

Huapai: Fruitful Futures

Regional Context

Background

Located on the peri-urban edge of Auckland, the adjacent towns of Huapai and Kumeu are becoming a hub for residential expansion. Being situated on State Highway 16 makes commuting to key business areas of the North Shore and Auckland CBD an easy task. Huapai is not only stationed on a main vehicular route, but also directly beside the North-Western train line, however commuter trains do not reach Huapai and instead stop in Swanson. According to the Victoria University website, Huapai is a "modern coined name, meaning the place of excellent fruit." This is appropriate because in the rural land surrounding Huapai there are vineyards, strawberry fields, apple, pear, kiwifruit orchards and many others. By shifting the main town centre from Kumeu, towards Huapai, it will result in better accessibility for the residential developments currently under construction on either side of the highway.

Vision

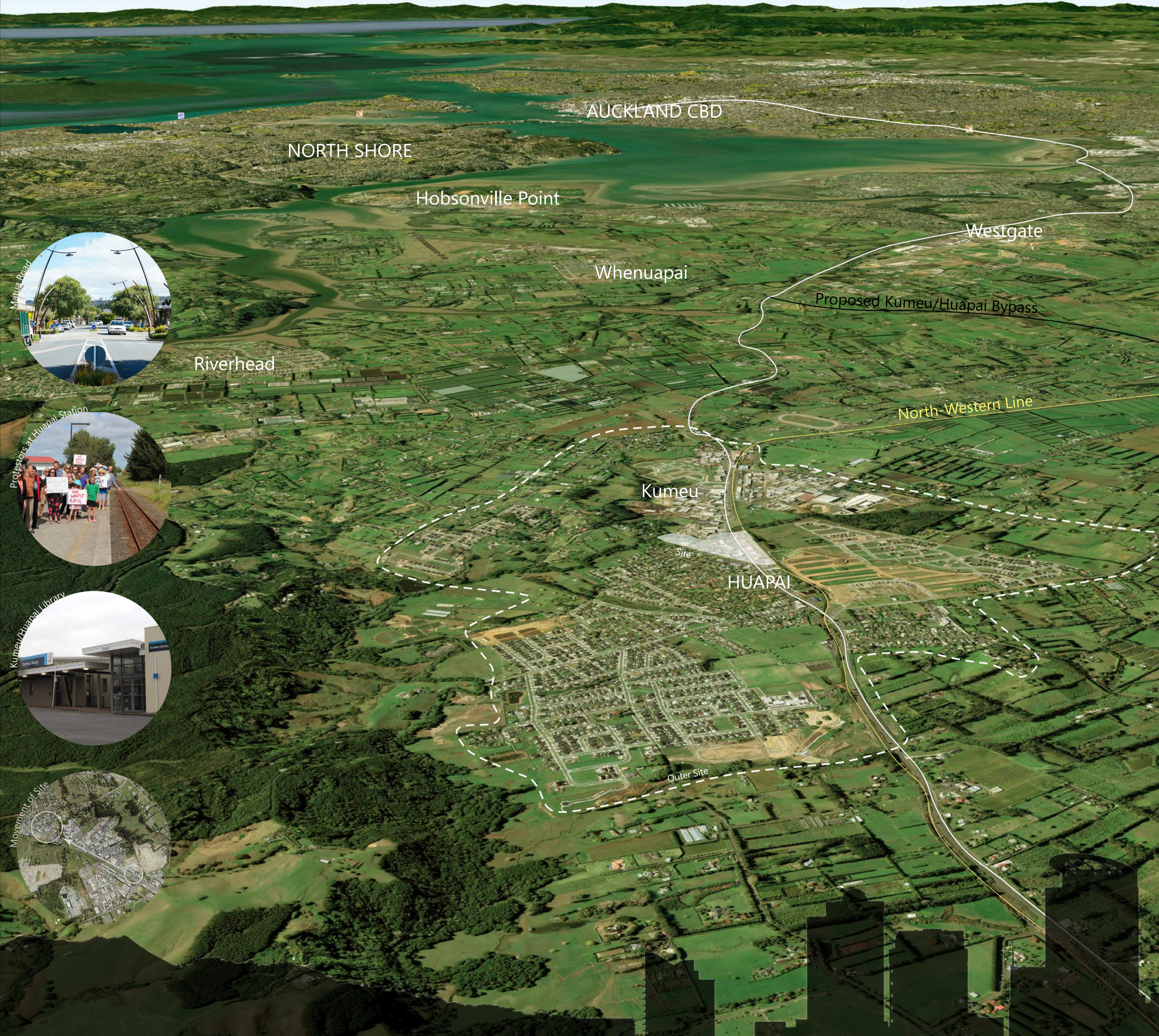
Huapai will become an exemplary urban development that has ecological, social, economic and environmental benefits. It shall be a place where people from the local community and from further afield can come together, where all the necessary amenities, and more, are provided in a central hub. Huapai shall embrace its rich local history, acknowledging the past by utilizing the stories of fruit horticulture.

Goals

- 1 Develop a town centre that enhances daily lives of locals, while acting as a destination for visitors both within Auckland and even abroad.
 - To improve the ease of access to amenities, while prioritizing pedestrians and cyclists.
 - Provide a vibrant and energetic space that maintains that atmosphere during the day and late evenings.
 - To offer local businesses the opportunity to sell their goods or services to people.
- 2 Create a water management strategy that will control and improve stormwater runoff.
 - Design a drainage scheme that will capture the majority of stormwater runoff quality.
 - Implement artificial wetlands in order to improve water quality from both the urban development as well as surrounding residential and industrial areas.
 - Maximize permeable surfaces to allow for infiltration not the ground.
- 3 Develop public transport connections to allow reduce the reliance on personal vehicles.
 - Propose train stations further North past Swanson.
 - Improve public bus connections and design a transport hub.
 - Prioritize and encourage the use of public transport systems through design.

Assumptions

Within the 'Auckland Future Urban Land Strategy', Auckland council have proposed approximately forty-two and a half thousand houses for North-West Auckland over the next two decades, with eight thousand in Kumeu, Huapai and Riverhead to be implemented by 2032. Assuming these numbers are reached, developments to urban centres and transport networks, must be made now. Additionally, Auckland Transport (AT) have proposed a bypass of Kumeu and Huapai, which would reduce the number of vehicles travelling through Huapai and Kumeu significantly. The public North-Western rail network that currently ends at Swanson will be extended as far north as Helensville, with improvements to be made to existing yet unused stations at Waitakere, Huapai, Waimauku and Helensville. Furthermore, the current single rail line will be expanded into a double line from Swanson to Helensville, allowing to multiple trains to travel in opposite directions simultaneously.



Grey-Blue-Green Infrastructure

Waterways

Large Vegetation

Development Ready

Development Ready

Source: Auckland City Council 2017

Legend:

- Rural Urban Boundary (RUB)
- Special Housing Areas
- Existing Urban Areas
- Development Ready
 - Actual, contracted or planned, 2013 - 2017
 - 1st Half Decade One, 2018 - 2022
 - 2nd Half Decade One, 2023 - 2027
 - 1st Half Decade Two, 2028 - 2032
 - 2nd Half Decade Two, 2033 - 2037
 - 1st Half Decade Three, 2038 - 2042
 - 2nd Half Decade Three, 2043 - 2047

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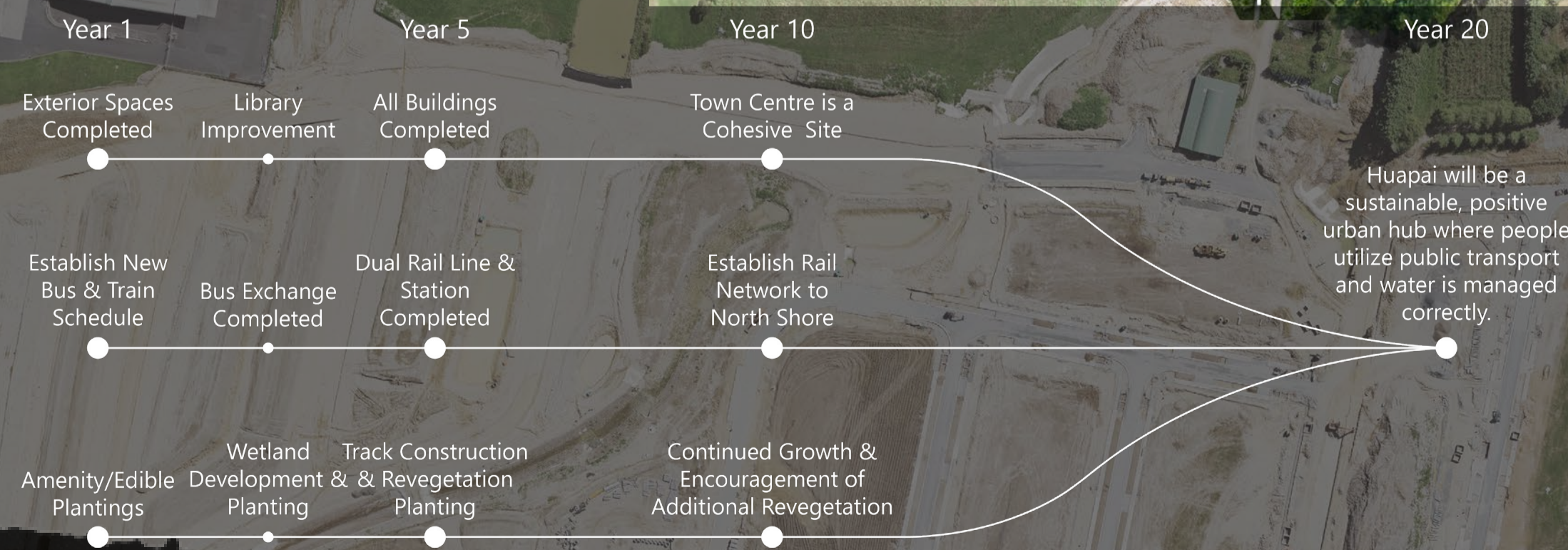
Masterplan 1:2,000

Design Intent

Huapai will be a lively semi-rural town with a vast range of amenities for all. Being located to the North-West of Auckland CBD, Huapai will have strong connections to areas in the immediate vicinity and further afield using a variety of transportation methods. This new town centre development will not only be a social hub for people in surrounding areas but also for people who will have the possibility to travel from the inner city by one of the improved transportation modes, further strengthening the local economy.

Key Design Interventions:

- 1 A new urban town centre/plaza gives users a place to meet up with friends, enjoy a meal and/or coffee and provides users the space to relax. The central water feature is both a pleasant aesthetic and will allow kids to play in safety.
- 2 A large underground carpark provides parking for a substantial amount of people, with simple access to the ground level through stairs and elevators, located below the supermarket and near the bus exchange.
- 3 Pedestrian street replaces the old Matua Road, providing access for those on the north side of the new town centre to cross State Highway 16 to get to the train station and other businesses.
- 4 A large open space with planting both helps to control stormwater, while also giving a space for craft and farmers markets and other community events to be held.
- 5 This park gives users a variety of different passive and active spaces. Large grass open spaces provide areas for active play for people of all ages, while the plantings provide smaller passive spaces for people to relax and enjoy the outdoors.
- 6 Re-vegetated areas create a green belt which connects the new Huapai development to the eastern side of Kumeu with walking tracks following the river. It supplies people with recreational/walking areas, while also enhancing the range of native ecology in the region.
- 7 The paths to and from the new residential developments are not a simple, straight path, which gives people a more interesting walk to the new urban development. The two directions of paths will give people the option of walking either a direct route, or a more leisurely route.
- 8 Large artificial wetlands collect stormwater runoff from the newly developed suburban/urban areas and the existing industrial areas and purifies it before releasing the water back into the natural waterways. Much like the green belt, the artificial wetlands enhances endemic ecology.



Walking
 To New Development (South) via Train Station:
 650m - 10 minutes

To Huapai Domain via footpath along SH16:
 850 - 13 minutes

To Kumeu (East) via tracks:
 2km - 30 minutes

Car
 To Westgate via Fred Taylor Drive:
 9km - 11 minutes

To Muriwai via Muriwai Road:
 15 km - 15 minutes

To Helensville via SH16:
 22km - 17 minutes

To North Shore via SH18:
 27km - Normal: 23 minutes
 Traffic: 30 minutes - 1 hour 10 minutes

To Auckland CBD via SH16:
 27 km - Normal: 24 minutes
 Traffic: 35 minutes - 1 hour 15 minutes

Train
 Swanson - CBD:
 59 minutes

Huapai - CBD (proposed):
 1 hour 30 minutes (approximate)

New Stations proposed for:
 - Helensville
 - Waimauku
 - Huapai
 - Waitakere

Bus
 To Riverhead (Proposed):
 6km - 10 minutes

To Westgate:
 10km - 20 minutes

To Helensville:
 22km - 27 minutes

To Auckland CBD (to be improved):
 27km - 1 hour 11 minutes

To North Shore via CBD (to be improved):
 27km - 1 hour 36 minutes



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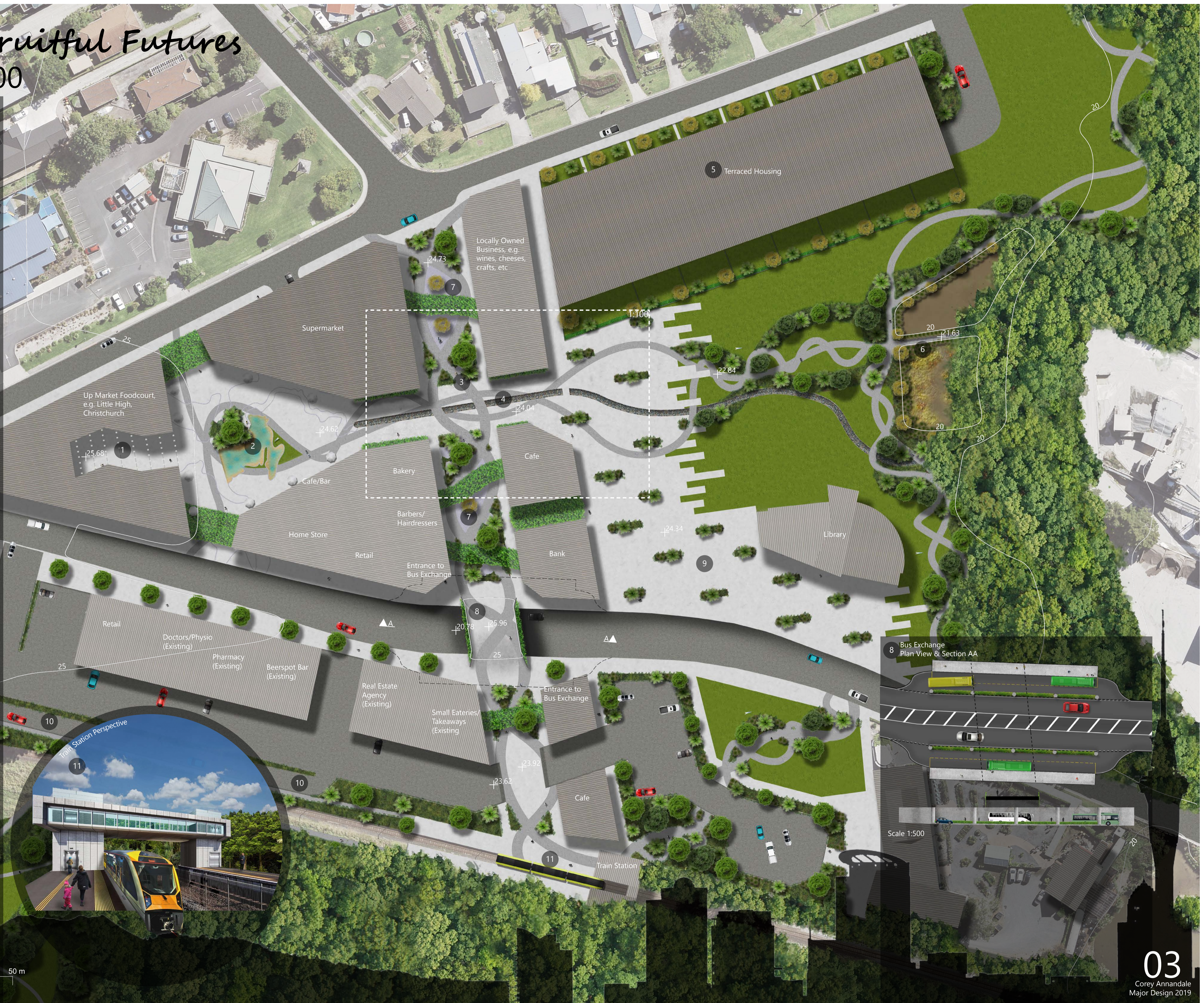
Intermediate 1:500

Design Intent

Huapai Town Centre will be a vibrant social hub with stores, cafes, restaurants and other essential facilities. The site is structured around two central axes, being the 'Street' that runs from North to South, and the 'River' axis that runs from West to East. The attractive outdoor spaces will provide appropriate indoor/outdoor flow. Appealing store frontages along the pedestrian street will encourage people commuting through the space to interact with stores. As many of the existing businesses will be given the opportunity to occupy new stores in order to maintain some of the existing character of the town.

