**Before the Joint Hearings Panel of Greater Wellington Regional Council and Porirua City Council**

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| **IN THE MATTER** | of the Resource Management Act 1991 |
| **AND** | |
| **IN THE MATTER** | Land use and subdivision consent application (RC6922-SL0046/15) and Discharge, land use and water permit consent application (WGN160028) |
| **BETWEEN** | Wellington Regional Council (Local Authority) |
| **AND** | Porirua City Council (Local Authority) |
| **AND** | Jagger NZ Limited (Applicant) |

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# Primary brief of evidence
## On behalf of Greater Wellington Regional Council (GWRC)

**Gregor McLean**
**5 April 2016**

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## INTRODUCTION

1 Land Matters NZ (agent) acting on behalf of Jagger NZ Ltd (applicant) has applied for various resource consents required to authorise earthworks and stream works for the development of Brookside Estate.

### Qualifications and experience

2 My full name is Gregor John McLean.

3 I am a Director of Southern Skies Environmental Limited. I am an environmental consultant with 20 years experience in preparation and processing of resource consents, erosion and sediment control design, consenting and implementation, project environmental management plans, monitoring and site auditing. Relevant experience includes:

- Environmental auditing for Greater Wellington Regional Council and Auckland Council.
- Development and delivery of environmental training courses for Northland Regional Council, Fulton Hogan, Hawkins, Transpower, Northpower, Auckland Council, Environment Canterbury, Higgins Construction, Electrix, Hopper Construction and Downer Construction.
- Preparation of chemical Flocculation Management Plans including soil bench testing for various contractors.
- Independent Erosion and Sediment Control expert for the Board of Enquiry – Transmission Gully Project and Erosion and Sediment Control expert for Mill Creek Windfarm.
- Co-Author of the Erosion and Sediment Control Standard for the New Zealand Transport Agency (August 2010) and Auckland Council Erosion and Sediment Control Guideline (2015).

4 I hold a Bachelor of Arts (Geography/ Environmental Planning) from Massey University and a Post Graduate Diploma in Natural Resource Management from Lincoln University. I have the status of a Certified Professional in Erosion and Sediment Control (CPESC Number 7628).

5 I am a Member of the International Erosion Control Association, an Affiliate Member of the New Zealand Planning Institute, and have completed the Auckland

Regional Council Erosion and Sediment Control – Plan Preparers and Flocculation Training Courses.

**Code of Conduct**

6 I confirm that I have read and agree to comply with Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014. I confirm that I have considered all the material facts that I am aware of that might alter or detract from the opinions that I express, and that this evidence is within my area of expertise.

**KEY ASPECTS OF THE PROPOSAL**

## Erosion and Sediment Control

1 The development site has an area of approximately 13ha. The site is located in the lower reaches of the Duck Creek catchment. Duck Creek itself flows through the site discharging to the Pauatahanui Inlet under State Highway 58.

2 The application proposes to undertake earthworks over an area of approximately 11.34ha associated with a 149 lot residential subdivision. The maximum cut depth is 4m and a fill depth of 3.5m. The earthworks are to be undertaken in four stages. Approximately 88,500$m^3$ of fill will be imported as there is a shortfall in cut material.

3 As part of the development 185m of Duck Creek will be reclaimed and a new stream channel of 114m will be constructed to the west of its current position.

4 Three permanent bridges will also be constructed as art of the development. The bridges are proposed to be clear of the 100 year flood levels.

5 Two temporary bridges to provide access across Duck Creek are proposed to be installed. Bridge 1 is proposed to be installed during the Stage 1 earthworks and is anticipated to be in place for two years. Bridge 2 is proposed to be installed prior to Stage 3 earthworks and is anticipated to be in place for 11 months. As a contingency for traffic management a temporary bridge could be required adjacent to permanent Bridge 1.

6 A draft Environmental Management Plan for Construction (EMPC) has been prepared for the development. The EMPC addresses environmental management for the project.

7 The Earthworks Construction Plan for Stage 1 is appended to the EMPC. The report contains an earthworks construction methodology and indicative sequence for the erosion and sediment controls measures. Preliminary calculations have been provided for the erosion and sediment controls.

