

To: OsborneHay**Date:** 21 January 2021**Attention:** David Hay**Ref:** 63967**Subject:** Freshwater Ecology Classifications – Warkworth Plan Change Area

Background Information

Bioresearches was engaged by OsborneHay to undertake an analysis of the potential freshwater ecological features within the proposed Warkworth South Plan Change area ('the site' – 1711 and 1723 State Highway 1 and 36, 40, 46 and 123 Valerie Close, Warkworth). Multiple overland flow paths are indicated to flow through the site, all indicated to be tributaries of the Mahurangi River (Figure 1).



Figure 1. A map of the Warkworth South Plan Change site (yellow polygon) showing predicted overland flow paths (dark blue lines) and Terrestrial Significant Ecological Areas (SEA-T; green crosses) from Auckland Council's GIS viewer.

Prior to the field survey, a map of the site was created from the Auckland Council GeoMaps GIS viewer, which defined the predicted overland flow paths, ecological overlays and contours of the properties (Figure 1). A site assessment was undertaken on 23rd November 2020, by a qualified freshwater ecologist. During the site assessment, the presence and extent of stream or wetland features within the properties were noted and the quality of any instream habitat was visually assessed.

Overland flow paths were ground-truthed and classified under the definitions within the Auckland Unitary Plan – Operative in Part (AUP OP) as to their permanent, intermittent or ephemeral status. Areas that contained wetland vegetation were assessed, generally following the wetland delineation protocols¹.

Watercourse Classification

Definitions

Under the AUP OP, an **intermittent stream** is defined as:

‘Stream reaches that cease to flow for periods of the year because the bed is periodically above the water table. This category is defined by those stream reaches that do not meet the definition of permanent river or stream and meet at least three of the following criteria:

- a) it has natural pools;*
- b) it has a well-defined channel, such that the bed and banks can be distinguished;*
- c) it contains surface water more than 48 hours after a rain event which results in stream flow;*
- d) rooted terrestrial vegetation is not established across the entire cross-sectional width of the channel;*
- e) organic debris resulting from flood can be seen on the floodplain; or*
- f) there is evidence of substrate sorting process, including scour and deposition.’*

Under the National Policy Statement for Freshwater Management 2020 (NPS-FM), a **natural wetland** is defined as:

‘A wetland (as defined in the Act) that is not:

- a) a wetland constructed by artificial means;*
- b) a geothermal wetland;*
- c) any area of improved pasture that, at the commencement date, is dominated by (that is more than 50% of) exotic pasture species and is subject to temporary rain-derived water pooling.’*

Improved pasture is defined as:

‘An area of land where exotic pasture species have been deliberately sown or maintained for the purpose of pasture production, and species composition and growth has been modified and is being managed for livestock.’

Rainfall

One significant rainfall event (>25mm) occurred within the month prior to assessment. Rainfall in the week immediately preceding the site assessment was very low, with generally no rain falling with the exception of two rainfall events (0.5mm and 3mm). Due to the very large rain event approximately two weeks prior to the site visit (>60mm), the catchment was likely saturated. Approximately 3mm of rainfall

¹ Ministry for the Environment (2020). Wetland Delineation Protocols.

occurred within 48 hours of the site assessment (Auckland Council Environmental Monitoring Site: Mahurangi @ Satellite Dish) (Figure 2), which may have resulted in the flow of ephemeral streams.