Key Design Interventions:

- 1 An alleyway for outdoor sitting for the restaurants and cafes of the 'up-market' food court, which provides users with a strong atmosphere at all times of the day.
- 2 Sandstone water feature provides a unique visual feature while allowing children to play in the shallow water. Its shape represents Kumeu River and the land cover on either side, with forest to the north and grasslands to the south.
- 3 This pedestrian road gives connections between the town centre, residential areas to the north and the public transport hubs. The pedestrian street is lined by a variety of businesses providing goods and services to all demographics. The braided paths represent the twisted grape vine tendrils which are grown in the region.
- 4 The artificial river is both aesthetically pleasing and functional. It collects surface rain water and channels it into the artificial wetland at the eastern edge of the site while also acting as a guide for people as they shift from the urban plaza to the more natural open park.
- 5 A selection of terraced housing provides cost effective housing options, ideal for first home buyers or young families with nearby public transport connections and easy access to essential amenities. It also cultivates the site into a mixed-used development helping to maximize the area into a sustainable design.
- 6 Artificial wetlands purify storm water runoff from a variety of surfaces and release it into natural waterways. It will also bring different ecology closer to urban areas and in turn closer to the general public.
- 7 These open areas with a ground surface of stone set (a permeable paving surface) allows storm water infiltration. Provides gathering spaces and connections for people to either side of the pedestrian street.
- 8 Pedestrian overpass gives access to either side of State Highway 16, an aspect that was previously extremely difficult. Underneath it provides space for the bus station on either side of SH16. The bus exchange has easy access for pedestrians either by stairs or elevator on both sides of the highway.
- 9 This open space gives area for farmers markets on the weekends. The planting not only helps to absorb stormwater runoff and also gives the area more shape and substance and breaks up the area yet maintains as a functional space.
- 10 This area gives place for vehicles to pull up and drop off people commuting towards town or instead north to Helensville.
- 11 The train station is located at the end of the pedestrian road making it a focal point of this design and encouraging people to utilize the train more.



Huapai: Fruitful Futures

Detail 1:100

Design Intent

The strength of the Huapai Town Centre Development is heavily reliant on the dual axes and the purposes they serve. These thoroughfares provide ease of access to other areas of the site, as well as the shops, stores and restaurants, etc. Whether the users are just commuting through the site or there for a more leisurely visit, people will enjoy being in the space, whether for a short moment or a longer period of time.

Key Design Interventions:

1 Tecomanthe and Grape vines will collectively cover the grey walls and replace it with an aesthetically pleasing green wall. Some Tecomanthe and Grape vines will also develop as a canopy as it climbs between buildings, providing the pedestrian street with a unique atmosphere by covering parts of it in vines. The grape vine will provide fruit while the Tecomanthe maintains its leaves/colour year round.

2 These spaces, which act as a communal meeting space, have a ground surface of StoneSet, which is a permeable material that is as hard as concrete yet flexes to the shape of tree roots. It has Sophora tetraptera planted as feature trees within the stone set to provide colour, a unique structure, and attract birdlife during flowering.

3 This exposed aggregate concrete will be both darker in colour and has a different finish to the ordinary concrete. This helps it to act as a guide for people to traverse through the site to key areas, for example along the pedestrian street to the train station as well as to and from residential areas.

4 These plantings along the pedestrian street have many benefits. Most obviously it beautifies the pedestrian street by greening the urban forms. It also acts as stormwater management by allowing water to absorb into to plantings. Finally, by using fruiting and flowering plants (Puriri, Kowhai and Nikau) it will attract bird life, bringing endemic ecology closer to the general public.

5 The artificial river takes stormwater from nearby building roofs, surface runoff and excess water from gardens, collects it and transports it to the eastern edge of the site, where it is put into an artificial wetland before being purified and released into the natural waterways. The water that flows between the rocks down the artificial river is a unique visual feature that acts as a guide from the town centre/plaza down the site to the naturalised spaces. This design intervention will also act as a reminder to people that water is an essential resource that is at the centre of everything we do. It give us life, hydrates our crops. etc.

6 These areas are smaller more intimate gathering spaces. They have a ground surface of stone set with permanent bar leaners and stools fixed in place. The vegetation surrounding provides users with a unique, semi enclosed space where informal business meetings or even a friendly catch up can take place. The ground surface is shaped in the form of grape bunches to connect back into the wider landscape of Kumeu and Huapai

7 A large semi-open area between the library and shops provides people from the community to gather and host events. A proposed Huapai farmers and crafts market will be held monthly, giving small businesses owners the chance to sell their products to the general public. The straight edges of the concrete will contrast the flowing lines of the paths. The sharp edges represent the urban areas of Huapai and Kumeu located on the peri-urban edge of the Auckland CBD.



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Planting Strategy

Design Intent

The intent for the planting takes the history of the area and integrates it with planting that has ecological benefits, as well as beneficial aesthetic and functional properties. The three types of planting; Amenity/Edible, Revegetation and Wetland plantings, collectively will support the overall aim of water management and purification, however each variety of planting will have different individual aims and benefits.

Planting Strategies

Wetland

These planting zones shall closely align with the Auckland Council Wetland Restoration Guide. The focus for the planting used throughout the artificial wetland areas is mainly to purify all kinds of water runoff (especially from urban areas). However, these species will have positive effects on aquatic and terrestrial ecology. Plantings will both purify water and provide habitat for aquatic species, while plants of the moist edges will attract and support birds and invertebrates.

Revegetation

Areas that are designated to be revegetated will have a large range of plant species in order to maximize biodiversity. All Species shall be eco-sourced in order to ensure that they cope with the large amounts of rainfall that the Auckland region is known for. In turn this will help in the effort of stormwater runoff management and control. Native terrestrial ecology will be strengthened while also providing people with significant amounts of walking tracks in between plantings.

Amenity/Edible

These plantings have many goals. Like other planting varieties the main objective is to help control water, however in conjunction to that, it aims to beautify the space by adding natural elements to the built forms. Native flowering trees such as Puriri and Kowhai will attract native birdlife into the urban area, while people will also be provided with some food due to the integration of edible plantings throughout the native amenity species.

Key Elements:

1 A section showing the types of plantings and where they might be located throughout different areas across the wider site.

2 Plant palette showing an image of the plants, along with some details of each species. Some plants are used in more than one area of planting.

3 This diagram shows when each species will be in flower along with the colour of the flower. The calendar labelled 'Edible' shows the when fruit is available for harvest of each edible species.

4 This selection of images shows the areas of planting varieties and where they will be located across the site, and in some cases further into the surrounding areas. It additionally shows phasing through of the different planting zones over the next fifteen plus years.

5 This section portrays how plantings will be spread across the pedestrian street that runs from the north edge to the south edge of the site.

6 This section portrays how people will walk along the path between the wetland and retention pond located at the East edge of the site. It also shows how some of these species will be spread between the wetlands and retention pond edge.

7 The planting plan shows how a garden bed along the pedestrian street will be planted with the specified amenity plants. Some areas shall also include the integrated edible species.

1 Planting Zones Section



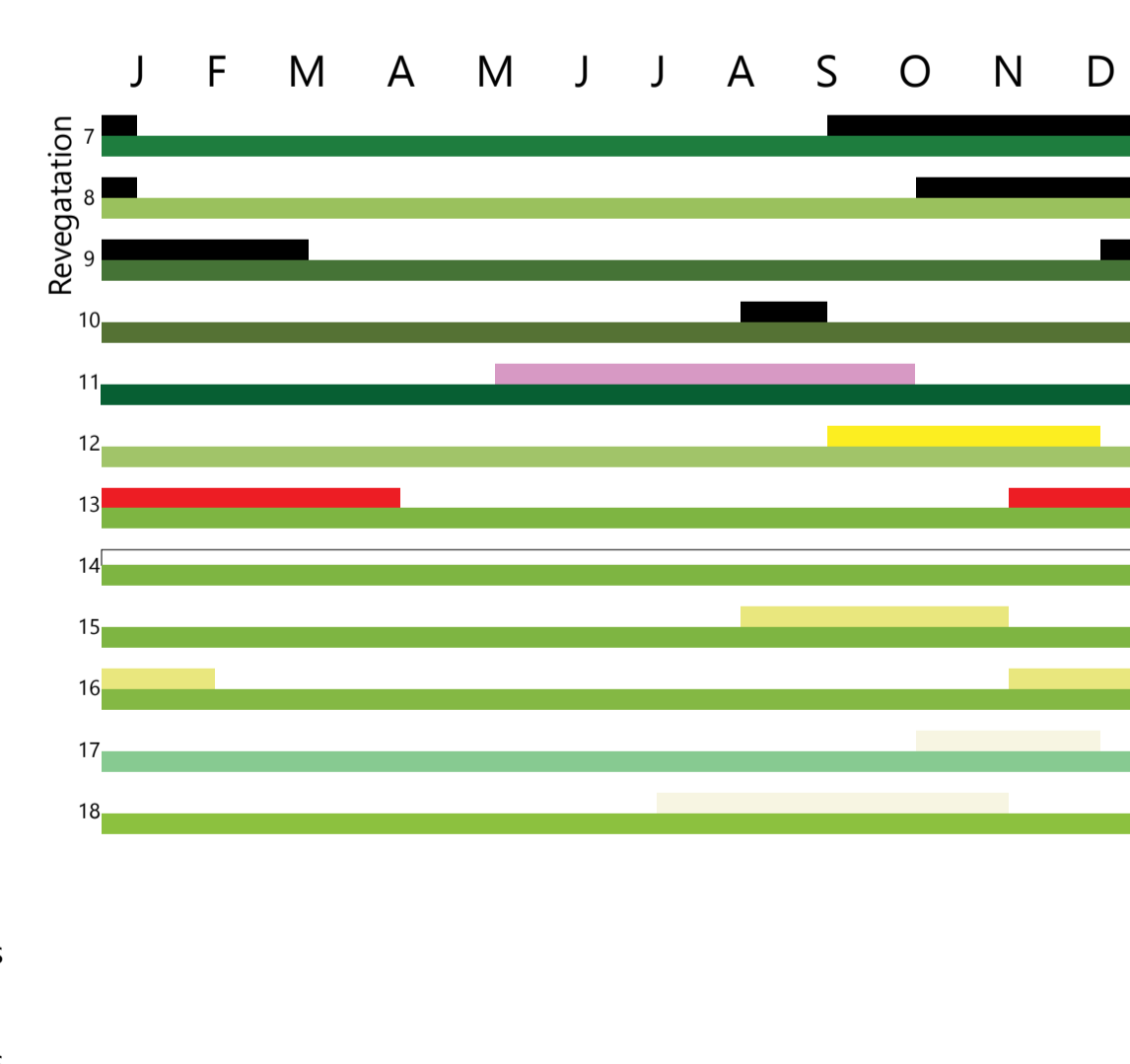
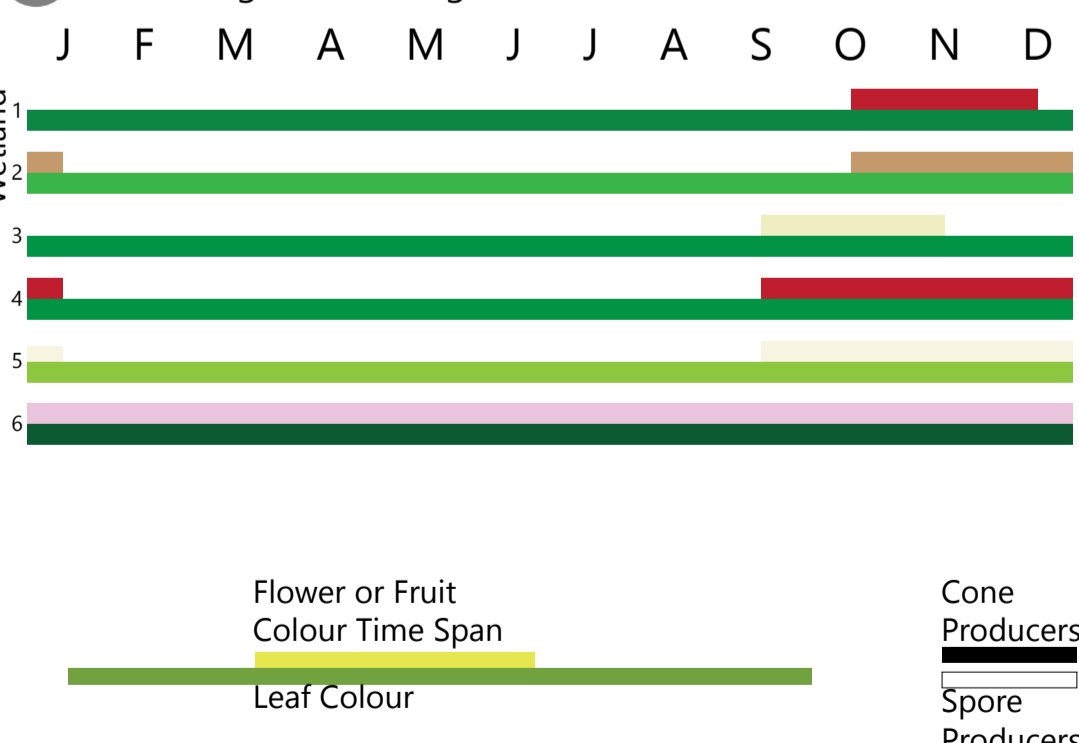
2 Planting Palette

