Aquatic Ecology

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Dear Bruce

Ecological values in the Two-Chain Road Block (Two Chain Road Ltd.)

Thank you for your email dated 9th July 2021. This memo is a revision sent 2nd September, and includes a field reconnaissance on the 6th September 2021.

I have undertaken a consideration of aquatic ecology values in the vicinity of the land parcel depicted in App. I, Fig. i. The land area proposed for Plan Change has a total combined area of 98.3 Ha, and is zoned as Rural. The current land use is of rural use. There is a small block of production forest in the north-west corner (c. 4.25 Ha).

The proposal

The proposal involves a private plan change request to the Selwyn District Plan from rural to Business 2A, but an Outline Development Plan is currently not available.

Physical Description

Based upon our desktop survey and field inspection (14th July 2021), there is a significant surface water body in the Plan Change area, which forms a branch of the Rolleston Raceway (yellow path in App. Fig. ii). This waterway traverses the Plan Change Area, flowing from north to south (App. I, Fig. i). The relevant reach is approximately 600 m long. Water for this perennial waterway arises from the Waimakariri River intake for the Paparua Irrigation network (App. I, Fig. ii) (Agriculture N.Z. Ltd 1997). The waterway is fenced on the true left bank, although there is no riparian protection on the true right bank. The waterway has reaches with a stony base and others with mixture of fine sediment and cobbles. At the time of the field inspection, the water was turbid (App. II, Figs. i, iii), and low electrical conductivity (90μS at 4.0°C), suggesting low nutrients. Limited patches of watercress (*Nasturtium sp.*) are present in this waterway (App. II, Fig. ii).

In addition, a minor blind raceway intrudes into the Plan Change Area in the vicinity of No. 15, Two Chain Road, depicted as the blue arrow in App. I, Fig. i. At Two Chain Road, it appears as a rivulet flowing south under the road (App. II, Fig. iv) and terminates approximately 25m past the Plan Change area boundary.

Historically, the Waimakariri River flowed through this development area which it discharged in Te Waihora/Lake Ellesmere several thousand years ago (Cowie *et al.* 1986). The meandering fluvial channels are still apparent in the pasture growth patterns (App. I, Fig. iii), and the land has a gentle undulating nature which reflects the old channel morphology.

Background ecology

I have accessed the New Zealand Freshwater Fish Database (NZFFDB), the Paparua irrigation network (Agriculture N.Z. Ltd 1997), and our own recent fish translocation of the Rolleston Raceway (c. 400 m) through the township of Rolleston along Tennyson Street. The fish fauna from the AEL translocation was composed of 112 fish; 89 upland bully (*Gobiomorphus breviceps*), 20 juvenile brown trout (*Salmo trutta*), 2 shortfin eel (*Anguilla australis*), and 1 common bully (*Gobiomorphus cotidianus*) (data AEL/Downer). We consider that the composition of the fish fauna through the south tributary of Rolleston Raceway (yellow path in App. I, Fig. ii) will be very similar, due to the connectivity of the Paparua Irrigation network. The NZFFDB also identified the presence of upland bullies and brown trout in the vicinity of the Two Chain Road development. The shortfin eel, upland bully and common bully are

all considered “Not Threatened” (Dunn *et al.* 2017), and the brown trout is an introduced species with no conservation status in New Zealand.

A macroinvertebrate sample was not obtained, because AEL has reliable and recent data on aquatic macroinvertebrates in similar habitats from the Paparua Irrigation water race network. These are presented in App. III (Conservators Road, Carmen Road, Tables i, ii). At both Sites, aquatic snail species (*Potamopyrgus antipodarum* and *Physa acuta*) were abundant in both hard bottom (cobble, gravel) reaches, and soft bottom (silt, sand) reaches, and the biota were composed of a mixture of soft-substrate and hard-substrate species, even those from stony habitats. Stream health measures were similar across samples (stream health (MCI) ‘poor’ c. 70), reflecting poor stream health (Stark & Maxted 2007).

It is noteworthy that the Rolleston raceway extends south into a relatively new residential development in Rolleston. A part of the suburbanised reach is culverted and piped, but there are some naturalised reaches as well (App. II, Figs. v, vi). No known survey work has been conducted in the Rolleston area (other than AEL work along Tennyson Street mentioned above), and there are no entries on the NZFFDB.

Summary

Based on the ecology, and stream health measures determined elsewhere in the Paparua Irrigation raceway network, the Rolleston Raceway reach within the Two-Chain Road development block is likely to have low ecological value due to water quality, habitat quality and dispersal issues. High turbidity caused by the glacial flour from the Waimakariri River also results in low levels of primary production, with consequent reduced habitat values for fish and invertebrates. In respect to native fish, there is likely to be some shortfin eels, and possibly longfin eels, in the impacted reach, but also some upland bullies, as they spawn and rear locally, and prefer stony habitats. In addition, some reaches of the Paparua Irrigation raceway support brown trout. A branch of this raceway, which flows down Tennyson Street, Rolleston, was recently found to contain significant numbers of juvenile trout (parr)(AEL data Feb 2020).