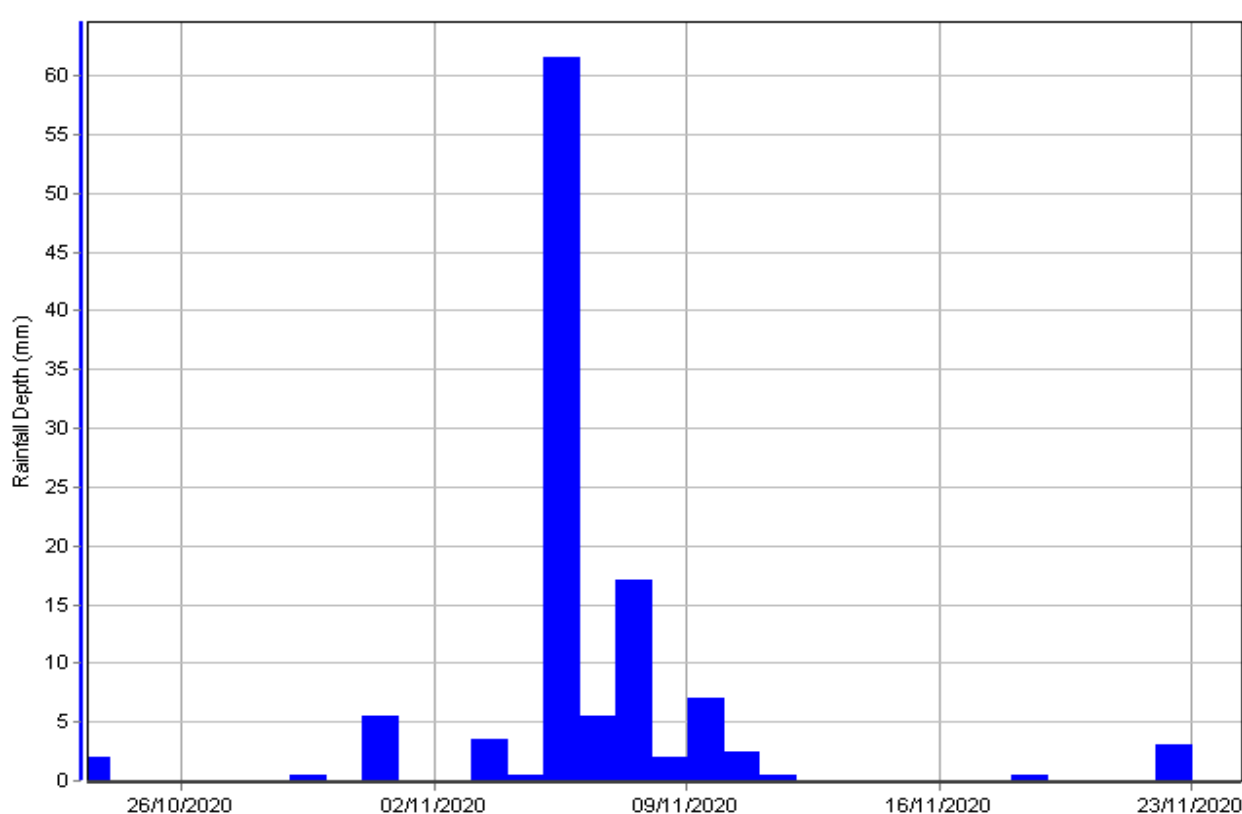


Figure 2. Totalled daily rainfall in the month preceding site assessment (23/10/2020 – 23/11/2020) from Auckland Council’s environmental monitoring site at Mahurangi @ Satellite Dish.

Watercourse 1

A watercourse was predicted to flow through a southern portion of 1711 State Highway 1 in a south to north direction (Figure 1). Water exited a culvert running under Valerie Close and into a well-defined channel within the site (Photo 1). The culvert was not overhanging, however appeared undersized for the size of the stream and scour was evident immediately downstream of the culvert outlet.

Water was slow-flowing and contained predominantly in deep runs and pools, with shallow runs occasional (Photo 2). The wetted width of the upper reach was 0.5-1.5m wide and the deepest section was 0.38m. Water was present for the entire length of Watercourse 1 and, due to the consistently deep water and large catchment size (14.5ha), the watercourse was classified as a **permanent stream** (Figure 3). The stream was straight and may have been modified (through straightening and deepening) at some point in the last century, however has existed in its current state since at least 1963 (Figures 4 and 5).

