Lessons from Te Awarua-o-Porirua

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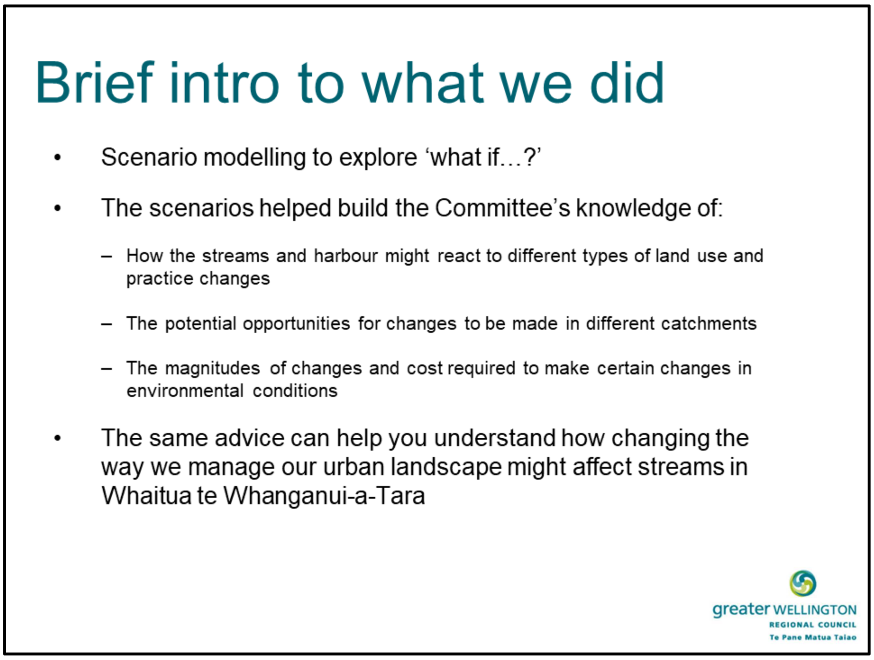


The general approach behind the scenario modelling was to help explore 'what happens to the rivers and streams if…' type questions. They were never intended to be a blueprint or proposal of what change should or shouldn't occur.

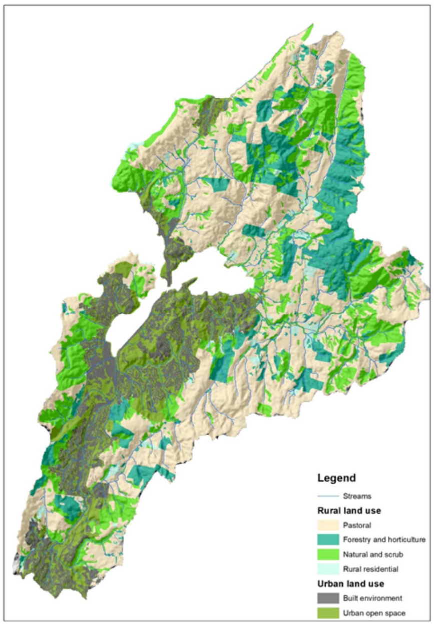
The results and insights from this work helped the Committee build up a picture of…

A lot of these insights can be generally transferred now to help broadly understand how changing the way we manage our urban landscape might affect similar streams in this Whaitua.
With some additional work that we have planned (see Biophysical Science presentation), we can also then apply this existing knowledge and provide this kind of advice at a catchment scale

Current state

Current state

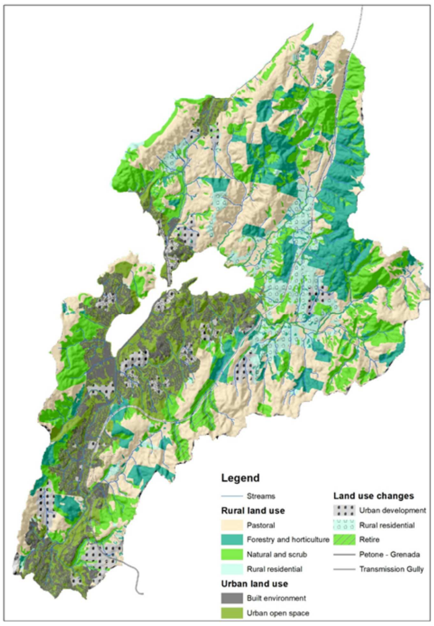
- snapshot of current landuse and practices