	Apodasmia similis Oioi 1m x 1m		Agathis australis Kauri 30+m x 7m		Rhopalostylis sapida Nikau 7m x 2m
	Juncus pallidus Giant Rush 1.5m x 0.6m		Dacrycarpus dacrydioides Kahikatea 30m x 10		Dicksonia squarrosa Rough Tree Fern/Whēki 4m x 3m
	Austroderia splendens Toetoe 2m x 2m		Dacrydium cupressinum Rimu 10m x 7m		Melicytus ramiflorus Whiteywood/Mahoe 5m x 4m
	Phormium tenax Harakeke 3m x 2m		Podocarpus totara Totara 15m x 8m		Macropiper excelsum Pepper Tree/Kawakawa 2m x 1.5m
	Cordyline australis Cabbage Tree/Ti Kouka 8m x 1.5m		Vitex lucens Puriri 20m x 20m		Astelia chathamica Astelia Silver Spear 1.5m x 1.5m
	Leptospermum scoparium Tea Tree/Manuka 5m x 3m		Sophora tetraptera North Island Kowhai 6m x 3m		Coprosma Robusta Karamu 4m x 2m

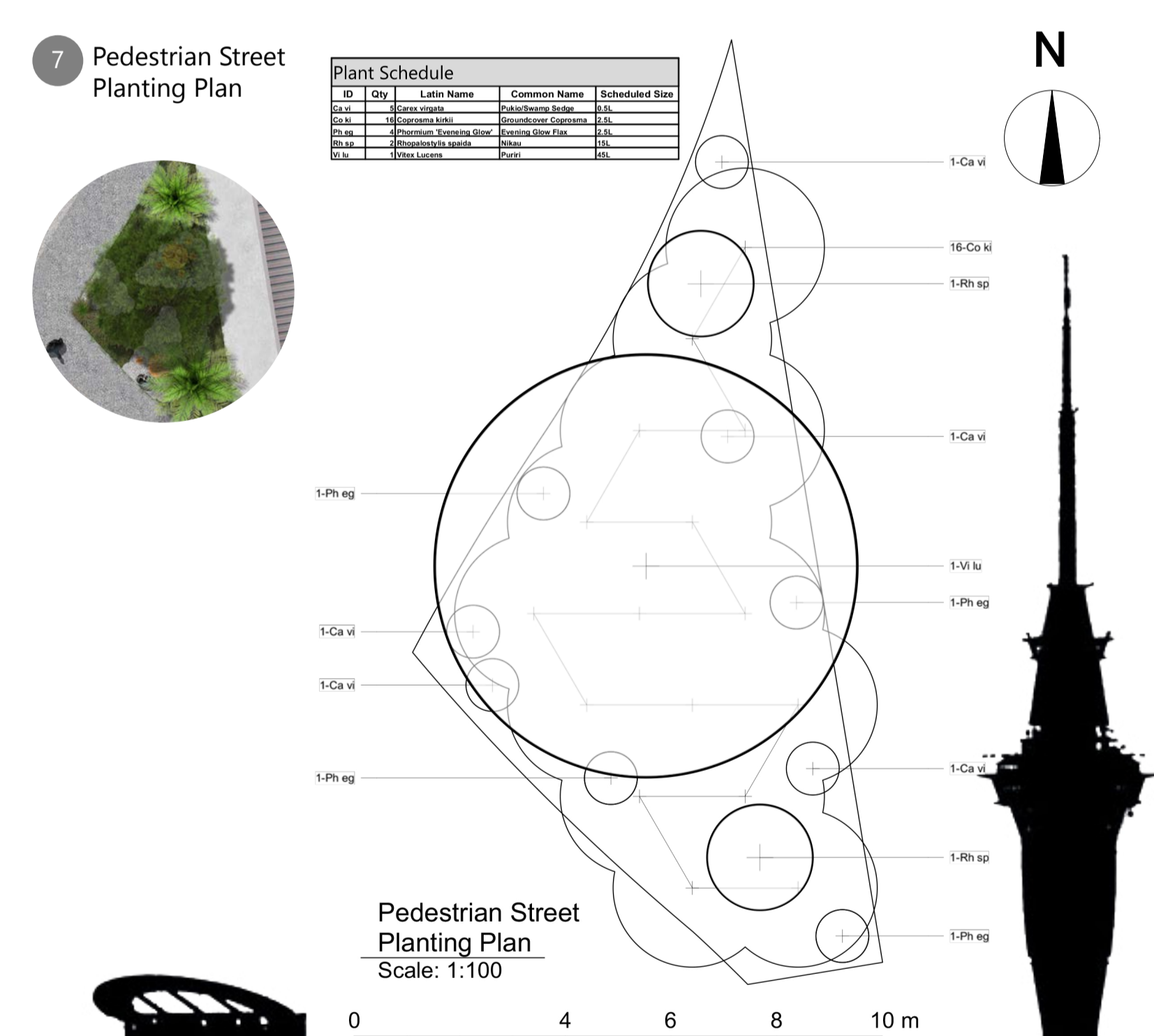
Key:

- Attracts Birds
- Flowers
- Dry Soils
- Wetland Species
- Fruit for Human Consumption
- Well-Drained/Damp Soils
- Wet Soils
- Riparian

3 Flowering and Fruiting Times



	Vitex lucens Puriri 20m x 20m		Malus domestica Apple 'Braeburn' 5m x 4m
	Sophora tetraptera North Island Kowhai 6m x 3m		Prunus domestica Luisa Plum 5m x 3m
	Rhopalostylis sapida Nikau 7m x 2m		Prunus persica sp. April White Peach 4m x 3m
	Phormium 'Evening Glow' Evening Glow Flax 1m x 1m		Acca sellowiana sp. Feijoa 3m x 2m
	Carex Virgata Carex 1m x 1m		Vitis sp. Red Seedless Grape 2m x 4m
	Coprosma kirkii Coprosma Groundcover 0.5m x 1.5m		Vaccinium sp. Blueberry 'Delite' 2m x 2m
	Tecomanthe speciosa Tecomanthe 3m x 1m		Citrus reticulata sp. Mandarin 'Encore' 1.4m x 2m



Huapai: Fruitful Futures

Materials Strategy

Design Intent:

The strategy for the selection of materials for this design is of course, also based upon the management of water. All impervious ground surfaces will direct water to a place where it can be utilized or removed appropriately. For example, stormwater runoff will be dealt with by one of the following three options:

- It will flow into either the artificial river, to be purified and released into the natural rivers system.
- It will be directed to an area of ground surface that is permeable such as lawn or stonaset.
- It will be utilized by watering plants which shall act as additional water absorption and green infrastructure.

All of this combined will help to reduce any potential pollutants in stormwater runoff entering drains and control stormwater surges.

Key interventions:

- 1 The material palette to show the variety of hard materials, their uses and their reasoning for using each material
- 2 This photomontage of the alleyway at night showing the string lights, the entrance into the upmarket food court, the furniture style and glow in the dark mural.
- 3 A perspective providing an insight into the intersection between the two axes. Additionally, this image shows how the artificial river is a cohesive element that flows gracefully through the entire site.
- 4 These bar leaners and stools will have a dark structure made from the black steel specified, with hardwood tops. Making these bar leaners rather than normal seats and tables gives these small spaces a more relaxed vibe.
- 5 The seat is made of black steel and hardwood decking. All details of the Huapai concept, even down to this seat, are designed to aid the management of stormwater. The water the lands on the top surface of this seat, drips down into a 'V' shaped catchment, which then runs out to each end and down the face, into an area of StoneSet, allowing for the infiltration of water into the ground.
- 6 These images show the style and shape of the sandstone water feature that will be used in the centre of the plaza. A model of the actual interactive water feature can be seen to the right of this image.
- 7 This collection of images illustrates how the surrounding area has influenced the design of the Huapai town centre. The first image is of Mate's Vineyard which is a part of the Kumeu River Winery. The second image is of a young grape vine tendril. The final image shows how the new growth weaving itself around other branches has inspired some of the design features in this design.
- 8 This collection of images also show how the aspects of the area has influenced the design of the Huapai town centre. The first image shows the path of Kumeu River around the back of Huapai. The contours show the landform of Huapai and Kumeu, and finally the last image shows how the contours correlate into the design in the form of StoneSet ribbons that run through the plaza

Material Palette



StoneSet

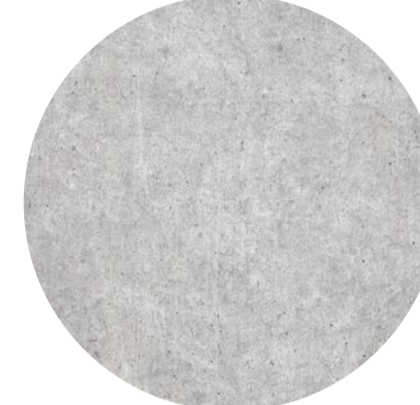
Use: Contours in plaza, grapes, central areas of pedestrian street and around some tree bases.

A permeable paving option that comes in a range of colours. In this case the Apollo Peake will be used for its light colour. StoneSet also can flex to tree roots as they grow which makes it possible for trees to be planted within the stone set.

Concrete

Use: Surfacing throughout the urban areas of the site.

This material is a cost effective, versatile surface coverage that will aid the design goal of controlling stormwater runoff by directing it to areas where it will be utilized, such as plantings or the artificial river where it is put into the artificial wetlands.



Exposed Aggregate Concrete

Use: Pathways and guides through all areas of the new development.

This variety of concrete obviously has very similar properties and benefits to that of ordinary concrete, however the difference in colour and finish acts as a guide for pedestrians, cyclists and other uses on how to navigate across the site.



Sandstone

Use: surface material for interactive water feature in plaza.

Not only is it a less slippery surface to walk on when constantly under water, but even on overcast days, the light and warm colour gives the water the appearance of warmth compared to a dull coloured surface, such as concrete.



Hardwood decking

Use: Top of street furniture, e.g. tables, stools and bench seats.

Hardwood decking will act as an accent and provide colour to the top of permanent street furniture. The warm colour shall attract people to use the furniture due to it being located in areas dominated by green and grey.



Black Brushed Steel

Uses: Construction of street furniture and plant pots.

The dark colours ensure both the plantings and street furniture stand out, making it easier to be seen by people, while also maximizing the vibrancy of the hardwood top. The brushed look adds texture and depth to an otherwise simplistic material.



River Boulders

Use: Placed in the artificial river.

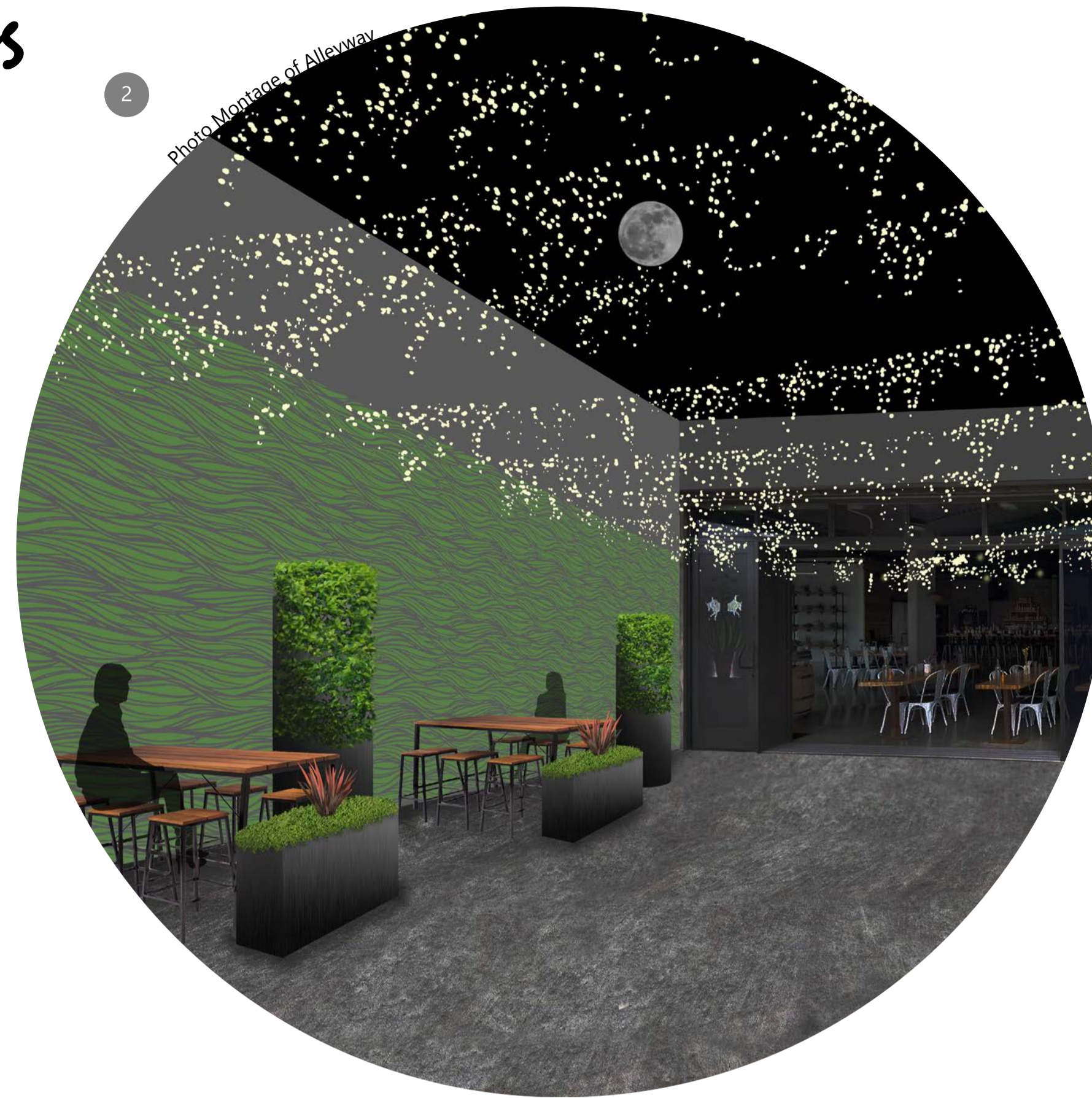
These rocks are to be set into the artificial river with space in-between to allow the movement of water between the rocks. This will give the river a more interesting base by having varying shapes, while also making the water flow in unique ways.



Glowing Paint

Use: Mural in alleyway.

By using glow in the dark paint, it will create a unique feature at all times of the day and will in turn attract people from a range of demographics. The mural (as seen in image 2) utilises similar shapes that are present throughout the design.



