



**PREPARED FOR PARIHAKA PAPA KĀINGA TRUST**

**AUGUST 2016**

**PROJECT NUMBER: 707116**

**Rev1 6 September 2016**

# **PARIHAKA INFRASTRUCTURE ASSESSMENT REPORT**

## COMMERCIAL IN CONFIDENCE

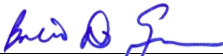
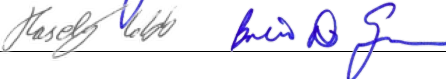
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**Calibre Consulting**  
**Level 13, Kordia House**  
**109 - 125 Willis Street**  
**WELLINGTON 6011**

**Ph: +64 4 384 2029**

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### QUALITY ASSURANCE STATEMENT

Task	Name	Signature
Project Manager	Brett Gawn	
Prepared by	Hasely Lobb and Brett Gawn	
Reviewed by	Various	

### DOCUMENT REVISIONS

Issue	Date	Issue Details	Author	Checked	Approved
Rev 1	6 September 2016	Elec Comments added	Brett Gawn		

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# 1 INTRODUCTION

Parihaka Papakāinga Trust (PPT) requested Calibre Consulting (Calibre) undertake an assessment of its current infrastructure, and report on:

- The requirements to upgrade it to properly meet current needs, and
- New infrastructure that will be required to enable the next phase of Parihaka's development.
- Preliminary cost estimates and an assessment on priorities and what needs to be done before each activity can occur, and
- An estimate of the costs for operation and maintenance.

This report relates to “horizontal bulk” infrastructure and therefore excludes residential and cultural buildings and structures. Calibre understands that these matters are being covered in separate reports.

Horizontal bulk infrastructure covers roads, water supply, flooding and stormwater management, wastewater treatment, electricity supply, communications that are “public” or “community owned”. It does not cover internal connections from the “public” space to “private” houses or new roads or connection that will be constructed as part of new development.

This report is based on the masterplanning that has been carried out by the PPT with the assistance of Calibre Consulting and Rau Hoskins of Design Tribe as illustrated in the latest version of the masterplan (Plan M-01 dated 29/07/2016) attached as Appendix A. The masterplan is based on some long term assumptions the PPT have agreed should be the basis for long term infrastructure and land use planning.

They are

- plan for the possibility of a population of 1000 people in 2040
- plan for 30-40 new houses, a visitor centre and assisted living complex in the next 5 years, within the existing Papakāinga boundary
- plan for the multi-purpose Administration and Education Centre
- growth will be planned and controlled by the PPT housing and other policies
- Parihaka X land will be available to cater for growth
- Parihaka will be a sustainable modern, low energy, low water-use Māori village
- the horizontal infrastructure and land will be community owned.

The masterplan outlines areas within the current Pā boundary where new housing can occur. That land can accommodate 30-40 houses but only if the land available for each house is less than the current norm within the Pā.

The costs provided in this report need to be seen as ball-park figures to allow comparison and prioritisation of activities and expenditure, and to allow an assessment of the funding requirements.

No detailed investigations or design work have been carried out and only indicative costings have been sought from some suppliers. Within the time available to prepare this report we have made our best efforts to provide information and advice that that will allow PPT to make decisions on where, when and to what activities to allocate resources and funding. When funding is available for particular activities full investigations, detail design and costing needs to be carried out to confirm the best options, solutions and costing for that work before proceeding.

Calibre cannot guarantee that the costs estimates provided in this report will be exactly what these activities will cost.

## 2 EXECUTIVE SUMMARY

Any significant growth at Parihaka both for new dwellings and visitor facilities requires a new waste water treatment system within Parihaka X land.

Security of water supply requires the existing water source and supply pipeline to be legalised.

These two things must happen.

A number of other activities will need to be done to improve the current situation and facilitate growth.

The activities identified as being required are outlined in the table below together with priority and estimated costs.

Included in the table are estimates of the annual costs to operate and maintain these assets.

