



Permaculture Design

Opara River Retreat, Okains Bay



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Introduction

- ❖ The Opara River Retreat is located on the north-east side of Chorlton Road in Okains Bay, Banks Peninsula. Property boundaries are approximately delineated in the south-west by Chorlton Road, and a Legal Road parallel to Opara Stream in the north-west. The land parcel is legally described as RS1893 and comprises a total land area of ~81,937m² (LINZ database 2016). Site maps are included as Section IV.
- ❖ The owners purchased the property in April 2017, which was then operating as a small backpackers/hostel on the Chorlton Road-side section of land adjacent to the 1890s Colonial Cottage, which the owners (Will and Reagan Knapp) reside in. Since October 2017, the hostel has been upgraded and is run as a guesthouse, open to parties of up to 8 guests for multiple day accommodation. The guesthouse and cottage are on mains electricity and the water source is from a spring near the top of Okains Bay, which is treated and sterilised on the property. Sewage is managed with a septic tank, located between the guesthouse and the cottage.
- ❖ Much of the land surrounding the guesthouse and owner's cottage is grassed with the occasional fruit or large canopy-type tree. The paddocks, which are primarily grassed farmland with local hummocky topography generally 0.1 to 1.2 m high, are kept tidy by a small flock of sheep. The 'garden' is a small fenced section approximately 25 metres from the cottage but has no substantial production as an extreme tidal event caused flooding and destroyed the species planted there, bar three apple trees, garlic, rhubarb, and raspberries which seem to have withstood the inundation of salt water. Raised beds are being constructed and planted, with completion estimated mid-2019.
- ❖ Since moving to the property in April 2017, the owners have had the chance to experience all four seasons at least once and have made observations of the normal patterns and quirks that the property offers. These observations have greatly assisted in the design of the permaculture plan and have identified challenges that are unique to the property.
- ❖ Currently, the owners have sourced resource consents to subdivide RS 1893 into two separate lots (referred to as the western and eastern lots), and to build a new house and barn on the eastern lot. The location of the proposed two lots, current location of the guesthouse and cottage on the western lot, and proposed locations of the new house and barn on the eastern lot, are shown as Figure 4 in the Site Maps Section.
- ❖ Design for the proposed house and barn are underway; however, it is anticipated that the building consenting and construction timeframe is approximately 1.5 years. Therefore, the owners have taken a multi-stage approach to the permaculture design. The first stage involves identification and creation of zones around the current guesthouse and cottage in the 'western lot', utilising the small fenced areas and boundaries already in place and resources/facilities/buildings already in place. The second stage involves creation of zones around the proposed house and barn on the 'eastern lot', where no buildings or structures are currently erected.

- ❖ The sections that follow outline the key components of the permaculture plan for the property in its entirety, including the western and eastern lots, followed by identification and analysis of the unique challenges presented by the property.

Site Analysis

General Site Information

- ❖ Latitude: 43° 43' 0" S; Longitude: 173° 1' 60" E
- ❖ Council Zoning: Rural Banks Peninsula Zone
- ❖ Land Area: 8.1937 hectares / 20.247 acres

Climate

- ❖ With Okains Bay's latitude at 43 degrees south, it lies within the Southern Hemisphere Temperate Zone.
- ❖ According to NIWA, all aspects of the climate of Canterbury are dominated by the influence of the Southern Alps on the prevailing westerly airflows. Banks Peninsula has relatively mild winters and rather high annual rainfall with a winter maximum.
- ❖ According to NIWA, westerly winds at all levels of the atmosphere move weather systems, which may also be either decaying or developing, eastwards over New Zealand giving great variability to its weather.
- ❖ These prevailing westerlies sometimes abate, and air from either tropical or polar regions may reach New Zealand with heavy rainfalls or cold showery conditions, respectively. The main divide of the Southern Alps acts as a barrier to the prevailing westerlies and has a profound effect on the climate of Canterbury, separating New Zealand's wettest region (the West Coast) from considerably drier regions east of the main divide.
- ❖ The Canterbury region is bounded in the east by the coast, and in the west by the main divide which reaches 3,724 m at the summit of Mount Cook. The coastal plain extends from Waimate to Waipara. The plains slope gently upwards to reach 150-200 m in the north, but where they are broadest in mid-Canterbury, the foot of the ranges lies at 350-400 m. Banks Peninsula lies to the east of the general run of the coast, and rises to 919 m at Mt Herbert.
- ❖ The following tables sourced from NIWA, show some key climate data from the 1981 – 2010 normal period for Akaroa, (https://www.niwa.co.nz/static/web/canterbury_climatology_second_ed_niwa.pdf), which is located approximately 13 km to the southwest, on the western side of the crater rim. If data is not available for Akaroa, the data available for Christchurch, located 87 km to the northwest is included.

