Macroinvertebrate Community Assessment Report Gleeson Huntly Quarry

Prepared for:
Gleeson Quarries Huntly Ltd
Gleeson Managed Fill Ltd

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Documentation

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1. Introduction

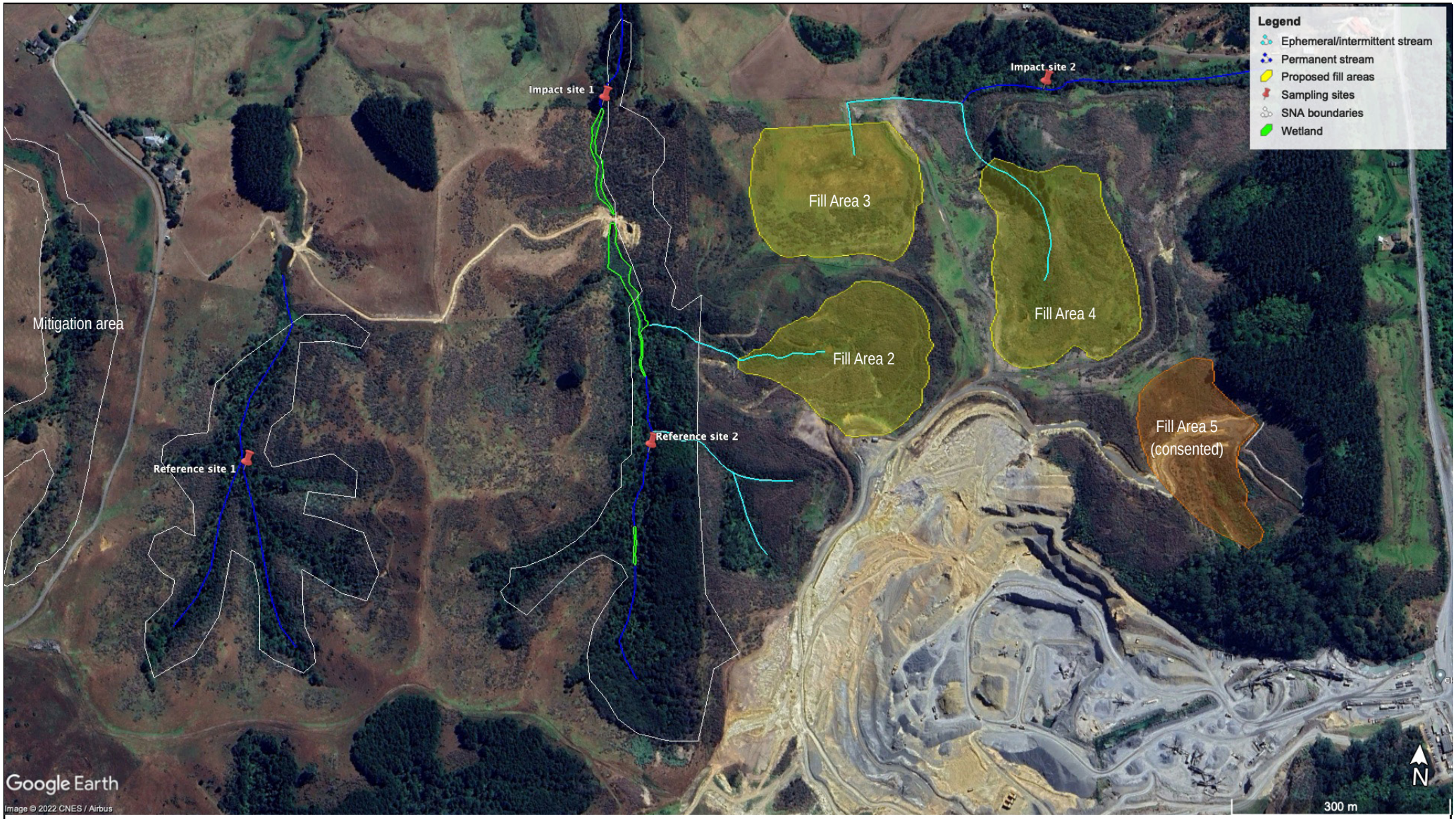
Gleeson Quarries Huntly Ltd and Gleesons Managed Fill Ltd are seeking resource consent for the disposal of quarry overburden material and imported cleanfill within three proposed fill areas located at Gleeson Huntly Quarry, 300 Riverview Road, Huntly. The proposed fill areas are gully systems containing ephemeral and intermittent streams and induced wetlands as a result of historical land use activities. Fill Area 2 discharges into a watercourse which runs north to eventually flow into Lake Puketirini, and Fill Area 3 and 4 discharge into a watercourse that runs east into the Waikato River.