Activity	Capital	Annual Operational and Maintenance	Importance / Urgency	Priority
New wastewater collection and treatment system in Parihaka X land. First stage. Requires Parihaka X approval	\$2.5 - 3 million	\$39,000 including power	high	1
Secure legal water supply. Significant legal risk of supply cut off if not done	\$30,000	Nil	high	2
Replace culvert behind Te Niho	\$30,000	Nil	medium	3
Road sections A1-A3 maintenance and water table improvements	\$60,000	All roads \$16,000	medium	4
Upgrade road entrance and first 90 metres	\$20,000		medium	5
Upgrade road sections A1-A2	\$40,000		medium	6
Balance road sections maintenance and water table improvements	\$40,000		medium	7
Locate new water supply source (high priority if existing source cannot be legally secured)	\$100,000	Water supply \$6,000	low	8
Telecommunication and data	nil	\$4,000	low	
Cover large reservoir	\$145,000	Included in water system	low	10
Sustainable Electricity Supply System	Unknown at report writing			9

All costs exclude GST

Costs are rough order only. No detailed investigations or design have been carried out.

The following sections in this report further outline the current status and current and near future infrastructure needs for Parihaka.

## 3 ROADS

### 3.1 CURRENT STATUS

The current roads within the Pā are quite narrow, generally with a sealed width not wide enough for cars to pass, and are relatively informal. Some are sealed and others have a gravel (metal) surface. While their widths do not comply with normal land development design codes for new roads in subdivisions, they work well for the current needs. Their narrow width contributes to the sense that this is a place for people – not cars, and as a result vehicle speeds are low and safe.

The PPT decided during the masterplanning process that the road environment within the current Pā is important to its amenity and "feel", and should not be compromised by future growth requiring widening and upgrade to more formal roads. As a result, the masterplan shows new roads accessing future growth areas in Parihaka X land to the north of the Pā to be constructed directly off Parihaka Rd. These roads would mean that most of the new traffic generated by long term growth would not have to travel along the current roads.

To support this, it is intended that visitor traffic will be encouraged to stop at the current entrance at a visitor centre to be built near the entrance, and in the future a visitor carpark would be built on opposite side of Parihaka Rd from the entrance.

Before setting out the maintenance and upgrade requirement for the existing roads we describe their current status. For this report, the roads on site have been numbered as shown on the attached Calibre plan number 707116 Road 01 (Appendix B).

A brief description of each of these sections of road is set out below.

**Section A1:** This section contains the main entrance to the site, up to proposed stage 1 Papakāinga.

Traffic tends to use the entrance to turn around, causing the grass adjacent to the seal to become muddy. There have also been several repairs in this area. Inside the gate the road is narrow, and the berm is higher than the seal, causing water to run on the surface of the road. When cars pass, one must pull off onto the berm causing the ground to become muddy in wet weather.

The surface is generally in good condition.

**Section A2:** This section of road is sealed and has several entrances to dwellings and areas that are used frequently for parking. The berm has become muddy in several areas. Vehicle crossings are not formed. The road is narrow, requiring vehicles to pull onto the berm while passing.

**Section A3** This section is the extension of the main road beyond the main junction point and serves a number of dwellings. The road is sealed but the berms are muddy due to them holding water and vehicles crossing them. Drainage of water once off the road surface in this area is poor due to the flat nature of the ground.

**Section A4:** This section leads from the main junction to a turning/parking area near Te Whiti's monument and Te Paepae o Te Raukura. The sealed surface is generally good except for an area with edge break due to vehicles crossing.

**Section A5:** This road rises from the main junction to the Parihaka X farm to the north. It has an unsealed metal surface, and has several large pot holes holding water near the start.

**Section A6:** This road separates from road A1 about 90m inside the gate. It provides access to two dwellings, and to the rear of Toroanui. The surface is unsealed metal, with the last 20m being lime. The berms on either side of this road are significantly higher and prevent water from running off the road.

**Section A7:** This unsealed section provides access to some elevated house sites off road section A2. It is in poor condition for the first 20m which holds water. The remainder is a metal track with limited metal on it. This road currently only serves one dwelling.