- Monthly and annual rainfall normal (a; mm) and monthly distribution of annual rainfall (b; %) for Akaroa:

Location		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Akaroa	a	51	53	68	67	92	101	131	123	70	82	70	63	969
	b	5	5	7	7	9	10	14	13	7	8	7	6	

- Average monthly rain days (a; days where at least 0.1 mm rainfall is measured) and wet days (b; days where at least 1 mm rainfall is measured) for Akaroa:

Location		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Akaroa	a	7	6	8	8	10	11	12	10	9	9	8	8	107
	b	6	5	7	7	9	10	11	9	8	7	7	7	93

- Highest and lowest recorded air temperatures, average number of days per year where maximum air temperature exceeds 30 degrees C and 25 degrees C, and average number of days per year where the minimum air temperature falls below 0 degrees C for Akaroa:

Location	Highest recorded (°C)	Annual days max temp > 30°C	Annual days max temp > 25°C	Lowest recorded (°C)	Annual days min temp < 0°C
Akaroa	35.5	5	35	-8.0	11

- Monthly and annual mean 9 a.m. earth temperatures (degrees C) at varying depths from the ground surface for Christchurch:

Location		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Christchurch	10 cm	17.4	16.7	14.3	10.8	7.3	4.5	3.8	4.8	7.3	10.5	13.7	16.2	10.6
	20 cm	18.5	18.1	15.6	12.2	8.4	5.4	4.6	5.7	8.1	11.2	14.5	16.9	11.6
	30 cm	19.2	18.9	16.6	13.3	9.5	6.3	5.4	6.5	8.9	12.0	15.1	17.6	12.5
	100 cm	18.1	18.4	17.2	14.8	11.6	8.6	7.0	7.4	9.0	11.4	14.2	16.4	12.9

- Average number of days each year with snow, thunder, hail and fog recorded for Christchurch:

Location	Snow	Thunder	Fog	Hail
Christchurch Airport (37 m)	3	3	6	49

Geology, Surface Water and Groundwater Flow

- ❖ The most recent published geological map for the site (Forsyth et al, 2008), show the valley slopes in Okains Bay consist of airfall loess (windblown silt; code: mQe) overlying Akaroa Volcanic Group basaltic lava flows and associated volcanic intrusions (code Mva). The Okains Bay valley floor is comprised of silt and sand of lagoons, estuaries and bay heads (code: Q1a) up-valley, and beach gravel and sand of post-glacial shorelines (code: Q1b) down valley where the subject site is located. These geological codes are shown in Figure 3 of the Site Maps Section. A geotechnical investigation for the site was performed in 2016 and the highlights of this investigation relevant to the permaculture design are summarised below:
 - The nearest available ECan well record (N36/0049) is located ~630m south-west of the site at 1172 Okains Bay Road. The borehole shows “blue-black sand” to 8.0m below ground level (bgl); “grey silt” with several ≤2.0m thick units of “grey gravelly silt” to 22.0m bgl; “brown clay-bound gravel” with a unit of “grey clayey silt” to 37.29m bgl; and volcanic rock to the hole termination at 55.4m bgl. Initial groundwater was intersected at -0.70m -MP with local ground level measured at -0.13m -MP. It is reasonable to interpret the dominant grey silts below 8.0m bgl as loess-derived clayey silt sourced by erosion from the surrounding hillslopes.
 - A 0.5-1.0m deep stream channel bisects the property and joins Opara Stream in the north-west, approximately 1km upstream of Okains Bay coastline. During inspections in November 2016 this drainage channel was largely dry but displayed soft ground towards the south-eastern property boundary, and water was flowing in the streambed towards the south-western boundary. Several dwellings and outbuildings presently occupy the site, most concentrated at the south of the property adjacent to Chorlton Road on proposed Lot 2.

- The proposed new titles are shown on Figure 4 in the Site Maps section, including proposed Lot 1 (45,169m² + 861 m² access) with a new dwelling and garage/barn, and Lot 2 (40,800m²) with existing dwellings in the south-east of the property. A new access way is proposed along the southern boundary for the proposed rear lot and a culvert or bridge structure will be required to span the natural drainage pathway intersecting the site.
- The existing dwellings did not sustain any significant damage during the earthquake sequence that commenced in the Canterbury region on 4 September 2010. The dwelling interior were not inspected as part of our investigation. There was no evidence of surface liquefaction noted during walkover inspections of the site, or of lateral spreading.

Water

- ❖ There is a permanent water source (initially sourced for stock water) connected to the property. Water is plumbed from the Okains Bay Road main and fed through a holding tank on the western lot. From here the water goes through a pump, filtration system, and UV sterilization bulb, before entering the existing two houses on the western lot.
- ❖ There are irrigation lines running throughout the gardens and paddocks across the entire site for stock water troughs that are disconnected from the treatment system.
- ❖ Christchurch City Council have announced that a new treated drinking water system has been approved for construction over 2019/2020. The owners intend to connect to this new system once it is in place to avoid having to treat drinking water for the eastern and western lots.
- ❖ For the eastern lot and new house, the owners will be laying utility lines including a water line to be connected to the mains water.
- ❖ The owners will be collecting rain water at the new house on the eastern lot.

Contaminated Areas

- ❖ There are no known areas of contamination throughout the property.

