ENGEO

Expect Excellence

Geotechnical and Environmental Due Diligence Review to Support Plan Change Application

Drury Metropolitan Centre Plan Change

Drury

Auckland

Submitted to:

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13.08.2019
13451.000.000_20

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Project No.	13451.000.000	Doc ID	20	
Client	Kiwi Property Group Ltd	Client Contact	Elizabeth D	
Distribution (PDF)	Kiwi Property Group Ltd			
Date	Revision Details/Status	WP	Author	Reviewer
21/12/2018	DRAFT	JT	DCB/AI	PF
07/02/2019	DRAFT	DF	DCB/AI	EM
11/02/2019	FINAL	DF	DCB/AI	EM
13/08/2019	Issued to Client - Final	DF	DCB/AI	EM

1 Introduction

This report has been prepared to inform the Drury East Metropolitan Centre Plan Change on behalf of Kiwi Property Group Limited (Kiwi). The boundary of the Plan Change area is marked in red on the plan included in Appendix 1.

The Plan Change area is approximately 95 hectares and is located to the south of the existing Drury Local Centre and Light Industrial area on Great South Road. The Plan Change area has frontage to Fitzgerald Road to the east, Brookfield Road to the south, Flanagan Road to the west, and Waihoehoe Road to the north. Kiwi Property currently own 52 ha of land within the plan change area as shown in Figure 1. All other properties within the wider Plan Change area are owned by various parties. The Plan Change area is primarily used for farming, with some residential activity.

The site is situated in close proximity to Great South Road and State Highway 1, currently accessible via Waihoehoe Road. The railway line is located to the immediate north of the site, however there is currently no train station servicing Drury. The western extent of the Plan Change area is traversed by the Hingaia Creek.

The Plan Change area is currently zoned Future Urban under the Auckland Unitary Plan. Kiwi Property are seeking to rezone the land to a mix of Metropolitan Centre, Mixed Use and Open Space – Informal Recreation.

The scope of work includes summarising previous intrusive work undertaken on parcels of the overall site combined with a desktop review and perimeter walkover of the remaining parcels.

2 Scope of Work

Our due diligence investigation for the site comprised the following:

- Review of published geotechnical and geological information, as well as publicly available information contained in Auckland Council's GeoMaps database.
- Review of historical aerial photographs available in the Auckland Council GeoMaps database and other publically available databases.
- Site walkover inspection by a contaminated land specialist to visually assess the potential for the site to have accommodated or currently be accommodating activities on the Ministry for the Environment's (MfE's) Hazardous Activities and Industries List (HAIL; MfE, 2011c).
- Preparation of this report presenting our findings and providing guidance on future work that may be required to address the preliminary identified geotechnical and environmental constraints at the site. This report is not intended to be used to support applications for Auckland Council Consent or to support subdivision and earthworks design.

At this stage our work does not include (1) geotechnical design of ground stabilisation or improvement measures that may be required, (2) preliminary or detailed environmental site investigations (PSI / DSI) which will likely be required to comply with the requirements of the NES, or (3) consulting during the developed design and construction phases.

3 Background Information

3.1 Published Geology

The majority of the site is mapped by GNS (Institute of Geological and Nuclear Sciences) as being within the South Auckland Volcanic Field (SAVF) and being predominantly underlain by early Pleistocene aged basalt lava of the Kerikeri Volcanic Group. These deposits are described as fine-grained and coarse-grained, porphyritic, olivine basalt, basanite and hawaiite lava flows. Volcanic air fall deposits comprising weathered silts, sands and gravels with occasional basalt cobbles overlie the lava flows.

The northern and western edges of the site are mapped as Puketoka Formation alluvial soils of the Tauranga Group sedimentary lithology. The soils generally comprise light grey to orange brown pumiceous silt, sand and gravel with lenses of muddy black peat and lignite. Puketoka Formation soils are expected to underlie the volcanic deposits across the balance of the site, with Waitemata Group bedrock at depth.

A geological map with the proposed plan change boundaries is shown in Appendix 2.

3.2 Seismicity

The Auckland area is one of the least seismically active regions in New Zealand. Over the last 150 years, only two earthquakes with magnitudes greater than M5 have been recorded in the region.

We have reviewed the GNS New Zealand Active Fault Database, which indicates there are no known active faults on-site. The nearest active fault is the Wairoa North Fault located approximately 13.4 km east of the site. The Wairoa North Fault dips at approximately 60 to 70 degrees to the west with a vertical slip rate of approximately 0.1 mm / year. GNS have not established a recurrence interval and date for the last event at the Wairoa North Fault.

Nearby inactive faults include the Glenbrook Fault, Waiau Fault, Drury Fault and Hunua Fault which are located within approximately 5 km of the site.

3.3 Volcanic Activity

The SAVF is located approximately 40 km south of Auckland City and is centred around the Manukau Lowlands, extending over 300 km to the Hunua Ranges in the east, Waikato River valley in the south, and Waiuku in the west. The SAVF comprises over 97 subaerial volcanic centres, and the majority of these volcanoes are monogenetic with phreatomagmatic and effusive eruptions creating scoria cones, basaltic lava flows, maars and tuff rings.

The eruption history of the SAVF is known to date from 0.5 and 1.6 million years ago with peak volcanic activity between 0.6 and 1.3 million years before present. This volcanic field is considered extinct and SAVF derived volcanism is unlikely to pose a risk to future developments.

4 Existing Work Packages

ENGEO has previously undertaken a number of due diligence level work packages to support the Drury Development Project which are listed below:

- Geotechnical and Environmental Due Diligence Investigation, 133 Fitzgerald Road, Drury, Auckland, ref. 13451.000.000_05, dated 25 January 2017.

- Geotechnical and Environmental Due Diligence Investigation, 120 Flanagan Road, Drury, Auckland, ref. 13451.000.000_06, dated 3 February 2017.
- Geotechnical and Environmental Due Diligence Investigation, 44 Flanagan Road, Drury, Auckland, ref. 13451.000.000_10, dated 18 July 2017.
- Geotechnical and Environmental Due Diligence Investigation, 64 - 66 Flanagan Road, Drury, Auckland, ref. 13451.000.000_09, dated 18 July 2017.
- Slope Stability Assessment for Western Slopes, 133 Fitzgerald Road, Drury, Auckland, ref. 13451.000.000_12, dated 22 December 2017.

These reports were prepared to inform Kiwi Property of the geotechnical and environmental conditions present within the boundary indicated in blue on the plan included in Appendix 1.

5 Existing Work Packages

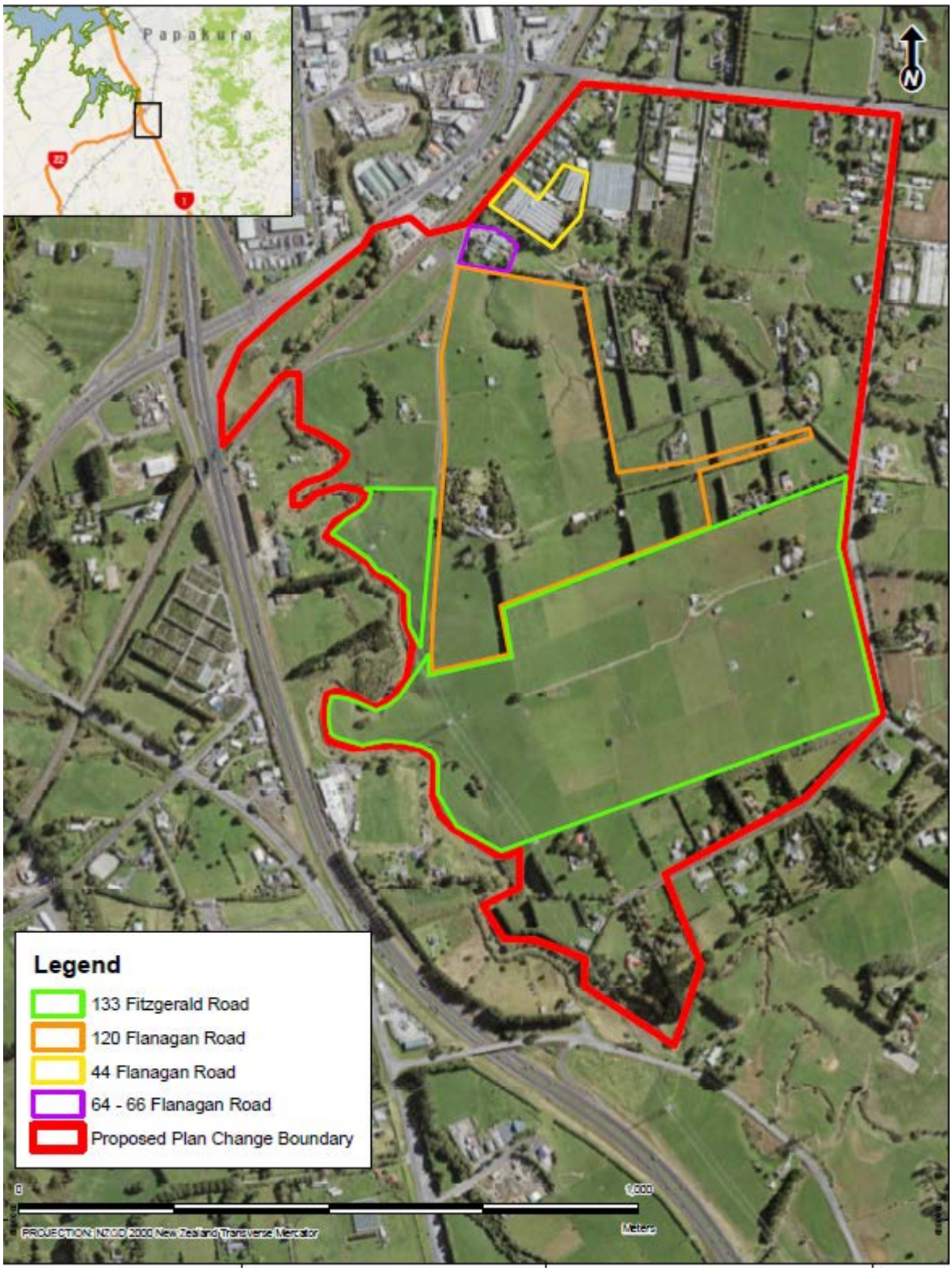
5.1 Geotechnical Discussion

ENGEO has undertaken a total of 44 hand augers boreholes and 6 machine boreholes over the following land parcels:

- 133 Fitzgerald Road
- 120 Flanagan Road
- 44 Flanagan Road
- 64 – 66 Flanagan Road

The location of these land parcels is shown below with reference to the overall plan change area.

