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Attention: Sally Lewis

Dear Sally,

Buckland Park – Environmental Impact Statement
Implications of the mosquito control measures recommended for the Buckland Park urban development project on the marine ecosystem.

Drs Williams and Kokkinn suggest that it is difficult to control mosquitoes without having an impact on other animals particularly insects which in turn leads to impacts on higher order animals (fish, crabs, birds etc.). The most significant breeding grounds of mosquitoes in Buckland Park are the coastal intertidal areas and therefore are the likely targets of insecticide applications.

There are two pathways in which an insecticide can affect coastal and marine fauna (1) the reduction of food source since mosquitoes (particularly larvae) are a source of food for fish and (2) the introduction of potential toxic substances in the food chain.

The first pathway was considered to have a small to an undetectable impact on the marine fauna because no local marine species is thought to be wholly dependent on mosquitoes as a food source. The second pathway is more likely to have an unintended impact on marine species; the extent of this impact is dependent on the insecticide used, the frequency of usage and concentration reaching the marine environment.

We have reviewed available literature to investigate each substance proposed in the mosquito control measure recommended for Buckland Park by Drs Williams and Kokkinn, each insecticide will be discussed separately in the following:

Bacillus thuringiensis israelensis (Bti) is a mosquito larvicide (substances that kill the larval stage of insects) that is applied to water bodies (as a liquid, pallets or briquettes). It will kill most mosquito larvae within days of ingesting. Our literature review shows that Bti does not persist in the environment after application, although the solid form is more persistent. Generally, reports of activity after application show a decline in efficacy within days and little residual activity after several weeks.

In the literature reviewed we noted that over 40 tons of Bti were applied in West Africa, without any reports of safety or non-target concerns. The environmental threat posed by Bti would appear to be significantly less than that posed by most other forms of mosquito control which have a similar level of efficacy, T. R. Glare and M. O'Callaghan (1998). Personal observations in First Creek, Port Pirie noted a significant reduction in mosquitoes with no visible impact on non-target marine organisms.

Application of larvicide may involve extensive treatment. The recommended mosquito monitoring program will ensure that applications of larvicide are based on the risk of nuisance and disease evident at the time. As stated by Drs Williams and Kokkinn, the decision to spray extensively would be the subject of negotiation with coastal protection authorities.

Insect Growth Regulator (IGR) S-Methoprene can be used, formulated as pellets or briquettes, to prevent the pupation of mosquito larvae (Drs Williams and Kokkinn, 2008). Methoprenes are not harmful to birds or mammals, but can be "somewhat toxic to some fish and aquatic invertebrates" (US EPA, Fact sheet October 2008). Risk assessments by the US EPA show that concentrations of the active ingredient in aquatic environments, if the products are used according to label directions, should be well below the levels that are harmful in laboratory toxicity tests.

Extensive studies in New Zealand by Glare and O'Callaghan (1999) have shown that methoprene breaks down quickly in the environment and poses little hazard to humans. Methoprene was found to have little phytotoxicity and very low toxicity to mammals. However they found that methoprene is slightly toxic to coldwater fish and the examination of benthic communities (bottom dwelling animals) after application against mosquitoes had negative impacts on some organisms, however recovery after application was rapid.

Methoprene has longer residual activity than Bti, but is toxic to a greater range of species than Bti. However, the use of more than one agent during mosquito control is advisable, considering the risks of resistance developing and both methoprene and Bti should be considered (Glare and O'Callaghan, 1999)

Bifenthrin is a contact insecticide and one of the most popular pyrethroids used for home gardens. It is stable in light, has a long shelf life and has a residual effect. It is also effective in controlling ants, the number one problem insect for residential users. While this pesticide is highly toxic to fish and other aquatic organisms, it was originally thought that it would not pose a water quality problem because it is very insoluble in water and strongly binds to soil organic matter.

However, research conducted at the University of California Riverside and University of California Berkeley found that bifenthrin is carried on fine soil particles in surface runoff and is highly persistent in water bodies. This results in levels toxic to aquatic organisms.

Drs Williams and Kokkinn suggest that bifenthrin can be applied to vegetation or mesh barriers erected between the coastal salt marshes (larval habitat) and Buckland Park, but they caution that there remain concerns about their impacts on non-target insect species. However the strategic and monitored use of mosquito barriers may be important in controlling mosquitoes, given Buckland Park's proximity to the breeding grounds of the coastal mosquitoes *Aedes camptorhynchus* and *A. vigilax*.

Malathion is a broad-spectrum organophosphate (OP) insecticide first registered in 1956. It is used widely in agriculture and regional pest eradication programs. Risk assessments by the US EPA indicated some occupational handler and post-application, residential bystander, and ecological risks of concern. Occupational risks have been mitigated through personal protective equipment or engineering control requirements on the labels and extending re-entry intervals for some sites, and ecological risks have been addressed through adding buffer zone and spray drift requirements to the labels, and amending use patterns for many uses.

Drs Williams and Kokkinn suggested that the application of malathion to barrier vegetation has been demonstrated to provide control of coastal mosquitoes in the United States (Anderson et al. 1991). It was suggested that insecticide-treated barriers may consist of vegetation, or artificial structures such as fencing.

We endorse the research recommended by Drs Williams and Kokkinn:
- Impact on non-target species.
- Optimal configuration for physical deployment (mesh screens, vegetation barriers special plantings).
- Comparison of ecological impact with coastal insecticide application.
- Impact on nuisance and disease-vector mosquitoes.
- Costs relative to broadcast insecticidal applications.

We recommend using an integrated approach to pest management by;
- protecting species that feed on mosquitoes at all growth stages,
- applying pesticide only as recommended by the manufacturers,
- limiting the use of pesticides to only the affected area,
- strategically applying insecticides during the breeding season,
- ensuring that insecticides are not applied to impervious surfaces, like concrete, where it is easily washed into surface runoff,
- encouraging residents to use mosquito screens to windows and doors,
- educating residents about limiting opportunities for mosquito breeding grounds close to residential areas.

References:
Travis R Glare and Maureen O'Callaghan (1998). Environmental and health impacts of *Bacillus thuringiensis israelensis*. Report for The Ministry Of Health July, 1998.

Travis R. Glare and Maureen O'Callaghan (1999). Environmental and health impacts of the insect juvenile hormone analogue, S-methoprene. Report for the Ministry of Health. March, 1999

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Regards

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