User Requirements

- ❖ **Client**
 - A couple (Will and Reagan) both aged 33 with a daughter turning 1 year old in July 2019 (Arwyn).
 - Will works full-time on the property and Reagan is currently on maternity leave from her typical engineering job for the foreseeable future.
 - Will and Reagan run the guesthouse for spring, summer and autumn on the property, and it is typically closed in winter.
 - Will still has a business in the USA that requires occasional time during the morning hours on week days.
 - Beginning in late winter / early spring 2019, Will will be the second builder for the new house and Reagan will be project managing the build.

- Therefore, it is anticipated that resources are available in the capacity of approximately 5-15 hours per week outside the summer months to dedicate to the permaculture design implementation and maintenance.
- Will has a post-graduate certification in sustainable construction and was Leadership in Energy and Environmental Design (LEED) certified in the States before moving to NZ.
- Will designed the new house based on passive solar concepts and has EcoWorkshop architects drafting the plans. EcoWorkshop has indicated we will include as many eco concepts as possible, including solar panels on the new barn roof, collection of rainwater, recycling of grey water, rechargeable battery storage, etc.
- The construction of the driveway from Chorlton Road is underway and the new barn is anticipated to be built in late autumn or winter 2019. The barn will also be used to store building materials for the house.
- Will and Reagan are both keen gardeners and have begun growing a selection of fruit tree and shrubs to move to the eastern lot once the new house is built.

❖ **Goals of the Land Owner**

- The dream for the property is to become as self-sufficient as possible, to grow and produce the majority of our own food to sustain our family, to utilise the grazers on our property to their full extent, and to reduce the amount of labour and resources required to maintain the land, all while “living the life” in a beautiful piece of NZ.
- Current and potential grazers include sheep (meat, wool, lanolin); cows (meat, rugs); chickens (eggs for consumption and possibly selling/using feathers for crafting); geese/ducks/quail (grazers, manure, eggs).
- Low to medium budget: The owners are working towards building a new house and are looking to be cost effective in their choices. Part of managing the budget for plantings includes growing from seed in the new greenhouse, beginning in autumn 2019.
- Aesthetic values: Okains Bay is the most idealistic and pristine places the owners have lived and they hope to work within and with the landscape, retaining (or even enhancing) its raw, natural beauty.
- The owners wish to continue generating income from the property, potentially beyond the income from the guesthouse.

❖ **Resources**

- Within the winter 2019 months, Will and Reagan will be travelling for 5 weeks (late May / all of June), and have July and August to dedicate much more time to the permaculture design implementation. During their time away, ‘helpers’ will be staying at the property and will look after the farm (grazers, plantings, etc).
- Will and Reagan will have ‘helpers’ at various times of the year of 2019 who will continue to help with all aspects of the property (e.g., cleaning the guesthouse, tending to the gardens, the permaculture design implementation, sharing childcare time, etc.) into the foreseeable future.
- Will and Reagan are somewhat new to the rural, farming lifestyle, having only moved to Okains Bay from Christchurch in 2017. However, the community has been very supportive and helpful in regard to maintenance and upkeep of the current flock of sheep. Little River’s Chook Manor is supportive in regard to care of the chickens. Additional expertise will be sought as required in the form of books, online forums, and project-specific consultants.

❖ Market

- The nearest town is Akaroa, a small French village settled 150 years ago, with a permanent population of approximately 700 which swells significantly over summer due to tourists, bach owners and cruise ship visitors. The drive time to Akaroa is approximately 25 minutes.
- There are two weekend markets in the Akaroa township which run from October to April each year:
 - Banks Peninsula Craft Market
 - Farmer's Market
- The scenic mail run and postal delivery/pick up service operates six days a week.

Identified Challenges and Considerations

Invasive plant species

- 1) Marram Grass:
 - Marram grass was historically planted in Okains Bay along the beach and estuary to assist with erosion and the building of sand dunes. Marram grass has spread throughout the paddocks on our property, with some paddocks now more invaded than others.
 - It does not appear to grow in shady areas including underneath the canopy trees such as pine and macrocarpa.
 - We have not yet identified a means of effectively eliminating / replacing marram grass. In the past several years, cattle were brought to the land to “stomp out” the grass which was somewhat effective. However, due to the competition between the temporary cows and the permanent sheep flock, there was not enough grass to keep both grazers resulting in the cows being relocated prior to our moving to the property.
 - During the geotechnical investigation performed on the property during the resource consent application phase (2017), a sizable drilling rig was brought onto the proposed eastern lot to perform two cone penetrometer tests (CPTs). In the two areas where the rig forced pressure onto the land for the CPTs, marram grass has been eliminated, likely due to the sheer weight of the rig on the land killing the grasses. The drilling mud / completion liquid (concrete?) would have been filled into the CPT holes, which also could have had an effect on eliminating the marram grass.
 - Some ideas regarding elimination of the marram grass (without spraying plant-eliminating poisons), include:
 - Hand-pulling / Hand-tools
 - Tilling via tractor
 - “Gorse Gobbler” - see <https://www.trademe.co.nz/services/other-services/farming-agriculture/auction-1424114529.htm?rsqid=bc8b8debo75404986d6158a245869df>
 - Cutting through the roots with a disc-machine on the back of a tractor
 - plantz.co.nz representative mentioned there was a large machine on the north island that can “steam” the roots with a probe.
 - Shading via weighted coverings over the grass in sections, basically depriving the grasses from sunlight
 - Introduction of other grazers, if identified - Goats? Donkeys? Others?