**Section A8:** This section of road is metal track that currently provides access to one dwelling of the north side road section A2. The first part of this section will be upgraded to provide access to some of the stage 1 Papakāinga houses

**Section B1** Currently serving 2 dwellings this road is unsealed and comes directly off Parihaka Road, on the south side of the stream. It is also used by foot traffic crossing the pedestrian bridge to the north side of the stream

There are also other entrances to single dwellings in area B directly off Parihaka Road.

**Area C** on the plan is south of Parihaka Rd and all the houses in this area have access directly from Parihaka Road.

## 3.2 CURRENT NEEDS

The entrance from Parihaka Road is in need of widening to allow for turning vehicles. The surface should also be rebuilt, as it is prone to damage and an asphalt surface would improve the wear properties in this area and reduce the need for maintenance.

Section A1 is in need of removal of the high berm, to allow water to disperse away from the seal. The berm is in need of strengthening to allow vehicles to pass.

Section A2 is in need of the construction of vehicle crossings at all areas that vehicles cross regularly. It also requires the removal of the high berm, and the strengthening of the berm for when vehicles do need to drive onto it.

Section A3 requires improvement to the drainage. The road surface is in need of repair. The berm is in need of strengthening in areas that require traffic to pass.

Section A4 requires construction of a vehicle entrance in the area that has edge break.

Section A5 requires additional metal to fill the potholes and create a road surface that is higher than the adjacent land.

Section A6 requires additional metal to create a road surface that is higher than the adjacent land. There is also the need to have a turning area near the end of this section.

Section A7 needs the soft material removed from the first 20m. There needs to be drainage away from the surface with the addition of a culvert at the low point to allow water to pass from one side to the other. Once this is done the first 20m can be reconstructed with metal. The remainder of the driveway should also have additional metal placed on it.

Section A8 requires additional metal placed on it.

We estimate the above maintenance and improvement works for the existing roads would cost approximately \$100,000.

### **3.3 NEEDS FOR NEXT PHASE OF DEVELOPMENT**

The masterplan indicates that there will be approximately 30-40 new dwellings within the existing Pā boundaries. These are likely to be built before further growth and new roads are developed in Parihaka X land to the north. Further, we understand that there may be an education and administration centre built on the Te Raukura site. This will draw some traffic and a few buses into the main road junction area. These traffic pressures will place some strain on road sections A1 and A2.

There are several options to deal with this.

- 1) Widening the road, in accordance with normal land development road standards. This will allow the best vehicle access to the site with the carriageway width increasing to 6m from the currently 3.5m-4.0m. However as noted above it will alter the amenity of the Pā for people that is highly valued and create a vehicle orientated environment.
- 2) Installing Passing bays. This relies on the curtesy of the drivers to use the Passing bays when they are needed.
- 3) Creating a 1-way system to minimise the need for cars to Pass. This may require signage that will change the current feel of the area.
- 4) Create trafficable areas adjacent to the road surface for cars to pull off with minimal damage to the surface. An example would be Firth Gobi Block and Firth Grass Pavers. These would allow grass to grow through them to maintain the current feel of the area, and allow cars to Pass when needed. This solution could also be used in areas that cars frequently Park.

For the purposes of this report we have allowed to widen the first 90 metres of road section A1 to the junction of road section A6 to allow cars to pass and park near the entrance. The estimated cost of this is \$20,000.

For the balance of road sections A1 and A2 to the main junction, we recommend using option 4 above at a cost of approximately \$40,000 over and above the cost outlined in Paragraph 3.3 above.

Section A4 will need to be upgraded if the Te Raukura development proceeds, however the cost of that upgrade has been allowed for in the separate report provide for that building.

Remaining road sections will require some upgrading if new dwellings or other development occurs along them but that cost needs to be allowed for in the capital works for those projects.

