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Appendix 8

Marlborough Urban Growth and Development Study – Assessment of Suitability for Residential Development

- Prepared for
  Marlborough District Council

- May 2011

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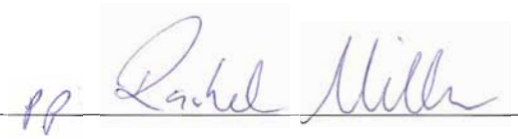

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Limitations:

The report has been prepared for the Marlborough District Council, according to their instructions, for the particular objectives described in the report. The information contained in the report should not be used by anyone else or for any other purposes. This report has been prepared on the basis of a desktop review of publicly available information provided by others. The information provided by others has been taken on good faith and has not been independently confirmed by Pattle Delamore Partners Limited. A detailed site inspection was not undertaken as a part of this assessment.

The information contained within this report applies to the date of the assessment (April 2011) and the report should not be used in the future without confirming the validity of the report's information at that time. The report has been prepared for MDC according to its instructions, for the particular objectives described in the report. The use of this report by anyone else is at the party's own risk.

Executive Summary

An assessment of eight potential land development blocks was undertaken on behalf of the Marlborough District Council (MDC) to determine, within the limitations of the assessment, whether the land blocks in question are likely to have sufficiently high levels of chemical residues in the soil such that risks to human health may exist and therefore affect the suitability of the land for future residential development. Seven of the land blocks are situated on the outskirts of Blenheim and one divided into three parcels around Renwick township as described in MDC's proposed Marlborough Urban Growth and Development plan (MDC, 2010).

A risk assessment was conducted for each of these land blocks based on a desktop review utilising available information provided by MDC, archives and aerial photographs. Anecdotal information where obtained was also used to compile a history of past site use.

Agricultural land use associated with potential contaminants was identified such as; orcharding and horticulture (prior to the 1970s lead, arsenic, DDT and dieldrin were in common use), animal dips (prior to the 1970s arsenic, DDT and dieldrin where in common use), and general agricultural activities such as spills from storage of fuel and other farm chemicals near farm buildings.

The investigation concluded the majority of land use until the 1990's/2000's was cropping. Pesticides were not commonly used in cropping and it is unlikely that significant residues of persistent pesticides are present across the land blocks. However, there is the possibility of the use of persistent pesticides on parts of the land blocks where horticultural crops (including glasshouses), orchards or berry fruit growing occurred. These persistent pesticides were in popular use on certain crops in the 1950s and 1960s. These areas have been flagged during this study as areas requiring further investigation. Potential chemical residue build up may have also occurred from chemicals such as copper chromium arsenic (CCA) in soil around treated posts in vineyards, and hydrocarbon or other chemical contamination from storage and spills, farm waste fires or sheep dips. Resultant chemical residues from these activities are persistent and can accumulate in soil in concentrations above that recommended for residential land use. These areas where identified have also been flagged for further investigation prior to any residential development.

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1.0 Introduction

The Marlborough District Council (MDC) has engaged Pattle Delamore Partners (PDP) to undertake a desktop assessment of eight potential urban development areas in and around Blenheim that were identified in the Southern Marlborough Urban Growth and Development report (MDC, 2010). The eight areas of land are growth pockets N1(N-a) and N2(N-b), Renwick, W2, Outer Limits, SE, E1/Dillions Point Road, Marris and David Street as described in MDC's proposed Marlborough Urban Growth and Development plan (MDC, 2010).

The overall objective of the assessment is to determine, within the limitations of the assessment, whether the land blocks in question are likely to have sufficiently high levels of chemical residues such that risks to human health may exist and therefore affect the suitability of the land for future development.

It is known that horticultural and possibly orchard activities have been carried out and, in some cases, are still being carried out on the land parcels being investigated. Whether these activities have the potential to be contaminating, and the likelihood of actual contamination, depend on such things as the time of commencement and duration of such activities, the types of chemicals potentially used and the persistence in the soil of the chemicals. Chemicals that may be of concern that may have been used are:

- For orcharding and horticulture (prior to the 1970s) – lead, arsenic, DDT and dieldrin (mainly berry fruit)
- For animal dips (prior to the 1970s) - arsenic, DDT and dieldrin
- For general agricultural activities - fuel storage, other farm chemicals near tractor sheds and other farm buildings
- Since the 1970s a variety of organophosphates and organonitrogen pesticides have been used. These general have lower toxicity and persistence than earlier chemicals, although they could still be of concern if they were spilled in storage locations.

Aerial photographs from the 1930s through to the present were used to identify potential 'hot-spot' areas where contaminants arising from agricultural activities or industrial/commercial sites may have occurred. Persistent organic pesticides were in use in the 1950's and 1960's and aerial photographs from this period of time were studied to identify horticultural land use associated with pesticide use. Council property files were accessed for any information on land use. Locals were also interviewed where possible to help construct land use history. These information sources have been used to identify areas within the land blocks warranting further investigation and have mapped. The results are presented in the following report.

2.0 Objectives and Scope

To determine the potential risks, the following scope of work was conducted:

- Collection of background information to identify the historic uses of the land, such that any associated activities that may have resulted in residual ground impacts are identified. Council files and archives and historical aerial maps were examined. Where possible, landowners were interviewed.
- Identifying potential "hotspots", for example glasshouses, spray sheds and implement/tractor sheds (on the assumption fuel storage could be nearby), that are likely to require detailed investigation prior to any development occurring.
- Preparing this report on the basis of the information received and from other studies carried out by PDP around New Zealand. The report is to identify whether the past uses of particular areas are likely to have resulted in residual ground impacts of sufficient concern that remediation may be required.

No soil sampling or laboratory analysis was carried out as part of the investigation.

The eight growth pockets referred to in the MDC strategy are discussed in separate sections below. Each section is presented so that it may be used as a stand-alone document for the growth pocket discussed, without reliance on any other material contained in this report.

3.0 Growth Pocket - N1(N-a) and N2(N-b)

3.1 Site Description

Two areas, N1(N-a) and N2(N-b), referred to as N-a and N-b in this report, are located adjacent to each other (Figure 1). The N-a parcel of land covers an area of 35.5 ha and the N-b parcel 35.7 ha. N-a lies to the south of N-b. The site is bounded by rural properties to the north, Clearwater Place and the Opawa River reserve area to the east and Thomsons Ford Road to the west. To the south, the boundary is formed by Old Renwick Road, and a number of residential properties and other properties along the northern side of Old Renwick Road that are not included in either parcel. Indenting into the south west corner of N-b is an electricity sub station.

Currently the majority of the land is used for horticultural purposes, primarily in grapevines. There are also residential dwellings and a number of farm buildings. Lot 2 DP345136 is currently lying fallow, and part of Lot 1 DP 1150 is used for horses and contains a large farm building and stables. The front of Lot 3 DP 367826 is currently used for grazing, and the rear of the property has a number of large farm buildings.

The two land parcels are on an area with minimal relief. Current stormwater drainage is direct to soil or channelled towards Caseys Creek. The properties within the land parcels are not connected to a reticulated sewage system and waste water is to septic tanks and on-site effluent disposal systems.

3.2 Environmental Setting

3.2.1 Geology and Hydrogeology

The site like much of Blenheim is located on Quaternary swamp deposits consisting of poorly consolidated silt, mud, peat and sand (Begg and Johnston, 2000). The two land parcels were originally swamp land prior to draining approximately 100 years ago (Carol Locke, 2011, pers.comm.).

A search of the MDC bore records using the council's online GIS Dekho site was conducted. Most, if not all, of the households within N-a and N-b are on bore supply which are utilising the Wairau Aquifer. The Wairau aquifer is confined and shallow in this region. Most bores are to a depth of between 10m and 20 m below ground level (bgl). Groundwater flow direction in the region of the two land parcels is towards the east.

3.2.2 Hydrology

The Opawa River runs to the north east of the site approximately 70m distance at the closest point. Caseys Creek is a spring feed stormwater channel that runs along the southern part of the site originating on the western part of parcel N-a between Lots 1 and 2, DP 322891. The creek runs through several properties, then along Old Renwick Road before joining the Opawa River.

3.3 Information Sources

3.3.1 Aerial Photographs

A search was undertaken for historic aerial photographs from three sources; MDC, the Marlborough Museum Archives (Archives), and New Zealand Aerial Mapping Limited (NZAM).

Aerial Photograph from 1938, source NZAM

The earliest aerial photograph for the area is from 1938 which shows the whole of the N-a and N-b parcels. The site is well drained and all the main roads have been built as observed today. The image shows N-a and N-b divided into smaller sections of varying sizes for cropping not too dissimilar to the current configuration. Due to the scale (1:10800) the type of crops grown are hard to determine but fields are large and have spiral patterns indicating grains rather than parallel lines indicating horticultural crops. However, there are some smaller plots which could be horticultural crops. There do not appear to be any orchards or berries on any of the plots. There are no signs of livestock, stock yards or sheep dips on any of the plots. There are a number of residential dwellings with associated farm buildings.