- Shading via canopy species (main problem with this would be introducing tall species that would block the view of the river from the proposed house/barn)

- 2) Stinging Nettle: Stinging nettle is present in small to large patches, mainly in the eastern lot.
- 3) Scottish Thistle
- 4) Californian Thistle

Invasive Animal Species

Invasive animal species include: rabbits, possums, mice, rats, cats, muskaldids.

Tidal Influences

Understanding tidal influences is a work in progress and we plan to monitor and plant salt-tolerant species near and in low spots along the river.

Wind Protection

We plan to use existing hedges and tree lines for higher zone and less hearty plants. Establish additional wind barriers with wind-tolerant natives.

Seasonal Sunlight

We lose sun in early afternoon in winter months behind the large hill to the northwest. Long days of unobstructed sun spring through autumn.

Seasonal Rainfall

Majority of rainfall is in winter. Possible ponding of rainwater in low-lying areas. June has been the rainiest month the last two winters with very little sun. Mid-summer can be hot and dry; may need to provide tree water bags for the introduction of new plants. Plan to plant natives in the autumn to take advantage of wet winters.

Soil composition

Based on our work within the garden on the western lot, the soil composition consists of approximately 0.1 to 0.3m organic topsoil, underlain to approximately 0.6m with sandy silt / silty sand.

Site Maps

The following site maps are provided to demonstrate the topography, soil type, water dynamics, sector analysis, existing features and proposed zones of production for the property.



Figure 1. Regional Setting: The Opara River Retreat is located in Okains Bay, one of the eastern bays on the Banks Peninsula, alongside the Opara River.

