Memo

To:	**Rachel Morgan**	**Job No:**	**1003297.6000**
From:	**Justine Quinn**	**Date:**	**24 March 2020**
cc:	**Nick Carter, Gary Bramley**		
Subject:	**Drury East Plan Changes - Ecology Response**		

This memo has been prepared to address selected ecological responses as required by the Request for Further Information (RFI) from Auckland Council for Drury East Plan Change requests by Fulton Hogan, Oyster Capital and Kiwi Property. It has been prepared by three ecologists, being Gary Bramley (for Fulton Hogan), Justine Quinn (for Kiwi Property) and Nick Carter (for Oyster Capital) and summarises the results of an ecology workshop, literature review and collaborative drafting of this response. This memo should be read in conjunction with the stormwater memo and only applies to those specific matters outlined below.

1 Erosion and sedimentation effects

The following response has been prepared in relation to RFI E10 (Kiwi), E11 + E12 (Fulton Hogan), E10 + E11 (Oyster) which collectively request that more information is provided to assess the effects of sediment and erosion on the life supporting capacity of the marine significant ecological area.

Existing environment – plan change area

The collective area that the three plan changes apply to (the plan change area) is currently in predominantly agricultural and horticultural land use, including cropping, dairy farming and grazing. Many of the streams within the plan change area are intermittently flowing headwater systems that have unrestricted stock access to enable grazing when the streams are dry in summer. The Hingaia Stream which flows along the western boundary of the wider plan change area is the largest stream affected by the plan change. Photograph 1.1 below provides a representative image of the smaller streams within the plan change area.

Riparian vegetation is effectively absent over much of the plan change area and most of the stream length is unfenced. Stream banks and channels have been impacted by stock access, with slumping and bank instability prevalent throughout the plan change area. Auckland Council's survey of streams in the Hingaia area[1] revealed that bank stability was generally poor to fair. While erosion scars were typically less than 20%, erosion at inlet/outlets was often moderate or severe. Banks were identified as being highly erodible due to the general lack of vegetation and the soft erosive soils within the catchment. Sediment deposition was overserved to be ~17% on average across the entire Hingaia catchment, and notably, areas of active sediment deposition of >30% were linked to areas where stream banks of >20% erosion scarring was present.

[1] Spyksma, A., Bennett, K., Kane-Sanderson, P., Lindgreen, M., Pertziger, F., Allen, J., Gasson, S and Canal, L. (2018) Hingaia Stream Catchment Watercourse Assessment Report. 4Sight Consulting and Urban Solutions for Auckland Council. Auckland Council [technical report, TR20xx/xxx]

Auckland Council also surveyed streams within the Slippery Creek area[2], however most of the stream length present within the plan change area was not mapped. Therefore, we rely on the observations made during field assessments and reported in Freshwater Solutions (2019) where intermittent watercourses were found to be unfenced with severely damaged streambanks and channels. The section of the Waihoihoi Stream flowing adjacent to the plan change area was fenced but lined with low stature weed species and occasional mature trees so the streambanks were susceptible to streambank undercutting, slumping (i.e., due to poor root stability) and sedimentation (Photograph 1.2).

Photograph 1.1: Evidence of unrestricted stock access, lack of riparian margins, upper bank instability.

Photograph 1.2: Lack of riparian margins and bank instability along Waihoihoi Stream.

[2] Ingley, R., Rieger, A., Magee, J., Reeves, E., Macintosh, K., Lowe, M., Young, D. (2016) Watercourse Assessment Report: Slippery Creek Catchment. Morphum Environmental for Auckland Council. Auckland Council [technical report, TR20xx/xxx]

Existing environment – marine receiving environment

The marine receiving environment is the Drury Creek and wider Pahurehure Inlet. The immediate marine environment is recognised as a Significant Ecological Area (SEA), which includes SEA-M1_29a, SEA-M2_29b and SEA-M2_29w1-2, shown on Figure 1.1.

Immediately adjacent to State Highway One, the intertidal area is classified as an 'SEA-M1' indicating that its physical form, scale or inherent values are considered to be the most vulnerable to any adverse effects of inappropriate subdivision, use and development. The AUP OP identifies that within these upper tidal reaches of Drury Creek there are a variety of marshes, grading from mangroves through to extensive areas of jointed rush-dominated saltmarsh, to freshwater vegetation in response to salinity changes. This same area is a migration pathway between the marine and freshwater environments for a number of native diadromous freshwater fish species.