Directly east of the two land parcels is Waipuna Street but it is yet to be developed and the surrounding land appears to be used for cropping or horticulture. The Waterlea Racecourse can be seen to the south of the site with some residential development to the east of the course. To the west of the course is some residential development but still dominantly cropping land and market gardens.

Aerial Photograph from 1948, source MDC

The majority of the area in the 1948 aerial photograph appears to be used for cropping. Stacks of grain can be seen on one recently harvested plot. Faint rows of a possible horticultural crop appear to occupy one of the smaller plots, although this could be a mark on the aerial photograph. There do not appear to be any orchards or berries on any of the plots. There are no livestock visible or any sign of stock yards or sheep dips.

To the east of the land parcels the area around Waipua Street still appears to be market gardening with rows of what appear to be vegetable crops. To the south of the land parcels across Old Renwick Road on either side of Waterlea Racecourse is more residential development than observed in the 1938 aerial photograph. Further west of the racecourse the land is being used for cropping, horticultural crops and some small orchards.

1950/1951 Aerial Photograph, sourced Archives

The resolution is poor in this image but both the Na and Nb land parcels appear to be used for cropping only.

Aerial Photograph from 1964, source NZAM

This aerial photograph was taken in early October 1964 and many of the plots appear either fallow or freshly ploughed/planted. There appears to be a farm building on the south-west corner of Lot 1 DP 12092, which is still on site. There is also a farm building on the northern part of Lot 1 DP 7489 which is clearly not for residential purposes. There are sheep on one of the unploughed plots of Lot 6 DP3536. There are also possibly sheep on Lot 1 DP 12092, which is also not ploughed. There are no obvious stock yards or sheep dips on either of these two lots. To the rear of section Lot 6 DP3536 is what appears to be a stock watering trough but there are no other signs to indicate the predominant use for these two plots is now grazing. Lot 3 DP367826 has a residential property and a number of farm buildings around the site. There appears to be a small horse training track in the far east of Lot 1 DP 9215 and possibly stables.

Glenroy Crescent to the south of the N-a and N-b land parcels is now developed. Most of the horticultural plots to the south of the two land parcels appear to be replaced by residential development. To the south-east of the two land parcels, on the corner of Old Renwick Road and Thomsons Ford Road, the power sub station has been built along with the power pylon on the neighbouring section on Thomsons Ford Road, which is part of the study area.

Aerial Photograph from 1967, source MDC

Only the southern section of the N-a land parcel above Waterlea Racecourse is shown in this aerial photograph. This aerial photograph was taken in early May and the plots appear to be in between crops, and the crop type is unclear. There are some sheep grazing in a couple of the plots but there are no sign of stock yards or other indications that the land is now predominantly used for grazing.

Aerial Photograph from 1973, source NZAM

The aerial photograph was taken in March 1973 and shows the land use to be similar to that observed in the 1964 aerial photograph. However, there are no signs of livestock on any of the plots. There are two more residential dwellings and there are a couple of small storage sheds on Lot 1 DP 7489 and Lot 2 DP 347834. There appears to be a lot of unidentifiable material stored around the farm buildings on Lot 3 DP367826. The small horse training track still remains on Lot 1 DP 9215.

The land use surrounding the N-a and N-b land parcels is similar to that observed in the 1964 aerial photograph.

Aerial Photograph from 1981, source MDC

This aerial photograph shows just the southern part of the N-a land parcel above Waterlea Racecourse. Most of the plots still appear to be used for cropping. A large house and large farm building both of which still remain have been built on Lot 1 DP 1150. Part of a private horse training track which no longer exists can be seen in the large field behind the dwelling and farm building.

Aerial Photograph from 1983, source Archives

The 1983 aerial photograph shows grapevines have been planted on Lot 3 DP 7940 and Lot 1 DP 12092. The majority of the rest of the study area appears to still be used for cropping. There are two small horse training tracks one on Lot 1 DP 1150 as observed in the 1981 aerial photograph and one on Lot 1 DP 9215 as observed in the 1964 and 1973 aerial photographs. There are more buildings on Lot 2 DP 7489 possibly farm buildings, and there are double pylons now on the section directly to the south. There does not appear to be any livestock on any of the plots and there is no evidence of stock yards or sheep dips.

Directly to the east of N-a where Clearwater Place is now built, berry fruit appears to be being grown. In general little development appears to have occurred in the area surrounding the two land parcels since the 1970s.

Aerial Photograph from 1986, source MDC

This aerial photograph shows only the southern section of the N-a and N-b parcels along Old Renwick Road. Horses or cattle are grazing on Lot 1 DP 1150 and there does not appear to be any cropping on the plot. Also on this lot sheep are grazing, and there appears to be a small stock yard at the northwest corner of the paddock south of the residential dwelling but there is no sign of any sheep dips. The majority of the remaining plots within the N-a and N-b parcels visible in this aerial photograph are used for cropping.

Aerial Photograph from 1993, source Archives

This aerial has low resolution but shows that the majority of the land within the two parcels was still being used for cropping at this time. There still appear to be grapevines on Lot 3 DP 7940 and Lot 1 DP 12092. There are still two small horse training tracks on Lot 1 DP 1150 and Lot 1 DP 9215. The stock yards are no longer on Lot 1150.

Aerial Photograph from 2007, source MDC

The 2007 aerial photograph shows the site as it currently appears, with the exception of Lot 3 DP 367826 which has small fruit trees covering a large part of the section in this photo. These trees are no longer on the site, which had horses and some sheep grazing during the 2011 February visit. This lot also appears to have a lot of farming materials stored around large farm sheds to the rear of the site.

3.3.2 Marlborough District Council Records

A search of the MDC files was conducted for properties within the N-a and N-b land parcels. Most records were from the last 20 years, with the majority containing building permit applications. There was some information pertaining to possible contamination from septic tanks and illegal open fires. Information regarding land use was limited, but there was some mention of land used for flower growing and other references to keeping horse and donkey stables on some of the properties. There was reference to an old

woolshed on Lot 2 DP 7489, and a fuel spill that occurred in December 1998 on Lot 2 DP 345136. It was unclear from the file whether or not the area of the fuel spill was remediated.

3.3.3 Marlborough Museum Archives

Historic Photographs and Accounts

There were early 20th century photographs of farming activities around the broader Blenheim region. Due to the dry climate, and prior to widespread irrigation, grains were the main crop for the region. Photographs showed grains being harvested, stacked on fields and brought to town by horse and cart.

1969 Land Use Map

A Marlborough County Council (1969) land use map for the Blenheim and outlying areas had the N-a and N-b land parcels marked as Intensive Cropping. The surrounding properties and general area were marked as Mixed Farming, Sheep, Cropping, and Cattle.

3.3.4 Site Visit

Due to the size of the site, a walk over of the individual properties was not practicable. However, the area was visited to get a feel for the current layout and land use. As mentioned earlier the area is predominantly planted in grapevines. Sheep and horses were observed on some properties and one large area was lying fallow. No cropping or market gardens were observed within the study area. Some of the properties had large farm sheds with scrap metal and old machinery out in the open. It is unknown whether any of the sites stored bulk fuel. There was evidence that there had been farm waste fires on some of the properties with blackened areas observed in fields.

Attempts were made to contact landowners prior to and during the site visit, but only two were available. A telephone interview was conducted with these two resident landowners prior to the site visit, although neither was available during the visit. One of the landowners, Mrs Carol Locke, had been on the property for 25 years and said that she was one of the longest residents currently living in the neighbourhood. She said the majority of other property owners within the two land parcels had only been in the area for the last 10 years. Mrs Locke was given a letter from a previous landowner from the local area which describes the area approximately 100 years ago. The letter describes the area as originally being swampy and covered with flax which was being harvested. Around that time the area was drained and cropping (wheat) began. Mrs Locke recollected that the area had been used predominantly for cropping until grapevines took over in the 1990's as the dominant use of the immediate area. Mrs Locke's property currently contains grapevines. Short term land uses that Mrs Locke mentioned included an organic apple orchard and a pony club on one of the neighbouring properties. Mrs Locke also recalled that there may have also been a small dairy herd on one of the neighbouring properties for a short period of time.

Mrs A.M. Cobbett-Tribe from a neighbouring property said that horses were grazing on her property when she bought it in the late 1990's. Prior to this time the former owner had grapevines which had been removed in the 1980's. The current property owners planted grapevines soon after they bought the property in 1999.

3.3.5 History Summary

Originally the area was swampy and the locals harvested the flax that was growing. Approximately 100 years ago the area was drained and cropping began as was common for the region in the early 1900s. The earliest aerial photograph of the two land parcels indicate that cropping was still the main land use in 1938. Subsequent aerial photographs indicate cropping continued as a main land use until the 1990's. However, some horticultural crops may have also been grown to a lesser extent within the area.