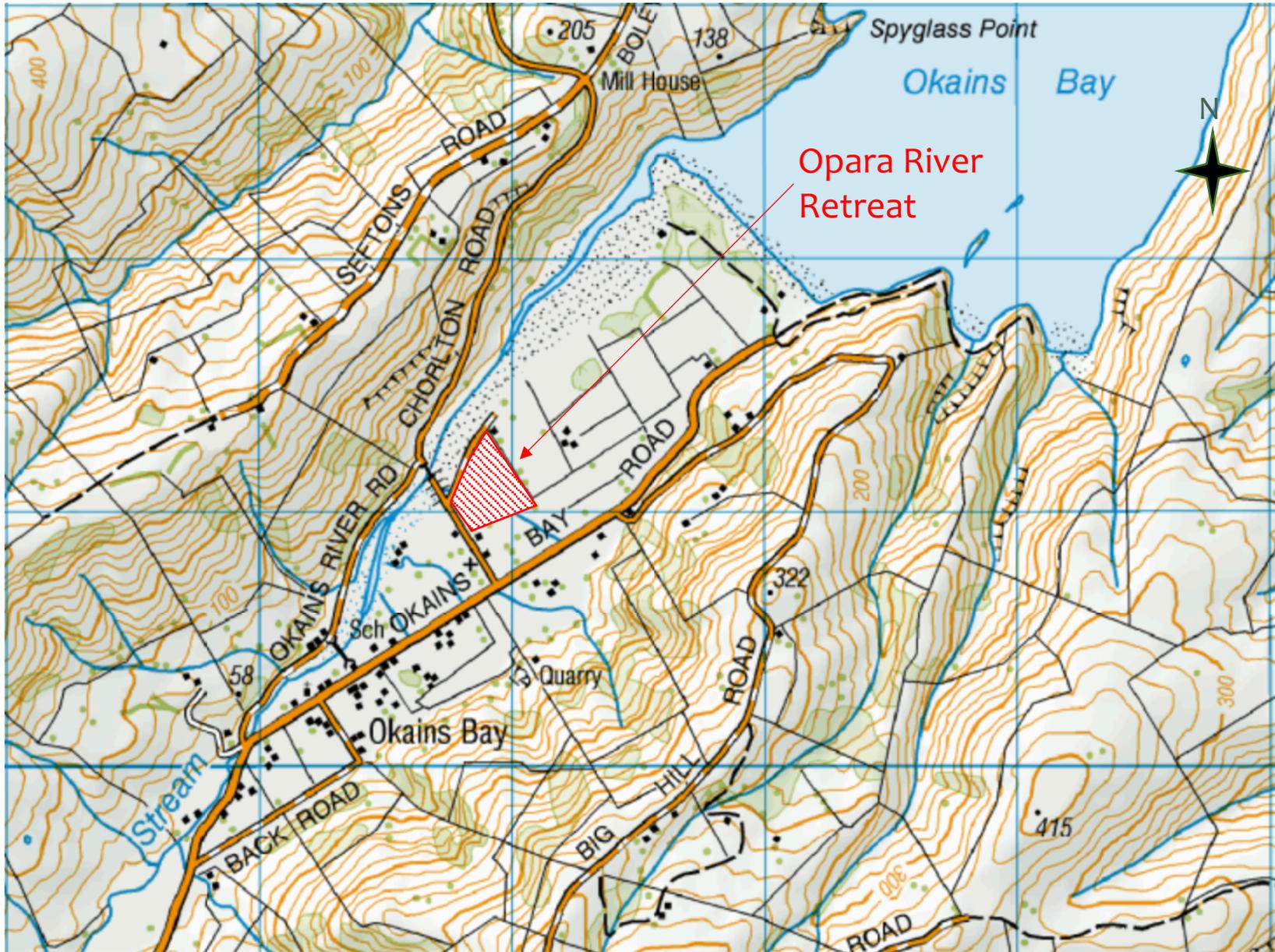


Figure 2. Topography of the Opara River Retreat within Okains Bay.



Figure 3. Geological map showing the site location. Yellow (mQe) = loess and loess-colluvium; light speckled yellow is Q1a = silt and sand of active beaches and estuaries, and Q1b = silt and sand of post-glacial beaches; and light pink speckled is Akar.



Figure 4. Soil Type and Groundwater Level Observations across the Opara River Retreat.

A full geotechnical report and further correspondence was prepared for the property as part of the resource consent application. This included a multi-tiered analysis on the land which was required by Christchurch City Council. One aspect included soil composition. Based on the information gained from this report, the property is generally underlain by beach gravel and sand of post-glacial shorelines.

Two shallow hand-augers were performed and resulted in the following observations: The hand auger holes intersected 150-200mm of organic-rich sandy silt topsoil, which was underlain by medium dense, uniformly graded fine (to medium) sand. Hand augering terminated below the groundwater table due to hole collapse in the non-cohesive soils at 1.6m below ground level (bgl) and 2.0m bgl, respectively.

Groundwater was observed at the proposed building site at approximately 1.5m bgl on an elevated dune ground surface, and during summer at 0.8m bgl in the garden near the cottage.

Based on our work within the garden on the western lot, the soil composition consists of approximately 0.1 to 0.3m organic topsoil, underlain to approximately 0.6m with sandy silt / silty sand.

It is generally considered that the majority of the soil across the property is 'degraded' due to the overgrazing of sheep and cows, historically and presently. The 'garden' adjacent to the guesthouse has nearly loamy soils due to previous owner care of the land; however, due to saltwater inundation, raised beds are proposed in this area.



This figure demonstrates the water dynamics at the ORR.

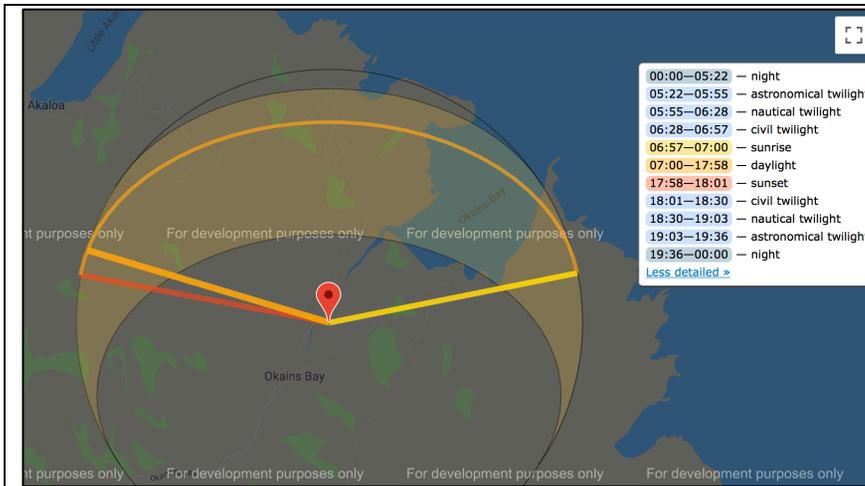
The Opara River (shown as Stream on the figure) is tidally influenced and fluctuates from a small stream at low tide (as shown in the figure) to filling the entire riverbed at high tide.

Decades ago, 13 drainage channels were dug throughout Okains Bay in 'the flats' which all lead to the Opara River. One of these drainage channels is situated on the property, mainly on proposed lot 2 as shown in the figure. A flood gate was installed by the previous owners which works to allow water to flow west towards the Opara River and drain the site, but not to let water into the drainage channel during high tides.

