unsealed roads. The Handbook and Field Guide produced as part of the project outline best practice unsealed road maintenance measures to control sediment and improve stormwater quality. These resources are designed to present the findings of the project in a user friendly format that can easily be transferred into on-ground practices.

While the findings of the Unsealed Roads Stormwater Project have importance to maintenance practices for unsealed roads, the limitations encountered during the study should be taken into consideration when speculating about the results. Further investigation on sediment generation from unsealed roads would be beneficial, particularly over a longer period of time.