## 4 STORMWATER AND FLOODING

### 4.1 CURRENT STATUS

Waitotara Stream runs through the Pā. Its normal level is some five metres below most of the land and building sites on Parihaka. We are not aware of any evidence that the stream flooding has caused any problems historically. In general, the land to the north of the main entrance road slopes to the north and drains to a different catchment than the Waitotara Stream. The balance of the stormwater falling on the Pā south of the main road drains to the stream, some via the wetland at the eastern edge of the Pā.

There are areas that are low spots within the Pā and are susceptible to ponding. They are:

- behind Te Niho Marae where it appears a stormwater drain pipe has collapsed or is undersized, and there is a need for a sump at the low point to drain water that ponds.
- the main field area papa takaro, has a small culvert crossing the main road. This is at a level that will only receive water after the field is completely flooded and will be of inadequate size to drain the area in that kind of rain event.
- the sump near the entrance to the Pā is receiving water from only one side of the main road while the water from the secondary road is continuing out the gate. It is unknown where this culvert leads.
- the sump on the turning area near Te Whiti's monument is receiving very little water, and the outlet is unknown.
- the driveway to the Mason house on the hill behind Te Raukura, has a low point which may be best served by concreting the driveway in that area to transport water across the surface.

### 4.2 CURRENT NEEDS

Currently there is a need to replace the culvert pipe behind Te Niho. While this is being installed, a field sump should be installed in the centre of the Te Niho area, to allow water to drain from this area. The estimated cost for this is \$30,000.

Most of the other issues noted above can be rectified together with the road upgrade work or as part of future development activities.

### 4.3 NEEDS FOR NEXT PHASE OF DEVELOPMENT

All further stages of development will require consideration of stormwater.

New roads should be constructed to allow stormwater to be managed without ponding. In keeping with the present feel, the use of swales instead of kerb and channel would be desirable with surface water flow toward the existing streams. Where stormwater must cross roads, the use of concrete crossings should be considered. Where this is not desirable or possible, the use of sumps and culverts etc. may be necessary.

## 5 WASTEWATER TREATMENT

### 5.1 CURRENT STATUS

All current buildings on the Pā use individual septic tank or similar wastewater collection from the houses or marae and then to land disposal trenches contained within each building site. For large gatherings portable toilets are sometimes hired for the occasion. We are aware that some septic tanks and disposal fields have been upgraded in recent years to newer designs. The cost of these upgrades is met by each individual householder and we would estimate that an upgrade would cost approximately \$15,000.

The soil conditions around Parihaka are slow draining and in winter the water table is high so the current systems require large land areas around each of the buildings to cater for the wastewater treatment land disposal fields. At present the requirement for these large land areas for disposal fields is not an issue because of the low number of houses within the Pā.

Calibre have not carried out individual assessments of each treatment system so is unable to advise how many are functioning adequately, but it is reasonable to assume that some are not and there is a risk of some overflow and contamination of stormwater in heavy rainfall events. It is likely that some systems have not been maintained adequately



or are at the end of their life and their owners cannot afford to upgrade them. There is a risk of soil and water contamination as a result.

## 5.2 CURRENT NEEDS

Currently Parihaka is experiencing growth pressure on its wastewater treatment system from two sources. More people want to live there, and more people are visiting, more often. If these pressures were not happening the current individual on-lot systems would be adequate as long as they are maintained and upgraded when required. This will eventually require most of the existing dwellings on the Pā to upgrade their systems with a collective expenditure in the order of \$400-500,000.

Current planning is underway to build six new dwellings, shown on the masterplan as stage 1 Papakāinga and we are aware that there may be a few other people planning to build houses in the near future. A small community waste treatment system has been designed that incorporates a central wastewater collection chamber followed by low pressure pumped effluent to ground disposal on the sloping land on the north side of the reservoir mound. The land area available and the soil dispersal characteristics can only support 6-10 houses, so this system is only an interim solution to allow the stage 1 Papakāinga and a few other houses to be developed.

## 5.3 NEEDS FOR NEXT PHASE OF DEVELOPMENT

Over the next five years Parihaka is planning for a further 30-40 houses, a conference and administration centre, a visitor information centre near the Pā entrance, and possibly an assisted living centre.