Scenario 1

"Business as Usual" scenario represented

- Projected residential growth as we do it now
- Transmission Gully and Petone to Grenada motorways constructed
- Offset retirement from Transmission Gully construction

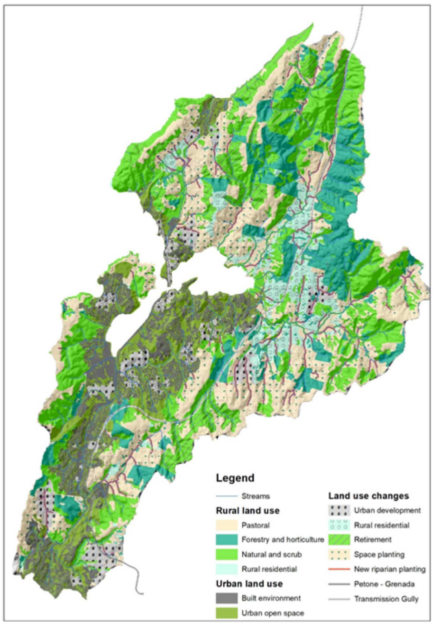


See scenario description table for examples
http://ourspace.gw.govt.nz/ws/envplan/cmp/Te-Awarua-o-Porirua%20Whaitua/Scenario%20description%20table.docx

Scenario 2

"Improved" scenario represented

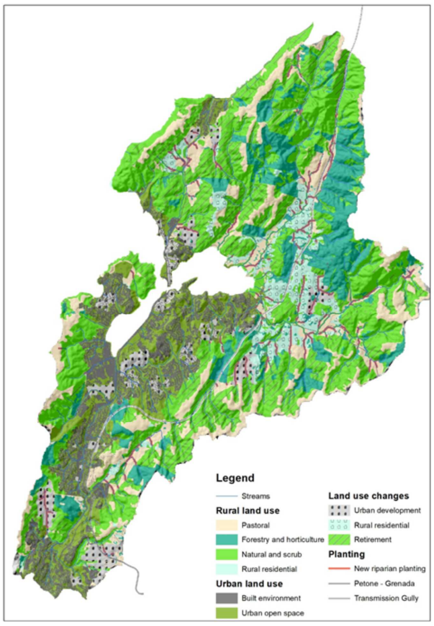
- The "BAU" changes PLUS…
- Some water sensitive practices to residential growth
- Some retrofit improvements to our existing urban landscape
- Rural erosion control measures
- Livestock exclusion and riparian planting



Scenario 3

"Water sensitive" scenario represented

- The "Improved" changes PLUS…
- Further water sensitive practices in residential growth
- Further retrofit improvements to our existing urban landscape
- More retirement of rural erosion prone land
- Greater livestock exclusion setback and riparian planting



Lessons for Whaitua te Whanganui-a-Tara

How do these bundles of changes to an urban landscape broadly affect indicators of…

- Pathogens
- Nutrients
- Sediment
- Zinc and copper
- Flows
- Ecology

…in streams and estuaries?

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Following on from these environmental indicators outlined in last month’s presentations on urban streams, and the way that urban activities tend to affect these, some of the headline lessons we learnt about were . . . [next slides]

How do these changes to an urban landscape affect pathogens in streams and harbours?