Figure 1: Existing Work Packages Lot Identification Plan



Not to scale.

Materials encountered in our subsurface investigations are broadly consistent with published mapping and are interpreted to comprise South Auckland Volcanic Field (SAVF) basaltic air fall (tuff and ash) deposits with weathered basalt lava flows at depth in the central and southern portion of the site. Puketoka Formation alluvium was encountered both underlying SAVF deposits and at ground surface in the northern portion of the site. No evidence of intact basalt lava flows was encountered, with materials recovered as soil across the full depth of the investigations undertaken to date.

5.1.1 133 Fitzgerald Road

Near surface soils (upper 5 m) across the central and eastern portions of the site were found to comprise inorganic silts and clays, typically very stiff to hard. Pre-existing fill was not encountered at any of our borehole locations. Soils below 8 m depth in machine boreholes BH01 and BH02 (eastern portion of site) predominantly comprise weathered basalt and volcanic air fall deposits with a high gravel component that, if exposed in future cuts, may be difficult to earthwork. The near surface soils in the western portion of the site, and to the full depth of machine borehole BH03, were found to contain significant proportions of basalt gravel and cobbles.

Laboratory testing undertaken at 133 Fitzgerald Road indicate that the near surface soils are likely to be highly to extremely expansive, and contain low levels of allophane clay minerals.

Groundwater levels were measured at or below 13 m across the site, however, perched groundwater and / or groundwater springs may be encountered in deep cuts, particularly in the vicinity of the shallow gully-type depression features.

5.1.2 120 Flanagan Road

Near surface soils (upper 5 m) across the site were found to typically comprise inorganic silts and clays that are typically very stiff to hard. With the exception of locations where pre-existing fill was identified, these soils should be generally suitable for use in conventional earthworks operations and in which to found future buildings. However, expansive soils and allophane clay content considerations will apply.

The deeper soils encountered in borehole BH04 comprised silty gravel derived from weathered basalt below 6.7 m depth

Alluvium comprising clays, silts and sands with occasional organic clay or peat layers is present within the northern portion of the site, and underlying the volcanic soils in the central gully area. Localised soft and organic deposits in the vicinity of creeks and tributaries should also be anticipated.

Groundwater was recorded at 11.8 m below the ground surface in borehole BH04 at the most elevated portion of the site, and between 2.5 m and 3.5 m below the ground surface in boreholes drilled in or adjacent to, the northern and central gully features.

5.1.3 Western Slopes – 133 Fitzgerald Road / 120 Flanagan Road

The western slopes on which a main road alignment is proposed, slope towards Hingaia Stream in the west at angles between 5 and 20 degrees. The slopes are locally steeper where they form the stream embankment, rising to 25 degrees or greater.

The Hingaia Stream meanders on a north-south alignment at the toe of the slope, and evidence of toe erosion through active stream processes was observed during our site walkover. The prevailing landform across the slope is defined by a series of broad, undulating slopes with subtle spurs extending east-west from the dominant north-south ridgeline at the eastern extent of the study area.

The broad geomorphic site features are shown on Figure 2.

The Hingaia Stream delineates the western extent of the study area. A series of short, shallow tributary gullies were observed on the eastern side of the stream, extending into the toe of the western slopes. These features were observed to be shallow, with over-steepened flanks and swamp-type hydrophilic vegetation in the base. Surface water was not observed, but is likely to be present in winter months during periods of persistent rainfall.

Soil creep was observed on some steep slopes (typically greater than 18 degrees) in the form of soil ridges and terracing, and had locally been exacerbated by stock movements.

Over-steepened stream banks were observed on the western side of the stream, with evidence of local slumping occurring, which is inferred to be associated with stream erosion of the toe of the embankment. Sub-vertical stream banks were not observed on the eastern side of the stream within the study area, though not all portions of the stream could be accessed at the time of our walkover assessment.

A shallow headscarp approximately 30 m wide was observed in the northern portion of the study area, adjacent to a bend in the stream where active stream erosion is occurring. The crest of the headscarp extends approximately 25 m upslope from the stream edge.

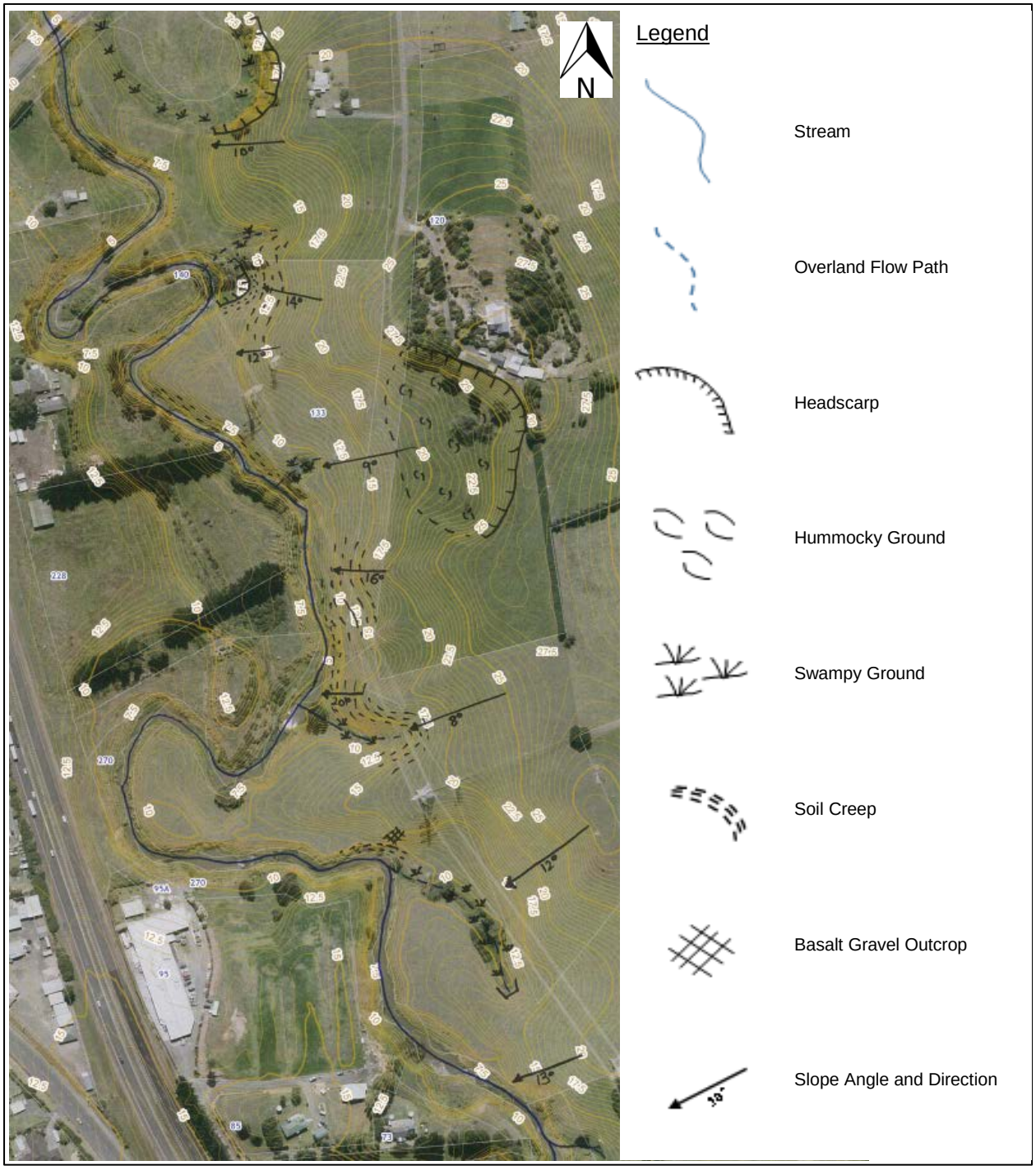
A large headscarp measuring approximately 150 m wide was observed adjacent to the dwelling at 120 Flanagan Road, extending to the south on the flank of the ridge. The land below the scarp is broad and hummocky over approximately 100 m length, beyond which it slopes at approximately 9 degrees towards Hingaia Stream. No evidence of tension cracks, consecutive headscarps or groundwater springing was observed in the vicinity of this feature.

A rubbly basalt outcrop was observed in a track cutting on the southern side of the east-west lobe that offsets the stream in the southern portion of the study area. The cutting exposed rounded basalt gravel, cobbles and boulders in a weakly cemented, fine grained matrix. This lobe is inferred to be part of the ancient lava flow mapped across the site.

Aside from the features mapped below, no other significant geomorphic features were observed on the western slopes within the study area. The undulating slopes do not appear to be presently subject to slope instability beyond the areas of creep and toe erosion identified.

With few exceptions, the absence of pronounced, large-scale instability features suggests that the landform is inherently stable with episodic soil creep and small rotational failures likely to occur as a result of loss of toe support and elevated groundwater levels.

Figure 2: Geomorphological Map of Western Slopes



Base image sourced from Auckland Council GIS. Not to scale.