The ecological mitigation package as part of the resource consent for Fill Area 5 and the other three proposed fill areas has involved the ongoing restoration of a 4ha Significant Natural Area (SNA_16743) located on farmland owned by Gleeson Quarries Huntly Ltd to the west of the quarry. Resource consent LUC0176/20 (Waikato District Council) and resource consent AUTH141283.06.01 (Waikato Regional Council) permit works for Fill Area 5, which commenced around April 2021.

Gleeson Quarries Huntly Ltd have engaged Envoco Ltd to sample macroinvertebrate communities in the watercourses downstream of the discharge points of Fill Areas 2, 3 and 4 to obtain baseline water quality data prior to any works within the fill areas. It is of interest to monitor macroinvertebrate communities in these receiving environments (impact sites) and elsewhere in the catchment that will not be affected by fill discharge (reference sites) to gauge long term trends in water quality and assess the effects of localised impacts (ie. fill and extraction works).

Aquatic macroinvertebrates are useful indicators of stream health as they are found in almost all freshwater environments, respond to changes in water quality as a result of human pressures, have a relatively sessile mode of life, and are easy to sample and identify. The Macroinvertebrate Community Index (MCI) and its variants is a widely-used biotic index used to quantify stream ecological health, and is derived from the number of taxa in the sample and the tolerance value for each taxa (measurement of tolerance to pollution/nutrient enrichment). A high MCI is indicative of a macroinvertebrate community with a high proportion of taxa sensitive to pollution/nutrient enrichment, and indicates that the stream ecosystem is in a healthier, more natural state. Of interest to this assessment is also the presence and abundance of EPT taxa (Ephemeroptera (mayflies), Plecoptera (stoneflies), Trichoptera (caddis flies)), which are only found in relatively clean, undisturbed stream ecosystems containing high quality habitat.

This report describes results from macroinvertebrate sampling from two reference sites and two impact sites to obtain baseline data for future monitoring.



Gleeson Huntly Quarry showing macroinvertebrate sampling sites, proposed fill areas and locations of SNA's.

Gleeson & Cox

Prepared for Gleeson Quarries Huntly Ltd, May 2022.

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2. Site description

2.1. Reference site 1

The first reference site is located in a catchment to the west of the quarry and fill areas, and is characterised by secondary podocarp-broadleaf gully forest and small permanent hard-bottomed streams fed by springs. The site is impacted by the effects of pest mammals and livestock, aerial herbicide damage and edge effects caused by lack of continuity with similar habitat. The stream appeared to be in baseline flow conditions and had a variety of habitat types within the channel suited for macroinverebrate colonisation, such as runs and riffles with high amounts of organic matter and varying sizes of gravel.

2.2. Reference site 2

The second reference site is located in a forested gully directly west of the quarry and fill areas, and is also characterised by secondary podocarp-broadleaf gully forest. The site contains a water-course running south to north, containing sections of permanent hard-bottomed stream and sedge-dominated wetland. Much of the site, particularly the periphery, is impacted by pest mammals, livestock and wild goats. The sample site was located approximately 175m upstream of the discharge point of Fill Area 2, meaning water chemistry and macroinvertebrate communities will remain largely unaffected by potential impacts of the fill. The stream was similar to the first reference site, appearing to be in baseline flow conditions and containing a variety of habitat types.

2.3. Impact site 1

The first impact site is located underneath a pine plantation with a sparse naturally regenerating native understorey. Much of the watercourse below the fill discharge point is wetland, making it unsuitable for macroinvertebrate sampling. The sample site was located below the wetland area in the stream channel approximately 315m downstream of the discharge point of fill area 2, meaning water chemistry and macroinvertebrate communities may be affected by potential impacts of the fill. The stream and surrounding environment is heavily modified, with the channel substrate dominated by concrete, rock rubble and submerged macrophytes. There is a high dominance of exotic vegetation within and surrounding the channel, paritcularly *Tradescantia fluminensis* (wandering jew). The stream was also in baseline flow conditions, however the habitat was relatively homogenous with little area available for sampling.

2.4. Impact site 2

The second impact site is located in a fragment of early successional native forest to the north of the quarry and fill areas and is also impacted by pest mamals, wild goats and exotic pest plants. The stream is characterised by a narrow, slow-flowing channel with mainly hard-bottomed substrate (small gravels along with organic matter). The sample site is located downstream of fill areas 3 and 4, so any impacts resulting from fill works may potentially show up in the macroinvertebrate community. The stream appeared to be in baseline flow conditions and was relatively homogenous, containing narrow and shallow sections of run as well as small pools.

Figure 1: Section of stream in reference site 1 that was sampled.

Figure 2: Reference site 2 showing section of riffle habitat which was sampled.