- Scenarios gave up to 70-85% improvements in *E. coli,* but didn't shift *E. coli* from very poor to fair
- Risks remained highest at the inner parts of the harbour near freshwater sources
- Biggest changes came from repairing leaking wastewater pipes and cross connections
- Treating runoff in developments is highly effective locally, but benefits get masked at bigger catchment scale

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At Kenepuru and Porirua stream sites, the improved scenario gave a 50-75% reduction in *E. coli* and the water sensitive scenario gave a 70-85% reduction in *E. coli.*
Remained elevated across all conditions in both scenarios (ie, both wet and dry weather).
Didn't shift to C band.

Saw a band change improvement in most places within the harbour, and risks remained highest at the inner parts of the harbour near freshwater inputs. This was typically related to the peak concentrations during wetter weather.

The biggest changes in the scenarios for reducing *E. coli* come from repairing leaking wastewater pipes and cross connections.
These reduce E. coli in those areas by around 75%, and wastewater overflows reduced from an average of 12/yr to 2-4/yr.

Treatment of runoff in infill and greenfield development areas is highly effective for *E. coli*, removing around 90% of E. coli from those areas. However, those areas were relatively small and their effects became somewhat masked at the bigger catchment scale.

How do these changes to an urban landscape affect nutrients in streams and harbours?

- Improvements in peak ammonia levels (25-50% reductions), largely due to the modelled reduction in wastewater overflows
- Nitrate levels showed little change in the scenarios (~10%).
- There were no scenario treatments to the largest urban source which was parks and greenspaces.

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Remained in the B or C band because even any short term peaks present a risk of toxic effects from ammonia

Note nitrate similar to what was presented last month from Hutt Valley study, though the transport pathways might be slightly different (ie, greater groundwater path in Hutt versus more overland paths in TAoP. Possibly more similar transport paths through Wellington City areas?)

Majority of that nitrate reduction likely due to retirement of erosion prone land in the catchment headwaters as there were no scenario treatments to the largest urban source which was parks and greenspaces.

How do these changes to an urban landscape affect sediment in streams and harbours?

- Difficult to separate relative contributions of urban or rural sources
- In urban areas, construction areas estimated to generate 100-1,000 times more sediment than other parts of the urban areas
- Sediment control applied to all construction sites with 90% removal performance

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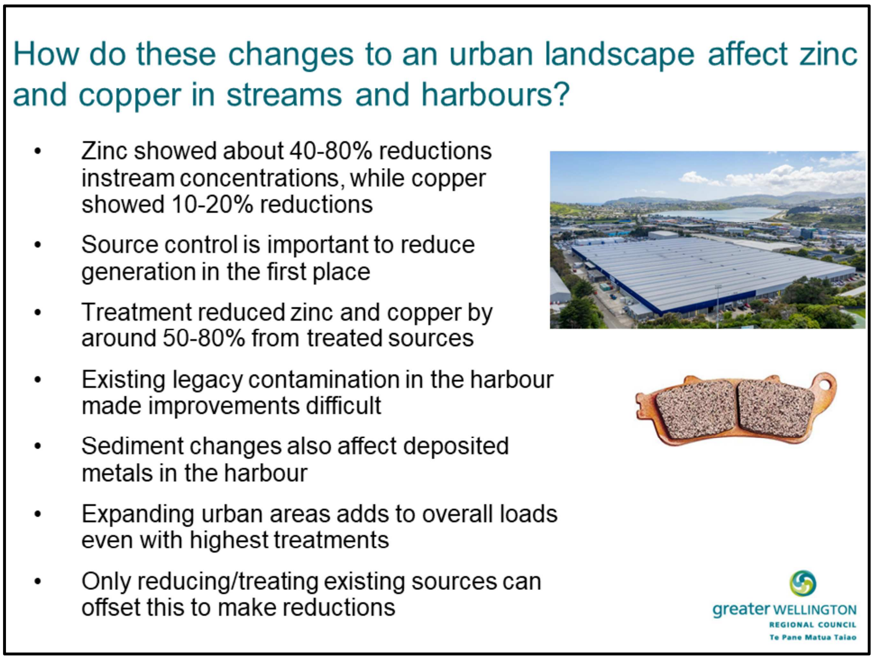
Sediment (Total Suspended Solids) yields from Contaminant Load Model
Urban surfaces increased from 5 => ~260 (high traffic roads and steep urban parks)
Construction is 2800 - 19,000 depending on slope – so even treating min slope construction still yields more than any other untreated urban surface



Source control is important to reduce generation in the first place.
Painting/replacement of high zinc yielding roofs can reduce zinc by around 60% - Residential roofs got this and are extensive so had big impact and is part of the reasons we saw such big reductions in zinc.
Removing copper brake pads etc.