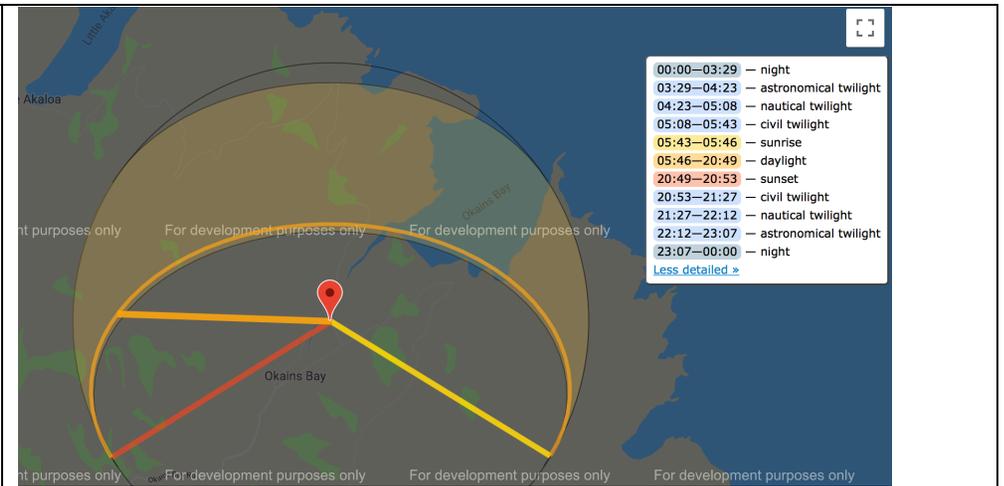
The estuary-side paddock functions like a wetland-type atmosphere in some senses, with large, thick grasses thriving in the saline conditions in sandy soil. However, water does not appear to pond or remain wet like a wetland; with the exception of extreme wet weather events where this paddock may remain wet for a day or two.

The hummocky eastern corner of the property appears to be at a slightly higher elevation and tends to stay drier than the western portion of the property.

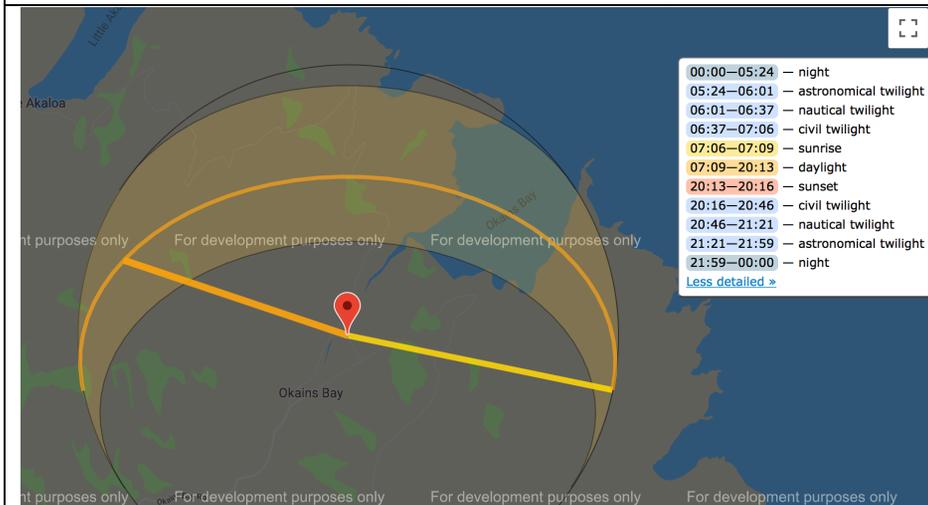
Figure 5. Water dynamics (water bodies, wet areas, dry areas, flow of water) across the Opara River Retreat.



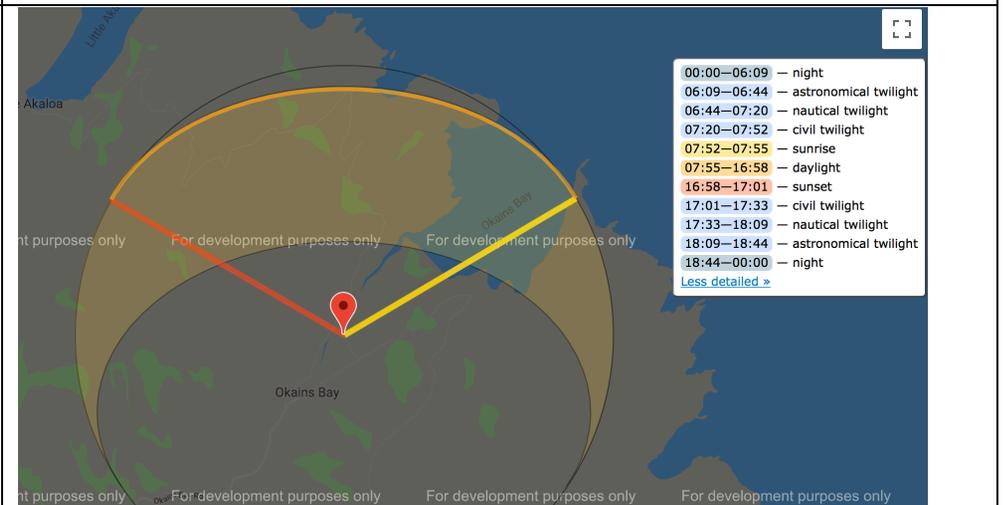
SunCalc for **September 1, 2018** (Represents beginning of **Spring**)



SunCalc for **December 1, 2018** (Represents beginning of **Summer**)



SunCalc for **March 1, 2019** (Represents beginning of **Autumn**)



SunCalc for **June 1, 2019** (Represents beginning of **Winter**)

Figure 6. Sector analysis: Sun path (source: suncalc.net). This figure shows sunrise/sunset times for the beginning of each season.