Short term grazing of animals sheep, horses and possibly milking cows (short term) has occurred. Features such as stock yards and sheep dips were not observed, with the exception of a stockyard on Lot 1150 in the 1986 aerial photograph. This stock yard existed for less than 10 years between 1983 and 1993.

Apart from a brief period of time during the 2000s (possibly the organic apple orchard) there have been no orchards observed on the land parcels. There was also no evidence of glasshouses or berry farms on either of the land parcels. The land has been used predominantly for grapevines for the past 10 years.

3.4 Proposed Development

MDC propose the development of the N-a and N-b parcels as residential land to accommodate residential growth. There are plans for a neighbourhood centre, medium density residential areas, low density residential and neighbourhood parks and green public open spaces. The aim is for a gross residential density of 14 dwellings per hectare, giving average lot sizes of approximately 710 m^2, which is sufficiently large that vegetable gardens may be established.

3.5 Risk Assessment

3.5.1 General

Risk to potential future residents within the N-a and N-b land parcels can arise through exposure to chemical residues in the soil, the residues arising from past use of chemicals on the land. The modes of exposure normally considered in a risk assessment are soil ingestion, dermal adsorption, inhalation of contaminated dust and consumption of home-grown produce.

Sampling in other regions in New Zealand indicate excessive chemical residues in soil are commonly associated with horticultural activities such as orchards, berry farms and market gardens and in localised areas on livestock farms with sheep dips.

An analysis of receptors and exposure pathways, assuming medium to low density residential housing, identifies the potential exposure routes as:

- Dermal contact with soil for residents or maintenance workers (eg excavation);
- Ingestion of soil by residents;
- Consumption of home grown produce by residents.

3.5.2 Land Use Contamination Potential

Cropping

Use of pesticides was not common practice with cropping in New Zealand. Some use of preemergent and post-emergent including herbicides for weed control in herbicides such as Simazine or Atrazine may have occurred in more recent times but these herbicides break down in the soil relatively quickly. It is unlikely that fungicides would have used to any extent given the dry Blenheim climate.

There is the possibility of pesticide use on any horticultural crops that may have been grown on site. Persistent organochlorines such as DDT and aldrin were used on certain crops and dieldrin were used on fruit, soil and seed. Use of these pesticides was popular in the 1950s and 1960s but effectively ceased in the late 1960s. Therefore given the majority of land use until the 1990's was for cropping it is unlikely that significant residues of persistent organochlorines are present.

Vineyards

Insecticides and fungicides are used on grapevines in New Zealand. However, modern pesticides including herbicides used in the industry tend not to be persistent, breaking down reasonably quickly in soil. Of more concern in the industry is the use of treated wooden poles to support the vines. A 2004 study for MDC investigated the impacts from chemical leaching from treated posts in vineyards in the Marlborough region (HortResearch, 2004). The results indicated that copper chromium arsenic (CCA) leaches from treated posts over time, possibly leading to a gradual accumulation of CCA in the soil. The accumulation rate depends on the age of the posts and how often they have been replaced. Given the age of most of the vineyards within the two land parcels the accumulation of CCA in soils around the posts is not expected to be significant (HortResearch, 2004).

3.5.3 Hot Spot Contamination Potential

Fuel Storage and Spills

A hydrocarbon spill was recorded on one property (see attached plan for location). It is unclear from the council file if the affected soil was removed and whether validation sampling was conducted. Even though the area impacted is small (6m by 2m) it is possible residual hydrocarbons remain within this area which are above Ministry for the

Environment (MfE) guidelines for residential land use. Soil sampling is recommended to determine residential concentrations and extent.

No fuel storage was observed in the aerial photographs or during the site visit, nor were there any records in the council files. However, it is not uncommon for bulk fuel to be stored on farms and there may be or have been above or below ground petroleum storage tanks. Leaks from tanks and their associated pipe work or spills on to unsealed ground occur, and it is recommended that if any underground tanks or hydrocarbon impacted soils are encountered during development, sampling of soils be conducted and compared with MfE guidelines for residential land use.

Fires

It is not uncommon practice for farm waste to be burnt on site. One burnt area was observed on one of the properties during the site visit. Elevated heavy metals and polycyclic aromatic hydrocarbons in near surface soils are often associated with fire pit areas. Soil sampling of any old burn pit areas is recommended.

Landfilling

Burial of farm waste on site was a common practice and often there are no obvious surface features to indicate where these areas may have been. Often these landfill areas are small and contain reasonably benign waste. However, some farm waste may have been disposed of such as chemical containers or other hazardous material and if uncovered during development should be assessed.

Sheep dips

Arsenic, DDT and dieldrin are associated with sheep dips. The historical aerial photographs did not identify any sheep dips but a stock yard was observed on property Lot 1 DP 1150 in the 1986 aerial. It is possible that a sheep dip was associated with this site, which would require further investigation. However, it is unlikely persistent chemicals would have been used during this period.

A woolshed on Lot 2 DP 7489 was referred to in one of the council files. The age of this woolshed is unknown and it was unclear from the aerial photographs which building this would be as none of the buildings appeared to have any yards usually associated with woolsheds. Sheep dips are often found close to woolsheds and further investigation into the existence of this woolshed is recommended.

Farm buildings

A couple of large farm buildings containing machinery and general farm stores (including possible agricultural chemicals) where observed during the site visit. There was also a lot of storage of timber and scrap metal at one of the properties. Elevated heavy metals and residual hydrocarbons are a possibility in the near surface as a result of leaching on to ground or spills, although high concentrations are not expected. Lead paint residue build-up around older buildings may also occur, and such locations should be investigated.

3.6 Conclusions and Recommendations

A desktop assessment has been carried out on the land areas N-a and N-b. Overall the area appears suitable for residential development with limited potential for contamination. The assessment found that the area was predominantly used for cropping until viticulture began to dominate in the 1990s. Persistent pesticides residues in soil resulting from these land uses are not expected. However, limited potential chemical residue build up may have occurred in localised areas, and hydrocarbon or other chemical contamination from storage and spills, farm waste fires or sheep dips. Resultant chemical residues from these activities are persistent and can accumulate in soil in concentrations above that recommended for residential land use. It is therefore recommended that the following considerations are made prior to any residential development at the site:

- Further investigation into possibility of sheep dips at one of the properties.
- Soil sampling in areas where waste fires have been, long-term storage sheds, and near the former hydrocarbon spill.
- If fuel tanks or hydrocarbon impacted soils are encountered during development, soil sampling is likely to be indicated to determine any residual hydrocarbon impact. Expert advice should be sought.

4.0 Growth Pocket - Renwick

4.1 Site Description

Three areas around the limits of Renwick have been marked as possible locations for urban development (See Figure 2, appended for land parcel locations). Renwick Township (referred to as parcel A) is bounded by Blicks Road to the north, a rural area and Uxbridge Street to the east, SH6 and residential properties lining High Street to the south and west. The second area is also situated to the north of the main Renwick urban area (referred to as parcel B) and is bounded by rural properties to the north, Pak Lims Road to the east, residential properties along High Street and Oudenarde Street to the south and a rural property to the west. The third area lies to the west of Renwick Township and is bounded by rural property to the north, a new residential subdivision (River Terrace) to the east and rural properties to the south and west.

The majority of the land is currently used for horticultural purposes. At least 50 percent is in grapevines and the remainder is smaller rural plots that are either being used for grazing or horticultural crops. There are residential dwellings and a number of farm buildings. There is also a Department of Conservation (DOC) regional field office and yard.

The three land parcels are on areas with minimal relief. Stormwater drainage is direct to soil or on-site drainage systems. Not all properties within the land parcels are connected to a reticulated sewage system and for these properties waste water is to septic tanks and on-site effluent disposal systems.

4.2 Environmental Setting

4.2.1 Geology and Hydrogeology

Parcels A and B are situated on well sorted flood plain Quaternary gravels (Begg and Johnston, 2000). Parcel C is situated on poorly to moderately sorted Quaternary gravel with minor sand or silt underlying aggradational and degradational terraces.

A search of the MDC bore records using the council's online GIS Dekho site was conducted. There are no bores registered on Parcel C but Parcels A and B have a number of bores. Most bores are to a depth of between 5m and 20 m bgl, and are likely to be utilising the Wairau aquifer, which is unconfined in this part of Wairau Plain (Rosen and White, 2001). The inferred groundwater flow direction in the region is eastwards towards Cloudy Bay.

4.2.2 Hydrology

The Wairau River lies approximately 2.5km to the north-west at its closest point to the parcels (Parcel A). The Omaka River lies approximately 1.5km to the south from its closest point to the parcels (Parcel C). Gibson Creek is a tributary of the Omaka River

and runs through Parcel A from west to east through Lot 1 DP11694, Lot 1DP11504 and Lot 2 DP 11504, then heads northward to Blicks Road where it exits Parcel A. An unnamed modified tributary of Omaka River runs along the southern and western boundaries of Lot 3 DP 11530.