There is insufficient land within the current Pā boundary to accommodate any community owned central wastewater treatment system, and if the current individual on-lot systems are to be used for new houses, there is only room for about 15-20 new homes. The masterplan assumptions are for 30-40 new dwellings within the Pā, which prevents the use of on-lot individual house treatment systems

The implementation of the masterplan relies on use of Parikaka X land for both long term housing growth and for wastewater treatment.

This growth will require a new community owned wastewater treatment system to the north of the current Pā in Parihaka X land the likely area for this is shown on the Plan in Appendix C. The wastewater treatment system needs to provide for a high level of treatment and outcomes in terms of human and environmental health risks, and be as much in keeping as possible with Māori cultural and spiritual concerns. It needs to be able to deal with significant fluctuations in load and have simple operation and maintenance needs.

In collaboration with NIWA's Chris Tanner, we have proposed individual or cluster on-site modern septic tanks fitted with effluent filters with effluent pumped to a treatment area away to north in Parihaka X. Treatment will be to tertiary standard and then discharge to created habitat wetland.

There is a need to consider some flow buffering for dealing with large events, plus contingency use of portaloos if/when numbers get above design loadings.

The current marae and existing houses would be connected to this system and their current land disposal fields would be decommissioned.

It needs to be reiterated that Parihaka X's cooperation to allow the waste-water treatment system to be constructed on its land is a precondition of any further growth in accordance with the masterplan, including development of the proposed multipurpose education and administration building.

Total estimated cost of this waste water treatment system to cater for the full 30-year masterplan development is in the order of \$8-9million. However, construction of the system can be staged and our estimate for the first stage to cater for approximately 30 new dwellings, the education/admin centre, three maraes and connect the existing houses, is \$2.5 – 3 million.

## **6 WATER SUPPLY**

### **6.1 CURRENT STATUS**

PPT have advised that the water supply source for Parihaka Pā is from a spring (puna) that is approximately 4.5 km towards the mountain located within the property of the Bolland farm. The Papakāinga have a verbal agreement with the Bolland family for water use and land access. There is no documented legal agreement that protects this supply.

The spring water quality is of a consistently high standard. The pipeline then runs through the property of the Parihaka X farm land with some stock water usage which is shared. The pipe initially is 80 mm reducing down to 50 mm and passes through a Pressure Reducing Valve (PRV) due to the high pressure that is generated by the considerable elevation difference.

We estimate the supply pipe capacity is approximately half a litre per second, or approximately 43,000 litres(L) per day. We have not undertaken any monitoring of the flow rate from the spring, nor the pipe as it arrives at Parihaka, so these assumptions will need to be confirmed, but are sufficient for the purposes of this report.

When it arrives at the Papakāinga water flows up the hill to the reservoir, which is a 75,000 L concrete under-ground storage tank, which provides gravity feed to the Papakāinga. There is a second reservoir of 2,000,000 L which is open, concrete lined and surrounded by a secure child proof fence.

Water then gravitates via underground pipes to the Papakāinga reticulation via a UV Treatment system. Most places within the Pā are approximately 15 metres below the reservoir so have adequate pressure for low pressure household fittings but some of the houses on the higher ground will require domestic pumps to boost pressure.

### **6.2 CURRENT NEEDS**

Based on water use of 250L per person per day, the current puna supply is sufficient for approximately 170 permanent residents or about 55 dwellings.

Based on a storage requirement of 500L/per person the current 75,000L concrete underground reservoir is capable of serving approximately 150 people. There is a normal population on the Pā of about 75 people (25 houses @ 3 persons/house). Given that there is also the 2,000,000L reservoir in reserve, the water supply and storage capacity is more than adequate for the current use. The large reservoir also serves as a source of water for firefighting.

There is also adequate storage for the occasional large event.