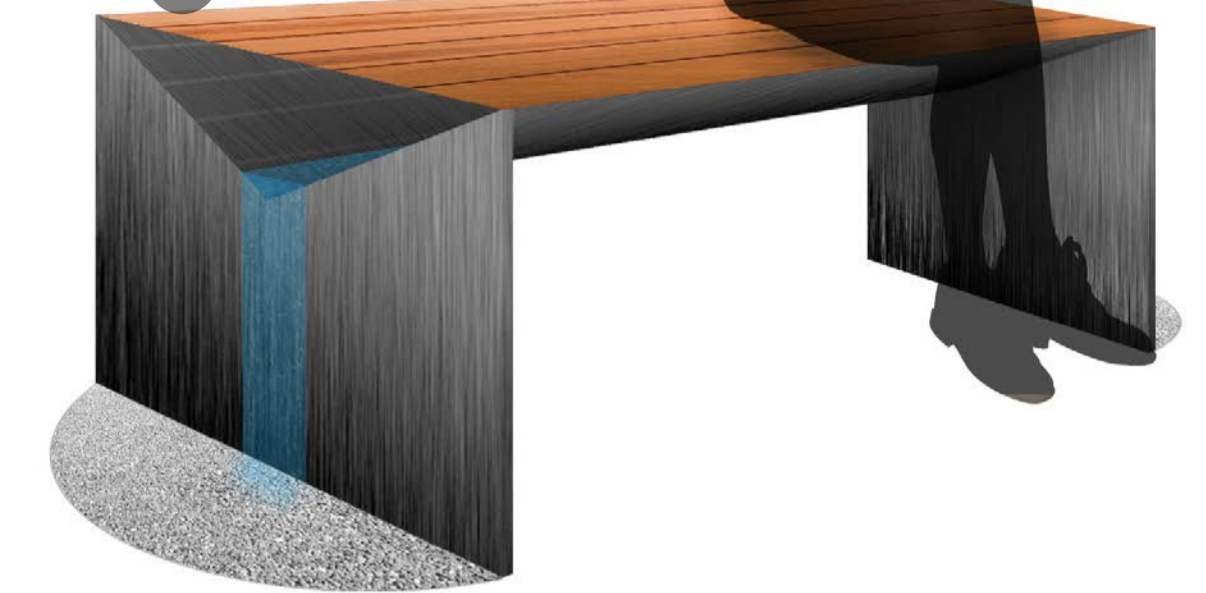
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Photo Montage of Alleyway

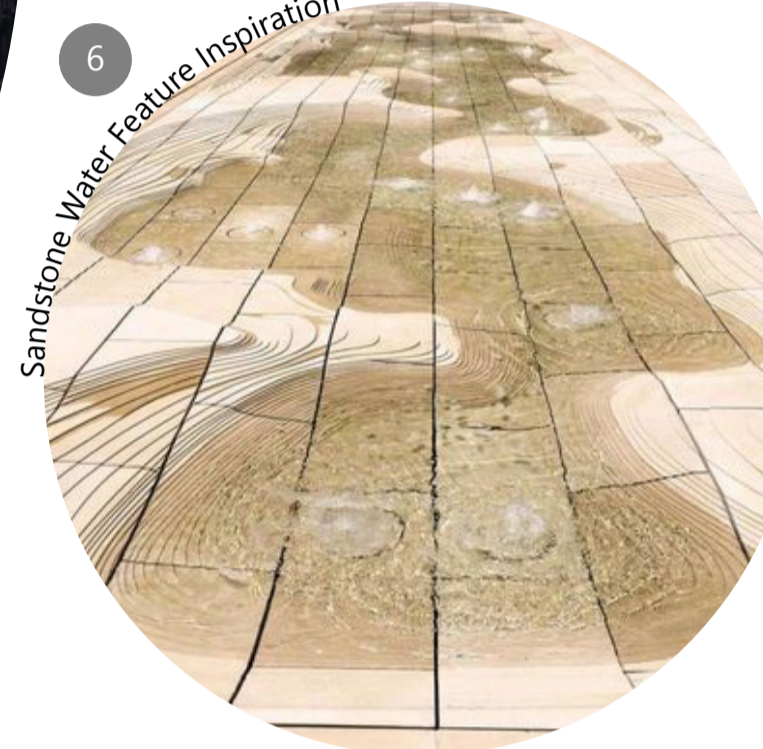
4 Bar Leaner & Seats for Pedestrian Street



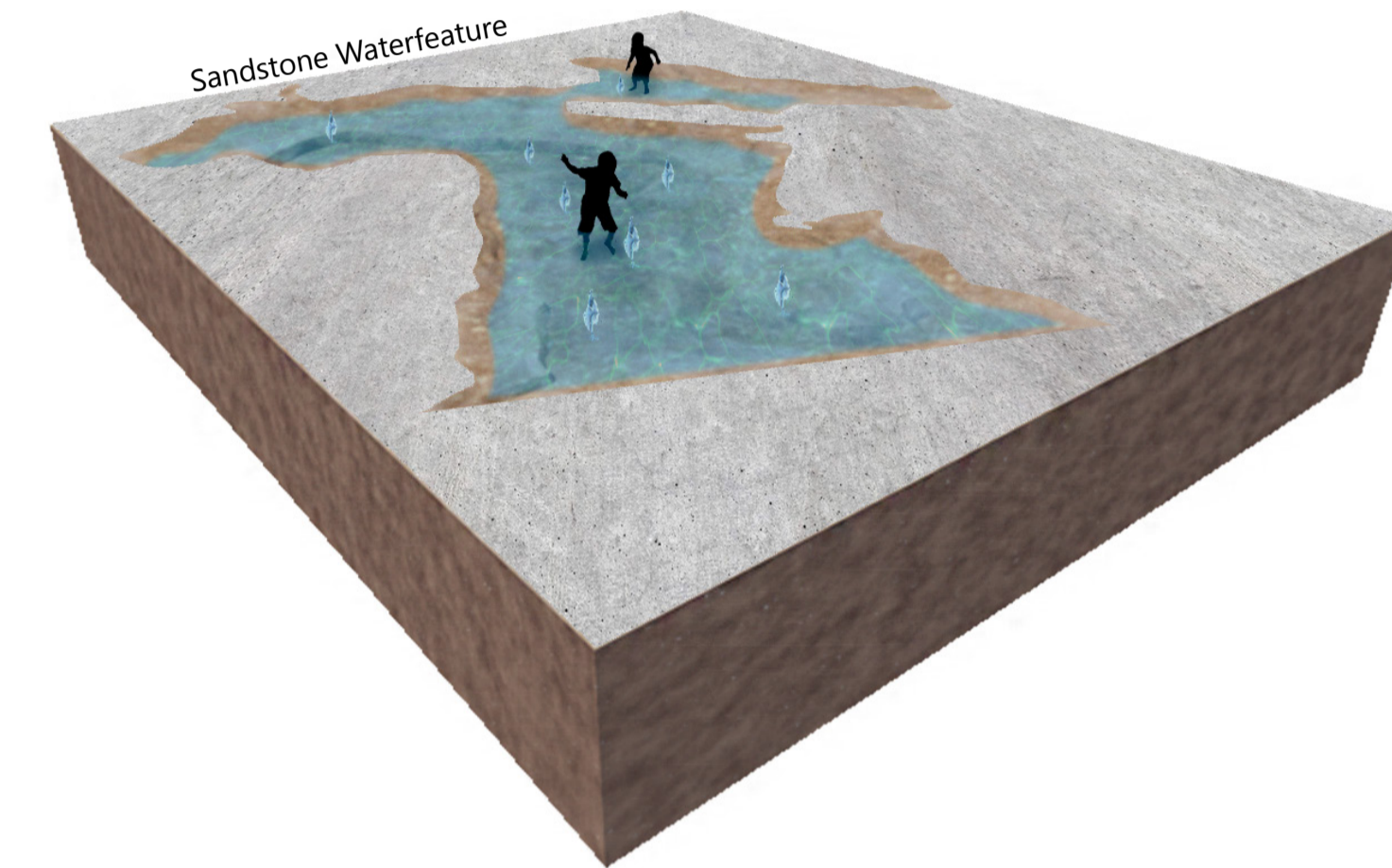
5 Street Furniture/Seating



6 Sandstone Water Feature Inspiration

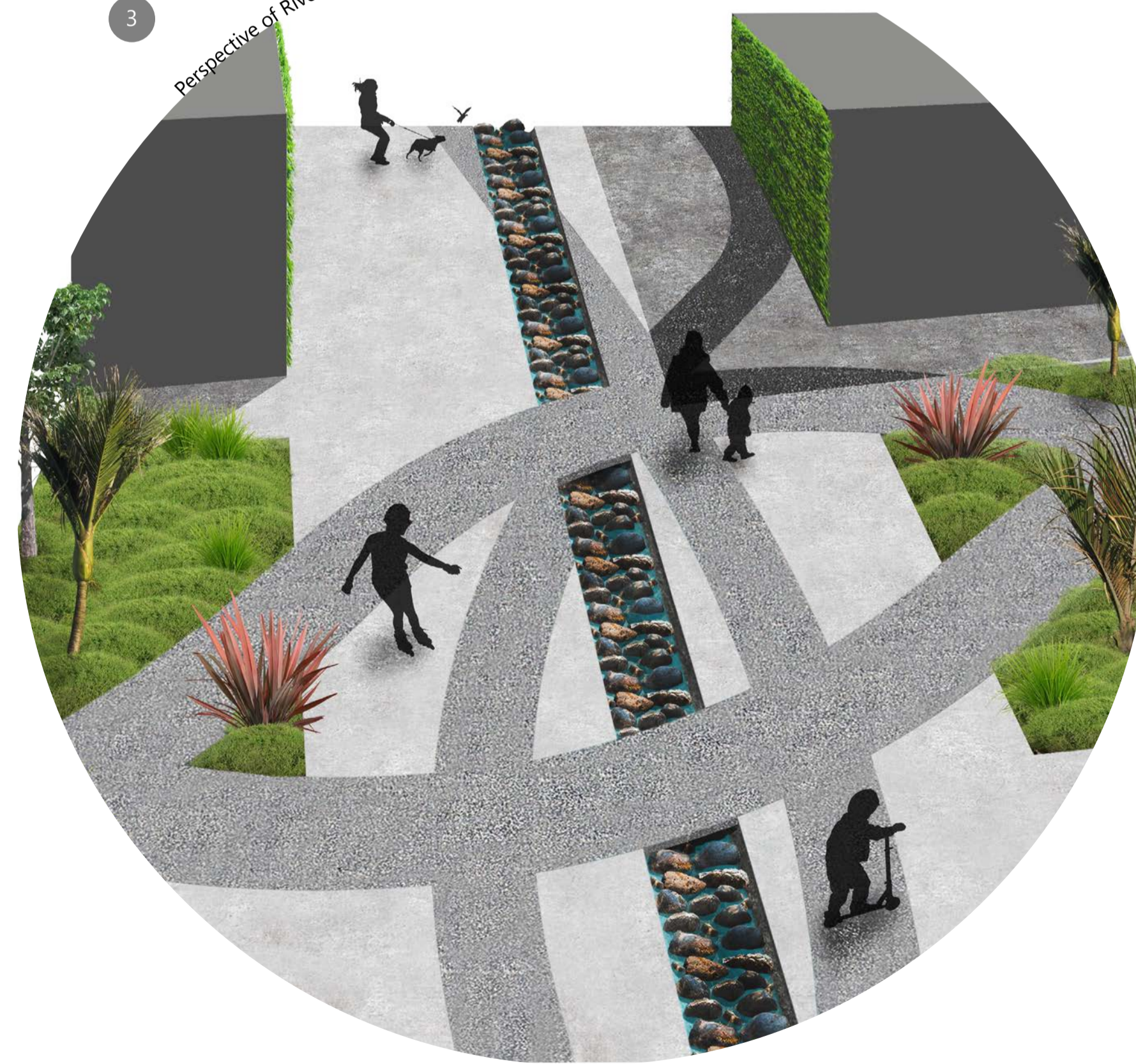


Sandstone Waterfeature



3

Perspective of River and Pedestrian Street Crossing



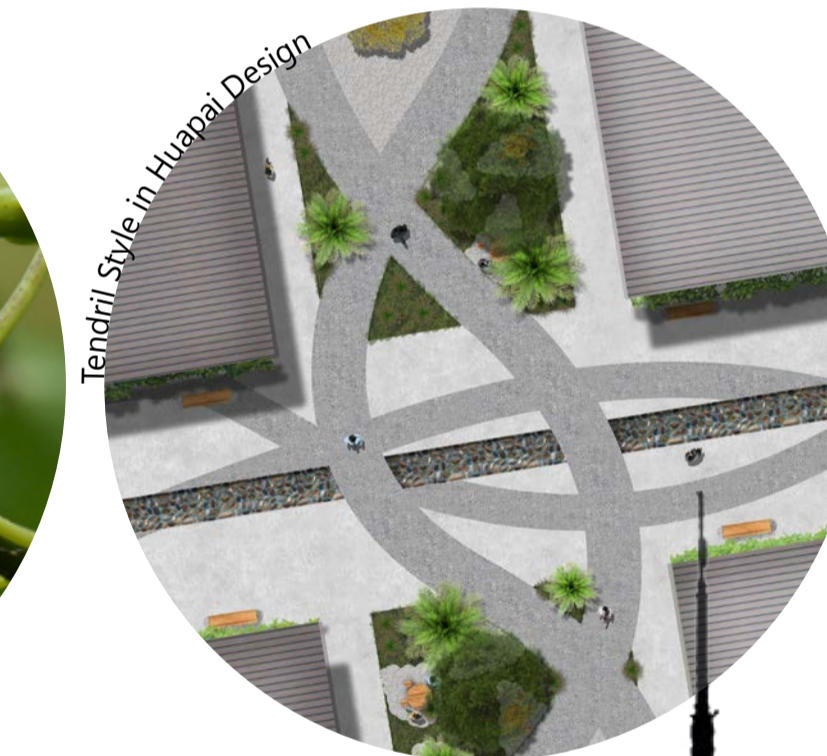
7 Kumeu River Winery's 'Mate's Vineyard'



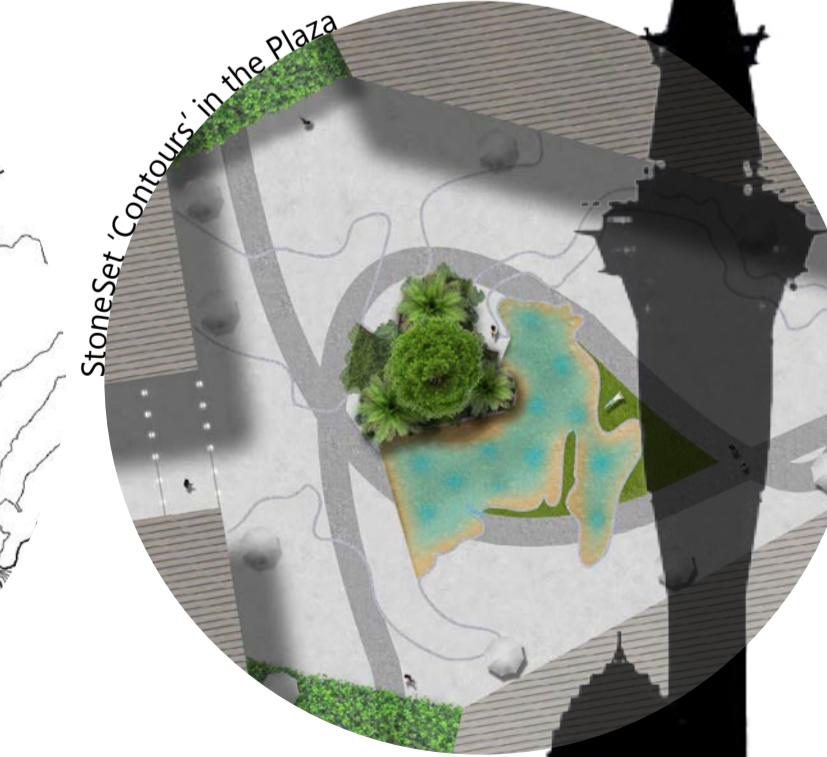
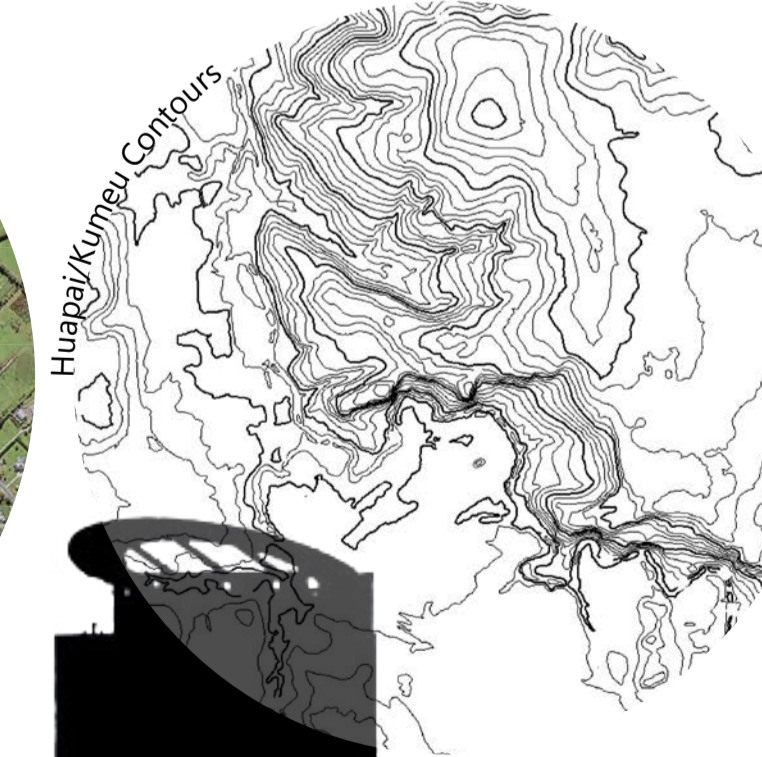
Grape Vine Tendril