4.3 Information Sources

4.3.1 Aerial Photographs

A search was undertaken for historic aerial photographs from three sources, MDC, the Marlborough Museum Archives (Archives), and New Zealand Aerial Mapping Limited (NZAM).

Aerial Photograph from December 1937, source NZAM

Parcel A – The curved part of the main road joining SH6 and High Street, and Nelson Place, have not yet been built. There is a light scattering of residential development around the township but only a few houses on Parcel A. There are a couple of large fields which appear to be used for cropping. There does not appear to be any horticultural crops or orchards. It is possible that there is some pasture land but the resolution is too poor to identify any livestock. There are no signs of stock yards or sheep dips on any of the plots.

Parcel B – Brook Street, Oudenarde Street and the northern part of Pak Lims Road are yet to be built. There a few large plots to the north of the parcel which appear to be used for cropping. There are smaller plots to the south of Parcel B which could be used for a mix of horticultural crops and pasture land. There are no signs of stock yards or sheep dips on any of the plots.

Section C – Not covered by this photograph.

Aerial Photograph from 1948, source MDC

Parcels A and B – The curved part of the road joining SH6 with High Street is built. Oudenarde Street, Brook Street North and the northern part of Pak Lims Road are still not built. There are a few more dwellings along High Street and several of the small plots lining High Street have horticultural crops growing and one site appears to be in berries or an orchard (south of Parcel B). Slightly to the north on Parcel B, Lot 1 DP 5928 appears to be used for horticultural crops. The remainder of Parcels A and B appear to be either used for cropping or pasture. There are no signs of stock yards or sheep dips on any of the plots.

Section C - not covered by this photograph.

Aerial Photograph from 1951/1952, source Archives

Parcel A appears to be a mix of market gardens, pasture and possibly berries or fruit orchards. Parcels B and C appear to be in pasture. Livestock were not observed on any parcels but the photograph has poor resolution making small objects difficult to identify.

Aerial Oblique Photograph from 1964, source Archives

The photograph covered parcels A and B. These two parcels appear to be mostly void of buildings except for a scattering of residential properties. Crops are being grown but whether these are grains or horticultural crops is unclear.

Aerial Photograph from October 1964, source NZAM

Parcel A – Lots 1 to 10 DP 5359, just to the south of Parcel A's border, are in horticultural crops. Within Parcel A, Pt Lots 1 and 2 DP 37 appear to be planted in berries. Lots 1 and 2 DP 327803, Lot 2 DP 11694, Lot 2 DP11504, Lot 1 DP 6415 and Lot 2 DP 3797 all have potential horticultural crops. Lots 1 and 2 DP 327803 also have a small building, possibly a storage/chemical mixing shed. The remainder of plots within the parcel are in cropping or pasture but no livestock are visible. There are no signs of stock yards or sheep dips on any of the plots.

Parcel B – Oldenarde Street and Brook Street North are now built. There are recently planted fruit trees on part of Lot 1 DP 5928, Lot 1 and part of Lot 3 DP 11530. Lot 2 DP 5928 still has four sheds on site, most likely packing sheds. The remainder of the site appears to be used for either cropping or pasture but no livestock are visible. There are no signs of stock yards or sheep dips on any of the remaining plots.

Parcel C – not covered by this photograph.

Aerial Photograph from March 1973, source NZAM

Parcel A – there are four properties now containing glasshouses. Lot 2 DP 3797 on SH6 and three Gee Street properties, Lot 1 DP 365452, Lot 2 DP 11504 and Lot 1 DP 37. Lots 1 and 2 DP 327803 still appear to be used for horticultural crops and there is still a small building on the plot which could be a chemical mixing shed. Lot 1 DP 11504 also appears to be still used for horticultural crops. The remainder of the plots within Parcel A appear to be used either for cropping or pasture. There are no signs of stock yards or sheep dips on any of the remaining plots.

Parcel B – Land use in Parcel B appears to be similar to that observed in the 1964 aerial photograph. Fruit trees are still visible on part of Lot 1 DP 5928, Lot 1 DP 11530 and part of Lot 3 DP 11530. Lot 2 DP 5928 still has a number of packing sheds on site. The remainder of Parcel A appears to be used for either cropping or pasture but no livestock are visible. There are no signs of stock yards or sheep dips on any of the remaining plots.

Parcel C – not covered by this photograph

Aerial Photograph from 1983, source Archives

Parcel A - The glasshouses on Lot 2 DP 3797 have been removed. The other three glasshouse sites along Gee Street (Lot 1 DP 365452, Lot 2 DP 11504 and Lot 1 DP 37) are still there. Horticultural crops appear to be growing on Lots 1 and part Lot 2 DP 11504, Lot 74 DP 24, Lot 2 DP 11694, Pt Lot 1 DP 37 and Lot 3 DP 3797. Pt Lot 1 DP 37 has berries or small trees growing alongside the glasshouses. Lot 2 DP 37 contains new commercial/industrial buildings. The remainder of Parcel A appears to be used for either cropping or pasture but no livestock are visible. There are no signs of stock yards or sheep dips on any of the remaining plots.

Parcel B – There are fruit trees on Lot 1 DP 5928. Only one pack house can be seen on the neighbouring property, Lot 2 DP5928. There are fruit trees on Pt Lot 36 Deeds 5A. Grapevines have been planted on Lot 1 DP 11227, Lot 1 DP 11215 and part Lot 2 DP 7753. The remainder of Parcel B appears to be used either for cropping or pasture. There are no signs of stock yards or sheep dips on any of the remaining plots.

Parcel C – Lot 2 DP 354630 appears to be used for cropping. There are no signs of livestock, stock yards or sheep dips on site.

Aerial Photograph from January 1993, source Archives

Parcel A - This aerial photograph shows only the southern end of the parcel. What appears to be berries or fruit trees are on Lot 1 DP 8989 and Lot 1 DP 11063. Berries also appear to be grown on Lot 1 DP 11504. Grapes have been planted on Lot 3 DP 3797. The three glasshouse sites (Lot 1 DP 365452, Lot 2 DP 11504 and Lot 1 DP 37) along Gee Street still remain. A new glasshouse has appeared on Lot 2 DP 3797 (formerly there were at least two glasshouses on the site but these were removed prior to 1983). Horticultural crops appear to be growing on Lot 1 DP 6415 and Lots 1 and 2 DP 327803. Grains still appear to be growing on some of the remaining plots in the land parcel and other lots appear to be between crops or in pasture.

Parcel B – This aerial photograph captures the majority of Parcel B, missing only the northern part of the parcel. Fruit trees are on Lot 36 Deeds 5A and Lot 2 DP 5928 (possibly cherry trees). There is some activity on Lot 2 DP 5928 with a number of vehicles on site around what was referred to in MDC records as a cherry packing house. The remainder of Parcel B appears to either be in pasture or used for cropping. There are no stock yards or sheep dips identifiable.

Parcel C – Approximately two thirds of Parcel C is visible in this aerial photograph. The lot is divided into two fields and appears to be used for cropping.

Aerial Photograph from 2007, source MDC

The 2007 aerial photograph shows the parcels as they currently appear, with the exception of two sites, Lot 1 DP 365452 which still shows two glasshouses (now removed) and Lot 3 DP 401946 which has an orchard in the 2007 image but currently has a industrial/commercial building on site. Parcel A is currently a mixture of grapevines,

fruit orchards, pasture land, residential properties and the occasional commercial building.

The majority of parcel B is in grapevines.

Parcel C is completely covered in grapevines.

4.3.2 Marlborough District Council Records

A search of the MDC files was conducted for properties within the Renwick land parcels. Most records were from the last 20 years, with the majority containing building permit applications. There was some information pertaining to possible contamination from septic tanks. Information regarding land use was limited, but there was a reference to a packing shed and blueberries and stonefruit being grown on Lots 1 and 2 DP 316712 and Lot 1 DP 8989.

The files also refer to Lot 2 DP 37 as formerly being owned by Timberlands Nelson (in 1977 New Zealand Forest Service (NZFS) as owner). The site was brought by DOC in the late 1980s for a field centre. From the files it appears that NZFS used the site as their Wairua Fire Service Head Quarters and the site contained stores, office, fire depot and garages. There is no evidence to suggest site use changed under Timberlands Nelson. Currently the site is used as a regional field office and depot by DOC and site use is similar to that of NZFS and Timberlands Nelson.

Three sites where identified in the files as having potential for contaminants in soil. These were three of the four glasshouse sites observed in the earlier aerial photographs. Lot 2 DP 11504 is the only site where glasshouses still remain. There have been glasshouses on site since 1971. There was a coal fired boiler on site. The file contained an application from 1999 for resource consent for discharge to air from the boiler. This indicates at least 25 years of discharges to air, coal storage and possible disposal of ash and clinker on site. Due to this, the file contained a note referring to the potential for contamination on site.