Figure 3: Impact site 1 showing open area of channel where sample was taken.

Figure 4: Impact site 2 showing run and pool habitat which was sampled.

3. Methods

All four samples were taken on the 11th April 2022 during fine weather and baseline flow conditions.

A fine-mesh (0.5mm) D net was used for to sample in suitable macroinverebrate habitat in the four sampling sites. Approximately 1m^2 of stream habitat was sampled in each site, focussing on riffle habitat where possible. Protocol C1 (hard-bottomed semi-quantitative) sampling method was used for the reference sites and protocol C2 (soft-bottomed semi-quantitative) sampling method was used for the impact sites, following methods outlined in 'Protocols for sampling macroinvertebrates in wadebale streams' (Stark et al. 2001). There were some difficulties with finding suitable riffle habitat to sample particularly in the impact sites due to access and hydrological conditions of the stream (ie. low flow). Other suitable habitat, such as bank margins, aquatic macrophytes, submerged leaf litter and woody debris within the stream channel were sampled to help achieve a representative sample of the macroinvertebrate community. Macroinvertebrate samples were transferred from the net to 300ml containers with 70% preservative (ethanol), and were sent to a lab for identification and analyses from a taxonomist. Protocol P3 (full count with subsampling option) was used for sample processing, following methods outlined in Stark et al. 2001. This protocol method produces a QMCI value (Quantitative Macroinvertebrate Community Index), which uses the same tolerance scores as the MCI but uses relative abundances of taxa to produce a score that is more sensitive to subtle changes in water quality, rather than soley using presence/absence data as with the MCI.

Figure 5: Sampling a section of stream in reference site 1.

Figure 6: Sampling a section of stream in impact site 1.

4. Results

4.1. Reference site 1

Reference site 1 was located in a gully adjacent to the impact sites and was sampled in order to assess the condition of the impact stream relative to local stream conditions and communities within a similar ecosystem type. Sections of riffle and run habitat in the hard-bottomed stream were sampled, with an MCI score of 125 and QMCI score of 5.66 obtained for the site. According to the National Policy Statement for Freshwater Managament (MfE, 2020), these scores reflect mild organic pollution or nutrient enrichment. Water quality classes outlined in 'Table 2. Interpretation of MCI-type biotic indices' (Stark & Maxted, 2007) place this site in the 'excellent/clean water' category based on the MCI score and 'good/doubtful quality or possible mild pollution' based on the QMCI score. The percentage of EPT taxa was 50%, indicating relatively diverse habitat and healthy ecosystem within the stream. A *Paranephrops planifrons* (northern koura/freshwater crayfish) was captured during sampling at this site and was returned to the stream. This species has an MCI score of 5, meaning it is moderately tolerant to pollution/nutrient enrichment.

4.2. Reference site 2

Reference site 2 was located upstream of the impact sites and was sampled in order to assess the condition of the stream above the impact site within the same catchment. Sections of riffle and run habitat in the hard-bottomed stream were sampled, and obtained similar scores to the first reference site with an MCI of 122.86 and QMCI of 6.89. These scores also fall within the 'mild organic pollution or nutrient enrichment' category of the NPS-FW and 'excellent/clean water' category in Stark and Maxted (2007). The lower MCI and higher QMCI relative to the first reference site is reflective of the higher proportion of EPT taxa (57%) in a smaller sample size with fewer taxa overall. These results also indicate that the stream contains relatively diverse habitat and a healthy intact ecosystem.

4.3. Impact site 1

Impact site 1 was located downstream of the discharge point of Fill Area 2 and was sampled to assess the baseline condition of the stream prior to any works. Due to the heavily modified environment it was difficult to find a sampling point containing high quality macroinvertebrate habitat (ie. riffles and runs), so the stream bed, margins, submerged macrophytes and debris were also sampled. This section obtained an MCI score of 85 and a QMCI score of 4.33, falling below the national bottom line defined in the NPS-FW as 'indicative of severe organic pollution or nutrient enrichment', and within the 'fair/probable moderate pollution' category in Stark & Maxted (2007). These results are reflective of the lack of EPT taxa and the small sample size, which is likely caused by the surrounding modified environment. Upstream of the site is a long stretch of wetland within retired farmland heavily impacted by aerial herbicide spraying and past livestock grazing. The wetland and stream channel appeared to contain a high amount of sediment, which would explain the low MCI scores.