8 The erosion controls consist of:

- A Stabilised construction entrance off SH58, until such time Bridge 1 is completed.
- Cleanwater diversions to divert upper catchment overland flow around the area of earthworks.
- Sediment laden diversions to direct sediment laden water to the sediment retention ponds.
- Progressive and rapid stabilisation.

Sediment controls consist of:

- Chemically treated Sediment Retention Pond's (SRP). The SRP's will be fitted with 5 porous baffles to increase settlement.
- A stormwater pipe is required to be installed across Duck Creek to convey sediment laden water from Stage 2 earthworks, to SRP1. The pipe is to be appropriately anchored and protected to ensure that it is not damaged during flood events.
- Decanting Earth Bunds (DEB's);
- Super and Silt fences for areas that is unable to be diverted to a SRP or during construction of the SRP's.

9 The erosion and sediment controls have been designed to be located above the Duck Creek 5 year flood event.

10 All erosion and sediment control devices will be As Built prior to earthworks commencing. The maintenance of the erosion and sediment controls is the responsibility of the contractor.

11 A draft Bridge Construction Plan (BCP), Flocculation Management Plan (FMP), Stream Diversion and Stream Works Plan (SDSWP) have been provided. These

plans provide draft details in terms of environmental management of these individual aspects.

12 Environmental Monitoring is proposed as part of the application through a Environmental Monitoring and Adaptive Management Plan and its purpose is to establish the methods for monitoring stream health during and after construction and provides a framework for adaptive management.

**ASSESSMENT**

13 The site poses significant sediment related risks as a result of the proximity of Duck Creek and the Pauatahanui Inlet. In this regard a precautionary approach to the management of earthworks and sediment laden runoff is considered appropriate.

**Performance of Erosion Control Practices**

14 Erosion control and sediment control practices are implemented to reduce downstream sediment loadings. Implementation of erosion control practices reduce particle dislodgement while implementation of sediment control practices capture sediments in transport and prevent those sediments from migrating downstream. The focus of any erosion and sediment control plan should be on avoiding sediment generation in the first instance by the implementation of erosion control measures.

15 Erosion and sediment control measures should generally be planned to link functionally to form a “treatment train” with each measure having a specific role within the framework of surface water management, soil protection and stabilisation, and sediment capture. This approach can be a combination of structural (e.g. sediment ponds, silt fences) and non-structural practices e.g. seasonal restrictions and staging.

16 Table 1 provides an indicative summary of the effectiveness of various erosion control practices. This table is based on national and international research.

17 The erosion control practices proposed for this project as detailed in section paragraph 8:

18 The proposed erosion control measures will assist in reducing the erosion potential and these practices will improve the effectiveness of the sediment control measures.

| Effectiveness of Erosion Control Practices at Sedimentation Reduction | |
|---|---|
| Practice | Performance for Sediment Reduction |
| Runoff diversion channels | Not a sediment removal practice but used as an effective transport mechanism. |
| Contour drains | Not a sediment removal practice but used to minimise flow across bare soil areas. |
| Slope benches | 49% less erosion than a uniform slope (Zhu, Dabney, Flanagan, 1999) |
| Rock check dams | They do not remove significant amounts of sediment but reduce channel velocities to prevent channel scour |
| Temporary or permanent seeding | 90+% (Fifield, 1999) |
| Hydroseeding | 50-60% (Caltrans, 2002) |
| Mulching with straw or other suitable material | 53-99% (Harding, 1990) |
| Stabilised construction entrance | Does not remove sediment but reduces potential for sediment to be generated at site access points. |
| Pipe/flume drop structures | There is no information on the effectiveness of pipe slope drains to prevent erosion |
| Level spreaders | It is not a sediment removal practice but rather a practice to disperse water flow and avoid concentration of flow |
| Phasing of construction | 42% reduction (Claytor, 1997) |
| Surface roughening | 18% (Dane County, 2007) |

Table 1 - Effect of Erosion Control on Sediment Reduction[1]

19 Looking at the performance of erosion control practices, minimising the area of earthworks and stabilisation are the most important elements in reducing erosion potential. Other practices need to be considered but their benefits are more incremental. The cumulative effect of a number of erosion control practices provides significant benefit and reduces the amount of work that sediment control practices will have to do.

20 It is acknowledged that the Applicant has proposed to stage the earthworks, divert cleanwater and progressively and rapidly stabilise exposed areas as they are completed.