Lot 1 DP 365452 is identified as being used for commercial horticultural activity using glasshouses since at least 1965. A soil investigation was undertaken in 2004. The results indicated that soil contaminants were present but at concentrations below residential guidelines.

Lot 1 DP 37 is identified as having glasshouses on site since at least 1964 and as a result there is a potential for contamination. The file contained a 1966 building application for one glasshouse to grow tomatoes.

4.3.3 Marlborough Museum Archives

Historic Photographs and Accounts

There were early 20th century photographs of farming activities around the broader Blenheim region. Due to the dry climate, and prior to widespread irrigation, grains were

the main crop for the region. Photographs showed grains being harvested, stacked on fields and brought to town by horse and cart. Newspaper clippings from the early 1900s held at Archives refer to chaff (oats, grains and maize) as the main crop of the Renwick area (the clippings did not have the newspaper reference).

1969 Land Use Map

A Marlborough County Council (1969) land use map for the Blenheim and outlying areas had the Renwick land parcels marked as Mixed Farming, Sheep, Cropping, and Cattle. The surrounding properties and general area were also marked as Mixed Farming.

4.3.4 Site Visit

Due to the size of the site, a walk over of the individual properties was not practicable. However, the area was visited to get a feel for the current layout and land use. A brief site visit in March 2011 indicated that most plots were either in grapes, residential properties or in pasture.

Parcel A - Two olive groves where observed in Gee Street as well as a small apple orchard. There was also another orchard and possibly berry fruit on Inkerman Street North. Only Lot 2 DP 11504 still contains commercial glasshouses, which is situated on the corner of Gee and Inkerman streets. The rest of Parcel A is either in grapevines (approximately 1/3), residential properties or pasture.

Parcel B – The majority of parcel B is currently in grapevines. There are some residential properties and most of Lot 2 DP 5928 appears disused.

Parcel C – This parcel of land is currently all in grapevines. A conversation was held with a tenant living on an adjacent lot (under the same ownership as Parcel C). To the tenant's recollection, prior to grapevines the site had been used for sheep grazing and cropping. There had been a sheep yard on site but the tenant had no recollection of a sheep dip.

4.3.5 History Summary

Records from the early 1900s indicate that the Renwick area was used for growing grains and pasture. The earliest aerial photograph, taken in 1937, indicates that cropping was still the main land use in 1937. Subsequent photographs indicate cropping and pasture were the predominant land use for the three parcels. In the mid to late 1960s more intense use of land began to occur in some areas and glasshouses were put on four properties in Parcel A. Orcharding also took place on a couple of lots in Parcels A and B. Around the same time there appears to have also been horticultural crops in Parcel B. Anecdotal information on Parcel C indicates that the site has been used for cropping and grazing until the last 10 years when it was planted in grapevines.

Short term grazing of animals (most likely sheep) has occurred on one or more of the parcels. Features such as stock yards and sheep dips were not observed on aerial photographs, however it is understood that there was a sheep yard on Parcel C.

The land has been used predominantly for grapevines for the past 10 years but there are still some orchards and horticultural crops in the area.

4.4 Proposed Development

MDC propose the development of rural sites around Renwick as potential residential land to accommodate residential growth. The growth projection is for 191 new dwellings for the period up to 2031. Projected gross residential density is unknown but it has been assumed that the average lot size will be sufficiently large that vegetable gardens may be established.

4.5 Risk Assessment

4.5.1 General

Risk to potential future residents within the Renwick land parcels can arise through exposure to chemical residues in the soil, as a result of the past use of chemicals on the land. The modes of exposure normally considered in a risk assessment are soil ingestion, dermal adsorption, inhalation of contaminated dust and consumption of home-grown produce.

Sampling in other regions in New Zealand indicate excessive chemical residues in soil are commonly associated with horticultural activities such as orchards, berry farms and market gardens and in localised areas on livestock farms with sheep dips.

An analysis of receptors and exposure pathways, assuming medium to low density residential housing, identifies the potential exposure routes as:

- Dermal contact with soil for residents or maintenance workers (eg excavation);
- Ingestion of soil by residents;
- Consumption of home grown produce by residents.

4.5.2 Land Use Contamination Potential

Cropping

Use of pesticides was not common practice with cropping in New Zealand. Some use of preemergent and post-emergent including herbicides for weed control in herbicides such as Simazine or Atrazine may have occurred in more recent times but these herbicides break down in the soil relatively quickly. It is unlikely that fungicides would have used to any extent given the dry Blenheim climate.

Horticultural Crops

There is the possibility of pesticide use on horticultural crops that may have been grown on any of the land parcels. Persistent organochlorines such as DDT and aldrin were used on certain crops and dieldrin was used on fruit, soil and seed. Use of these pesticides was popular in the 1950s and 1960s but effectively ceased in the late 1960s. From the

aerial photographs potential horticultural crops were identified at a couple of sites. However, given the short period of time these pesticides were used, and the frequent turning of soils associated with cropping, it is unlikely that significant residues of persistent organochlorines are present. Similarly, there are not expected to be significant residual pesticides or heavy metals.

Orchards and Berry Fruit

Orchards were identified in sections A and B in the 1960s when organochlorines were in popular use. Insecticides such as Dieldrin and DDT were used on some berry and fruit crops. Lead arsenate was also used on pip fruit. It is understood that there was most likely a mix of pip and stone fruit as well as berries on some of the properties during the 1960s therefore there is some potential for persistent organochlorines and heavy metals in the soil. These areas have been marked on Figure 2.

Vineyards

Insecticides and fungicides are used on grapevines in New Zealand. However, modern pesticides including herbicides used in the industry tend not to be persistent, breaking down reasonably quickly in soil. Of more concern in the industry is the use of treated wooden poles to support the vines. A 2004 study for MDC investigated the impacts from chemical leaching from treated posts in vineyards in the Marlborough region (HortResearch, 2004). The results indicated that CCA leaches from treated posts over time, possibly leading to a gradual accumulation of CCA in the soil. The accumulation rate depends on the age of the posts and how often they have been replaced. Given the age of most of the vineyards within the land parcels the accumulation of CCA in soils around posts is not expected to be great (HortResearch, 2004).

4.5.3 Hot Spot Contamination Potential

Glasshouses

Contamination of soils can occur as a result of coal or diesel fired boiler use on site. Build up of PAH's in soil can occur in locations where coal has been stored and from clinker and ash boiler waste. It is possible clinker was disposed of on site either by burial or piled on the ground surface. Clinker has also commonly been used for building paths or roads on farm land. If diesel fired boilers were used there is potential for spills and leaks at storage locations.

There is also potential for build up of persistent pesticides in soils in glasshouses operating in the 1950's and 1960's due to the intensity of crops and pesticide use.

Four glasshouse locations (one still in operation) were built in the 1960's and there is a potential for residual persistent organochlorines and PAH's in soil at these sites which should be further investigated.

Fuel Storage and Spills

No fuel storage was observed in the aerial photographs or during the site visit, nor were there any records in the council files (apart from a LPG tank at Lot 2 DP 11504), but see above with respect to glasshouses. However, it is not uncommon for bulk fuel to be stored on farms and there may be or have been above or below ground petroleum storage tanks. Leaks from tanks and their associated pipe work or spills on to unsealed ground occur. It is recommended that, if any underground tanks or hydrocarbon impacted soils are encountered during development, sampling of soils should be conducted and compared with MfE guidelines for residential land use.

Fires

It is not uncommon practice for farm waste to be burnt on site. Elevated heavy metals and polycyclic aromatic hydrocarbons in near surface soils are often associated with fire pit areas and soil sampling of any old burn pit areas is recommended.

Landfilling

Burial of farm waste on site was a common practice and often there are no obvious surface features to indicate where these areas may have been. Often these landfill areas are small and contain reasonably benign waste. However, some farm waste may have been disposed of such as chemical containers or other hazardous material and if uncovered during development would need to be assessed.

Sheep dips

Arsenic, DDT and dieldrin are associated with older sheep dips. The historical aerial photographs did not identify any sheep dips, but communications with a tenant on property Lot 2 DP 354630 (Parcel C) indicated that sheep grazing occured. Although the tenant did not recall a sheep dip there is a possibility that there was one on the site, which would require further investigation.

Farm buildings

Farm buildings were identified on the aerial photographs including one site which had a small building in the middle of a crop field (potentially a chemical mixing shed). Farm buildings tend to contain machinery and general farm stores (including possible agricultural chemicals). Elevated heavy metals and residual hydrocarbons are a possibility in the near surface as a result of leaching on to ground or spills, although high concentrations are not expected with the exception of mixing sheds where “hot-spots” are expected. Lead paint residue build-up around older buildings may also occur, and such locations should be investigated.