The biggest risk in the current system is the security of supply as the PPT has no enforceable legal right to take water from the puna, nor any easement over the pipeline between the puna and the Pā. Nor is it clear if there is a resource consent requirement to take the water. These matters need to be investigated, formalised and legally documented.

We estimate the surveying, legal, planning and project management costs of this to be approximately \$30,000.

### **6.3 NEEDS FOR NEXT PHASE OF DEVELOPMENT**

The current puna water supply is capable of supplying the needs of the Pā for the next five years based on the masterplan assumptions for growth, provided that the supply can be legally secured. Once the population exceeds about 170 people there will be a need to increase the potable water supply. If the puna is capable of increasing the water take it would be possible to increase or duplicate the existing pipe. An alternative would be to locate a bore-water supply closer to the Pā within Parahaka X land. A bore-water supply delivering sufficient supply for foreseeable future growth would cost between \$70-100,000 and would likely be less expensive than duplicating the pipe from the current puna.

Another alternative supply is to capture and store rainwater. This is a viable and sustainable option to be considered at the same time as other alternative supply options.

The current total storage capacity of the two reservoirs would appear to be sufficient for the foreseeable future needs based on the masterplan assumptions. The large 2,000,000L reservoir is not covered, so is open to dust and bird

dropping contamination. So while there is sufficient storage, the water quality of the large reservoir needs to be secured for it to be certain to be of potable water quality. We know the PPT have considered covering this and this will be required to provide sufficient potable water storage sometime in the next stage of growth, but our assessment is that this is not needed until the number of permanent residents reaches approximately 150 estimated to be in about 5 years' time.

PPT have obtained one estimate of \$145,000 but we believe there may be more cost effective options to achieve this.

## **7 ELECTRICITY**

### **7.1 CURRENT STATUS**

The network electricity company have recently replaced the 60 ka transformer on the Pā to 100kva. Until that occurred the old transformer was barely sufficient.

There is anecdotal information that some of the electricity connections from the “public” electricity infrastructure to existing houses is not adequate and potentially a safety risk. For the purpose of this report Calibre has considered any issues of this nature will be identified by the assessments being undertaken of the buildings by others, and any upgrade costs to rectify deficiencies will be included in those building upgrade reports by others.

### **7.2 CURRENT NEEDS**

The new 100kva transformer means that the current electricity needs of the Pā are being met.

### **7.3 NEEDS FOR NEXT PHASE OF DEVELOPMENT**

Massey University are currently carrying out a study to determine the renewable energy resources available within Parihaka and Parihaka X land. This includes studies on wind, solar and mini-hydro. They are also undertaking demand analysis on the Pā and plan to report on recommendations for future energy options later in 2016.

Parihaka have a goal to be capable of being independent of the grid and with high levels of energy sustainability. Until Massey have provided their report it is not possible for Calibre to provide cost implications. It is likely that new dwellings will incorporate solar energy systems and high levels of passive energy design.

We estimate the new 100kva transformer network supply will be adequate for up to 40-50 houses in total – so for 3-5 years. We have been advised that if the medium term future electricity needs are to be met by the existing network the cost is approximately \$100,000 per each 40 new houses, plus the cost of upgrading the power lines if that is required.

## **8 COMMUNICATIONS**

### **8.1 CURRENT STATUS**

The current landline telephone network accommodates the existing houses and could cater for an additional 1 or 2 sites. Mobile telephone reception is available but mobile data speeds are slow. Current data needs are being met by the recently installed community owned wireless broadband system. We understand this system relies on wireless units in each of the three marae. There is also some communications plant shared with Parihaka X.

The current Rural Wireless Broadband which is available on site from Spark costs \$95.99/month for internet, or \$105.99/month including phone.

### **8.2 CURRENT NEEDS**

The needs are generally being met by the existing systems although there are some instances of degraded connectivity.

## 8.3 NEEDS FOR NEXT PHASE OF DEVELOPMENT

If future growth requires broadband fibre connections, Chorus estimate those costs to be:

- 10 connections: POA \$619,700 ex GST
- 100 connections: POA \$662,936 ex GST
- 300 connections: POA \$795,356 ex GST
- The ongoing cost is likely to be a monthly rental of \$74.99/month to \$94.99/month.