Ground conditions encountered during these investigations were broadly consistent with the mapped geology for the area, comprising a mantle of volcanic clays, silts and sands to depths of between 6.5 m and 8.0 m below the ground surface. Highly to completely weathered basalt gravel was encountered below the volcanic soils in the machine boreholes, which were drilled near the crest of the western slopes. Borehole BH04 penetrated the basalt gravel layer and encountered alluvium below 16.9 m depth, comprising clay overlying silty sand. This material extended beyond the base of the borehole.

5.1.4 44 Flanagan Road

The material encountered in our subsurface investigations is broadly consistent with published mapping and is interpreted to be Puketoka Formation soils.

Pre-existing, undocumented fill was encountered to depths between 0.5 m and 1.1 m across the majority of the site and up to 3.1 m depth at hand auger borehole location HA04.

Measured standing water levels between 1.1 m and 1.2 m depth suggest groundwater levels may be locally perched within the cohesive near surface soils.

5.1.5 64 – 66 Flanagan Road

The material encountered in our subsurface investigations is broadly consistent with published mapping and is interpreted to be Puketoka Formation soils.

Pre-existing, undocumented fill was encountered to depths between 0.4 m and 1.4 m across the site.

Measured standing water levels between 0.9 m and 1.5 m depth suggest groundwater levels may be locally perched within the cohesive near surface soils.

5.2 Environmental Discussion

ENGEO has undertaken a site walkover and limited environmental investigations of the following land parcels:

- 133 Fitzgerald Road
- 120 Flanagan Road
- 44 Flanagan Road
- 64-66 Flanagan Road

A review of the findings can be found below.

5.2.1 133 Fitzgerald Road

The environmental scope of work comprised a sampling programme to provide an initial indication of the risks that may affect a future development at the site.

The following was undertaken during the soil sampling works:

- Collection of six shallow soil samples to investigate the presence of horticultural contaminants including heavy metals and organochlorine pesticides (OCPs). Sample locations were positioned to provide a spread across the site.

- Collection of eight surface soil samples to investigate the presence of asbestos fibres, placed around the dwelling and in areas of potential fill (i.e. the farm race).
- Soil samples for chemical analysis were compressed directly into new laboratory supplied containers using a new pair of nitrile gloves for each sample – for asbestos analysis, soil samples were double-bagged in plastic zip-close bags.
- All soil samples were screened for visual and olfactory evidence of contamination during sample collection by a trained and experienced technician.

Human Health Criteria

All of the heavy metal and OCP results for the sampled soils are below the adopted human health criteria.

Asbestos was found in one of the eight samples analysed (collected from a farm race). Millboard comprising chrysotile (white) asbestos was detected; however, the concentration was below the adopted human health criteria (New Zealand Guidelines for Assessing and Managing Asbestos in Soil – BRANZ, 2017)

The results of this investigation indicated that the site may be suitable for residential or commercial redevelopment without remediation or management of soil to address human health concerns.

Regional Discharge Criteria

All of the heavy metal and OCPs results for sampled soil are below the adopted regional environmental discharge criteria (i.e. permitted activity criteria).

The results of this investigation indicated that discharge consents are unlikely to be required for the redevelopment earthworks or on an on-going basis. However, a PSI and / or DSI will be required to confirm these results.

Background Concentrations

With three exceptions (cadmium, chromium and lead), all heavy metal concentrations were below regional background levels for volcanic soils. The exceedance of cadmium, lead, and chromium in one sample were only marginally above the regional background level.

The results of this investigation indicated that shallow site soils in some areas of the site may not be considered “cleanfill” based on the definition in the Auckland Unitary Plan (AUP; AC, 2016). Therefore, this material would not be suitable for off-site disposal as cleanfill or re-use on another earthworks site. Testing may be performed to assess whether a portion of excess site soil can be considered cleanfill.

Based on the site investigation and observations, no activities listed on the MfE’s HAIL (MfE, 2011c) have been identified, however there is some indication that the near surface soils on-site may have been impacted to a minor degree (i.e. marginally above regional background levels in the Auckland region) or the elevated concentrations may be due to natural regional variations. We consider the site at 133 Fitzgerald Road to likely be suitable for residential or commercial redevelopment. However, a consent under the NES may be required to support the redevelopment earthworks due to the low level contaminants present on-site.

5.2.2 120 Flanagan Road

This site investigation did not include a contaminated land assessment. Although no obvious evidence of contamination was observed during the site walkover (e.g. waste products, stained soil, bare soil patches, odours), a possible offal pit or other fill area was in the north-eastern corner of site. Additionally, undocumented fill was observed in several locations across the site during the geotechnical investigation (e.g. culvert stream crossings and adjacent to the tractor shed). It is possible that this fill contains contaminants and should be investigated as part of a contaminated land assessment to support resource consent for site redevelopment. There is also a possibility for other potentially contaminating activities to have taken place historically or currently be taking place in areas of the site not observed during the geotechnical investigation.

Based on our site investigation and observations for the neighbouring property (133 Fitzgerald Road), it was concluded that the 120 Flanagan Road property is likely suitable for residential or commercial redevelopment. However, additional environmental investigation studies, in line with contaminated land guidelines and legislative requirements, will be required to support this conclusion and for the NES resource consent application.

5.2.3 64-66 Flanagan Road

ENGEO visited the site on 5 July 2017. A summary of our site observations is provided below.

- The northern portion of the site (No. 64 Flanagan Road) is relatively flat, with a steep northern slope that descends to the stream on the northern boundary, and a steep southern slope that ascends to the residential property to the south. The majority of the site is occupied by two large workshops. The larger building to the east is primarily used as a storage / workshop area, and the smaller building to the east, as a workshop.
- The southern portion of the site (No. 66 Flanagan Road) is moderately sloping from Flanagan Road toward the centre of the site. The central area occupied by the residential dwelling and rear garden is relatively flat, and slopes gently down to the southern boundary, at the southernmost end of the site.
- The site is bound to the north by a meandering stream, which was noted to be moderately turbid during the site walkover. The banks of the stream were eroded and showed signs of instability. The southern boundary intersects a gully, which is assumed to be the stream observed in historical aerial photography. No surface water was observed in the gully.
- During the site walkover, the current site occupier, Steve Gould (Zenith Horse Floats), noted that:
    - Zenith Horse Floats have occupied the site for the past three years. The workshop buildings have been empty for approximately 30 years prior.
    - The site has historically been used for storage of fertilisers, evidenced by the five concrete bays observed inside the main workshop building.
    - The residential dwelling was constructed in the 1990's.
    - The workshop buildings are currently used for the repair of horse floats and storage of various other miscellaneous items including vintage carriages. No significant volume of chemicals or fuels are stored on-site.

  - The 200 L empty resin drums present at the front the site were not used on-site, and had been left by a customer.

- All buildings, driveways and fencing on-site is generally in good condition. A manhole was observed in the eastern portion of the site; the service associated with this manhole was not clear.
- Surface water was observed in areas of low lying ground, and was noted to be clear with no obvious indication of potential contamination.
- The main workshop building at No. 64 Flanagan Road contained various building materials and equipment including vintage carriages, forklift, ride-on mower, gas cylinders, fridges, tyres, signs, furniture, polystyrene, timber, scrap metal, cars, trucks, and tools. The small workshop contained a truck, benches and tools.
- The driveways and floor of the main warehouse at No. 64 Flanagan Road were constructed of compacted gravel, and the floor of the smaller workshop was concrete hardstand. No evidence of contamination was observed (e.g. waste products, stained soil, bare soil patches, odours).
- 20 L fuel containers were observed in the main warehouse, however those inspected were empty and no staining or odours were observed.
- No asbestos containing material (ACM) was observed at the surface of the site, however there is potential for ACM to be present in the site building materials (note that an asbestos survey of site buildings was not performed).
- No potential contamination sources were identified at No. 66 Flanagan Road.

5.2.4 44 Flanagan Road

ENGEO visited the site on 5 July 2017. A summary of our site observations is provided below.

- The site is bound to the east and south by a creek at the property boundary, to the north by residential properties, and to the west by Flanagan Road.
- The site is generally flat with a moderately steep mixed gravel fill slope along the north-eastern boundary and small (approximately 1.5 m), moderately steep slopes to the creek level. Additionally, mounds of soil were observed to the east of the southernmost greenhouse.
- The site currently consists of two greenhouses used by a commercial flower and vegetable grower (Beyond Rose Garden Limited), as well as a mixed use residential and workshop building.
- A workshop used for storage of building materials and machinery is located approximately at the centre of the southern greenhouse. The workshop has a concrete floor, with no obvious staining or cracking.
- Two above ground storage tanks are located adjacent to the southern greenhouse. The larger of the two tanks (approximately 25,000 L) is located on the outside of the greenhouse. The smaller tank (approximately 10,000 L) is housed in a shed adjoining the greenhouse. Both tanks were positioned on top of a concrete pad and may have historically contained fuel.

- During the site walkover, an employee of Beyond Rose Garden Limited noted that:
    - Beyond Rose Garden Limited has occupied the site for more than five years. Prior to this, the site was used for commercial rose growing.
    - The workshop area adjoining the residential dwelling is primarily used for the processing of flowers prior to them being dispatched.
    - Approximately two years ago, the greenhouses were renovated, and fibreglass roofs were replaced with plastic sheeting.
    - The two large tanks on-site were not used by the current occupier, however he was not aware of what they had previously been used for or whether they were now empty.
    - The intermediate bulk containers (IBCs) observed on-site, were used to mix fertilisers prior to spraying.
- Scrap corrugated metal and fibreglass was noted around the greenhouses. In some areas, the fibreglass sheets appeared to be melted into the underlying soil.
- All buildings, driveways and fencing on-site is generally in good condition.
- Surface water was observed in areas of low lying ground, and was noted to be clear with no obvious indication of potential contamination.
- No evidence of significant contamination was observed (e.g. waste products, stained soil, bare soil patches, odours). Some darker areas were noted on the concrete hardstand beneath the refilling points of the large tank on the outside of the building. Bonfire residue was observed at the western end of the site.
- No ACM was observed at the surface of the site, however there is potential for ACM to be present in the residential building materials (note that an asbestos survey of site buildings was not performed).
- Agrichemical containers and fertiliser were observed in the greenhouses, workshop and around the external areas of the greenhouses, however, they appeared to be of a relatively benign nature and no staining or odours were observed.