Watercourse 2

Water exited a pipe on the eastern boundary of 1711 State Highway 1. A very large pool directly downstream of the pipe contained water more than 1m deep (Photos 3 and 4). Water then flowed through a well-defined channel in a south to north direction before joining watercourse 1. Watercourse 2 was classified as a **permanent stream** (Figure 3) due to the presence of deep, continuous flowing water.



Warkworth South Plan Change Area

1711 and 1723 State Highway 1
36, 40, 46 and 126 Valerie Close Road

Legend

- Permanent Stream
- Intermittent Stream
- - - Ephemeral flow path
- - - Artificial watercourse
- Constructed Wetland
- Offline pond
- Site boundaries



21/01/2021 Project No.63967 Drawn by NRK

Figure 3. Ground-truthed and classified watercourses within the Warkworth South Plan Change area. Numbers correspond to Watercourse numbers in text and on photographs.



Photo 1. 1 – water entered via a culvert under Valerie Close.



Photo 2. 1 – the stream flowed along a straight path through deep runs and pools.



Photo 3. 2 – water entered via a culvert under SH1.



Photo 4. 2 – the stream was very deep near the culvert.



Photo 5. 1 & 2 – after the confluence of the watercourses.



Photo 6. 3 – no stream characteristics in the area.

Watercourse 3

An overland flow path was indicated to be in the Watercourse 3 area on Auckland Council’s Geomaps. Within the area, there was a small depression however there was no well-defined channel, surface water or aquatic vegetation that would suggest a stream or wetland present in the area (Photo 6). Buttercup (*Ranunculus* sp.) grew occasionally throughout pasture grass within the area. This area was classified as an **ephemeral overland flow path** due to the lack of stream or wetland characteristics.

Watercourse 4

Water entered the site via a pipe under SH1. Water was shallow and the stream was often clogged with macrophytes such as parrot's feather (*Myriophyllum aquaticum*) (Photo 7). Further downstream, the stream narrowed and deeper sections were observed (Photo 8). Water then flowed through a culvert under the driveway and discharged into Watercourse 5. This watercourse was classified as a likely **permanent stream**, due to the continuous flowing water, presence of deeper reaches and large catchment size (approximately 37ha).

Watercourse 5

On the northern side of the driveway, a drainage channel had been constructed. The upper portion of this contained very little surface water, however a few still pools were present and there was no terrestrial vegetation growing throughout the channel width (Photo9). Whilst the channel had been clearly constructed, a flow path was likely naturally present through this area and it is expected that water has been diverted to this channel. As such, this upper portion of Watercourse 5 was considered a modified **intermittent stream**. After the confluence with Watercourse 4, water became deep and the channel was much wider (Photo 10). Banks were very steep and had been reinforced in places with wooden boards. From the confluence, the watercourse was classified as a **permanent stream**.



Photo 7. 4 – the upper reach was wide and clogged with macrophytes.



Photo 8. 4 – the lower reach was narrow and incised.



Photo 9. 5 – the upper intermittent reach had r small pools of water



Photo 10. 5 – the lower reach was wide and water was often deep.



Figure 4. Historic aerial image of the site (yellow polygon) from 1966. Image from Retrolens.