Figure 7. Sector Analysis: Good Views and Areas Requiring Plantings for Aesthetics.



Figure 8. Existing features (roads, plantings, fences, buildings, contaminated areas, wetlands, natural areas).



Figure 9. Zones of production (General Overview).



Figure 10. Zones Legend

Zone Details

Zone 1: House, Raised Garden Beds, Barn, Greenhouse, Path between Raised Garden Beds to Barn

Production systems: The area between the house and the barn/shed will be the most protected and easiest accessed outdoor part of the property.

- 1) The most protected area is where we will have the orchard trees that most appeal to us for personal consumption and need the most shelter (Mandarin, lemon, lime, orange, grapefruit). More scattered through the zone will be our favorite, more temperate orchard trees which are selected for varying harvest. (Apples, pears, peaches, plums, apricots, cherries).
- 2) The variety of fruit and nut trees will be planted along the driveway (included in Zone 1) and in other easily harvested places of the property within this zone. Preference will be given to heritage varieties and attention will be paid to any varieties that require cross-pollination.
- 3) An irrigation system (perhaps quite basic, e.g., water bags) will be used to supplement the fruit trees' water needs. These trees are in addition to those that will be found in the foodforest.
- 4) Note: Currently there are fruit trees around the existing guesthouse and cottage (apricot, plum, pear, peach, feijoa, apple), and several walnut trees that are somewhat difficult to access. The walnut trees need to be limbed up and taken care of as they have been neglected for probably 10+ years.
- 5) The raised beds will be just further North of the citrus trees as they will not block the sun from hitting the citrus trees behind them. Plants in the raised beds will be seasonal, and of the more traditional garden variety. They will also be plants that we most often consume (e.g., broccoli, cauliflower, lettuces, spinach, tomatoes, jalapenos, basil, mint, cilantro and many other herbs, kales, peppers, carrots, garlic, and many more). Raised beds will prevent over-saturation of the plants during what can be very wet winters in Okains Bay, as well as elevating the plants above a level where they might be

damaged by extreme high tides or flooding (both which have been observed on the property in the last two years). Raised beds will ideally be put on an irrigation system, and ideally the water used will be harvested rainwater from the roof of the new house and new barn. Raised bed will be maintained using the “weed free” method. The basic idea being a yearly compost spread followed by newspaper and/or cardboard, and mulch.

- 6) Scattered throughout the zone will be our favorite berry bushes and vines. (Blueberries, thornless blackberries, raspberries, star jasmine)
- 7) The greenhouse will also be located in zone 1. Here we will be starting from seed most of the plants listed above. Further, the greenhouse will allow us to extend the growing seasons, (e.g., to start our tomatoes and peppers much earlier in the spring and to add additional harvests for our traditional garden crops).
- 8) The new house will be accessed via a new driveway from Chorlton Road, along the southern boundary of the property. It is envisioned to have either ground-level or raised pathways connecting various zones, beginning in Zone 1.

Infrastructure: Zone 1 is the primary area where we live and accordingly the primary area where we will have invested in the infrastructure of the farm.

- 1) The house itself will have a large Northern exposure of glass windows and doors. This area in the colder months can serve as an extended growing area for plants that we will move from inside to outside in pots. Some ideas we have now are a dwarf grapefruit tree and heavily pruned mandarin trees.
- 2) The raised beds as mentioned above will allow for easy, ascetically pleasing gardening near to the house. Materials have not been sourced yet, but we will look for reclaimed materials.
- 3) The greenhouse will either be moved from the existing garden, or we may choose to build a new one. We would likely build one from scratch (timber and clear wavy polycarbonate) rather than a kitset like our current one, as we have doubts about its long-term durability. Either way, it will be oriented either facing directly towards the northeast if we want more even light distribution, or perpendicular if we wish to maximise sun for some plants and provide shade for others.
- 4) The path from the house to the barn will be lined with flowers and herbs. We have not decided on the path’s material yet, but it would likely be gravel or pine mulch.
- 5) The barn/shed will house all of our garden and farm tools.
- 6) The compost bins will be on the edge of the zone. Close enough to be easy to use, but far enough away to avoid any unwanted pests or odors.