Based on a review of historical aerial photographs, the greenhouses on-site were constructed after organochlorine pesticides (e.g. DDT) were banned in New Zealand. Additionally, no obvious evidence of significant contamination was observed during the site walkover (e.g. waste products, stained soil, bare soil patches, odours). However, it is possible that one or more activities listed on the Ministry for the Environment's (MfE's) Hazardous Activities and Industries List (HAIL; MfE, 2011c) have occurred on-site. The two large tanks on-site may have historically contained fuel, and a number of agrichemical containers were observed. Additionally, undocumented fill was observed in several locations across the site during the geotechnical investigation. It is possible that this fill contains contaminants and should be investigated as part of a contaminated land assessment to support resource consent for site redevelopment. There is also a possibility for other potentially contaminating activities such as persistent pesticide application to have taken place prior to construction of the greenhouses on-site.

We consider the site at 44 Flanagan Road to likely be suitable for residential or commercial redevelopment. However, some targeted remediation of site soil (e.g. around tanks) may be required.

6 Supplementary Work

ENGEO has been provided an expanded project area (i.e. “the site”), which was defined previously as the area within the red boundary but outside the blue boundary shown on the figure in Appendix 1.

6.1 Geotechnical Considerations

Landform within the additional land parcels are characterised by rolling hills generally similar to the sites characterised by our intrusive investigations. Reviewing the GNS geological maps the additional parcels to the south are interpreted to be SAVF basaltic air fall (tuff and ash) deposits with weathered basalt lava flows at depth. While the additional parcels to the north are mapped to be consistent with the Puketoka Formation alluvium encountered in the west and north of the investigated sites.

A northwest trending gully is present within the most northern area of the broader plan change area. This gully has over steepened sides and it should be anticipated that localised soft and organic deposits may be present in the base of this gully.

No significant scarps of signs of instability were observed during our perimeter walkover. While we expect there may be some localised areas of shallow instability, a review of the aerial and topographical maps do not indicate any areas of large scale instability. A detailed geomorphological walkover followed with site specific investigation will be required to confirm site specific parameters and conditions to support the development of a proposed concept plan.

6.2 Environmental

6.2.1 Historical Aerial Photographs

Aerial photographs of the site dating from 1942 to 2016 have been reviewed (refer to Appendix 4). The relevant visible features are summarised in Table 1. Note that the northern and southern portions of the site are discussed separately below.

Table 1: Aerial Photograph Review

Date	Description
1942	North: The site is predominantly pastoral land. Several buildings are identified; at least four residential buildings are present in the northeast portion of the site, as well as buildings associated with rail activities in the northwest. The majority of which coincide with the current day building locations (i.e. commercial buildings along the northeast boundary). A meandering stream cuts across the site from west to east. South: The site is predominantly pastoral land. One building is present near the southeast boundary. The surrounding land use is of a similar nature with low-density residential housing and pastoral land.

Date	Description
1960	North: Four farm dwellings / buildings are now present on the northeast boundary. South: No significant change to land use. No significant change to surrounding land use.
1981	North: No significant change to land use. South: No significant change to land use. Commercial / industrial development has occurred on the surrounding land to the north of site, as well as additional residential lots to the northeast of site. Three greenhouses have been added to land on the southwest boundary.
1996	North: Pastoral land use still occupies the majority of the land. Pastoral land in the northeast corner of site has been converted to residential land. Large commercial warehousing as well as multiple residential properties occupy the northwest portion of site. A timber yard occupies land along the northwest boundary. Several mixed land use (commercial / residential) properties are along the western boundary. South: Formal pastoral land has been subdivided for residential land use. Higher density commercial / industrial buildings have been constructed on the surrounding land northwest and east of site.
2003/4	North: No significant changes to the site barring further subdivision for residential land use in the north – northeast of site. South: No significant change to land use. No significant change to surrounding land use barring an extension to commercial / industrial land east of the site as well as further subdivision of pastoral land as well as the greenhouses along the southwest boundary being removed.
2010/2011	North: No significant change to land use. South: No significant change to land use. No significant change to surrounding land use.
2016	North: No significant change to land use. South: No significant change to land use. No significant change to surrounding land use barring further subdivision of pastoral land for residential land use.

6.2.2 Site Walkover

An ENGEO environmental scientist visited the site on 10 December 2018. A summary of our site observations is provided below. Photographs from the walkover can be found in Appendix 3. Note that due to limited access, ENGEO were only able to view the site from site boundaries.

- The northern portion of the site is relatively flat, with slopes that descend to the stream which runs from the northwest to the northeast. The majority of this portion of the site is occupied by large commercial buildings which appear to be used for greenhouse activities as well as former pastoral land subdivided for residential land use.
- Carters Timber Yard occupies land near the northwest boundary of site. As access was relatively limited during the walkover, it was difficult to tell whether or not the timber was treated.
- The western portion is primarily gently sloping followed by a steep drop to the stream that runs north-south along the eastern boundary (of western portion) of the site. Two residential and two commercial / industrial properties that appeared to be used as timber and steel workshops occupy land in the western portion of site.
- A rail line and small rail buildings run northeast to southwest along the northwest boundary.
- A stockpile (approx. 20 m^3) of fill material was identified adjacent to the commercial buildings in the western portion of site.
- The southern portion of site is former pastoral land which has been subdivided for residential land use. The site slopes gently to the south. One burn pit was identified in the southeast paddock.
- During the site walkover, the resident of 133 Fitzgerald Road, Anne Flanagan, noted that:
    - Shelter belts planted in the northeast portion of site were not for sheltering market gardens.
    - The southern portion of site was formally a dairy farm.
    - An irrigation bed was constructed within the western portion of site by the Tegel Factory which boarders the south-western boundary.
    - Stevensons quarry to the southeast of site had once been audited for silt discharge to the stream which runs through the site.
- All buildings, driveways and fencing on-site is generally in good condition.
- No ACM was observed at the surface of the site, however there is potential for ACM to be present in the site building materials (note that an asbestos survey of site buildings was not performed).

7 Discussion

7.1 Geotechnical

Due diligence geotechnical investigations have been performed for the land parcels associated with:

- 133 Fitzgerald Road
- 120 Flanagan Road
- 44 Flanagan Road

- 64 – 66 Flanagan Road

The additional land parcels being considered within the wider plan change area are observed to have similar landforms as those above with no obvious significant geotechnical hazards observed.

We would expect that the ground conditions encountered would be similar to that which has been encountered throughout the land parcels which intrusive work has been undertaken in line with the GNS geological maps. Localised soft and organic deposits in the vicinity of creeks and tributaries should also be anticipated. These soils can be prone to consolidation settlement under fill and building loads, as well as having the potential to liquefy under seismic loading. Identification and consideration of these soft soils should be undertaken when necessary in areas proposed for development.

Based on the laboratory testing undertaken on 133 Fitzgerald Road, it is likely the future buildings founding in soils at or near to the existing surface will be subject to specific foundation design to counteract shrink / swell behaviour in the upper 1 m of the soil profile, and specific structural measures such as control joints may be required to accommodate seasonal ground movement. Future buildings in cut or fill areas that differ significantly from the existing ground levels will be subject to further testing at design ground levels to confirm the expansive site class and what design measures, if any, are required for foundation design in those areas.

Allophane clay soils require careful handling by an experienced earthworks contractor as they have a tendency to lose their strength when subject to excessive traffic or overworking during fill compaction. However, the allophane content of the soils tested appears to be low (generally less than 7%), so this is not anticipated to be a significant issue. Further testing should be performed to confirm allophane concentrations at the site.

Future geotechnical work at the site will include a detailed subsurface exploration of the additional land parcels and areas yet to be investigated to support design of all earthworks and development concepts. This may include, but is not limited to additional hand augers, machine boreholes, CPTs and test pits including additional laboratory testing of soil samples to provide parameters for earthworks design.

Based on the available information, we consider that the proposed plan change area - including the area shown in Appendix 1 is generally suitable for a future residential and commercial development.

7.2 Environmental

Due diligence environmental investigations have been performed for the land parcels associated with:

- 133 Fitzgerald Road
- 120 Flanagan Road
- 44 Flanagan Road
- 64 – 66 Flanagan Road

Based on the available information, we consider that the proposed plan change area is generally suitable for a future residential and commercial development.

However, additional environmental investigation studies, in line with contaminated land guidelines and legislative requirements, will be required to support this conclusion and for the NES resource consent application. At a minimum, a PSI will be required. If it can be confirmed that contamination risks are low, no further sampling may be required. If this cannot be demonstrated, or if required by Auckland Council, additional sampling to complete a full DSI for the site may also be required to support site redevelopment. Areas that are likely to require further investigation include (but not limited to):

- Locations of asbestos pipes (e.g. soil sampling following removal).
- Farm races (to confirm that significant asbestos containing material has not been placed to form the tracks).
- Commercial / industrial buildings identified as timber and steel workshops.
- Stockpiled fill material in the western portion of site.
- Rail lines and associated rail buildings along the northwest boundary.
- Former dairy farm areas in the northern and southern portions of site.
- Burn pits identified in the southern portion of site.
- Workshops / implement sheds / buildings associated with farming activities.
- Irrigation bed identified in the western portion of site.
- Possible contamination within the stream bed in the northern portion of site from Stevenson's Quarry.
- Site boundaries with adjacent horticulture activities (to investigate the potential for spray-drift).
- Possibility of former farm dumps / landfill areas.