Beyond this, the wider intertidal area is classified as an 'SEA-M2' being an area of regional, national or international significance which does not warrant a SEA-M1 identification as they are generally more robust. This has similar ecological values, but also provides roost areas of importance to wading birds including pied stilt.

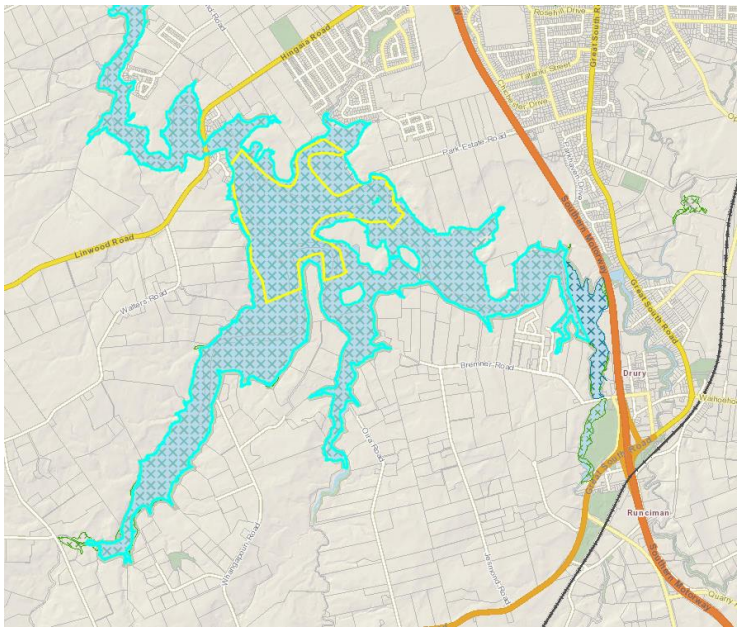

Figure 1.1: Marine SEA in the Pahurehure Inlet and wider Drury Creek estuarine area

Sediment in the marine environment

NIWA were engaged by the Ministry for the Environment to develop and apply a new empirical model that estimates mean annual river suspended sediment load and sediment deposition in coastal hydrosystems[3]. The model includes suspended sediment load and inherently includes sediment supply from eroding streambanks as well as upstream hill-slope erosion processes.

Shallow drowned valleys such as the Pahurehure Inlet have intermediate level deposition rates (median of 0.7 mm/year), where near-bed velocities are low, little resuspension by currents occurs, and a main channel morphology tends to be absent. The trapping efficiency of a shallow drowned valley is typically quite high, and the Pahurehure Inlet has a predicted trapping efficiency of 0.963. Trapping efficiency is the proportion of incoming sediment load that is retained and settles within the water body measured on a scale of 0 to 1, where 1 means that 'all river-sourced sediment is

[3] Hicks, M., Semadeni-Davies, A., Haddadchi, A., Shankar, U and Plew, D. (2019). Updated Sediment Load Estimator for New Zealand. Prepared by NIWA for the Ministry for the Environment. March 2019. NIWA client report 2018341CH.

retained in the coastal hydrosystem'. What this tells us, is that the marine receiving environment is a natural deposition zone and sediment deposition is expected and required for the environment to continue to function.

Zostera, the sea grass grows in soft-sediment environments and is present in the wider Pahurehure Inlet. One of the key functions of seagrass is to trap and stabilise bottom sediments, to protect against sediment erosion in the coastal environment[4]. Seagrasses also depend on sediments for nutrients and anchorage.

Potential sedimentation effects of the plan change

The plan change area is currently predominantly in rural land use which typically has a higher overall sediment load than urban land use[5]. The change in hydrological regime may result in streambank sediment entering the receiving environment at times (e.g. after heavy rain). This will be balanced in part by the effective removal of contributing sediment loads from agricultural land use and the future potential benefits associated with planting along the blue-green network throughout the plan change area (e.g., root establishment, increased streambank stability and filtering capacity).

The Hingaia Stream, which is known to have erosion issues, is most affected by the flows entering the stream from the wider catchment, which is currently undergoing significant development, thus the impact of the proposal on Hingaia Stream needs to be considered in the wider context of the whole catchment. The plan change area comprises only a very small portion of the 37,637 ha[5] Pahurehure Inlet catchment. Even at the more local scale of the upper Drury Creek, the plan change area comprises a small proportion of the overall contributing catchment. On that basis, any changes within the plan change area on sediment levels in Hingaia Stream would be very difficult to distinguish from changes elsewhere within the catchment.