Treatment can be effective where deployed.
Treatment of runoff in residential development areas, roofs and paved surfaces of commercial and industrial areas and high traffic roads, which reduced metals by around 50-80%.

Part of the reason we saw a small reduction in copper was that source from residential roads was a relatively major source. However, the extensive nature of this source meant treatment wasn't applied, therefore it remained a large source and meant smaller reductions (~200km of 'local roads' versus ~20km of 'major roads' >20k VPD)

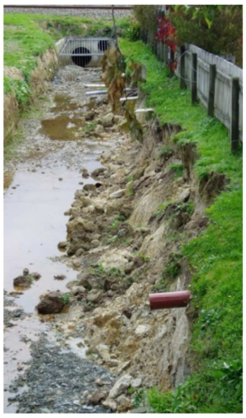
In the harbour, existing metal contamination in the sediment meant it was hard to get improvements, particularly in the deeper basins where sediment and metals tended to accumulate.
An important observation we noted was the connection between sediment changes and

metal changes in the harbour. When sediment reduced by more than the metal, we saw relative increases in the harbour metals and vice-versa when metals reduced by more than the sediment.
Need to be mindful to match sediment and metal reductions to avoid this relative increase.

Also important to manage peak concentrations as metals are washed into water with rainfall.

How do these changes to an urban landscape affect <u>flows</u> in streams and harbours?

- Urban development can increase runoff which increases streambank erosion and disturbance of aquatic habitat
- Partial implementation of water sensitive practices helps slow down this response
- Greater implementation can help shift the catchment further towards pre-development hydrological conditions



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Urban development can be expected to increasing the volume, rate and frequency of stormwater runoff discharges, which can increase streambank erosion and disturb the habitat of aquatic life in the stream.
Rainfall that might have barely reached the stream prior to development now runs into there quickly.

Improved scenario reduced the frequency of bed disturbing flows but still had modification of overall discharge and flows.
Water sensitive scenario, which included reuse of stored water within the house, also allowed the overall volume discharged and the flow conditions to more closely match the pre-development conditions.

Flow exceedance frequency
▪ Describes changes in the frequency with which particular flow rates of interest are exceeded, e.g. the 1-2-year ARI 'channel-forming' flow, or 'bed-disturbing' flows.
▪ High frequency bed disturbance directly affects habitat and food availability. This can lead to lower diversity communities dominated by a few tolerant species (typically small, rapidly colonising species) while more sensitive species are lost.

Cumulative frequency distribution curves
▪ Indicate a tendency towards a broadly higher or lower flow regime by describing the percentage of time that a flow rate of interest is likely to be equalled or exceeded.

The frequency of bed disturbing flows can be kept at/restored to pre-development levels using partial or comprehensive implementation of water sensitive practices. Greater implementation and incorporating water reuse in dwellings can also help shift the catchment further towards pre-development hydrological conditions.

How do these changes to an urban landscape affect ecology in streams and harbours?

- Modelled water quality improvements would be positive for some toxicants (eg, zinc and ammonia) and provide for minor ecological improvements
- Physical restoration of fish passage and habitat was not part of the modelled scenarios, but expert assessment suggested this would offer significant benefits to instream ecology.
- Small nutrient improvements and large sediment reductions estimated to offer small improvements for invertebrates and reductions in nuisance macroalgae in the harbour.

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Whaitua te Whanganui-a-Tara

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