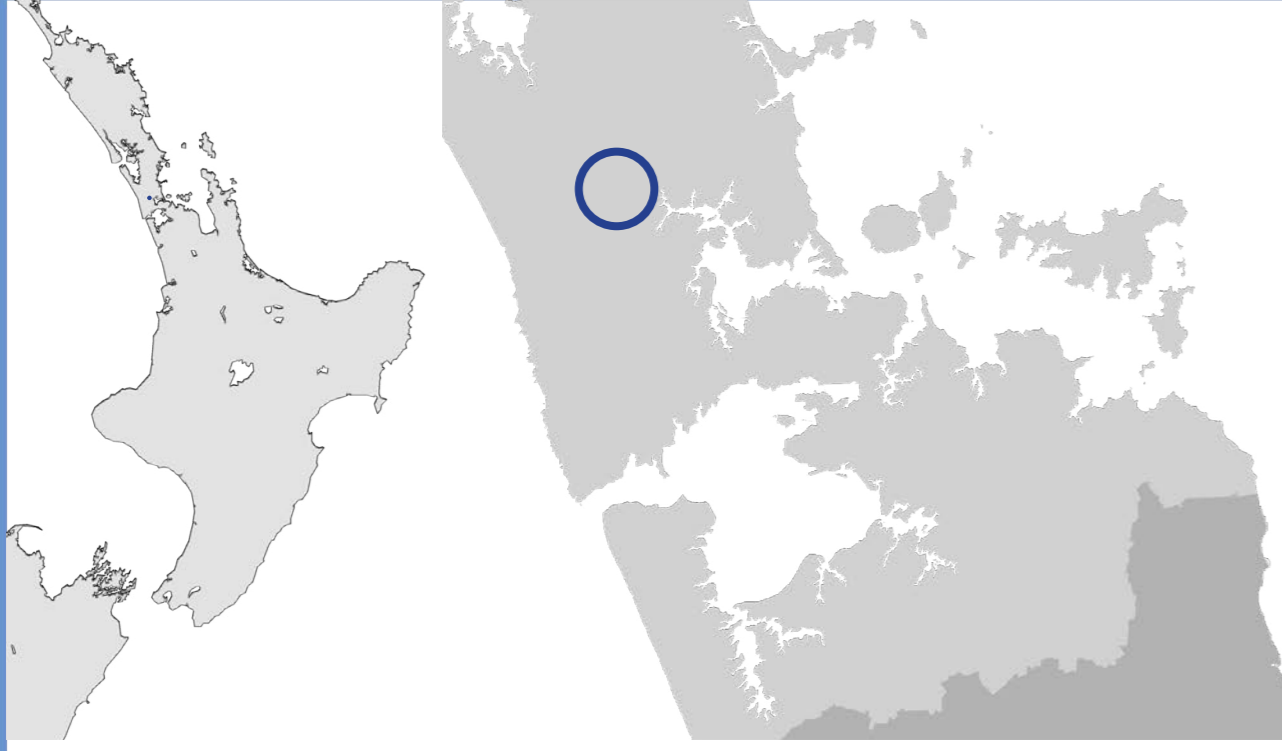


Tendrils Style in Huapai Design



8

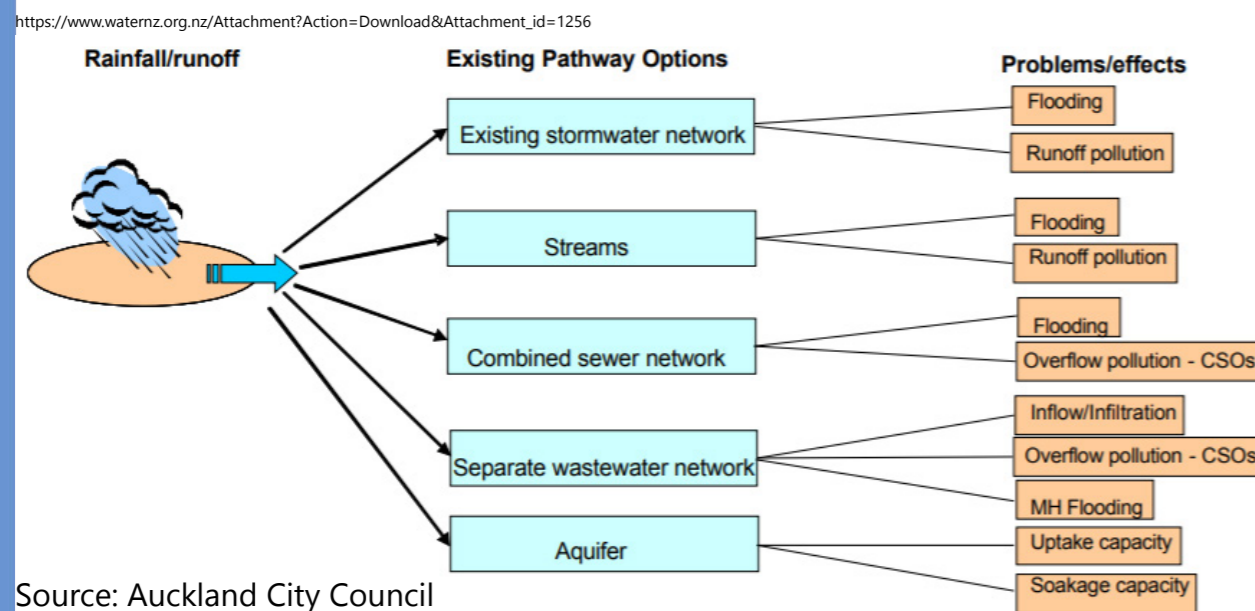




Site Context & Background

Located 30 minute drive north west of Auckland CBD, lies the small rural town of Kumeu. However, despite the rural context of this town, it is slowly becoming less rural with the addition of over 58,000 houses and dwellings between Kumeu, Riverhead, Massey and Hobsonville Point (shown above by the blue circle), not including any private/individual developments. In Kumeu/Huapai and Riverhead alone there will be an addition of 8,000, in turn bring with them the excess use of impervious surfaces that is generally used with current housing development. This rapid increase of impervious surface coverage is increasing the issue and risk of stormwater and the damages it can cause. The formally rural areas that have been used or will be used for housing developments were key areas that helped with the absorption of stormwater. However, with the permeable surfaces being reduced in these areas, there will be a greater strain on the current and already weak stormwater management system.

The image below comes from Auckland City Council's document 'A Citywide Strategy for Auckland Stormwater'. This diagram depicts the stormwater drainage pathways and effects. It shows how improvements must be made, mainly to the existing stormwater network, in order to reduce the problems and/or effects caused by stormwater following any of these pathways.



Source: Auckland City Council



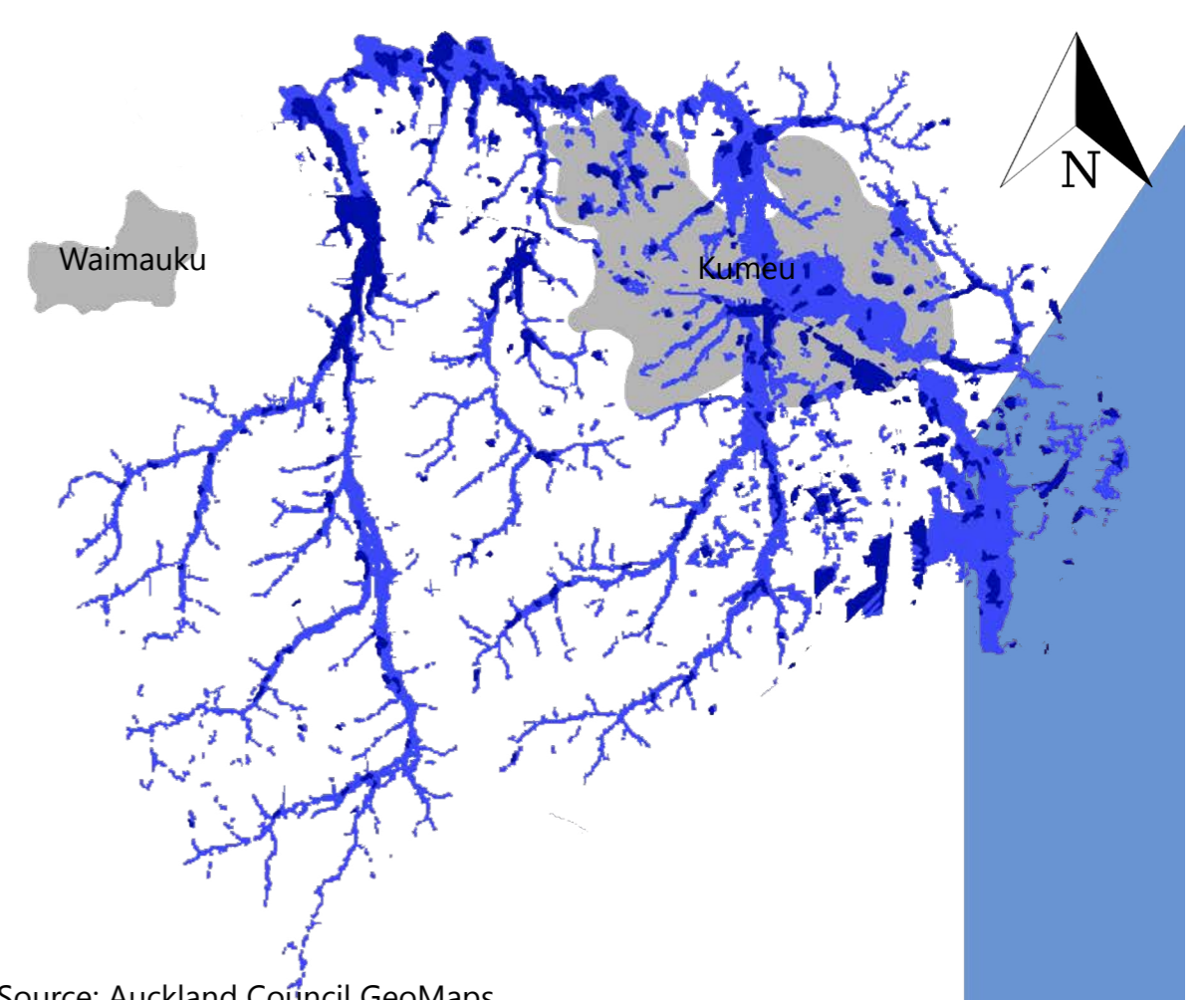
Scale - 1:15,000

Hollis (1975) states that when an urban development is placed in a previously rural setting, it obviously causes drastic changes to the land cover in turn having "...major effects on the functioning of the hydrological cycle during flood condition" (Hollis, 1975). Flooding can cause structural, environmental and human health issues and with the ever-growing urban centers and sub centers, the extensive addition of hard surfaces will continue to be the underlying factor of this worsening dilemma (Hollis, 1975; Patz, Campbell-Lendrum, Holloway, & Foley, 2005). Therefore, in order to counteract this an appropriate stormwater management plan must be put in place. Generally, stormwater management schemes centre around two main concepts; infiltration and containment (Wanielista & Yousef, 1992). Infiltration is the absorption of water into the ground, which tends to be the most natural method of stormwater management. Containment is controlling the water runoff, then storing and/or purifying it so that it can be reused by humans or fed back into the natural water system. Infiltration is an attempt to reduce the runoff during major downpours therefore reducing flood risks and mass accumulation of stormwater, whereas containment is the task of managing the stormwater after it has gathered in one area. Both are key to reduce flooding risks.