If a native riparian area was installed, along with hydraulic variation in the form of riffles and meandering sections, ecology in this waterway has the potential to improve, depending on design.

AEL would not recommend the piping of the Rolleston Raceway across the development area, unless, upon survey it can be demonstrated that the reach across the development area does not hold significant ecological value **nor** the naturalised downstream section in Rolleston. The significant (600 m) length means a pipe has the potential to significantly impact fish passage and macroinvertebrate passage. However, this impediment would need to be considered in context with the other existing instream impediments already present (e.g., perched culverts and weirs). However, the minor blind waterway at No. 15 Two Chain Road may be piped, as the wetted habitat loss is negligible in this instance, and unlike the main water race, goes to ground after a short distance.

Currently, we have no information to suggest the waterway health would be harmed, per se, by a land zoning change. However, we have no information on the proportion of impervious land in the catchment or how stormwater will be treated. It is considered likely that stormwater will be treated, and then go to ground, leaving the raceway unaffected by stormwater runoff. My general comment is that I expect the waterway to be flow-stable with an associated flow-sensitive ecology and physical habitat. However, stream health is likely to be already compromised as elsewhere in the Paparua raceway system.

The site was re-visited on the 6th September 2021, which provided a partial overview of the development site periphery. With one exception, there was no vegetation change in the gullies to indicate even ephemeral aquatic habitat. However, there was vegetation associated with damp ground behind the property of 25 Two Chain Road (App. I, Figs. iii, iv), but was viewed only from a distance. This damp area coincides with still-visible fluvial channels of the old course of the Waimakariri River, so are likely to have a natural origin and be fed by a vestigial groundwater exchange. In rural settings, it has been my experience that these potential seep/waterbody areas are sometimes modified to enhance their amenity values, especially duck ponds, or if near a homestead, ornamental waterbodies. No similar damp areas were noticed during the site visit, but it is recommended the proposed plan change area is surveyed further prior to any subdivision works.

From a plan change/rezoning perspective, in respect to the Rolleston Raceway, and confirmed seep/waterbody areas, the likelihood of negative ecological impacts is low if the development adheres to the 10m waterbody setback rules.

Yours sincerely, Mark Taylor

References:

Agriculture N.Z. Ltd, G. P. L., Pattle Delamore Partners Ltd 1997. Paparua Water Race; system review. Christchurch. *No*. 83 p.

Cowie, B.; Milne, P. J.; Mason, C. R.; Lovis, P. M.; Lineham, I. W.; Griffiths, W. E.; Talbot, J. D.; Glennie, J. M.; Mosley, M. P.; Walker, S. W.; Dimbleby, B. R.; Carter, M. C.; Weeber, J. W. 1986. Waimakariri River and catchment resource survey: Volume 1. North Canterbury Catchment Board and Regional Water Board, Christchurch. *No*. 187 p.

Dunn, N. R.; Allibone, R. M.; Closs, G. P.; Crow, S.; David, B. O.; Goodman, J. M.; Griffiths, M.; Jack, D.; Ling, N.; Waters, J. M.; Rolfe, J. R. 2017. Conservation Status of New Zealand freshwater fishes, 2017. Department of Conservation, Wellington. *No*. 15 p.

Stark, J. D.; Maxted, J. R. 2007. A User Guide for the Macroinvertebrate Community Index. Cawthron Institute, Nelson. *Cawthron Report No. No. 1166*.p.

Appendix I. Canterbury Maps depiction of proposed Plan Change Area.

App. I. Figure i. Proposed Plan Change Area. Yellow arrow indicates the main impacted waterway and flow direction. The blue arrow indicates a minor blind waterway.

App. I. Figure ii. The Waimakariri River origin of raceway water through the proposed Plan Change Area (in red, bottom right side of page).

Appendix I. Figure iii. An area containing some potential seep/waterbody plants, probably rushes and sedges (ringed).

Appendix I, Fig. iv. Two possible seep/waterbody areas near the trees south of 25 Two Chain Road.

Appendix II. Images from the AEL field inspection, 14/07/2021

Figure i. Looking downstream from the northern boundary, showing stony substrate.

Figure ii. Patch of watercress in the relevant reach.

Figure iii. Looking upstream from the south boundary of the proposed development.

Figure iv. Looking downstream at the terminal race way branch vicinity of No. 15, Two Chain Road.