4.6 Conclusions and Recommendations

A desktop assessment has been carried out on 3 land parcels on the outskirts of Renwick. Overall the area appears suitable for residential development with limited potential for contamination. The assessment found that the area was predominantly used for cropping (approximately two thirds) and approximately one third in horticultural crops, orchards/berries and glasshouses. Viticulture began to dominate in the 1990s. Persistent pesticide residues in soil resulting from cropping and current land uses are not expected. However, potential chemical residue build up may have occurred in areas of land containing horticultural crops, orchards/berry fruit and glasshouses, and also from chemicals such as CCA in soil around treated posts, and hydrocarbon or other chemical contamination from storage and spills, farm waste fires or sheep dips. Resultant chemical residues from these activities are persistent and can accumulate in soil in concentrations above that recommended for residential land use. It is therefore recommended that the following considerations are made prior to any residential development at the site:

- Further investigation into possibility of a sheep dip at Parcel C.
- Further investigation into the possibility of fuel storage tanks on site.
- Soil sampling of “hot-spot” areas; where coal/clinker was stored and/or disposed, where waste fires have been or around storage/packing sheds.
- Soil sampling within the former and current glasshouse footprints (where not already tested) and orchards/berry fruit sites that were operating during the 1950s/1960s.
- Peer review of environmental report for glasshouse investigations.
- If underground tanks or hydrocarbon impacted soils are encountered during development, the need for soil sampling should be assessed to determine any residual hydrocarbon impacts. Expert advice should be sought on how to proceed.

5.0 Growth Pocket - W2

5.1 Site Description

Growth pocket W2 on the outskirts of Blenheim has been marked as a possible location for urban development (See Figure 3, appended for land parcel locations). The area is situated to the west of Blenheim on the Colonial Vineyard in Burleigh. The property covers 21 hectares, and is bounded to the north by New Renwick Road, to the east by Richardson Avenue, to the south by rural property and to the west by Aerodrome Road.

Currently the land is used for viticulture. There are one or two small sheds on site but no other structures. The area is situated on an area with minimal relief. The surrounding properties are residential to the north and east, and rural to the south and west. Stormwater drainage appears to be direct to soil.

5.2 Environmental Setting

5.2.1 Geology and Hydrogeology

Area W2 is situated on poorly to moderately sorted Quaternary gravel with minor sand or silt underlying aggradational and degradational terraces.

A search of the MDC bore records using the council's online GIS Dekho site was conducted. There are five bores registered on Area W2. Two of the wells are at a depth of 15 m bgl and one is 17 m bgl. There are no depths specified for the other two bores. The bores are most likely utilising one of the Southern Valleys aquifers (Rosen and White, 2001). Local shallow groundwater flow direction is inferred to be south-east towards the Taylor River. Regional groundwater flow is eastwards towards Cloudy Bay.

5.2.2 Hydrology

The Taylor River lies approximately 170 m to the south-east of the closest point from Area W2. There is a modified waterway 1100 m to the north of the site and Doctors Creek 1200 m to the north west of the site. There are no other significant surface water features within 2 km distance.

5.3 Information Sources

5.3.1 Aerial Photographs

A search was undertaken for historic aerial photographs from three sources, MDC, the Marlborough Museum Archives (Archives), and New Zealand Aerial Mapping Limited (NZAM).

Aerial Photograph from January 1938, source NZAM

It is hard to distinguish whether Area W2 is being used for cropping or pasture land in this aerial photograph. There are no buildings on site and no identifiable structures associated with livestock. There are some drainage patterns on site indicating surface water drainage towards Taylors River.

The surrounding properties with the exception of two young orchards to the south-west appear to be used either for cropping or grazing. There are only a few residential dwellings to the north and north-east of the site at this point and two small buildings directly south-east of the site.

Aerial Photograph from 1948, source MDC

Area W2 appears similar to that observed in the 1938 aerial photograph. The site looks to be used for cropping. There are no structures on site, only a stand of trees towards the south-east corner.

There appears to be a few more houses to the north of Area W2, otherwise the surrounding properties appear to be used for the same purpose as previously.

Aerial Photograph from 1950/1951 source Archives

The site appears to be used for cropping. There are no other distinguishable features on site.

The neighbouring properties appear to have the same land use as observed in the 1948 aerial photograph.

Aerial Photograph from December 1965, source NZAM

There is now a residential dwelling on Area W2, towards the south eastern corner by the stand of trees noted in the 1948 aerial photograph. The site is separated into four smaller plots but still appears to be used for cropping with the exception of the plot the house is on which is possibly being used for grazing.

There is also a new residential dwelling in place of the two smaller buildings observed earlier on the site to the south-east. Residential development has taken place to the east of the site and there are more residential dwellings north of the site. The fruit orchards are still visible to the south-west of Area W2 and the remaining rural land appears to be either used for cropping or for pasture.

Aerial Photograph from March 1973, source NZAM

The house is still on site and now there is a farm building to the rear of the dwelling. The majority of the site still appears to be used for cropping including the area around the dwelling and barn.

The orchards to the south-west of the site appear to be now planted with berry fruit although some of the fruit trees remain in the southern orchard. Despite more residential

infilling to the north and east, the surrounding land use appears to be similar to that observed in the 1965 aerial photograph - being either cropping or pasture.

Aerial Photograph from 1983, source Archives

Resolution is poor in this aerial photograph but the majority of Area W2 still appears to be used for cropping. There may be a small stock yard out the back of the farm building which indicates seasonal grazing at the site.

Surrounding land use appears similar with the exception of the two orchards. It now appears the berry fruit has been removed and only a few of the original orchard trees remain.

Aerial Photograph from January 1986, source MDC

Area W2 has been divided into smaller plots, which appear to be still used for cropping. However, there are sheep grazing on a couple of the plots. There is also a small stock yard to the rear of the farm building.

North of the site there is more residential infilling and further north the land is now in grapevines. Land to the south and west of Area W2 is not shown in this aerial photograph.

Arial Photograph from 1993, source Archives

The residential dwelling and accompanying farm buildings are still on site. The resolution is poor but the land appears to still be used for either pasture or a mix of cropping and pasture.

Aerial Photograph from 2007, source MDC

The 2007 aerial photograph shows Area W2 planted in grapevines as it currently is. The surrounding properties are also as currently observed.

5.3.2 Marlborough District Council Records

A search of the MDC files was conducted for properties within the W2 land parcel. Most records were from the last 30 years, with the majority containing building permit applications. There was some information pertaining to issues regarding burning inappropriate material on site. One file contained a photograph from 2003 showing pasture land but there was no livestock visible.

5.3.3 Marlborough Museum Archives

Historic Photographs and Accounts

There were early 20th century photographs of farming activities around the broader Blenheim region. Due to the dry climate, and prior to widespread irrigation, grains were the main crop for the region.

1969 Land Use Map

A Marlborough County Council (1969) land use map for the Blenheim and outlying areas had Area W2 marked as Mixed Farming, Sheep, Cropping, and Cattle. The surrounding properties and general area was also marked as Mixed Farming.

5.3.4 Site Visit

The site was visited on 18 March 2011. The entire site was covered in grapevines. Access onto the site was not possible but there were no structures or other features visible on Area W2.

Currently there is rural development to the north and east of the site. There are a few residential dwellings to the south eastern border of the site. The south and west of the site appears to be used for pasture. There are parcels of land used for viticulture to the north-west of the site.

5.3.5 History Summary

Early records and aerial photographs indicate that Area W2 was used for cropping and/or pasture. Cropping appears to have been the main use of the land for the last 100 years. In the 1980's what appeared to be a small stock yard appeared and was there for a few years. There was no sign of a sheep dip during this or any earlier period in any of the photographs. The land was planted in grapevines in the last 6 years.

Surrounding land use has been a mixture of residential and rural. The neighbouring rural properties have dominantly been used for cropping and/or pasture. There were a couple of orchards to the south-west of Area W2 from the 1930s through to the 1960s.

5.4 Proposed Development

MDC propose the development of Area W2 as residential land to accommodate residential growth. There are plans for a neighbourhood parks and medium and low density residential areas. The aim is for a gross residential density of 14 dwellings per hectare, giving average lot sizes of approximately 710 m^2, which is sufficiently large that vegetable gardens may be established.

5.5 Risk Assessment

5.5.1 General

Risk to potential future residents within Area W2 can arise through exposure to chemical residues in the soil, as a result of the past use of chemicals on the land. The modes of exposure normally considered in a risk assessment are soil ingestion, dermal adsorption, inhalation of contaminated dust and consumption of home-grown produce.

Sampling in other regions in New Zealand indicate excessive chemical residues in soil are commonly associated with horticultural activities such as orchards, berry farms and market gardens and in localised areas on livestock farms with sheep dips.

An analysis of receptors and exposure pathways, assuming medium to low density residential housing, identifies the potential exposure routes as:

- Dermal contact with soil for residents or maintenance workers (e.g. excavation);
- Ingestion of soil by residents;
- Consumption of home grown produce by residents.