Also note that, prior to demolition of any buildings on-site constructed pre-2000, an asbestos survey is required under current NZ health and safety regulations.

8 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Kiwi Property Group Ltd, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.

ii. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it should be appreciated that actual conditions could vary from the assumed model.

iii. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.

iv. This Limitation should be read in conjunction with the Engineers NZ/ACENZ Standard Terms of Engagement.

v. This report is not to be reproduced either wholly or in part without our prior written permission.

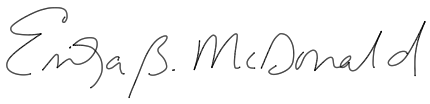
We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (09) 972 2205 if you require any further information.

Report prepared by

Andrew Ireland

Staff Environmental Scientist

Report reviewed by



Erika McDonald, CMEngNZ

Associate Environmental Engineer

Report prepared by

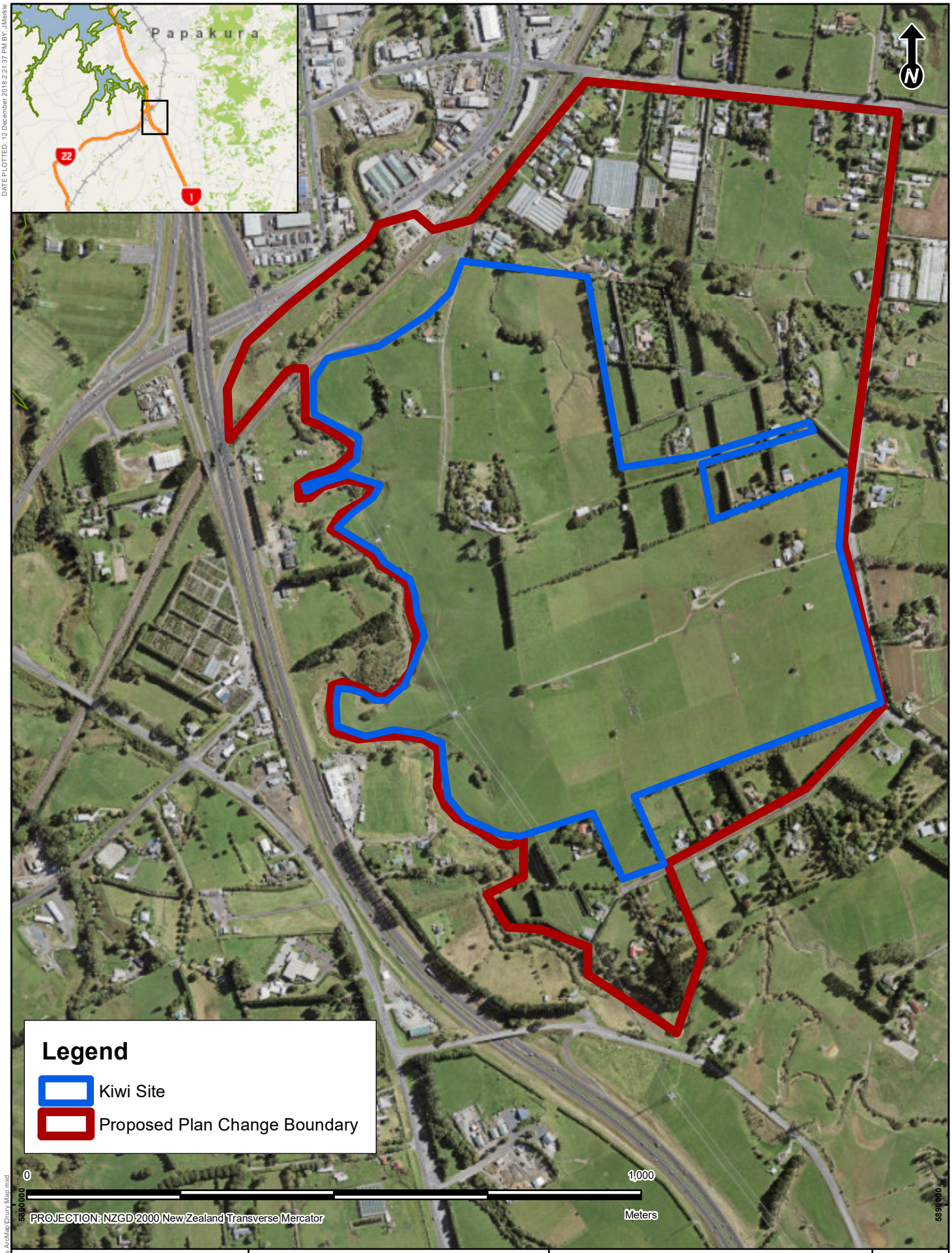
David Brodie

Senior Geotechnical Engineer

APPENDIX 1:

Drury Development Project Plan Change Boundaries – Aerial Map

DATE PLOTTED: 12 December 2018 2:21:37 PM BY: JMerkle



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ENGEO
Auckland Office
8 Greydene Place, Rosedale
Auckland 0622, Tel: 09 972 2205

Title: Drury Development Project Plan Change Boundaries - Aerial Map

Client: Kiwi Property Group Ltd

Project: Drury Development Project

Designed: DCB
Drawn: JM
Checked: DCB
Date: Dec 18

Figure No: 1

Size: A4

Proj No: 13451.000.000

Scale: 1:8,031

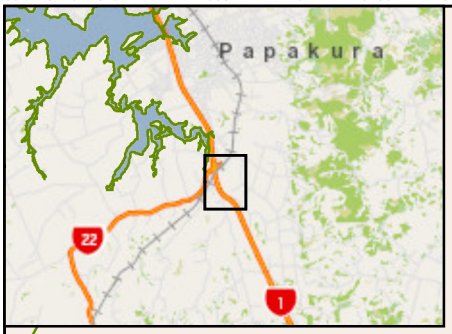
Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

APPENDIX 2:

Drury Development Project Plan Change Boundaries – Geological Map

DATE PLOTTED: 20 December 2018 2:40:02 PM BY: JMerkle



N

Legend

- Kiwi Site
- Proposed Plan Change Boundary

Geology

- Puketoka Formation
- South Auckland Volcanic Field

5890000

5890000

0 1,000

Meters

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

PATH: C:\Users\JMerkle\Desktop\Drury ArcMap\Geology Drury.mxd

ENGEO
Auckland Office
8 Greydene Place, Rosedale
Auckland 0622, Tel: 09 972 2205

Title:

Drury Development Project Plan Change Boundaries - Geological Map

Client: Kiwi Property Group Ltd

Project: Drury Development Project

Designed: DCB
Drawn: JM
Checked: DCB
Date: Dec 18

Proj No: 13451.000.000

Scale: 1:8,530

Figure No: 1

Size: A4

Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

APPENDIX 3:

Site Photographs

Pump Station on NW Boundary

Farm Buildings along western boundary

Farm Land along Western Boundary

Farm Land along Western Boundary

Farm Land along Western Boundary

Farm Race along Western Boundary

Farm Land along Western Boundary

ENGEO
Expect Excellence

Date	Dec - 18	**Client**	Blue Barn
Drawn by	AI	**Project**	Drury Due Diligence
Approved by	EM	**Description**	Northwest Portion of Site – Photographs
Scale (approx.)	NTS	**ENGEO Ref.**	13451.000.000

Farm Land along Western Boundary

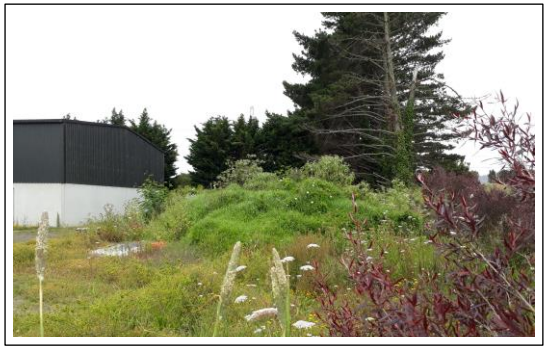
Irrigation Bed along Western Boundary

Irrigation Bed along Western Boundary

Commercial Building along Western Boundary

Commercial Land along Western Boundary

Commercial Building along Western Boundary



Stockpiled Material along Western Boundary

Commercial Building used for Timber and Steel Work

Commercial Land along Western Boundary

ENGEO
Expect Excellence

Date	Dec - 18	**Client**	Blue Barn
Drawn by	AI	**Project**	Drury Due Diligence
Approved by	EM	**Description**	Western Portion of Site - Photographs
Scale (approx.)	NTS	**ENGEO Ref.**	13451.000.000

Farm Land in Northeast Portion of Site

Farm Land in Northeast Portion of Site

Farm Land in Northeast Portion of Site

Farm Land in Northeast Portion of Site

Farm Land in Northeast Portion of Site

ENGEO
Expect Excellence

Date	Dec - 18	**Client**	Blue Barn
Drawn by	AI	**Project**	Drury Due Diligence
Approved by	EM	**Description**	Northeast Portion of Site - Photographs
Scale (approx.)	NTS	**ENGEO Ref.**	13451.000.000

Farm Land in Southern Portion of Site

Farm Land in Southern Portion of Site with Burn Pit in Foreground

Farm Land in Southern Portion of Site

Farm Land in Southern Portion of Site with Residential Dwelling in Foreground

Farm Land in Southern Portion of Site with Residential Dwelling in Foreground

Farm Land in Southern Portion of Site with Residential Dwelling in Foreground

Left & Right: Farm Land in Southern Portion of Site

Right: Farm Land in Southern Portion of Site with Residential Dwelling in Foreground

ENGEO
Expect Excellence

Date	Dec - 18	**Client**	Blue Barn
Drawn by	AI	**Project**	Drury Due Diligence
Approved by	EM	**Description**	Southern Portion of Site - Photographs
Scale (approx.)	NTS	**ENGEO Ref.**	13451.000.000