The economics suggest that Parihaka continue to use the Rural Wireless Broadband until there are 100 dwellings using this system, then re-evaluate, based on the technology available at that time.

We have assumed that there is no capital cost to further upgrade the Rural Wireless Broadband but have included the improved functionality is an annual operations and maintenance cost in our cost summary.

## 9 NEXT STEPS

This report has been prepared to provide an understanding of the current status of horizontal infrastructure at Parihaka.

We have then provided our assessment of what could be done to improve the infrastructure to a sustainable level for the existing residents. And then we have assessed what the future needs will be to enable the Parihaka masterplan to be implemented over the next 5 years or so, and what are the operations and maintenance costs.

We have also provided our assessment of what activities we consider to be the priorities. These need discussion and confirmation with PPT and funders.

When it is confirmed what elements funding is to be allocated for we recommend that full investigations, consultation with Parihaka to confirm the assumptions made in this report, and preliminary design be carried out to enable the costs estimated in this report to be confirmed. At that stage, a final decision to proceed with that element be confirmed based on the updated estimate.

Calibre is happy to answer any questions anyone may have about the content of this report and can provide further detail on how the costs have been derived if required.

We look forward to assisting where we can to implement the activities outlined above and in continuing our advisory role to PPT for infrastructure masterplanning.

## APPENDICES

**APPENDIX A   MASTERPLAN**





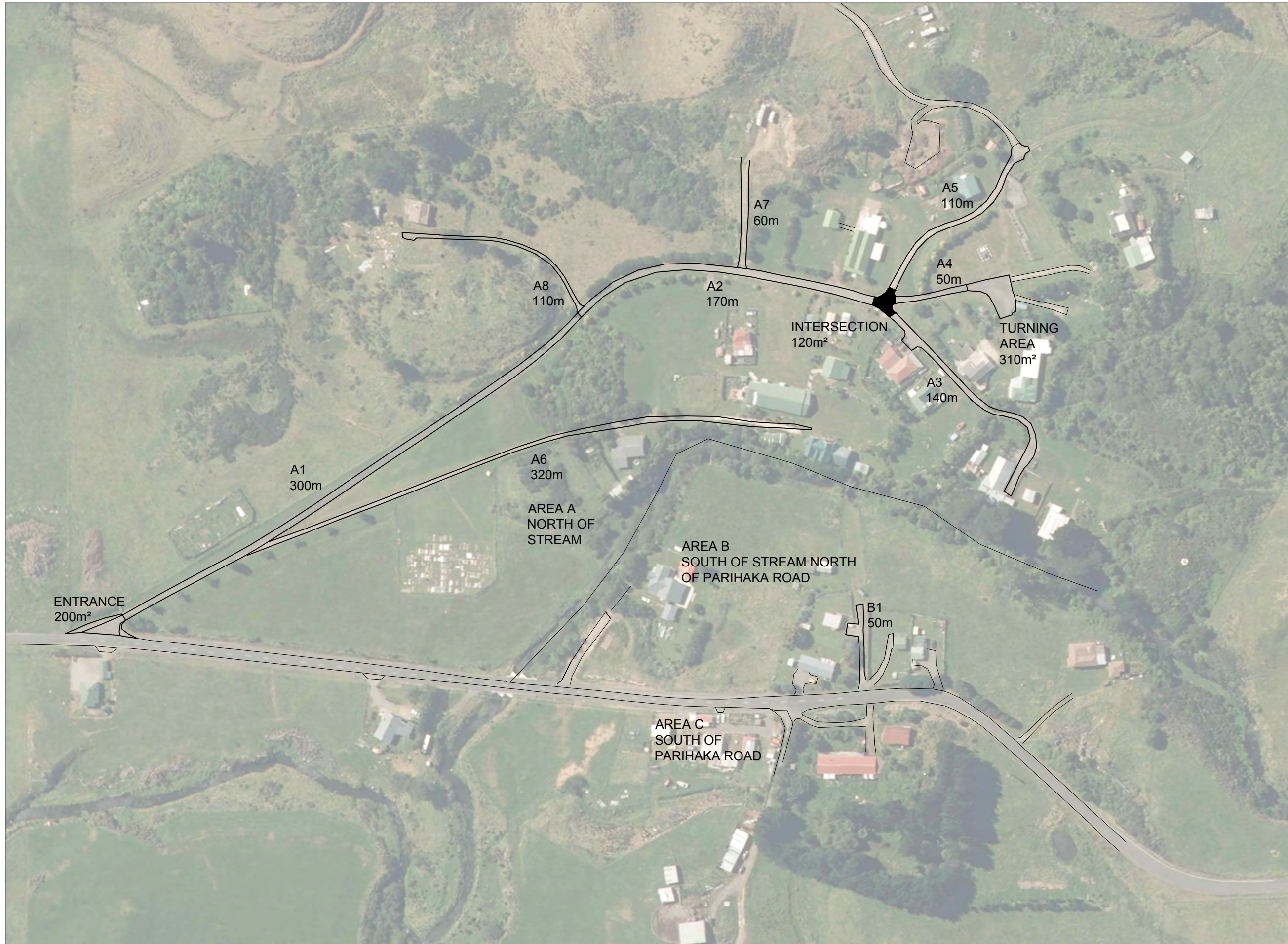