Auckland Council Stream Erosion Risk Tool

As is explained in the stomwater memo (ref W-REF: P16-335), the Auckland Council Stream Erosion Risk Tool was investigated to provide further quantifiable information regarding the potential risks of erosion from within the plan change. Some issues with this tool were identified and next steps are proposed within the stormwater memo. The tool when working will quantify the change in exceedance of critical shear stress will only indicate a change in erosion potential i.e. how much the erosion risk changes. It will not quantify how much extra erosion will occur, nor the change in sediment load will be to the receiving environment, so it cannot be used to directly assess effects. The tool will identify areas with increased erosion risk and where extra mitigation measures should be applied.

Until further assessment is undertaken, a robust ecological assessment of the potential effects of sedimentation in the marine SEA cannot be completed. Further assessment of the change in sediment contribution to the wider environment will be undertaken prior to a plan change hearing, although this may be risk based. This will provide more assessment of the anticipated changes in sediment risk and will incorporate mitigation measures which will reduce the potential stream bank erosion and therefore sediment generation.

Until further assessment or quantification is undertaken, a robust ecological assessment of the potential effects of sedimentation in the marine SEA cannot be completed. Further assessment to quantify the change in sediment contribution to the wider environment will be undertaken prior to a plan change hearing. This will provide a more quantitative assessment of the anticipated changes in sediment generation and will incorporate mitigation measures which will reduce the potential

[4] Turner, S. and Schwarz, A. (2006). Management and conservation of seagrass in New Zealand: an introduction. Science for Conservation 264. Prepared by the Department of Conservation.

[5] Parshotam, A. (2008). Southeastern Manukau Harbour / Pahurehure Inlet Contaminant Study. Sediment Load Model Results. Prepared by NIWA for Auckland Regional Council. Auckland Regional Council Technical Report 2008/052.

stream bank erosion and therefore sediment generation. We have identified a range of potential mitigation measures which may aid in the management of erosion and sedimentation in the plan change area:

- Removal of stock from the site and therefore avoiding active bank de-stabilisation through stock access and pugging.
- Incorporation of green spaces adjacent to stream networks to provide for planting of riparian margins to improve bank stability and reduce erosion potential.
- Modification of hydrograph mitigated through stormwater retention/detention (MSAF 1 hydrological mitigation) measures which will slow flows.
- Remediation or removal of existing in-stream structures (culverts, inlets/outlets) which are currently identified as having erosion issues.
- Realignment of streams which have been channelised to a more natural alignment.
- Incorporation of erosion and scour protection measures at all outfalls to minimise erosion at new structures.
- Potential targeted in-stream erosion protection measures within the Hingaia Stream and other larger streams.

While the effectiveness of these measures cannot be quantified at this stage, these are still considered to provide some benefit to erosion and sediment generation from stream channels affected by the change in hydrology within the plan change area.

2 Water quality

The following response has been prepared in relation to RFI Stormwater 01 and 03 to address questions pertaining to water quality and effects on ecology. This response should be read in conjunction with the planning response and stormwater memo.

Chapter E1 of the AUP OP identifies that where freshwater quality is degraded, that it be improved over time and that the macroinvertebrate community index (MCI) be used as a 'guideline' or indicator of freshwater ecosystem health. Aquatic macroinvertebrate community structure, abundance and diversity are standard indicators of the long-term health of streams. Different aquatic invertebrate taxa have varying tolerances of pollutants so their presence or absence can provide an indication of stream condition and overall health (i.e., water quality and habitat quality).

Policy E1.3.(2) identifies some 'national bottom lines' for stream health using the MCI and directs that where the current condition is lower than the bottom line that these systems be enhanced. If the bottom line is met, then the current condition should be maintained or enhanced. The bottom line MCIs of 94 and 68 for rural and urban environments respectively are relevant to this assessment. An MCI score of 94 is indicative of 'fair' stream health (i.e., MCI range 80-99) whilst anything lower than 80 is deemed 'poor' and representative of a degraded aquatic system.