APPENDIX 4:

Historical Aerial Photographs

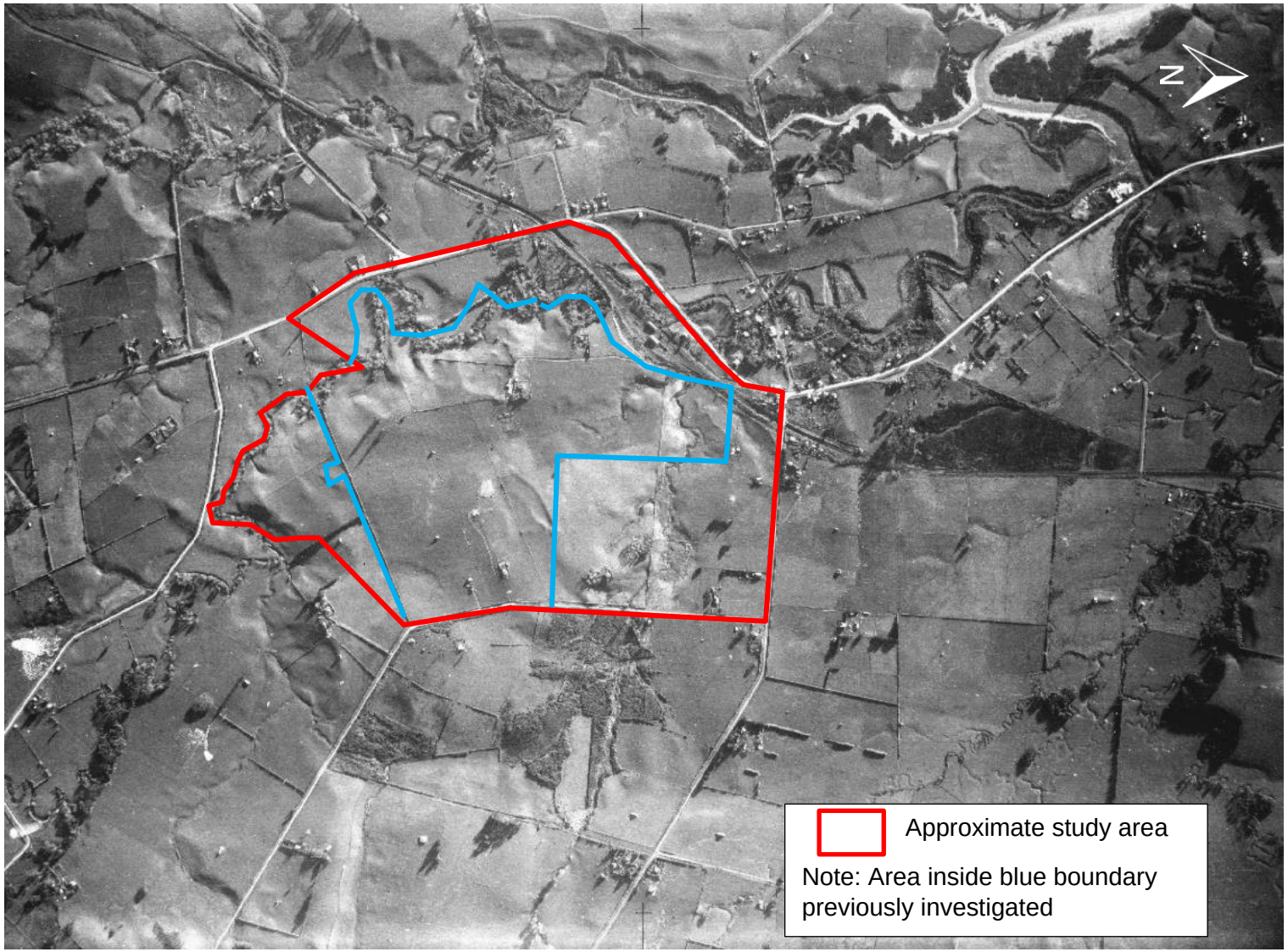


Image sourced from Retrolens

ENGEO
Expect Excellence

Date	Dec-18	**Client**	Blue Barn Limited
Drawn by	AI	**Project**	Drury Plan Change – Due Diligence
Approved by	EM	**Description**	Aerial Photograph - 1942
Scale (approx.)	Not to scale	**ENGEO Ref.**	13451.000.000

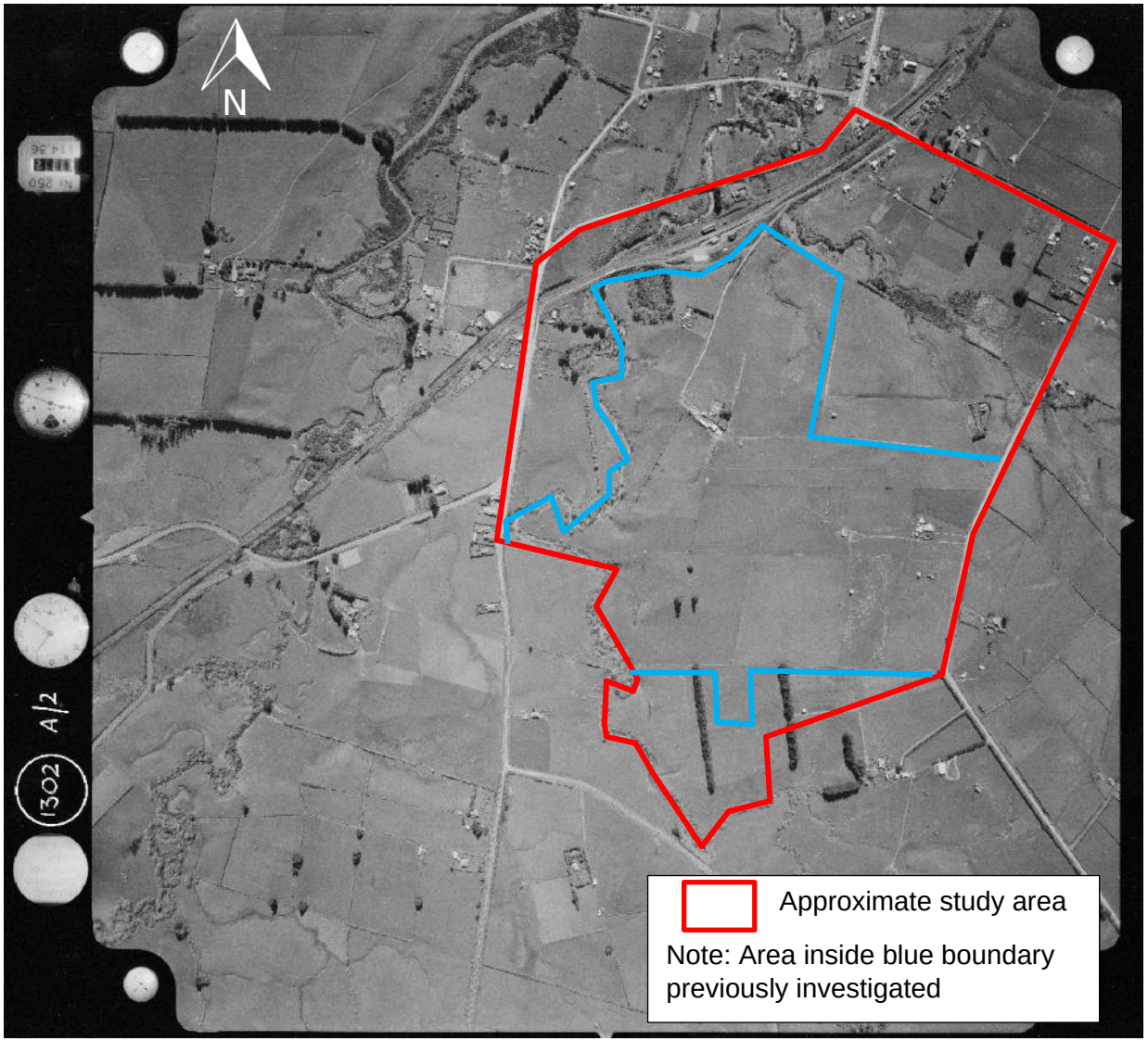


Image sourced from Retrolens

ENGEO
Expect Excellence

Date	Dec-18	**Client**	Blue Barn Limited
Drawn by	AI	**Project**	Drury Plan Change – Due Diligence
Approved by	EM	**Description**	Aerial Photograph - 1960
Scale (approx.)	Not to scale	**ENGEO Ref.**	13451.000.000