Design Goal:	Sub-Goals:	Objectives:	Scales:		
			Regional:	Master:	Intermediate:
Safeguard urban communities with nearby waterways by reducing impermeable surfaces and providing an appropriate storm water management plan through either absorption or containment.	Increase ground infiltration of stormwater.	<ul style="list-style-type: none"> - 1: Identify impervious and pervious surfaces. - 2: Discover the depth of ground water. - 3: Determine differences in soils and their absorption rates. - 4: Categorize material permeability for current urban surfaces and propose alternatives. 	2 & 3	1	4
			Produce a storm water management plan that maximises containment while also improving water quality.	<ul style="list-style-type: none"> - 1: Locate where natural depression are situated for a containment/wetland area. - 2: Categorize where water naturally flows through landscape and urban areas. - 3: Identify historic wetland communities and propose what communities would best suit the site and soils. 	2 & 3



Flood Plains & Flood Prone Regions (NTS)

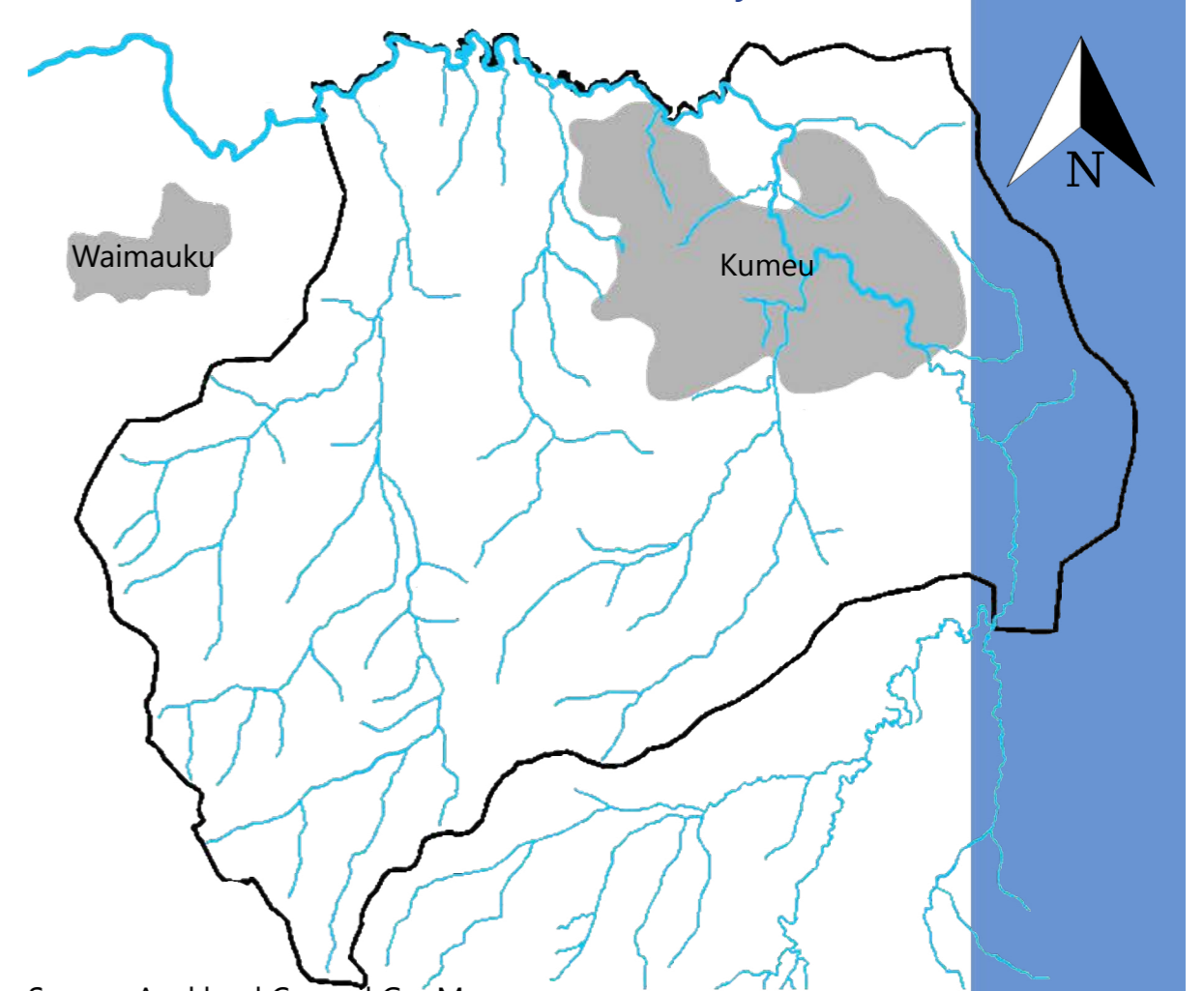


Source: Auckland Council GeoMaps

Legend: Flood Plains (light blue), Flood Prone Areas (dark blue), Townships (grey).

Flood plains are the area that extend from the waterways. They are the low lying regions that are most frequently effected from flooding. Flood prone areas are sections of the landscape that naturally lie lower than that of the surrounding land. These natural depressions can act as miniature catchments with stormwater draining into these areas without an escape creating severe puddling. Furthermore this causes these areas of land to water logged for the entire wetter months, whether there has been recent down pours or not. As shown in the diagram below, Kumeu Township is situated directly on top and beside major flood plains and flood prone areas.

Waterways & Catchment (NTS)



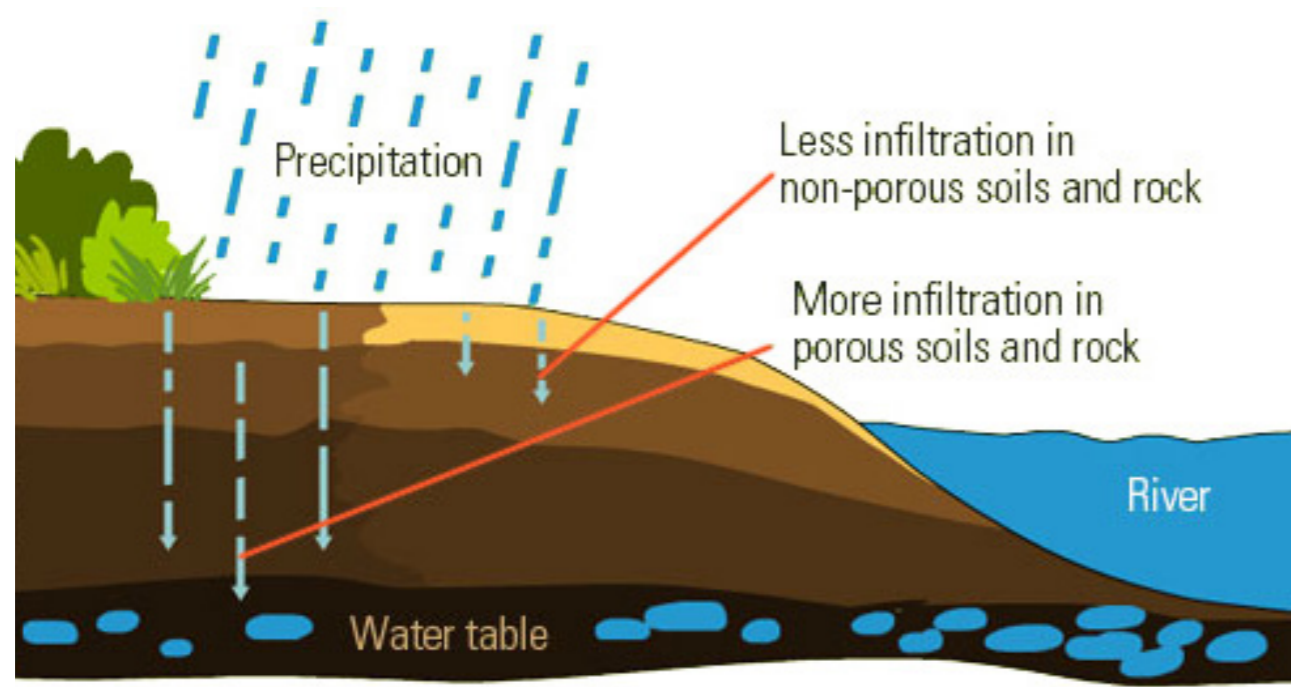
Source: Auckland Council GeoMaps

Legend: Waterways (light blue), Kumeu River Catchment (dark blue), Townships (grey).

The Kumeu River has a very large catchment that encompasses all of the total region of Kumeu. The catchment area has a perimeter of 32,598.6 m as well as a total catchment area of 38,510,509.5 m². The catchment contains approximately 75 kms worth of waterways. All these tributaries eventually lead into the Kaipara River and furthermore into the Kaipara Harbour.

Infiltration

"Infiltration is the movement of water from the surface into the ground, whether naturally occurring or artificially induced. Quantitative modeling of infiltration and its results is a basis for designing the hydrologic capacities of infiltration surfaces and basins on specific sites" (Ferguson, 1994).



https://www.eschooltoday.com/water-cycle/what-is-infiltration.html

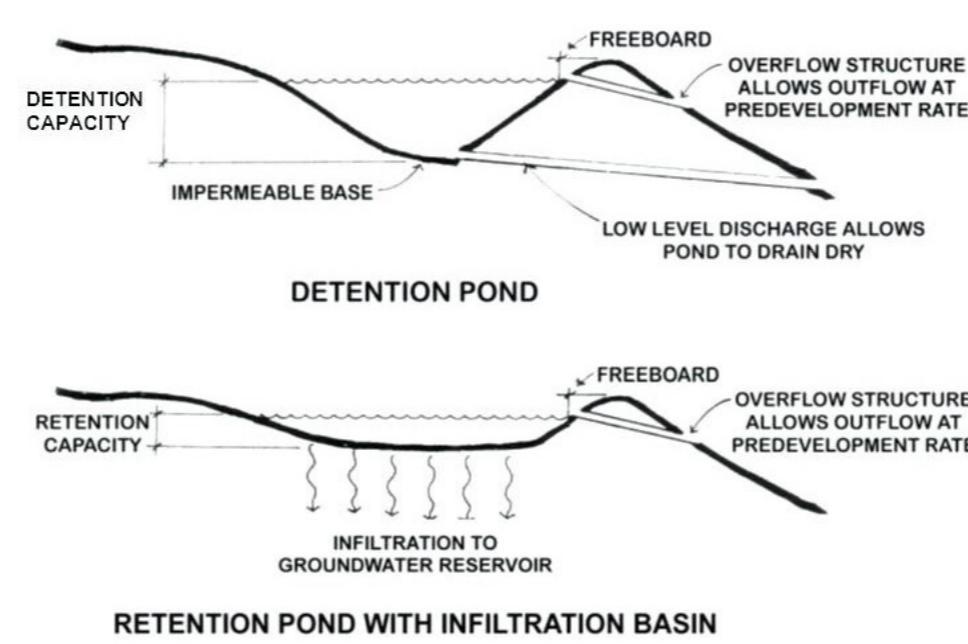
Infiltration is all about maximizing porous and permeable surfaces. The diagram above shows how less porous soils absorbs less water, however this also relates to man-made surfaces. Throughout Kumeu, especially in the newer developments, some surface materials choices may require alterations to make the ground cover more pervious. This may include simply changing material type or if possible, changing the land cover of an area, for example, reducing carparks and increasing natural surfaces.



http://wall.com

Containment

Containment is the process of controlling something in order to keep it within specific limits, in this case containing stormwater in order to reduce the risk of damage that it could cause.

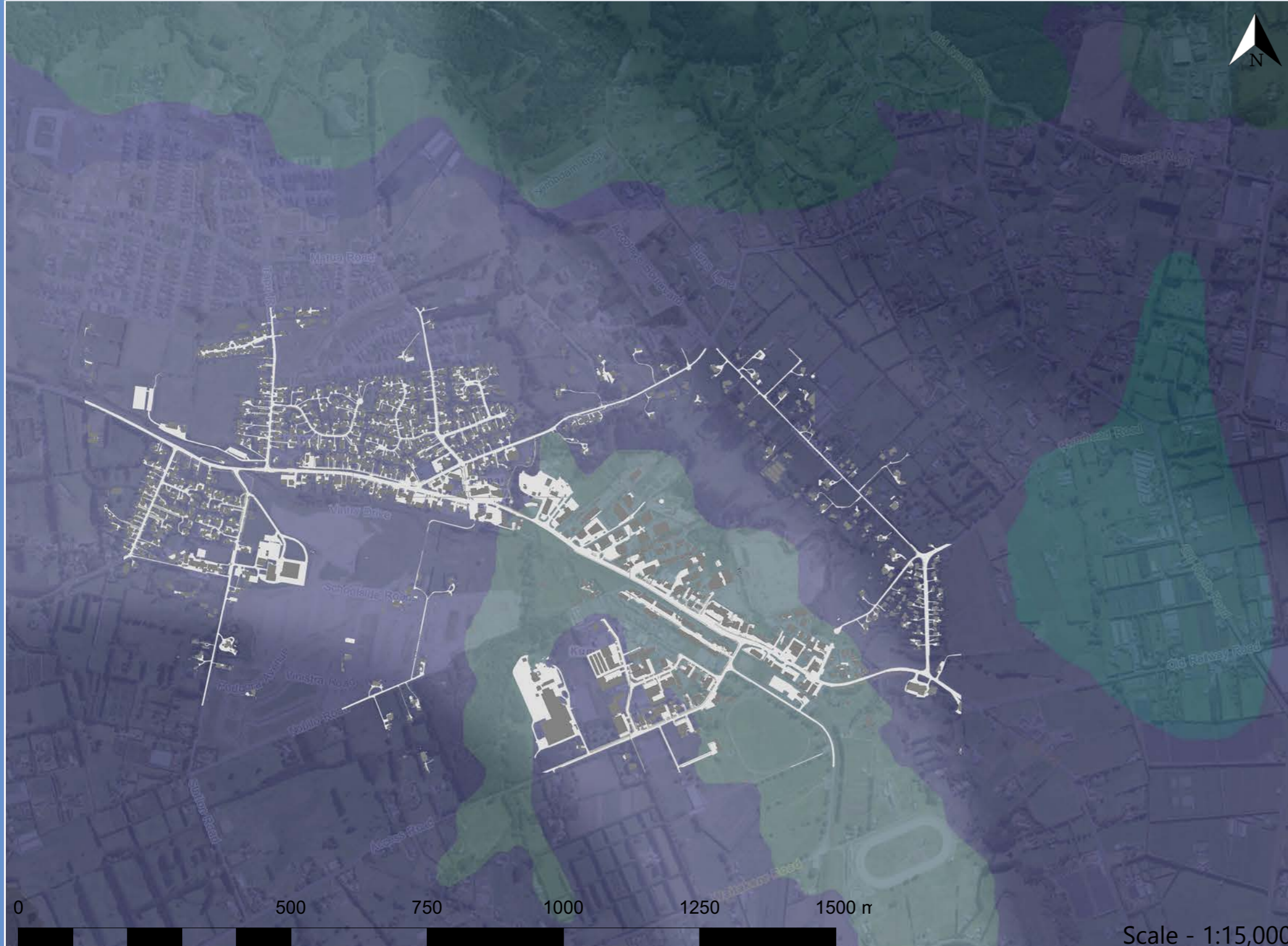


http://borovjany.com/top/101-gocommunity.com/retention-pond-design/retention-pond-design-detention-and-retention-pond-design-water-retention-pond-design/






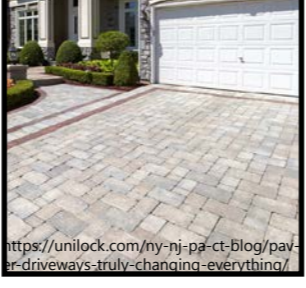
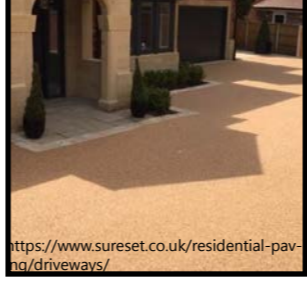
Containment methods are generally either retention ponds or detention ponds. The main difference between retention and detention ponds is whether or not a pool of water is present or not. This is due to detention ponds having a solid, impermeable basin, whereas retention ponds have a natural basin, allowing for infiltration, as shown in the diagram above.

Wet retention ponds help to treat and store stormwater runoff by encapsulating and keeping allowing natural processes occur. Water will absorb into the ground slowly however due to basin being constantly full of water, when vegetation is planted around it can create a unique habitat for wildlife and additionally provide beneficial ecosystems services. While wet retention ponds are usually multifunctional, dry detention ponds have more of a single purpose; the control of stormwater. With a hard surface, these basins tend to look more artificial and less aesthetically pleasing. Furthermore, detention ponds only contain stormwater for a short amount of time while it is treated and before it is released back into waterways, whereas retention ponds are more focused on retaining the water, naturally treating it and have it serve as at least one additional purpose; e.g. as an aesthetic pond within a subdivision such as Te Whariki in Lincoln, seen below.