4.4. Impact site 2

Impact site 2 was located downstream of the discharge points of Fill Area 3 and 4 and was also sampled to assess the baseline condition of the stream prior to any works. This site lacked riffle habitat so run and pool habitat containing some submerged leaf litter and woody debris was sampled. This section obtained a MCI score of 82 and a QMCI value of 3.40. Being lower than the first impact site, these scores also fall below the national bottom line defined in the NPS-FW as 'indicative of severe organic pollution or nutrient enrichment', and are within the 'poor/probable severe pollution' category in Stark & Maxted (2007). The site did however contain 20% EPT taxa (made up of mayflies *Tepakia* and *Zephlebia*), but due to high abundances of low-scoring taxa the MCI score remained low. The low MCI scores can be attributed to the lack of high quality macroinvertebrate habitat and historical land-use within the catchment (ie. farming, pine forestry, aerial herbicide

spraying and the use of Fill Area 3 as an overburden disposal site in the past). Although the scores reflect severe pollution when compared with interpretations in the literature, the presence of EPT taxa indicates there are still areas of habitat diverse and intact enough to support populations of macroinvertebrates sensitive to pollution, modification and disturbance.

Table 1: Macroinvertebrate community raw data from reference and impact sites in Gleeson Huntly Quarry, April 2022.

Sample no.			MCI 1 (Reference site 1)	MCI 2 (Reference site 2)	MCI 3 (Impact site 1)	MCI 4 (Impact site 2)
Taxa	MCI score	MCI-sb score				
Mayfly Tepakia	8	7.6	5			2
Mayfly Zephlebia	7	8.8	30	2		17
Caddisfly Plectrocnemia	8	6.6	1	6		
Caddisfly Polyplectropus	8	8.1	1	11		
Caddisfly Psilochorema	8	7.8		1		
Damselfly Austrolestes	6	0.7				7
Damselfly Ischnura	0	3.1				2
Bug Anisops	5	2.2			1	
Bug Sigara	5	2.4			2	
Beetle Elmidae	6	7.2	1			
True Fly Orthocladiinae	2	3.2				6
True Fly Paradixa	4	8.5	5	5		
True Fly Polypedilum	3	8				2
True Fly Tanytarsini	3	4.5		1		
Crustacea Ostracoda	3	1.9				162
Crustacea Paracalliope	5	0	38			
SPIDERS Dolomedes	5	6.2		1		
Mollusc Physella (Physa)	3	0.1			1	
Mollusc Potamopyrgus	4	2.1	14		2	3
Mollusc Sphaeriidae	3	2.9				2
OLIGOCHAETES	1	3.8				4

Number of Taxa	8	7	4	10
EPT Value	4	4	0	2
Number of Individuals	95	27	6	207
% EPT	38.95	74.07	0.00	9.18
% EPT Taxa	50.00	57.14	0.00	20.00
Sum of recorded scores	50.00	43.00	17.00	37.00
Count of recorded scores	8.00	7.00	4.00	9.00
MCI Value	125.00	122.86	85.00	82.22
Sum of abundance load	538.00	186.00	26.00	703.00
QMCI Value	5.66	6.89	4.33	3.40
Sum of recorded scores	48.90	50.50	6.80	42.10
Count of recorded scores	7.00	7.00	4.00	10.00
SBMCI Value	139.71	144.29	34.00	84.20
Sum of abundance load	395.80	207.30	11.30	546.20
QMCI-sb Value	4.17	7.68	1.88	2.64

5. Discussion

Two reference sites and two impact sites were sampled to obtain MCI values in order to gauge the baseline condition of watercourses that may potentially be impacted by three proposed fill areas. It is proposed that these sites will be monitored over time to track any changes in water quality, which will be evidenced by changes in the macroinvertebrate community. Both reference sites had MCI scores reflective of high water quality and a diverse assemblage of macroinvertebrates with a range of tolerances to pollution/nutrient enrichment. In contrast, both impact sites had MCI scores reflective of average to poor water quality and macroinvertebrate habitat, which is also indicative of moderate to severe pollution/nutrient enrichment. This may be attributed to the modified environment within the catchment, lack of suitable sampling areas (low flow conditions, lack of riffle habitat) and pollution/sedimentation from runoff from the surrounding land.

To continue monitoring macroinvertebrate communities at these sites, it is suggested that one summer and one winter sampling be done, as this will be adequate to assess species richness and may pick up changes in the community relating to climatic changes or land use activities.

Figure 7: Paranephrops planifrons (northern koura/freshwater crayfish) found during macroinvertebrate sampling at the first reference site.

6. References

Ministry for the Environment. 2020. National Policy Statement for Freshwater Management.

Stark, J.D., Boothroyd, I.K.G., Harding, J.S., Maxted, J.R., Scarsbrook, M.R. 2001. Protocols for sampling macroinvertebrates in wadeable streams. New Zealand Macroinvertebrate Working Group Report No. 1. Prepared for Ministry of the Environment. Sustainable Management Fund Project No. 5103.

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