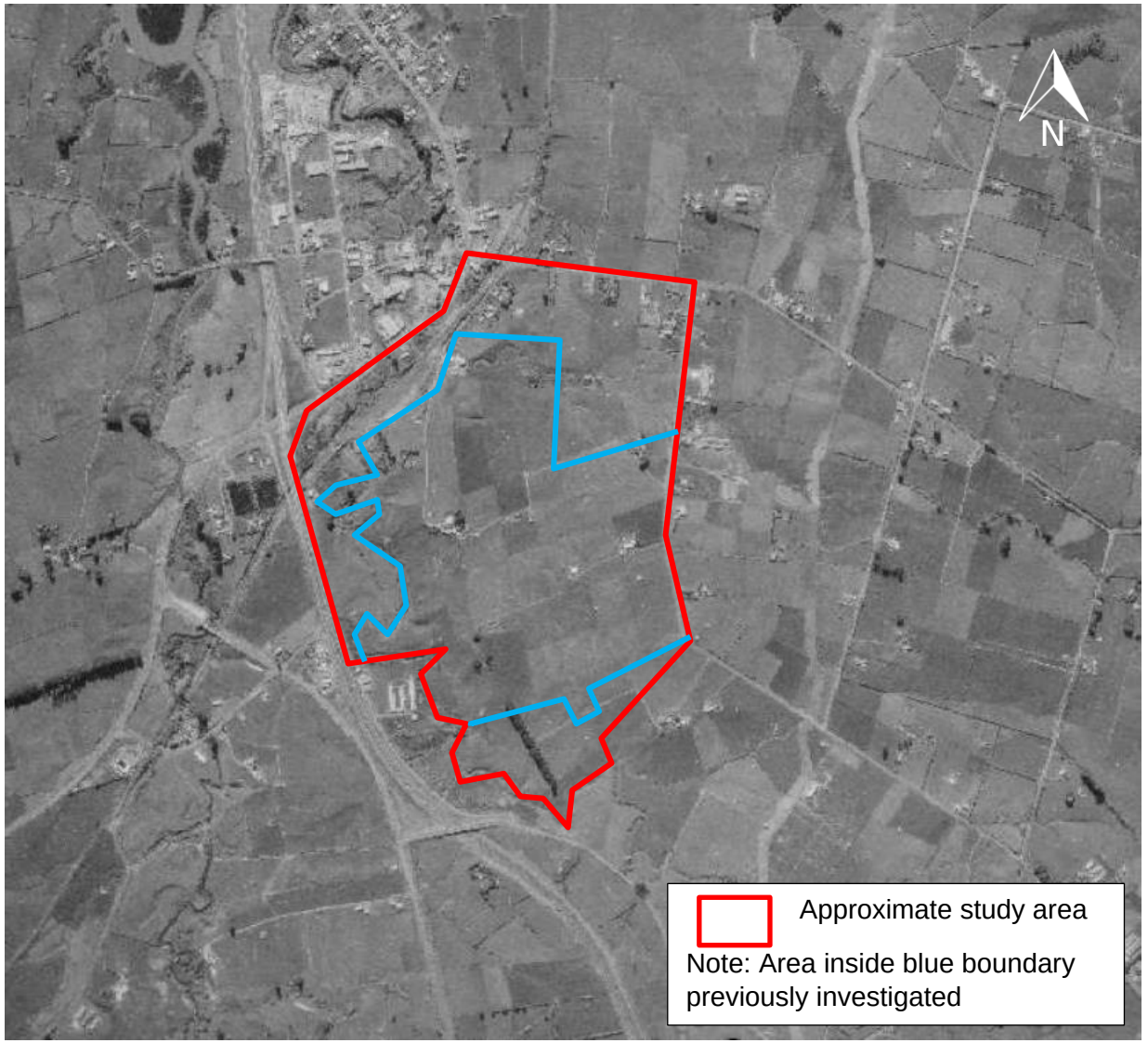


Image sourced from Retrolens

ENGEO
Expect Excellence

Date	Dec-18	**Client**	Blue Barn Limited
Drawn by	AI	**Project**	Drury Plan Change – Due Diligence
Approved by	EM	**Description**	Aerial Photograph - 1981
Scale (approx.)	Not to scale	**ENGEO Ref.**	13451.000.000

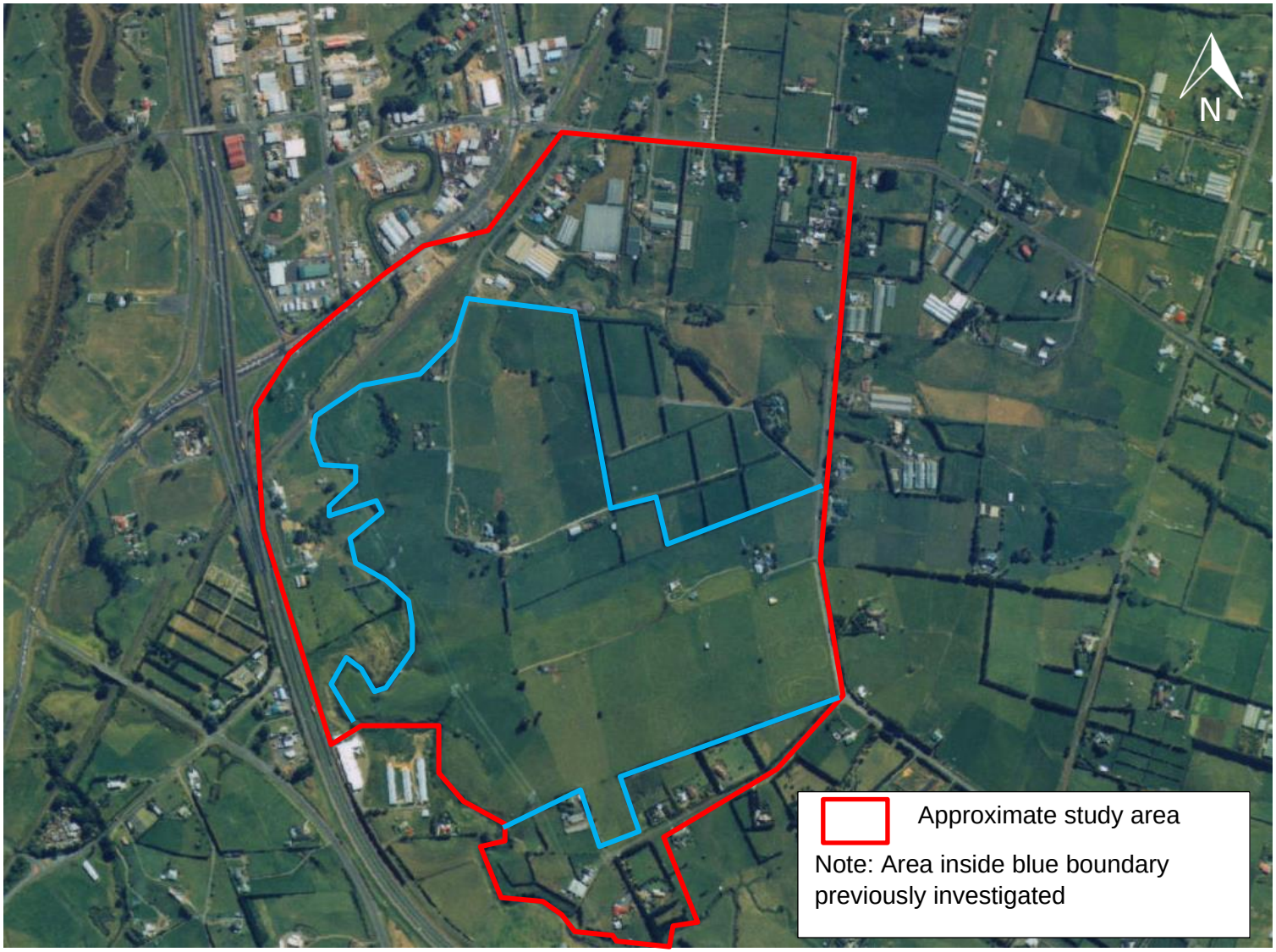


Image sourced from Auckland Council GIS Viewer

ENGEO
Expect Excellence

Date	Dec-18	**Client**	Blue Barn Limited
Drawn by	AI	**Project**	Drury Plan Change – Due Diligence
Approved by	EM	**Description**	Aerial Photograph – 1996
Scale (approx.)	Not to scale	**ENGEO Ref.**	13451.000.000