5.5.2 Land Use Contamination Potential

Cropping

Use of pesticides was not common practice with cropping in New Zealand. Some use of preemergent and post-emergent including herbicides for weed control in herbicides such as Simazine or Atrazine may have occurred in more recent times but these herbicides break down in the soil relatively quickly. It is unlikely that fungicides would have used to any extent given the dry Blenheim climate.

Vineyards

Insecticides and fungicides are used on grapevines in New Zealand. However, modern pesticides including herbicides used in the industry tend not to be persistent, breaking down reasonably quickly in soil. Of more concern in the industry is the use of treated wooden poles to support the vines. A 2004 study for MDC investigated the impacts from chemical leaching from treated posts in vineyards in the Marlborough region (HortResearch, 2004). The results indicated that CCA leaches from treated posts over time, possibly leading to a gradual accumulation of CCA in the soil. The accumulation rate depends on the age of the posts and how often they have been replaced. Given the age of the vineyard within the land parcel the accumulation of CCA in soils around posts is not expected to be great (HortResearch, 2004).

5.5.3 Hot Spot Contamination Potential

Fuel Storage and Spills

No fuel storage was observed in the aerial photographs or during the site visit, nor were there any records in the council files. However, it is not uncommon for bulk fuel to be stored on farms and there may be or have been above or below ground petroleum storage tanks associated with the farm buildings observed on Area W2. Leaks from tanks and their associated pipe work or spills on to unsealed ground occur, and it is recommended that if any underground tanks or hydrocarbon impacted soils are encountered during development, sampling of soils should be conducted and compared with MfE guidelines for residential land use.

Fires

It is not uncommon practice for farm waste to be burnt on site as has been the case on this site. Elevated heavy metals and polycyclic aromatic hydrocarbons in near surface soils are often associated with fire pit areas and soil sampling of any old burn pit areas is recommended.

Landfilling

Burial of farm waste on site was a common practice and often there are no obvious surface features to indicate where these areas may have been. Often these landfill areas are small and contain reasonably benign waste. However, some farm waste may have been disposed of such as chemical containers or other hazardous material and if uncovered during development would need to be assessed.

Sheep dips

Arsenic, DDT and dieldrin are associated with earlier sheep dips. However, the historical aerial photographs did not identify any sheep dips on site. A stock yard and sheep were identified in aerial photographs post 1980s but by this time persistent sheep dip chemicals were no longer in use.

Farm buildings

Farm buildings were identified to the rear of the residential dwelling on the aerial photographs. Farm buildings tend to contain machinery and general farm stores (including possible agricultural chemicals). Elevated heavy metals and residual hydrocarbons are a possibility in the near surface as a result of leaching on to ground or spills, although high concentrations are not expected with the exception of mixing sheds where “hot-spots” are expected. Lead paint residue build-up around older buildings may also occur, and such locations should be investigated.

5.6 Conclusions and Recommendations

A desktop assessment has been carried out for the W2 land parcel in Burleigh, Blenheim. Overall the area appears suitable for residential development with limited potential for contamination. The assessment found that the area was predominantly used for cropping and to a lesser extent grazing. Two plots to the south-west of the site were planted in orchards in the 1950s and 60s when more persistent pesticides were in common use orchards were separated from the site by a road and residue build up on Area W2 from spray drift would not be significant. Grapevines were planted in the 2000s and are still on site today. Persistent pesticides residues in soil resulting from cropping and current land uses are not expected.

Potential chemical residue build up may have occurred in “hot-spot” areas from chemicals such as hydrocarbon or other chemical contamination from storage and spills and farm waste fires. Resultant chemical residues from these activities are persistent and can accumulate in soil in concentrations above that recommended for residential

land use. It is therefore recommended that the following considerations are made prior to any residential development at the site:

- Further investigation into the possibility of fuel storage tanks on site.
- Soil sampling "hot-spot" areas where waste fires have been, storage sheds and near treated posts. In addition soil sampling in any areas that look like sheep dips may have been there.
- If underground tanks or hydrocarbon impacted soils are encountered during development, soil sampling is likely to be indicated to determine any residual hydrocarbon impact. Expert advice should be sought on how to proceed.

6.0 Growth Pocket - Outer Limits

6.1 Site Description

The Outer Limits area consists of two adjoining areas of land earmarked as possible locations for urban development (marked 'A' and 'B', shown on Figure 4). The sites are situated on Middle Renwick Road (SH 6). Parcel A is bounded by rural property to the north, Parcel B to the east, Middle Renwick Road to the south and rural land to the west. Parcel B is surrounded by rural land to the north, a mix of rural and industrial to the east, Middle Renwick Road to the south and Parcel A to the west.

Currently the majority of the land is used for horticultural purposes, with at least 50 percent in stone fruit and the remainder in horticultural crops. There is some light industry on Parcel A including a self storage facility and a food processing facility.

The two land parcels are on an area with minimal relief. Stormwater drainage is direct to soil or on site drainage systems.

6.2 Environmental Setting

6.2.1 Geology and Hydrogeology

The land parcels are situated on well sorted flood plain Quaternary gravels (Begg and Johnston, 2000).

A search of the MDC bore records using the council's online GIS Dekho site was conducted. There are nine bores registered on the two parcels ranging in depths from 2.75 m bgl to 19.5m bgl. These bores are likely to be utilising the Wairau aquifer which is likely to be unconfined to semi confined in this part of Wairau Plain (Rosen and White, 2001). The inferred groundwater flow direction in the region is eastwards towards Cloudy Bay.

6.2.2 Hydrology

The Taylor River lies to the south-east at a distance of approximately 1.5km at its closest point to the two parcels. Approximately 1.65 km to the north runs the Opawa River. Closer to the site are three tributaries of the Taylor River. Yelverton Stream to the south of the site is approximately 500 m at its closest point to the two land parcels. An un-named tributary to the south-east of the sites is approximately 200 m at its closest point. Another un-named tributary is approximately 600 m to the east at its closest point.

Previously a small stream ran through the northern part of the two land parcels. This stream has been modified and now runs in a straight line as a drain across Lot 1 DP 315224 and Lot 1 DP 367475.

6.3 Information Sources

6.3.1 Aerial Photographs

A search was undertaken for historic aerial photographs from three sources, MDC, the Marlborough Museum Archives (Archives), and New Zealand Aerial Mapping Limited (NZAM).

Aerial Photograph from January 1938, source NZAM

Both land parcels are being used for cropping in 1938. There is a small natural stream on the northern part of the site.

Most of the surrounding land is also being used for cropping and possibly grazing to a lesser extent. To the south-east of the parcels the site bordering Middle Renwick Road has glasshouses. Further to the south east is residential development.

Aerial Photograph from 1948, source MDC

Both land parcels are being used for cropping in 1948. The small stream is still crossing the top of the site.

Most of the surrounding land shown in the aerial photograph also appears to be used for cropping. The neighbouring property to the south-east has more glasshouses than previously observed.

Aerial Photograph from 1951/1952, source Archives

Both land parcels appear to be still used for cropping when this aerial photograph was taken. The stream is in its original state.

Some of the neighbouring properties to the south-east and south of the site have smaller plots that could be used for horticultural crops. More residential in filling is occurring further to the east towards the suburb of Springlands.

Aerial Photograph from 1959, source NZAM

The two land parcels still appear to be used for cropping in 1959.

Again some of the smaller plots to the south-east and south of the two land parcels appear to be growing horticultural crops. The stream is still in its original state.

Aerial Photograph from October 1974, source NZAM

Both the two land parcels are now covered in young orchards. There is also one small building to the north of the site – possibly a packing shed. The stream has been modified and now runs across the site in a straight line.

To the north of the site is a mix of orchards, cropping, pasture and horticultural crops. To the east is a mix of residential property with some smaller horticultural crop plots and at

least four or five glasshouse sites. To the south and west land is being used for a mixture of cropping, pasture and horticultural crops.

Aerial Photograph from 1983, source Archives

Only parcel B is visible in the 1983 aerial photograph. The site is covered in fruit trees.

Surrounding land use to the east is similar to that observed in the 1974 aerial photograph.

Aerial Photograph from 1993, source Archives

Both parcels are covered in fruit trees in 1993. However there is an area cleared around a new commercial building on the north of the site. This building appears to be the food processing facility that is still on site today.

Surrounding land use is similar to that observed in the 1974 and 1983 aerial photographs.

Aerial Photograph from 2007, source MDC

In the 2007 aerial photograph Lot 2 DP 315225 and Lot 2 DP 10461 appear to be in pasture and there are a couple of patchy areas where grass is not growing (possibly from fires). Fruit trees still cover the majority of the remaining area. The eastern side of Lot 2 DP 11015 is bare of trees and appears to have some waste stored on this part of the site. It is unclear what the waste is. There are now a few commercial buildings on Lot 1 DP 367475 and Pt Lot 2 DP 6230. There is a smaller building on the southern part of Parcel next to a driveway from Middle Renwick Road/SH6 which is most likely a packing/storage shed.