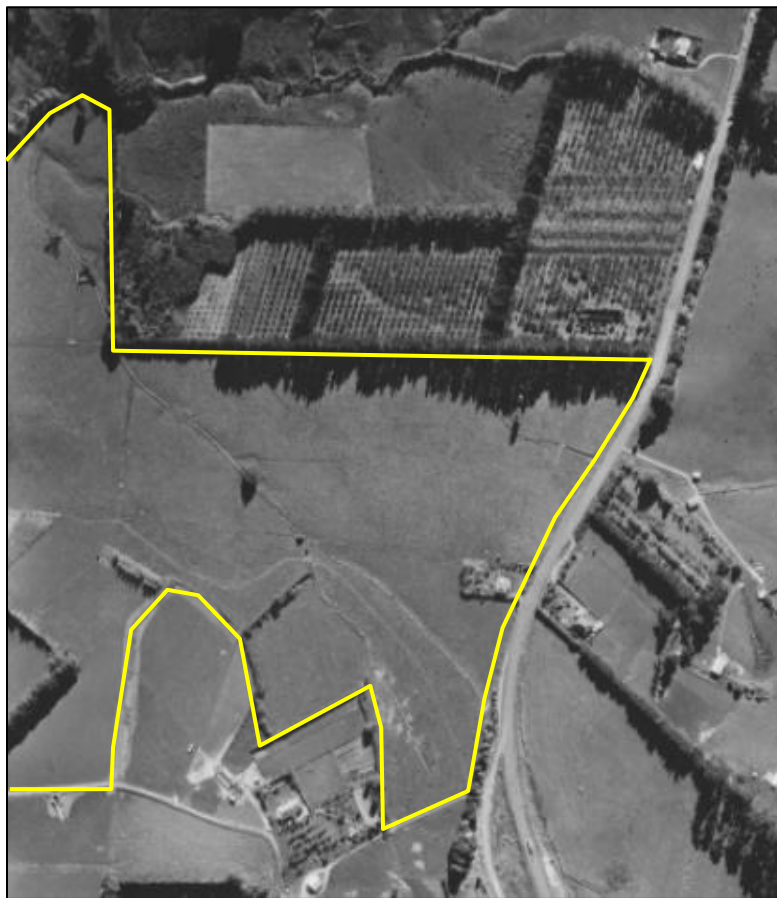


Figure 5. Historic aerial image of the eastern portion of the site (yellow polygon) from 1963. Image from Retrolens. State Highway 1 is the road running up the right-hand side of the figure.

Watercourse 6

On the southern side of the driveway a second, smaller drain was observed. There was no water within this drain and terrestrial pasture grass was rooted throughout (Photo 11). Further along the western portion of the drain, Yorkshire fog (*Holcus lanatus*) grew within the channel and the base of the drain was slightly boggy. A culvert connected this drain to the larger stream on the northern side of the driveway. This drain was classified as an **artificial watercourse** which has been constructed as a roadside drain to take water from the driveway. There were no natural portions of the drain from its headwaters (no natural intermittent or ephemeral streams fed into the drain) to its confluence.

Watercourse 7

A channel that had flattened banks was present within the Watercourse 7 area, and shallow surface water flowed between deeper pools along its length. Macrophytes such as starwort (*Callitriche stagnalis*), water pepper (*Persicaria hydropiper*) and watercress (*Nasturtium officinale*) often grew within the channel (Photos 12 and 13). The flow path was relatively straight, however did not appear to have been artificially created as it was very shallow (some modification may have occurred through straitening). Watercourse 7 was classified as an **intermittent stream** due to the presence of natural pools, flowing surface water and macrophytes. This transitioned into an **ephemeral overland flow path** within the upper reach, where the channel disappeared and surface water was not present.

Watercourse 8

A straight, deep drain had been created, running perpendicular to Watercourse 7 (Photo 14). There was no standing water or boggy ground within the base of the drain and terrestrial pasture vegetation was rooted throughout (Photo 15). Due to the lack of stream characteristics and lack of connectivity to natural watercourses, the drain did not appear to have been a modified natural freshwater system. As such, the drain was classified as an **artificial watercourse**.

Watercourse 9

Another straight watercourse was present along the edge of a driveway (Photo 16) (driveway not shown on map). Water entered the drain through a pipe (Photo 18) that appeared to be fed by stormwater from the surrounding area as no pipe inlet or channel was present within the area upstream. Water was present within a small pool, then the channel became dry for approximately 20m, before shallow, flowing water was observed for the rest of the channel length (Photo 17). The watercourse was clearly constructed and the surrounding flat catchment and lack of upstream freshwater habitat suggest that this watercourse was entirely artificial. As such, this watercourse was classified as an **artificial watercourse**.