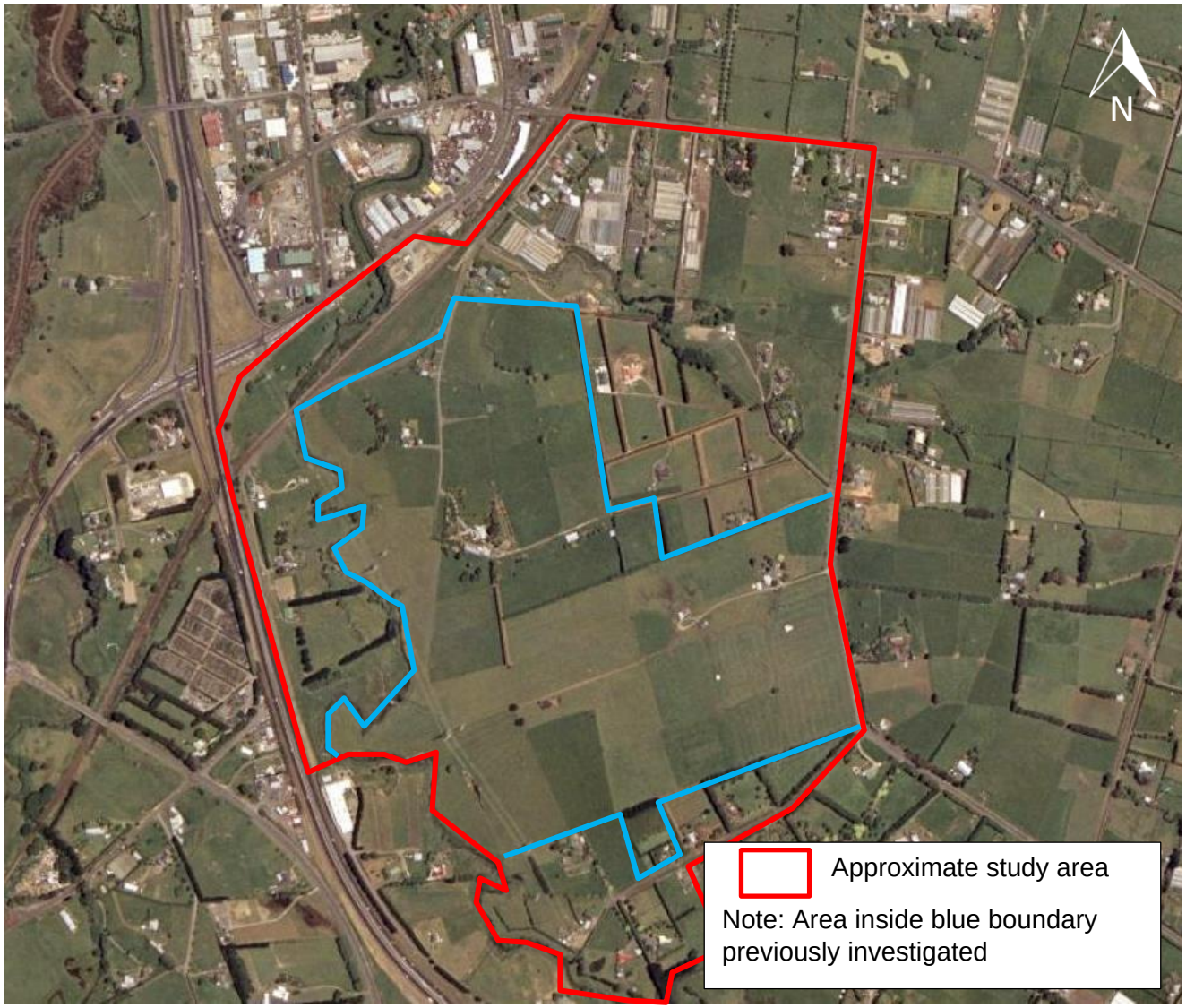


Image sourced from Auckland Council GIS Viewer

ENGEO
Expect Excellence

Date	Dec-18	**Client**	Blue Barn Limited
Drawn by	AI	**Project**	Drury Plan Change – Due Diligence
Approved by	EM	**Description**	Aerial Photograph – 2003/4
Scale (approx.)	Not to scale	**ENGEO Ref.**	13451.000.000

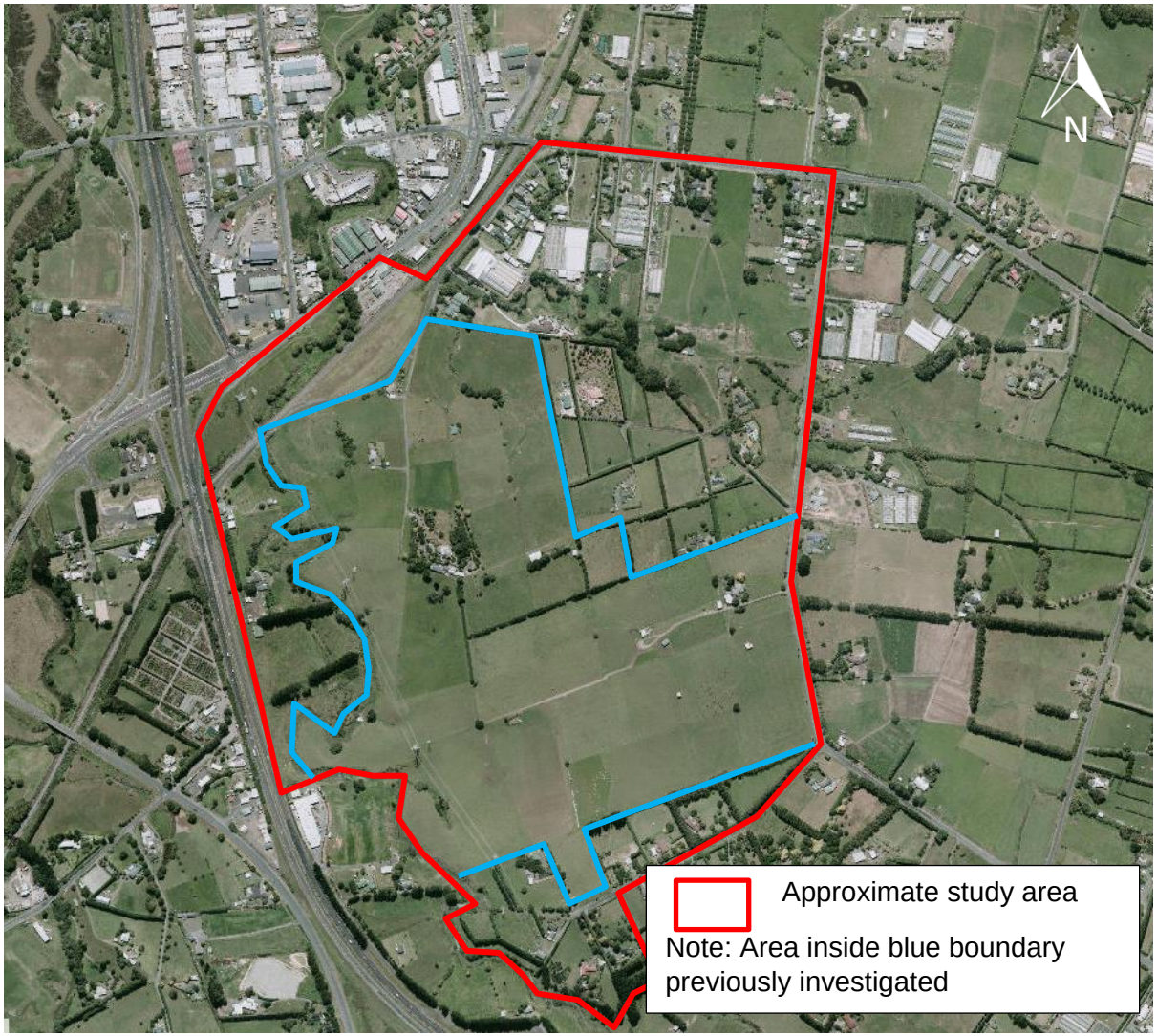


Image sourced from Auckland Council GIS Viewer

ENGEO
Expect Excellence

Date	Dec-18	**Client**	Blue Barn Limited
Drawn by	AI	**Project**	Drury Plan Change – Due Diligence
Approved by	EM	**Description**	Aerial Photograph – 2010/2011
Scale (approx.)	Not to scale	**ENGEO Ref.**	13451.000.000

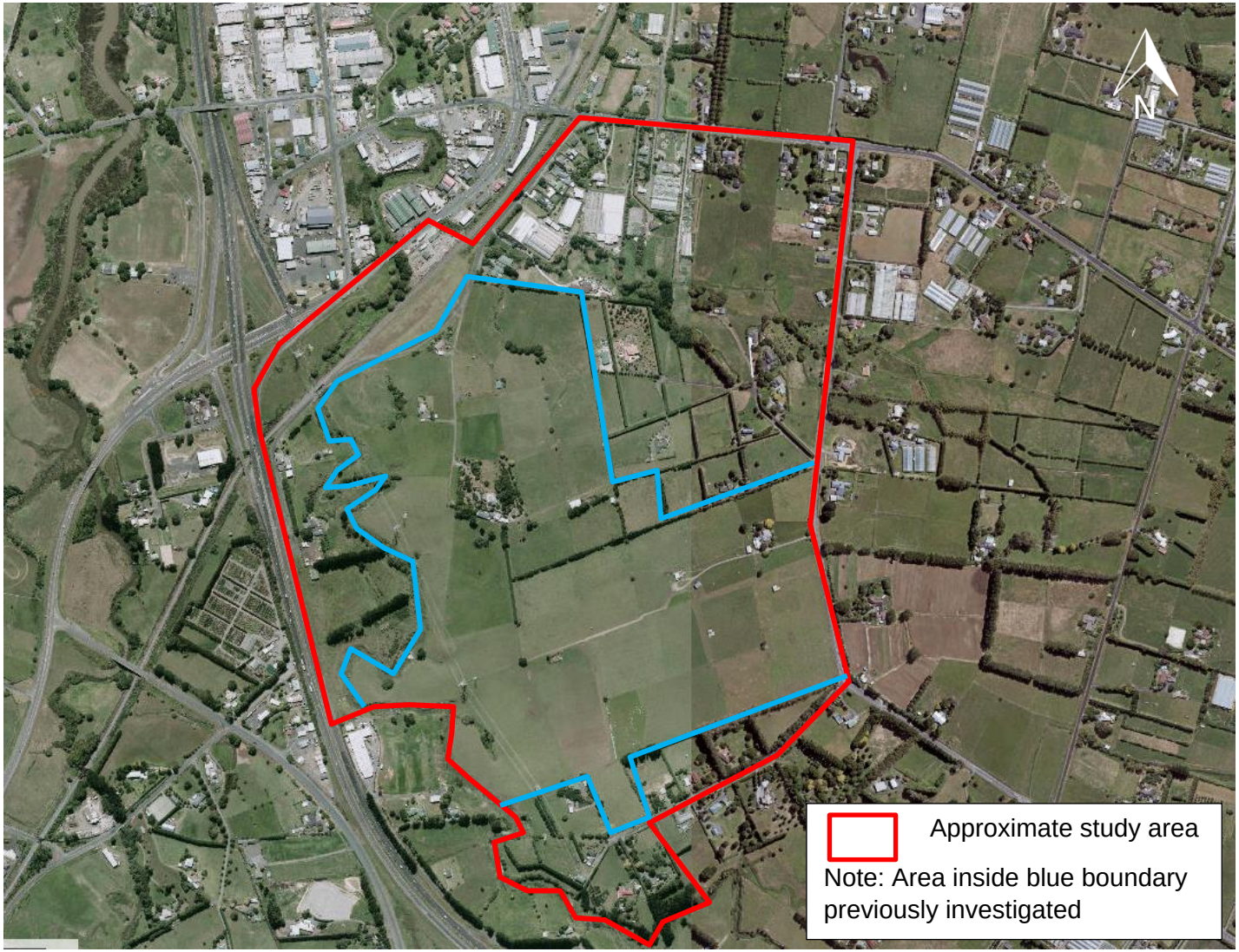


Image sourced from Auckland Council GIS Viewer

ENGEO
Expect Excellence

Date	Dec-18	**Client**	Blue Barn Limited
Drawn by	AI	**Project**	Drury Plan Change – Due Diligence
Approved by	EM	**Description**	Aerial Photograph – 2016
Scale (approx.)	Not to scale	**ENGEO Ref.**	13451.000.000