In the 2018 Hingaia Watercourse Assessment Report[1] (WAR), a sample taken from the Fitzgerald Stream was indicative of poor water and habitat quality (MCIsb = 68). Just downstream of the plan change area near Wykita Lane, a similar MCI of 67 was recorded. A similar assessment was undertaken for the 2016 Slippery Creek WAR however the streams within the plan change were not assessed. Downstream and in the mainstem of the Waihoihoi Stream a sample was taken which indicates 'fair' water and habitat quality (MCIsb=99). Freshwater Solutions sampled a section of the Waihoihoi Stream within the plan change area and reported an MCI-sb indicative of poor stream health (MCIsb = 78). The current state of freshwater ecosystems within the plan change area is typically below the bottom line for rural landuse (i.e., MCI = <94). Under a future landuse of urban the national bottom line of 68 is met. The proposed stormwater management approach needs to at least maintain, but preferably improve, on the existing condition.

Many of the stream systems are expected to be nutrient enriched at present based on the observed prevalence of macrophytes, unrestricted access by livestock and the adjacent agricultural and horticultural land use. Further, with a near complete lack of shade along a high proportion of watercourses within the plan change area, it is expected that elevated water temperatures may be limiting the presence of some invertebrate taxa. It is considered that the main driver of poor macroinvertebrate communities is the lack of riparian vegetation which provides shade, adult aquatic insect habitat, bank stability and source of woody debris and leaf litter. Proposed riparian planting along stream corridors to develop the blue-green network will result in a demonstrable improvement in instream habitat (i.e., increased stability, woody debris) and water temperature control that will enhance conditions for aquatic fauna. Further, the connectivity of the riparian margins with existing vegetation east of Drury Hills Road, will provide a corridor from source populations of macroinvertebrates in the headwaters throughout the catchment. Restoration of streams including restoring sinuosity, removal of inline ponds, adding retreats and armouring where appropriate is also expected to improve stream habitat quality.

An integrated stormwater management approach has been proposed as a 'Stormwater Management Toolbox' which incorporates a range of measures to manage potential effects associated with the proposed change in land use and outlines the devices proposed within each of the proposed zones. The proposed stormwater management approach includes a range of different devices that will be consistent with GD01[6]. The devices proposed and the overall approach is consistent with the recommendations of TR2013/035. Specifically, these devices (if designed and constructed properly) will meet the historically proposed 'design effluent quality requirements' (DEQR). In relation to zinc and copper (as surrogates for other urban contaminants) these were defined as 30 ug/l for zinc and 10 ug/L for copper. These concentrations were at the point of discharge and do not take into consideration the assimilative capacity of the environment, reasonable mixing or the benefits of a treatment train approach. Further, these values were considered to be conservative, in that most devices perform substantially better than these DEQRs and were chosen for that reason after consultation with Mana Whenua.

It is considered that the implementation of the stormwater management toolbox in conjunction with the enhancement of riparian margins will be sufficient to manage the potential effects associated with changes in water quality and as measured by the macroinvertebrate community indices.

3 Blue-green network

The following response has been prepared in relation to Stormwater 07 in relation to the blue-green network. Refer to Appendix A which shows the Blue-Green Network envisaged under the Structure Plan, overlain with the riparian corridors as proposed in the Plan Change. There are some parts of the site where stream alignment does not correspond between the two datasets. We consider that for the most part this relates to a lack of spatial resolution. The plan is conceptual and provides sufficient information at this time to identify that the Blue-Green Network, including the important connectivity with SEA to the west of Drury Hills Road, is integral to the Plan Change.

4 Riparian margins

Please refer to the Planning response in relation to RFI E11 + E12 + E13 + E14 (Kiwi), E14 + E16 (Fulton Hogan), E12 + E13 + E14 (Oyster) and Stormwater 06 to address questions in regards to riparian margins around streams and wetlands.

[6] Stormwater Management Devices in the Auckland Region, December 2017, Guideline Document 2017/001 Version1.

Appendix A: Blue Green Network Map

KEY

Council indicated new suburb park (Size 3-5ha) (Structure Plan)

Council indicated new neighbourhood park (Size 0.3-0.5ha) (Structure Plan)

Flood Plains

Stream Connections

Permanent and Intermitent Streams and 20m Riparian Margins (width may change) - from Structure Plan

Rail line

Rail station (indicative)

State Highway 1

Arterial roads (existing & upgrades)

New arterial roads (indicative)

Collector Road (existing & upgrades) with pedestrian and cycle connections

New collector roads (indicative) with pedestrian and cycle connections

Stream with pedestrian & cycle connections and a 10m riparian margin (Plan Change)

Parks (indicative) (Plan Change)

Scale 1:11,000