Within most urban and suburban developments, concrete and asphalt are the most used materials. This is a huge issue as they are impervious surfaces which causes any runoff from these areas to enter drains, causing a greater issue for the stormwater system. There are many alternatives to this selection of materials as seen to the left. Reducing man-made surfaces and increasing natural surfaces is huge for infiltration of stormwater into the ground. However, there are some other options of man-made permeable surfaces that are available and shown to the right. When the surface area of impermeable ground materials is increased it creates a lesser reliance on the stormwater management system.

Impermeable Surfaces		Permeable Surfaces	
	Concrete		Gravel
	Asphalt		Porous Asphalt
	Block Paving with Grout		Block Paving
			SureSet Pervious Paving

Source: <https://web.archive.org/web/2012/05/2012236/http://www.communities.gov.uk/documents/planningandbuilding/pdf/permeablesurfaces.pdf>

The map to the left shows the combined factors that lead to high infiltration rates. The darker areas of the map show where the groundwater is lower, allowing more seepage of water into the ground. The different variations of blue show the different types of soils, with once again, the darker colours showing the soils that will absorb stormwater at greater rates. The grey areas, shown in the centre of the map represent the building footprints, which are generally surrounded by white areas which show the significant surface area of impermeable surfaces with in Kumeu township. A key factor to remember is that this data was recorded before four different major developments around Kumeu had begun construction, therefore at the time this data was recorded, the unnatural impermeable surface area is significantly lower than what it is now and what it could be in ten or more years.

Buildings & Impervious Surfaces (NTS)



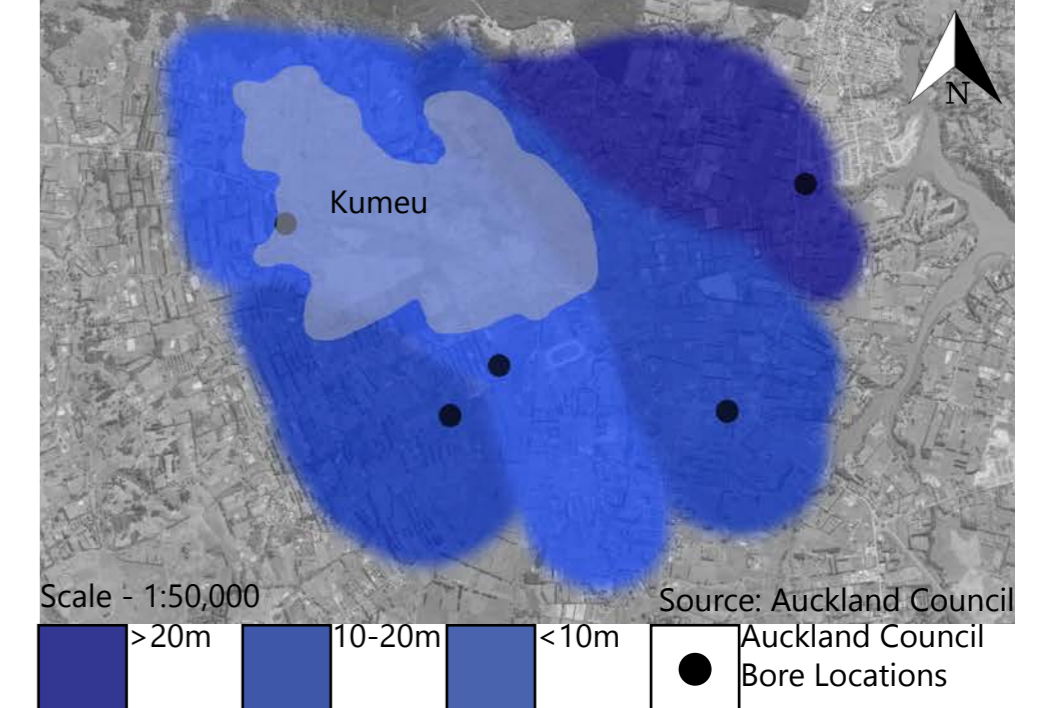
Throughout Kumeu impervious surfaces are increasing in frequency with the addition of two major developments in close proximity to the township. As more houses and buildings are erected, the quantity of impervious roads, paths and other such surfaces will increase. When this occurs, this will be an issue for stormwater management as this land being used for developments was previously a natural surface that could absorb water, however it will now impede any rainfall in this area. To counter this, a different selection of surfaces should be used in major developments. These new materials should be permeable to allow the natural absorption of stormwater into the ground.

Due to Kumeu being situated at the base of a large flat valley, the groundwater beneath the township sits generally quite shallow. With the higher water table, this will limit the quantity of water than can be absorbed in one space, therefore for the greatest amount of water to be taken into the ground, permeable surfaces should be maximized throughout the township.

Bore:	Aquifer Height at Bore (masl)	Bore Elevation (masl)	Groundwater Below Surface (m)
Selaks	23.0	36.4	13.4
Short Rd	6.23	31.3	25.07
Trigg Rd	20.72	27.9	7.18
Waitakere 1	24.16	25.4	1.24
Waitakere 2	18.27	33.2	14.93

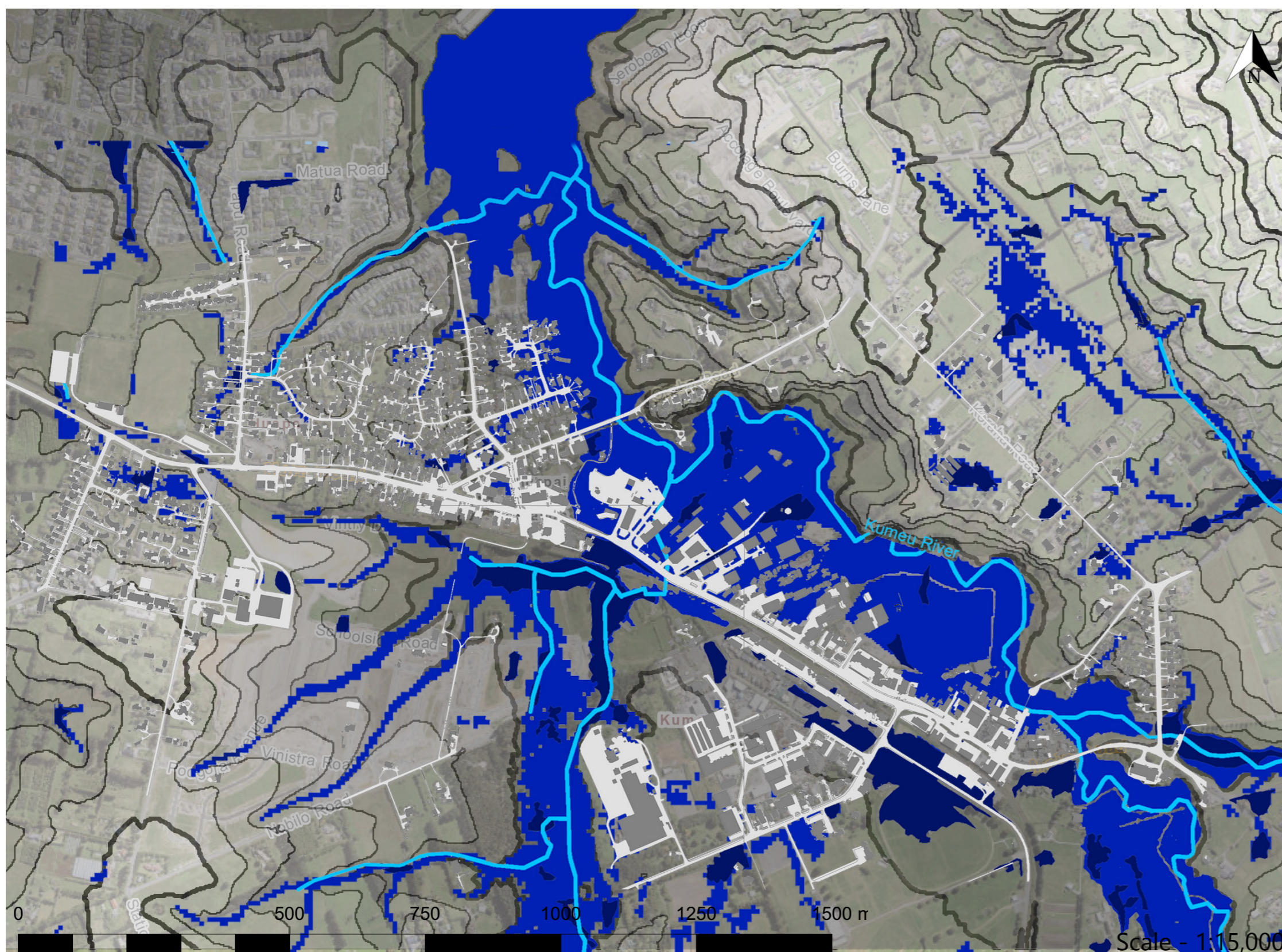
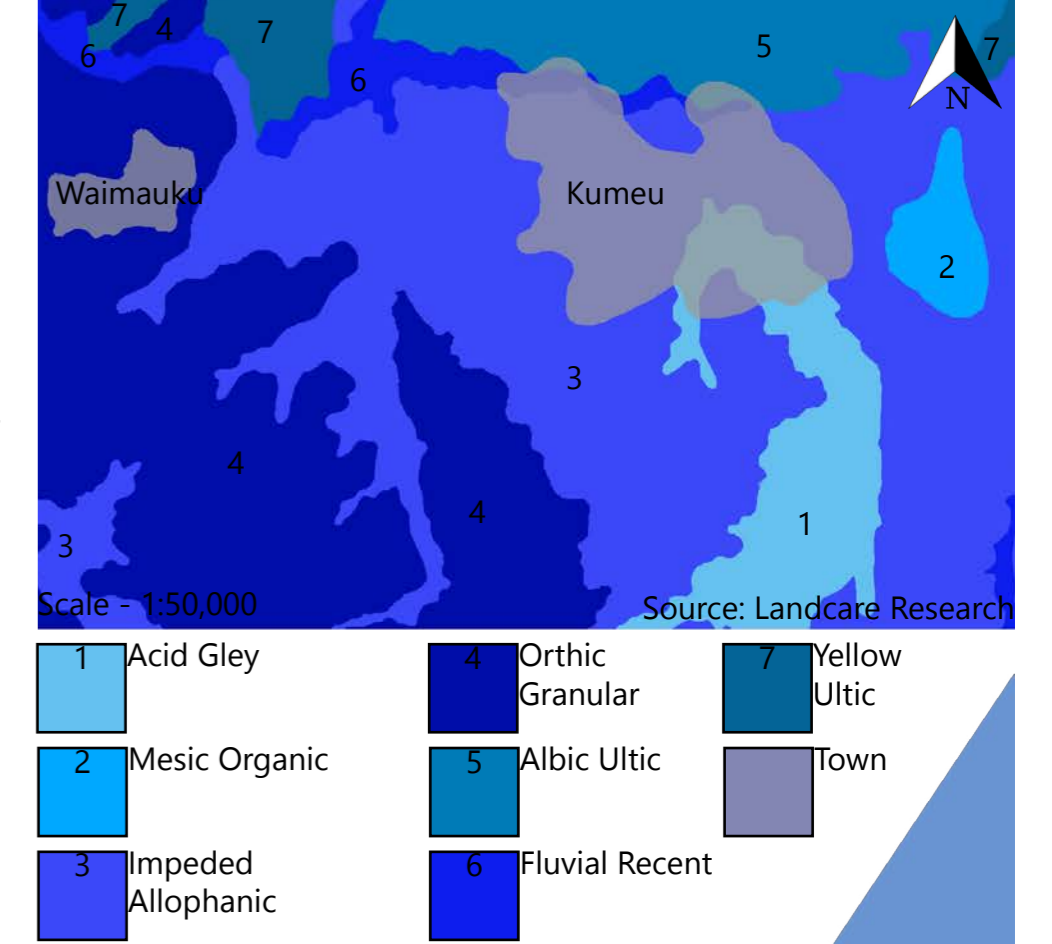
Source: Auckland Council

Groundwater Depth (NTS)

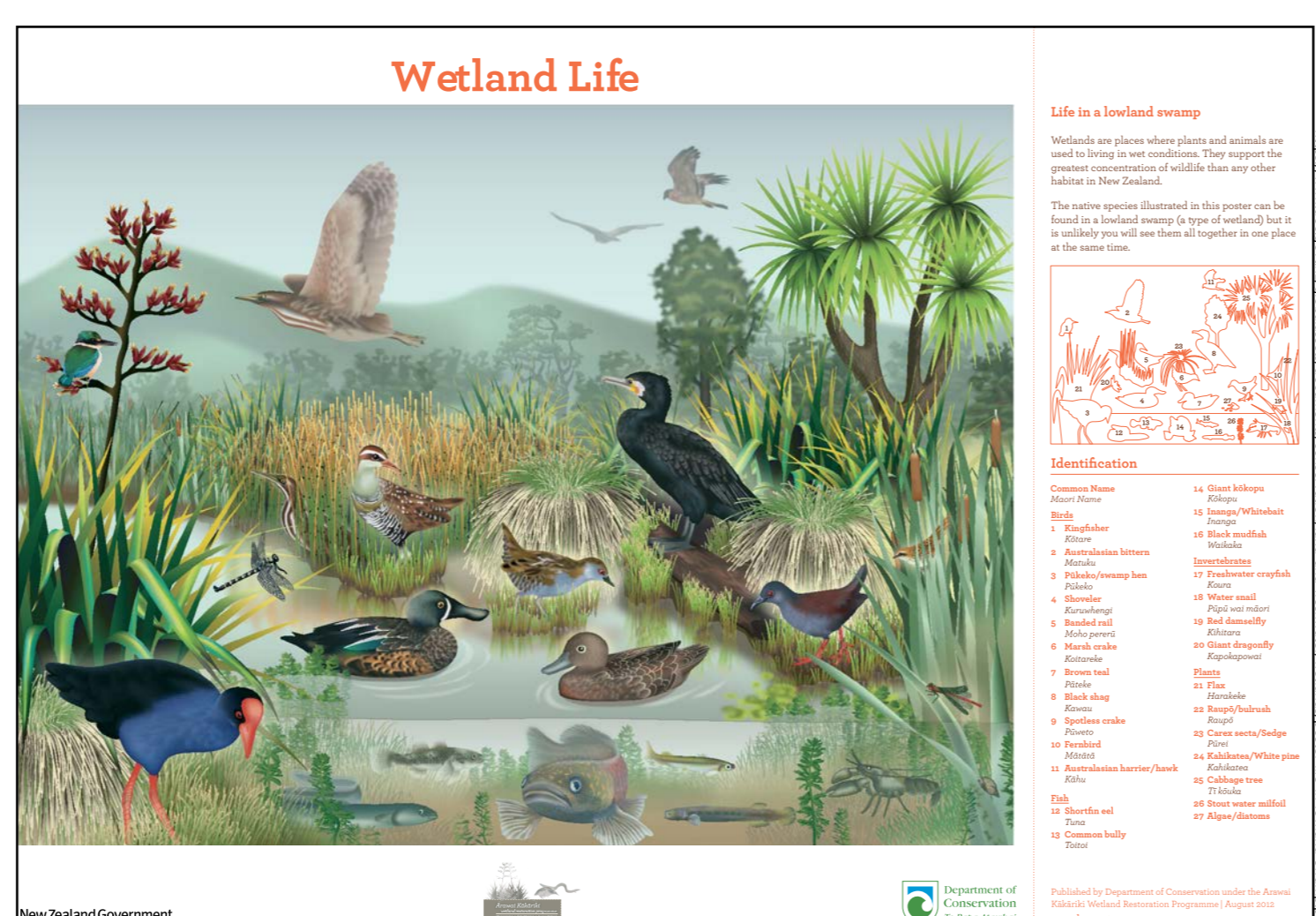


- 1: Acid Gley - Heavy waterlogging occurs in wetter months and can cause soils to remain wet year-round. They are found in low-lands where groundwater-tables are high.
 - 2: Mesic Organic - Formed by the partly decomposed remains of plant litter. They occur in wetlands or under forests that produce litter in areas with high rainfall. Highly porous soils.
 - 3: Impeded Allophanic - Firm layer that can be difficult for roots and water to penetrate.
 - 4: Orthic Granular - Clay dominated soils formed from material derived by strong weathering of volcanic rocks or ash, with a medium permeability.
 - 5: Albic Ultic - Aged soils with a well-structured, clay dominant subsoil and has a moderate level of water porosity.
 - 6: Fluvial Recent - Soils containing sediments deposited by water. Recent Soils are weakly developed, showing limited signs of soil-forming processes. Can generally be full of silt with slow to moderate absorptivity.
 - 7: Yellow Ultic - Aged soils with a well-structured, clay dominant subsoil and has a moderate level of water porosity.
- Source: Landcare Research

Kumeu Soils (NTS)



As a method of containment, an artificial wetland is an ideal solution as it provides a range of ecosystem services but most importantly can filter and cleanse stormwater to a high enough quality to be released back into the river system. According to Clarkson, Ausseil and Gerbeaux, "Wetlands purify water (which is why they are often called 'nature's kidneys') through storing nutrients and other pollutants in their soils and vegetation, and trapping sediments." (Clarkson, Ausseil, & Gerbeaux, n.d.). In addition to this, wetlands are also beneficial for controlling floods and reducing their risk (Clarkson, Ausseil, & Gerbeaux, n.d.). According to Auckland City Council most wetlands throughout Auckland tend to mainly consist of Cabbage Trees (*Cordyline australis*) and Harakeke (*Phormium tenax*). These along with other species additional plant varieties specified by DoC's 'Wetland Life' poster, seen right, will determine the species used in any artificial wetland development for stormwater containment and purification.