Watercourse 10

Similar to the Watercourse 6 drain (artificial watercourse), a shallow drain was present along the edge of the farm track/driveway, with shallow water flowing through the base (Photos 19 and 20). Soft rush (*Juncus effusus*) grew along the edge of the drain. This watercourse had been constructed, did not appear to have natural headwaters and did not flow along a path that would be expected to have historically have a natural stream. Furthermore, historic aerial images do not show any signs of a flow path through this area. Watercourse 10 was classified as an **artificial watercourse**.



Photo 11. 6 – ditch on side of driveway



Photo 12. 7 – downstream reach clogged with water pepper



Photo 13. 7 – upstream reach had shallow pools, macrophytes and flowing water



Photo 14. 8 – an artificial drain



Photo 15. 8 – there was terrestrial vegetation rooted throughout and no water



Photo 16. 9 – an artificial watercourse next to a new driveway.



Photo 17. 9 – a pool upstream of a culvert



Photo 18. 9 – pipe feeding the partially dry drain



Photo 19. 10 – drainage channel adjacent to the farm track flowing opposite to contours



Photo 20. 10 – standing water present in some areas

Watercourse 11

A small, natural headwater tributary was present flowing toward the wetland area (see Watercourse 15). There was a well-defined channel (Photo 22), boggy ground (small puddles of surface water) (Photo 21), and aquatic vegetation growing within the base of the channel. Watercourse 11 then joined Watercourses 9 and 10 which flowed into the wetland. Watercourse 11 was classified as an **intermittent stream**.

Watercourse 12

After the confluence of Watercourses 1,5 and 7, a deep channel containing water flowed in a south to north direction (Photo 24). This reach was classified as a **permanent stream** due to the presence of continuous flowing water and large catchment size. The stream had been fenced from stock and regenerating native planting was present within the 10m riparian yard (Photo 23).

Watercourse 13

Water entered the site through a well-defined channel and flowed to the confluence of Watercourse 12. The watercourse had been fenced and the riparian yard was planted with native vegetation (Photo 25). Upstream of the site, the watercourse narrowed and was overgrown with vegetation (Photo 26). This watercourse was classified as a likely **permanent stream** due to the well-defined channel, flowing water and large catchment size.



Photo 21. 11 – a short intermittent stream had patches of standing water



Photo 22. 11 – a well-defined channel overgrown with vegetation; mercer grass throughout



Photo 23. 12 – riparian planting and fencing



Photo 24. 12 – the stream was deep and overgrown



Photo 25. 13 – water beneath overgrown buttercup



Photo 26. 13 – shallow water upstream of site

Watercourse 14

A large depression at the edge of a vineyard block marked the upper extent of Watercourse 4. A well-defined channel that lacked terrestrial vegetation within the base was present, with water occasionally observed in pools (Photo 27). Aquatic vegetation was also common within the base of the channel and scour and deposition was present within the few meanders along the watercourse. The watercourse was completely straight and very deep and did not appear to have any natural features along its length. Watercourse 14 was classified as an **artificial watercourse**.

Watercourse 15 (including constructed wetland)

A number of watercourses flow into deep channels within a fenced area dominated by a variety of wetland vegetation (Photo 28). Some of this appeared planted, while other areas (predominantly exotic vegetation) appeared to have established naturally. Vegetation included carex (*Carex* spp.), kahikatea (*Dacrycarpus dacrydioides*), flax (*Phormium tenax*), pampas grass (*Cortaderia selloana*), Yorkshire fog (*Holcus lanatus*), giant rush (*Juncus pallidus*), broom rush (*Juncus sarophorus*), water pepper (*Persicaria hydropiper*) and crack willow (*Salix fragilis*) (Photo 29). Very few upland or facultative upland plant species were observed and the percent cover of terrestrial vegetation was less than approximately 10-20% (formal delineation was not undertaken).