21 Provided the erosion control devices outlined in the application are designed, implemented and maintained in accordance with GWRC ESC guidelines it is considered they are appropriate and will assist in reducing the erosion potential of the site.

[1] NZTA Erosion and Sediment Control Standard for State Highway Infrastructure.

**Performance of Sediment Control Practices**

22 Table 2 provides an indicative summary of the effectiveness of various sediment control practices. This table is based on national and international research.

23 Sediment control practices proposed for this project are identified in Paragraph 8:

| Effectiveness of Sediment Control Practices to Reduce Sediment Loads | |
|---|---|
| Practice | Performance for Sediment Reduction |
| Sediment retention pond (no chemical treatment) | 50-80% |
| Sediment retention pond (w/chemical treatment) | 75-95% |
| Silt fence | 40-75% depending on type of fabric, overflow rate and detention time (Barrett et al., 1995) |
| Earth bund | Not a sediment removal practice but rather to divert site sediment laden runoff to a trapping device. |
| Sump/sediment pit | No data available |

Table 2 - Effect of Sediment Control on Sediment Reduction[2]

24 Performance data indicates that regardless of best intentions and performance, sediment will be discharged downstream. Sediment control practices cannot remove 100% of incoming sediment from the water column. The key element is to reduce the magnitude and frequency of sediment discharge by a combination of erosion control and sediment control practices.

25 There will be situations through the construction of the project where rainfall will exceed the design volumes of the sediment control devices. For example sediment retention ponds will remove 75% of suspended solids for storms generally up to a 2 year rain event when discharged via the decant systems. Rain events greater than this would generally discharge to the receiving environment via the primary or emergency spillways. The water being discharged in this manner will have a higher concentration of suspended solids i.e. less efficient in sediment removal.

26 The performance of sediment retention ponds constructed to GWRC 'Erosion and Sediment Control Guidelines for the Wellington Region' is generally good, however, there are a number of situations where the addition of a chemical dosing system will provide enhanced treatment.

[2] NZTA Erosion and Sediment Control Standard for State Highway Infrastructure.

27 The main situations where chemical treatment provides substantial improvement over the untreated pond situation is where there is a high percentage of clay material, where receiving environments are noted to be sensitive and where extensive areas of earthworks are occurring within a single catchment. In cases it may not be appropriate to rely on the efficiency of a standard device as the discharge of residual sediment may still have a effect on the downstream receiving environments.

28 Sampling results from chemically treated (PAC) sediment retention ponds during ALPURT (Northern Motorway Extensions) and the Millwater development in Silverdale, show pond efficiencies ranging from 78% through to 99%.

29 The high efficiencies are generally associated with ponds where the design is similar or exceeds the design standards of GWRC guidelines and generally for smaller rainfall events. It should be noted that these high efficiencies are achieved through well maintained treatment systems that have been rigorously monitored. In situations where this has not occurred, efficiencies were well below what could be expected. A general lack of 'attention to detail' can result in chemical storage tanks not being refilled after an event and therefore running dry during the next event, blockages and breaks in the system, and the dosing requirements not changing as site and catchment conditions change.

30 This would indicate that the use of such treatment systems is very dependent on the experience of the monitoring staff and operators and the stringency of monitoring and maintenance. However, it is clear that high efficiencies can be achieved from a well maintained and monitored chemically treated sediment retention device.

31 It is acknowledged that the Applicant has proposed to over size and chemically treat the sediment retention ponds. In addition the Applicant has proposed baffles within the ponds. The use of baffles in correctly designed and constructed sediment retention ponds is a relatively new technique. Limited onsite performance monitoring has been undertaken however research[3] indicates that when correctly installed they will assist in increasing retention time of sediment within the sediment retention pond, thereby increasing efficiencies.

[3] Khan, S (2012) – "Hydrodynamics of Sediment Retention Ponds"

**CONCLUSION**

32 The proposed erosion and sediment controls are considered appropriate to minimise any potential sediment related effects. The oversized SRP's will include flocculation and baffles to increase sediment treatment. This is industry best practice and is considered appropriate in this regard.

33 Provided the works and mitigation measures are implemented and maintained in accordance with the respective plans and proposed conditions of consent, I am confident that they will ensure that any adverse sediment related construction effects are temporary and no more than minor.

Gregor McLean
5 April 2016