Wetland Life

Life in a lowland swamp

Wetlands are places where plants and animals are used to living in wet conditions. They support the survival of many species of plants and animals that are not found elsewhere in New Zealand.

This nature poster illustrates the life that can be found in a lowland swamp in New Zealand. It shows a variety of birds, including ducks, geese, and swans, as well as other animals like fish and insects. The plants shown are typical of a wetland, such as reeds, grasses, and water lilies.

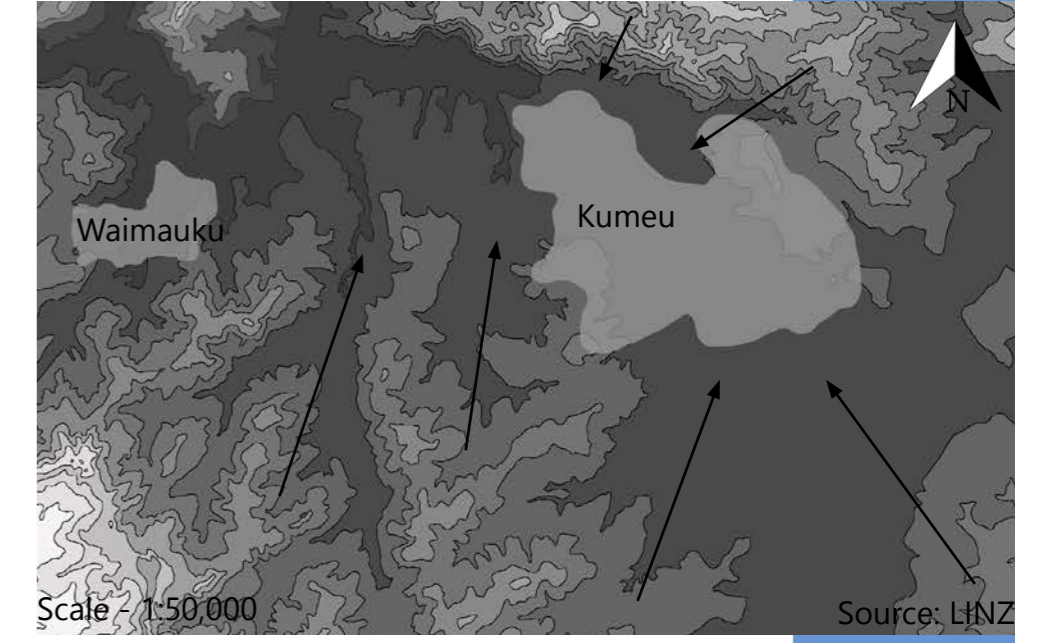
Identifications

1. Cabbage tree	14. Tuatua
2. Harakeke	15. Mānuka
3. Pūkeko	16. Mānuka
4. Mānuka	17. Mānuka
5. Mānuka	18. Mānuka
6. Mānuka	19. Mānuka
7. Mānuka	20. Mānuka
8. Mānuka	21. Mānuka
9. Mānuka	22. Mānuka
10. Mānuka	23. Mānuka
11. Mānuka	24. Mānuka
12. Mānuka	25. Mānuka
13. Mānuka	26. Mānuka

New Zealand Government

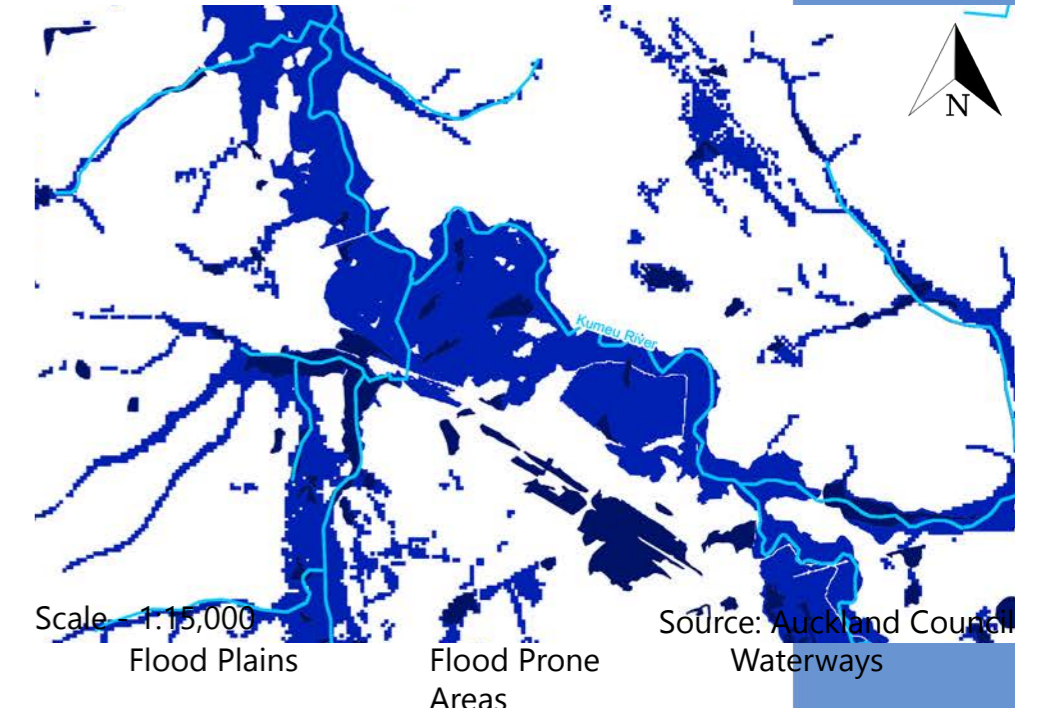
From the map to the left we can see that Kumeu's location is in a less than ideal spot. As previously mentioned, Kumeu township is located at the base of a valley and near the base of the river catchment. The consequence of this is that the majority of the stormwater that is collected in this catchment will travel through the town either over land or through the waterways, which have been known to easily flood in large downpours. In order to contain any mass accumulation of water the prime location must first be identified. This spot would have to be somewhere that runoff from impermeable surfaces can reach.

Slope & Elevation (NTS)



Kumeu is situated in the basin of the Kumeu River catchment area. This results in any water that is not absorbed into the ground is instead fed into the waterways and travels down Kumeu river, through Kumeu township. This puts the town at serious risk for flooding because within a catchment area of over thirty-eight and a half thousand square meters, a significant amount of water can accumulate in a short period of time resulting in potentially major flooding. Therefore, this map looks to analyze the landform to determine the direction that stormwater will most often take in order to ascertain the most ideal location for a stormwater containment area. The arrows on the map to the right shows the slope of the landscape and in turn the fall of any stormwater.

Waterways & Flooding (NTS)



Kumeu sits on flood plains along the bank of the Kumeu River as well as flood prone areas, which according to the Auckland City Council GeoMaps Website, "...are topographical depressions. The areas occur naturally, or are created by dammed gullies created by man-made features such as roads and railway embankments." These natural depressions would act as the best location for stormwater containment as it would be easy to create a system that ran down hill into these depressions. Additionally, it would be most ideal if the chosen depression was on or near the waterway in order for naturally purified stormwater to be easily released back into the waterways.

Auckland Wetland Sites (NTS)



This map to the right shows us where in Auckland there are significant wetland communities. The light blue spot shows the location of Kumeu and that there is currently no sizeable area of wetland in this area. This therefore provides the possibility of establishing an additional wetland patch that can act as a stepping-stone and/or a habitat, aligning with Wenche Dramstad's 'Landscape Ecology Principles'. Furthermore, this wetland patch must cover at least 25 hectares with an 'interpatch gap' of no larger than fifty kilometers for it to be considered a viable patch size (Meurk, Sullivan, McWilliam, 2016).

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- Goulden, S., Portman, M. E., Carmon, N., & Alon-Mozes, T. (2018). From conventional drainage to sustainable stormwater management: Beyond the technical challenges. *Journal of environmental Management*, 219, 37-45. doi:<https://doi-org.ezproxy.lincoln.ac.nz/10.1016/j.jenvman.2018.04.066>
- Taki, H., & Maatouk, M. (2018, November 30). Promoting transit oriented development typology in the transportation planning. *COMMUNICATIONS IN SCIENCE AND TECHNOLOGY*, 3(2), 64-70.

Regional Images URLs:

Matua Road

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Train Station

<https://www.stuff.co.nz/auckland/local-news/nor-west-news/64005868/huapai-train-dream-derailed>

Library

<https://www.stuff.co.nz/auckland/local-news/nor-west-news/97241608/priority-town-centre-plan-for-kumehuapai-approved>

Growth Map

<https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/topic-based-plans-strategies/housing-plans/Documents/future-urban-land-supply-strategy.pdf>

Plant Images URLs:

1 *Apodasmia similis*

<https://www.kauriparknursery.co.nz/plants/apodasima-similis-leptocarpus-similis-oioi/>

2 *Juncus pallidus*

<https://www.kauriparknursery.co.nz/plants/juncus-pallidus-giant-rush/>

3 *Austroderia splendens*

<https://i.pinimg.com/originals/68/01/25/6801253f70c4d644bbbf90b78871ea26.jpg>

4 *Phormium tenax*

<https://www.kauriparknursery.co.nz/plants/phormium-tenax/>

5 *Cordyline australis*

<https://www.kauriparknursery.co.nz/plants/cordyline-australis-cabbage-tree-ti-kouka/>

6 *Leptospermum scoparium*

<https://agrihq.co.nz/section/all/view/pulpit-beware-of-manuka-honeys-sting>

Revegetation:

7 *Agathis australis*

<http://www.terrain.net.nz/friends-of-te-henui-group/table-1/kauri.html>

8 *Dacrycarpus dacrydioides*

<http://www.terrain.net.nz/friends-of-te-henui-group/table-1/white-pine.html>

9 *Dacrydium cupressinum*

<http://www.terrain.net.nz/friends-of-te-henui-group/table-1/rimu.html>

10 *Podocarpus totara*

<http://www.terrain.net.nz/friends-of-te-henui-group/trees-native-botanical-names-m-to-q/podocarpus-totara-aurea-golden-totara.html>

11 *Vitex lucens*

<https://takana.co.nz/portfolio-item/puriri-vitex-lucens/>

12 *Sophora tetraptera*

<https://www.merceraledaffodils.co.nz/sophora-tetraptera>

13 *Rhopalostylis sapida*

<https://www.temotukairangi.co.nz/planting/native-plants/nikau>

14 *Dicksonia squarrosa*

<https://www.theplantstore.co.nz/products/nz-natives/dicksonia-squarrosa-rootrainer-x-50/>

15 *Macropiper excelsum*

<http://www.terrain.net.nz/friends-of-te-henui-group/trees-native-botanical-names-m-to-q/kawakawa.html>

16 *Melicytus ramiflorus*

<http://www.terrain.net.nz/friends-of-te-henui-group/trees-native-botanical-names-m-to-q/mahoe.html>

17 *Astelia chathamica*

<http://www.terrain.net.nz/friends-of-te-henui-group/new-plant-page/astelia-chathamica-silver-spear.html>

18 *Coprosma Robusta*

<http://www.terrain.net.nz/friends-of-te-henui-group/table-1/karamu.html>

Amenity Planting:

19 *Vitex lucens*

<https://takana.co.nz/portfolio-item/puriri-vitex-lucens/>

20 *Sophora tetraptera*

<https://www.mercerledaffodils.co.nz/sophora-tetraptera>

21 *Rhopalostylis spida*

<https://www.temotukairangi.co.nz/planting/native-plants/nikau>

22 *Phormium Evening Glow*

<https://www.kauriparknurseries.co.nz/plants/phormium-evening-glow/>

23 *Carex virgata*

https://www.nzherald.co.nz/lifestyle/news/article.cfm?c_id=6&objectid=10816877

24 *Coprosma kirkii*

<https://www.kauriparknurseries.co.nz/plants/coprosma-kirkii/>

25 *Tecomanthe speciosa*

<http://www.terrain.net.nz/friends-of-te-henui-group/plants-native-botanical-names-r-to-z/three-kings-vine-tecomanthe-speciosa.html>

Edible Plantings:

26 *Malus domestica*

Apple 'Braeburn'

<https://www.southernwoods.co.nz/shop/apple-braeburn/>

27 Plum 'Luisa'

<https://www.southernwoods.co.nz/shop/plum-luisa/>

28 Peach 'April White'

<https://www.southernwoods.co.nz/shop/peach-april-white/>

29 Feijoa 'Apollo'

<https://www.southernwoods.co.nz/shop/peach-april-white/>

30 Grape 'Flame Seedless'

<https://www.southernwoods.co.nz/shop/grape-flame-seedless/>

31 Blueberry 'Delite'

<https://www.southernwoods.co.nz/shop/blueberry-delite/>

32 Mandarin 'Encore'

<https://www.southernwoods.co.nz/shop/mandarin-encore/>

Materials URLs:

Stone Set

<https://www.sureset.co.uk/paving-ranges/crushed-marble/>

Concrete

<https://www.pinterest.nz/pin/829436456349691597/?lp=true>

Exposed Aggregate

<https://www.alliedconcrete.co.nz/products/decorative-concrete/ready-exposed/>

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