Discussions with the landowner have revealed that the area containing wetland vegetation historically consisted of two watercourses running through dry pasture. Approximately 15 years ago, he fenced the area and dammed these watercourses in order to slow the flow of water. He then planted wetland vegetation throughout the area. The purpose of damming this water and planting the vegetation was to create a wetland (pers. comms.). Historical aerial images also show that the wetland vegetation currently growing throughout the area was not present in 2001 (Figure 6). As the wetland has been purposefully constructed by artificial means, the area was not considered a natural wetland and was classified as a **constructed wetland**.

The western channel running through the area was considered a continuation of drain 14, an **artificial watercourse**. On historical aerials, it is clear the straight, deep channels have been constructed and do not appear to form part of a natural system, with no natural headwaters observed along its length.

The eastern channel is fed by three drains (9, 10 and 11). This watercourse appeared to have a small meander and contours show that this flow path is the low point of the surrounding area, suggesting water flow through here may be natural. Whilst there appeared to have been some straightening and/or deepening of the channel, the meander, contours and large catchment (approx. 5ha) suggest a natural flow path was likely present through this area prior to anthropogenic modification. As such, this watercourse was classified as a **modified permanent stream**. Water from these channels flow into a man-made pond (Photo 30), then into a narrow, well-defined channel (Photo 31). Below the constructed wetland, the narrow, well-defined watercourse was considered a continuation of the **permanent stream**. The banks and riparian yard of this channel consisted of predominantly terrestrial vegetation.



Figure 6. *Historical aerial image from 2001, showing the constructed western drain (14) and the potentially modified eastern stream (15). The wetland vegetation growing throughout the area currently, was not present in 2001. Image from Auckland Council's Geomaps.*



Photo 27. 14 – the watercourse was straight and deep



Photo 28. 15 – wetland vegetation grew throughout



Photo 29. 15 – the wetland vegetation included natives such as kahikatea



Photo 30. 15 – a pond at the downstream end of the constructed wetland



Photo 31. 15 – the stream reach below the constructed wetland had steep, incised banks



Photo 32. 16 – a shallow drain with grass growing through it

Watercourse 16

A shallow drain had been constructed along the edge of the farm track (Photo 32). This did not contain water, was ill-defined and terrestrial pasture grass was rooted throughout. This area was classified as an **artificial watercourse**.

Watercourse 17

Another shallow drain was present along the edge of a driveway in the north-west corner of the site (Photo 33). This did not contain water for its entire length and had been clearly constructed (Photos 34 and 35). The lack of water suggests that no natural flow path was historically present through the area that may have been modified. As such, Watercourse 17 was classified as an **artificial watercourse**.

Watercourse 18

A well-defined channel containing a large amount of water celery (*Apium nodiflorum*) was observed within the backyard of a property in the north-west corner of the site (Photo 36). There was no water within the channel, however the presence of a macrophyte rooted throughout suggests that this flow path contains water frequently. The channel joined the Mahurangi River at the western site boundary. Historic aerial images also show a natural flow path within the vicinity of Watercourse 18. The upper reaches of this appear to have been piped/reclaimed with just the current short downstream section left. Due to the well-defined channel, presence of macrophytes and evidence of a natural flow path, Watercourse 18 was considered an **intermittent stream**.

A large man-made pond was also present to the north of Watercourse 18 (Photo 37). This pond was lined with concrete/tiles and a pipe was present at its upper end. There was not natural inlet or outlet observed around the edges of the pond. This was considered an **offline, manmade pond** and not a natural freshwater feature.

Watercourse 19

A large river flowed along the northern boundary of the site (Photo 38). This **permanent river** is the receiving waters of Watercourses 1-17 on site and is a tributary of the Mahurangi River.