designTRIBE

REVISION	DATE	NOTES
1		NOTE: DO NOT SCALE FROM DRAWING. USE FIGURED DIMENSIONS ONLY. CHECK ALL DIMENSIONS ON SITE BEFORE ANY MANUFACTURING OR CONSTRUCTION.
PROJECT NAME <b>Parihaka</b>		
PROJECT ADDRESS <b>Parihaka Pa</b>		
CLIENT <b>Parihaka Papakainga Trust</b>		
DRAWING SHEET <b>Area master plan</b>		
DRAWING NUMBER <b>Master planning</b>		
PROJECT #	14010	DWG #
SCALE @ A1	1:1000	DATE
DRAWN	DT	CHKD
design TRIBE Architects LTD 553 Richmond Rd. Grey Lynn		
PO Box 47311, Parnell, Auckland, NEW ZEALAND		
T: (09) 3765075 F: (09) 3765043 W: www.designtribe.co.nz		
E: office@designtribe.co.nz		



**APPENDIX B ROAD PLAN**





Revision	App	Date
Surveyed		
Designed		
Drawn	HL	08/2016
Reviewed		
Approved		



Verify all dimensions on site before commencing work. Prioritise figured dimensions over scaling. Refer all discrepancies to Calibre.  
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Client  
**PARIHAKA  
PAPAKAINGA  
TRUST**

Project Title  
**PARIHAKA  
INFRASTRUCTURE  
ASSESSMENT**

Sheet Title  
**EXISTING ROAD  
LAYOUT**



Scale ( A3 Original ) 1:

**SCALE AS NOTED**



Project No                      Sheet                      Revision


707116                      ROAD 01                      0



**APPENDIX C   PLAN OF WASTEWATER TREATMENT AREA**







A First Issue

Revision	App	Date	Approved
BDG	19/08/16	08/16	BDG
PCV	19/08/16	08/16	PCV
BDG	19/08/16	08/16	BDG

Client

**PARIHAKA  
PAPAKAINGA  
TRUST**

Project Title

**PARIHAKA  
MASTER PLANNING**

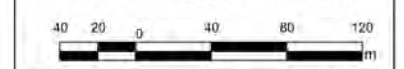
Sheet Title

**PROPOSED WASTEWATER  
TREATMENT**

Level 13  
Kordia House  
109-125 Willis Street  
Wellington 6011  
+64 4 384 2029  
calibreconsulting.co



Scale (A1 Original) 1:2000 (A3) 1:4000



Project No 707116 Sheet P03 Revision A