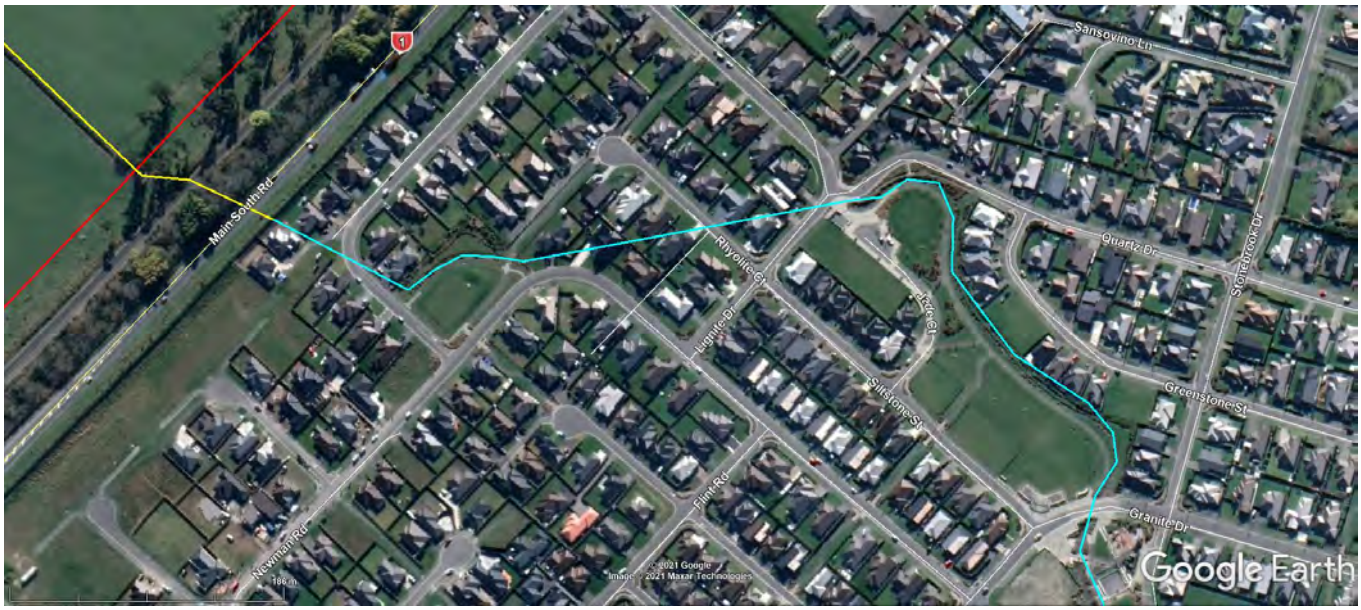

Figure v. The reach of the main waterway downstream of the proposed Plan Change Area, featuring both naturalised reaches and piped reaches.

Figure vi. Looking upstream at the naturalised raceway further south in Rolleston (near 28 Granite Drive).

Appendix III. Macroinvertebrate data from the Paparua Stockwater Race

Table i. Complete macroinvertebrate taxa list including corrosponding MCI values from the Paparua water race scheme, in the vicinity of Conservators Road (May 2019). Snails were abundant, highlighted in red text.

		Hard substrate		Soft substrate	
		No.	MCI-hb	No.	MCI-sb
ANNELIDA					
Oligochaeta		19	1		
Hirudinea		14	3		
MOLLUSCA					
Gastropoda					
Hydrobiidae	*Potamopyrgus antipodarum*	132	4	260	2.1
Physidae	*Physa acuta*	76	3	471	0.1
Lymnaeidae	*Lymnaea*	86	3	238	1.2
CRUSTACEA					
Ostracoda				84	1.9
INSECTA					
Lepidoptera					
Crambidae	*Hygraula nitens*			1	1.3
Diptera					
Orthocladiinae		1	2		
Muscidae				1	1.6
Simuliidae	*Austrosimulium*			8	3.9
Trichoptera					
Leptoceridae	*Hudsonema amabile*	10	6	4	6.5
Hydrobiosidae	*Hydrobiosis*	12	5	24	6.7
Hemiptera					
Corixidae	*Sigara arguta*	1	5	1	2.4
Odonata					
Coenagrionidae	*Xanthocnemis zelandica*			7	1.2
Coleoptera					
Elmidae	*Hydora*	305	6	64	7.2
No. Scoring taxa		10		12	
TOTAL No. of animals		656		1163	
Total indice score		38		36.1	
MCI-hb/MCI-sb		76.0		60.2	
% EPT taxa		3.4		2.4	

Table ii. Complete macroinvertebrate taxa list from the vicinity of the Riccarton racecourse (Champions Mile), downstream of Carmen Road (September 2013). Snails were abundant, highlighted in red text.

		Riccarton Racecourse		Riccarton Racecourse Site	
		No.	MCI-hb	No.	MCI-hb
ANNELIDA					
Oligochaeta		500	1	1	1
MOLLUSCA					
Gastropoda					
Hydrobiidae	*Potamopyrgus antipodarum*	500	4	19	4
Physidae	*Physa acuta*	500	3	31	3
Bivalvia					
Sphaeridae	*Sphaerium novaezelandiae*	40	3		
INSECTA					
Diptera					
Chironomidae		100	2		
Orthocladiinae		60	2	5	2
Muscidae		1	3		
Stratiomyidae		1	5	1	5
Trichoptera					
Leptoceridae	*Hudsonema amabile*	1	6		
Odonata					
Coenagrionidae	*Xanthocnemis zelandica*	6	5	2	5
No. Scoring taxa		10		6	
TOTAL No. of animals		1709		59	
Total indice score		34		20	
MCI-hb		68.0		66.7	
% EPT taxa		0.1		0.000	