Photo 33. 17 – lower section of drain completely dry and straight suggesting artificial nature



Photo 34. 17 – mid-section of drain dry; grass and some exotic rushes grew throughout



Photo 35. 17 – upper section dry, under shade there was no terrestrial (or aquatic) vegetation



Photo 36. 18 – small stream containing water celery near western boundary



Photo 37. 18 – an off-line artificial pond was located in the area



Photo 38. 19 – the large river running along the northern boundary is a tributary of the Mahurangi River (right branch)

Constraints

Freshwater Ecological Constraints

Under the Auckland Unitary Plan Operative in Part (AUP OP), the National Policy Statement for Freshwater Management 2020 (NPSFM) and the National Environment Standards for Freshwater 2020 (NESFW) there are a number of constraints that apply to developing land near/in freshwater ecosystems. A number of natural/modified intermittent and permanent streams flow through the site along with artificial watercourses and one constructed wetland:

- 1 – permanent stream
- 2 – permanent stream
- 3 – ephemeral overland flow path
- 4 – permanent stream
- 5 – intermittent/permanent stream
- 6 – artificial watercourse
- 7 – intermittent stream
- 8 – artificial watercourse
- 9 – intermittent stream
- 10 – artificial watercourse
- 11 – intermittent stream
- 12 – permanent stream
- 13 – permanent stream
- 14 – intermittent stream
- 15 – natural wetland; permanent stream
- 16 – artificial watercourse
- 17 – artificial watercourse
- 18 – intermittent stream; offline pond
- 19 – permanent river

Activity Table E3.4.1 (E3; Lakes rivers, streams and wetlands) in the AUP OP apply to the potential works at the site. Where there are the same rules within the NES-FW and AUP OP, the more stringent of the two rules would apply. These rules apply to permanent and intermittent streams and wetlands:

- (A19) – Diversion of a river or stream to a new course and associated disturbance and sediment discharge is a discretionary activity.
- (A23) – Replacement, upgrading or extension of existing structures complying with the standards in E3.6.1.12 is a permitted activity.
- (A29) – Bridges or pipe bridges complying with the standards in E3.6.1.16 are a permitted activity.
- (A32) – New culverts or fords less than 30m in length when measured parallel to the direction of water flow, complying with the standards in E3.6.1.18 are a permitted activity.
- (A33) – New culverts or fords more than 30m in length are a discretionary activity.
- (A49) – New reclamation or drainage including filling over a piped stream is a **non-complying** activity.

The following rule in E3.4.1 in the AUP OP applies to ephemeral overland flow paths:

- (A53) – Any activity that is undertaken in, on, over or within the bed of an ephemeral river and stream complying with the standards in E3.6.1.1 is a permitted activity.

The following rules in the AUP OP, relating to vegetation removal near freshwater bodies (Activity Table E15.4.1; Vegetation Management and Biodiversity) may apply to the development of the site:

- (A6) – Pest plant removal is a permitted activity.
- (A18) – Vegetation alteration or removal within 20m of a natural wetland or in the bed of a river or stream (permanent or intermittent) is a restricted discretionary activity.

- (A19) – Vegetation alteration or removal within 10m of streams is a restricted discretionary activity.

The rules in relation to natural wetlands detailed within the NESFW and the AUP OP do not apply to constructed wetlands.

As far as practicable, any streamworks or works within the riparian yards of natural streams should be avoided, minimised, mitigated or offset appropriately. If reclamation of an intermittent or permanent stream is proposed, ecological offsetting through the restoration of 'like-for-like' freshwater ecosystems will highly likely be required.

Regards,

Bioresearches, Babbage Consultants Limited



Nicky Kerr, M.Sc. (Hons) | Freshwater Ecologist

T +64 9 379 9417 DDI +64 9 367 5284 M 021 285 4335 W www.bioresearches.co.nz