Zone 2: Foodforest

The Foodforest will be an ever-evolving system consisting of a variety of (native, non-invasive introduced, and exotic) canopy trees, understory plants, ground cover plants, and the fauna, both wild and domestic, that will live among the plants of the foodforest. The food forest will rise out of a paddock overrun with marram grass, so it will be important early to plant fast growing trees that can shade it out (marram can’t stand shade). We will also clear selected areas of the marram grass to get small plants started. The foodforest will mostly be planted on the higher ground to prevent the occasional high tide flooding from damaging the more saline- and inundation-sensitive plant species and soil organisms. Paths will be maintained through the foodforest to provide for easy harvesting and enjoyment of the forest. Attention will be given to achieving a state of

continuous production of the forest achieved through a diversity of species. Edible weeds may play a part in the foodforest. The main components of the foodforest include:

- 1) Canopy trees – Southern Rata, Walnut, Pecan, Hazelnut, Kanuka, Manuka, Lancewood, Peaches, Apples, Nectarines, Pears.
- 2) Understory plants–Blueberries, Thornless Blackberries, Raspberries, Cranberries, Currants, Caperberries.
- 3) Ground covers – Miner’s Lettuce, Hedge Mustard, Vetch, Cow Parsley, Mallow, Native Celery, Italian and Native Parsley, Wood Sorrels, Beach Orache, Plantain, Wild Carrot, Calendula, Wild Sweet Pea, Kawakawa, Watercress, Native Silver Beet, Forgetmenot, Beach Spinach.
- 4) Fauna – We plan to build a mobile chicken coop for pasture grazing of the chickens. They will occasionally be allowed to forage through the foodforest. We are also planning on introducing ducks that would wander through the foodforest. We have native birds that will likely be attracted to the forest (kereru, piwakaka, bellbird, silvereve, kingfisher, heron, and hopefully tui as they have not reached our bay after being reintroduced several bays over). We hope to incorporate bees in the northern corner of Zone 2 along the edge of the Zone 5 native bush and have several beekeeper friends who have volunteered to help us get established.

Zone 3: Personal and Potential Commercial Crops (3A: Olives, 3B: Grapes)

The paddocks comprising Zones 3A and 3B are mainly covered in marram grass and are currently used for grazing sheep, although the grass is typically not plentiful enough to support as many sheep as would have been normal given the acreage due to the marram grass. One use that we have been strongly considering for these two paddocks is the planting of olives and/or grapes. For now, the Zone 3A paddock also comprises the yards for the sheep and several established and mature trees (walnuts and kanuka). Our focus in the immediate and mid-term will be on Zones 1, 2 and 5 over the next two years while we are under construction of the driveway, barn and new house. We would not want to plant these two Zones until construction is complete as we will not have the time or resources to dedicate to Zone 3 and would not want to compromise any new plantings during construction.

Zone 4A and B: Pine Forest and Pine/Eucalyptus Shelter Belts

These established pine and eucalyptus shelter belts provide protection of the property from the prevailing winds (easterly, southerly). In regard to the pine forest (Zone 4C), there are plenty of trees that have naturally fallen and can be harvested for firewood. This shelter belt in general will provide the firewood for our new house and existing cottage.

Zone 4C: Macrocarpa Hedge

This hedge provides protection of the property from the southerly winds and will be trimmed annually or biannually. It also provides privacy from the road for the guesthouse and cottage.

Zone 5: Native Forest

Zone 5 comprises paddocks that are basically dry wetlands adjacent to the estuary that occasionally have salt water inundation during extreme tidal events. We will be looking for salt-tolerant natives and sourcing local native seedlings and seeds to grow in the greenhouse and plant in the native forest area. The native plantings

will be focused along both the Opara River running along the property's boundary and the creek running through the middle of the paddock. The paddock bordering the estuary has now been gated so that the sheep are not allowed to graze this paddock until we move them there intentionally.

Native species will be as wide spread as can be arranged to promote biodiversity. Shorter mountain flaxes and lancewoods will be used in areas that more dense and/or tall species would obscure the view from the future house to the Opara River.

We have already contacted neighbours and have been given unwanted native flaxes and karaka seedlings. Some of the larger / canopy tree species we would like to incorporate into the property will include the Totara, Southern Rata, Pohutakawa, Kowhai. We also plan to focus on food trees for native birds such as silvereyes, kereru tuis and bellbirds (e.g., cabbage trees, flaxes, pohutukawa, rata, karaka).

Plantings will be laid out to incorporate large footpaths so that even as the natives grow and spread, the paths will remain to walk through them. The fern-like unfurling patterns will be included in the path design. We also plan to label larger specimen varieties of plants as an educational experience for our daughter and other visitors to the farm.

Remainder of the Property

Our plan is to leave it as it is for now, with the addition of protected specimen trees out in the paddocks. Specimen trees will be planted and protected from grazing sheep until they are tall enough. They will be spaced enough to allow for sunlight to still reach the pasture grasses between them, allowing the paddocks to continue to be used for a small flock of sheep. There will be a variety of species chosen for both aesthetic appeal and food/material/wood (limbs) production. Preference will be given to larger species here. We have reduced our flock to 15 sheep to make room for all of the new plantings that are taking many of the paddocks from the sheep. We have not decided whether we will get long term renter in the cottage or lease it out to holiday goers. Until we know which renters we will get we will keep things as they are, with the possible addition of specimen tree plantings.