Vineyards are becoming dominant on the properties to the north, east and south (west not visible in this aerial) of Outer Limits. The glasshouses that were situated on properties to the east of the site are removed or in the process of being removed.

6.3.2 Marlborough District Council Records

A search of the MDC files was conducted for properties within the Outer Limits land parcel. There was only one file for the A and B Parcels, containing notes regarding air and water discharges from the neighbouring property.

6.3.3 Marlborough Museum Archives

Historic Photographs and Accounts

There were early 20th century photographs of farming activities around the broader Blenheim region. Due to the dry climate, and prior to widespread irrigation, grains were the main crop for the region. Photographs showed grains being harvested, stacked on fields and brought to town by horse and cart.

1969 Land Use Map

A Marlborough County Council (1969) land use map for the Blenheim and outlying areas had the Outer Limits land parcels marked as Mixed Farming, Sheep, Cropping, and Cattle. The surrounding properties and general area were also marked as Mixed Farming.

6.3.4 Site Visit

The site was briefly visited on 18 March 2011. The majority of Parcel A and approximately half of Parcel B were covered in fruit trees. The fruit trees are stone fruit including cherries. The front two sections of Parcel B, Lot 2 DP 315225 and Lot 2 DP 10461 are growing horticultural crops.

The surrounding area is dominantly in grapes.

6.3.5 History Summary

Early records from the early 1900s indicate that the Outer Limits area was used for cropping. The 1938 through to 1959 aerial photograph show grain crops. There is a 15 year gap between 1959 and the 1974 aerial photograph, the latter showing the site planted in young orchard. It can be assumed that the orchard or part of the orchard was planted in the mid to late 1960s. With the exception of a few commercial buildings and accompanying sections on the northern part of the parcels the majority of the site remained in stone fruit till the present day. Lot 2 DP 315225 and Lot 2 DP 10461 were cleared of trees between 1993 and 2007 and have been used for horticultural crops since this time. Another section on the north of Parcel B was also cleared of trees and both this section and the two larger plots on the south of the site have bare patches of earth where vegetation is not growing, that have either been used for storage of waste or fires.

6.4 Proposed Development

MDC propose the development rural sites around Blenheim as potential residential land to accommodate residential growth. The Outer Limits area is being looked at potentially as a low density housing area, with sufficiently large lots that vegetable gardens may be established.

6.5 Risk Assessment

6.5.1 General

Risk to potential future residents within the Outer Limits land parcels can arise through exposure to chemical residues in the soil, as a result of the past use of chemicals on the land. The modes of exposure normally considered in a risk assessment are soil ingestion, dermal adsorption, inhalation of contaminated dust and consumption of home-grown produce.

Sampling in other regions in New Zealand indicate excessive chemical residues in soil are commonly associated with horticultural activities such as orchards, berry farms and market gardens and in localised areas on livestock farms with sheep dips.

An analysis of receptors and exposure pathways, assuming medium to low density residential housing, identifies the potential exposure routes as:

- Dermal contact with soil for residents or maintenance workers (eg excavation);
- Ingestion of soil by residents;
- Consumption of home grown produce by residents.

6.5.2 Land Use Contamination Potential

Cropping

Use of pesticides was not common practice with cropping in New Zealand. Some use of preemergent and post-emergent including herbicides for weed control in herbicides such as Simazine or Atrazine may have occurred in more recent times but these herbicides break down in the soil relatively quickly. It is unlikely that fungicides would have used to any extent given the dry Blenheim climate.

Horticultural Crops

There is the possibility of pesticide use on horticultural crops that may have been grown on any of the land parcels. Persistent organochlorines such as DDT and aldrin were used on certain crops and dieldrin was used on fruit, soil and seed. Use of these pesticides was popular in the 1950s and 1960s but effectively ceased in the late 1960s. From the aerial photographs, potential horticultural crops were identified at a couple of sites. However, given the short period of time these pesticides were used, and the frequent turning of soils associated with cropping, it is unlikely that significant residues of persistent organochlorines are present.

Orchards and Berry Fruit

Orchards were identified in sections A and B in the 1974 aerial photograph. It is possible these orchards where established during the 1960s when organochlorine insecticides were in popular use. Insecticides such as dieldrin and possibly DDT where used on some berry and fruit crops. Lead arsenate was also used on pip fruit. It is understood that there were most likely a mix of pip and stone fruit as well as berries on some of the properties during the 1960s therefore there is a potential for build up of persistent organochlorines, lead and arsenic in the soil. While the relatively short period of orchard use during the period of use of organochlorines and lead arsenate pesticides suggest soil concentrations are probably not particularly high, this would need to be confirmed with soil testing. The areas of concern have been marked on Figure 4.

6.5.3 Hot Spot Contamination Potential

Fuel Storage and Spills

No fuel storage was observed in the aerial photographs or during the site visit, nor were there any records in the council files (apart from a LPG tank at Lot 2 DP 11504). However, there are a couple of large commercial buildings on site and it is possible below ground petroleum storage tanks may be on site for boiler or generator rooms for these buildings. Leaks from tanks and their associated pipe work or spills on to unsealed ground occur, and it is recommended that if any underground tanks or hydrocarbon impacted soils are encountered during development, sampling of soils should be conducted and compared with MfE guidelines for residential land use.

Fires

There were a couple of bare areas and darkened areas observed in the aerial photographs. It is not uncommon practice for waste to be burnt on horticultural sites. Elevated heavy metals and polycyclic aromatic hydrocarbons in near surface soils are often associated with fire pit areas and soil sampling of any old burn pit areas is recommended.

Landfilling

Burial of farm waste on site was a common practice and often there are no obvious surface features to indicate where these areas may have been. Often these landfill areas are small and contain reasonably benign waste. However, some farm waste may have been disposed of such as chemical containers or other hazardous material and if uncovered during development would need to be assessed.

Farm buildings

A couple of sheds were identified on the aerial photographs. Farm buildings tend to contain machinery and general farm stores (including possible agricultural chemicals). Elevated heavy metals and residual hydrocarbons are a possibility in the near surface as a result of leaching on to ground or spills, although high concentrations are not expected with the exception of mixing sheds where “hot-spots” are expected. Lead paint residue build-up around older buildings may also occur, and such locations should be investigated.

6.6 Conclusions and Recommendations

A desktop assessment has been carried out on 2 adjoining land parcels on the outskirts of Blenheim on Middle Renwick Road. Overall the area appears suitable for residential development with limited potential for contamination. The assessment found that the area was predominantly used for cropping until approximately the mid 1960s when stone fruit orchards were planted. Potential persistent pesticide residue build up in soils may have occurred during the 1960s with pesticide use on fruit trees. Also potential chemical residue build up may have occurred in “hot-spot” areas from hydrocarbon or other

chemical contamination from storage and spills or waste fires. Resultant chemical residues from these activities are persistent and can accumulate in soil in concentrations above that recommended for residential land use. It is therefore recommended that the following occur prior to any residential development at the site:

- Further investigation whether the orchard site identified in the 1974 aerial was operating during the 1960s.
- Further investigation into the possibility of fuel storage tanks on site (i.e. whether boilers or generators associated with any of the commercial building on site).
- Soil sampling “hot-spot” areas where any waste fires have been or storage sheds.
- Soil sampling near sheds where orchard chemicals may have been stored.

7.0 Growth Pocket - SE

7.1 Site Description

Growth pocket SE, located on Alabama Road to the south-east of Blenheim, has been marked as a possible location for urban development (Figure 5). The site is bounded by Tavera Street to the north, rural property to the east, Alabama Road to the south and rural property to the west. The land has an area of 28 hectares, and consists of the whole of Sec 55 Opawa Dist and part of Lots 3 and 5 DP 3620.

The land is currently used for horticultural crops. There is also a residential building and associated farm buildings on site. The parcel is on an area with minimal relief. Stormwater drainage is direct to soil or on site drainage systems.

7.2 Environmental Setting

7.2.1 Geology and Hydrogeology

The site, like much of Blenheim, is located on Quaternary swamp deposits consisting of poorly consolidated silt, mud, peat and sand (Begg and Johnston, 2000).

A search of the MDC bore records using the council's online GIS Dekho site was conducted. There are three bores registered on SE. Two of them are at a depth of 17m bgl and the depth of the other well is unknown. The bores are likely to be utilising the Wairau aquifer which is semi-confined to confined in this part of Wairau Plain (Rosen and White, 2001). The inferred groundwater flow direction in the region is eastwards towards Cloudy Bay.

7.2.2 Hydrology

The Opawa River lies approximately 900 m to the north-east at its closest point. A drain, or modified stream, runs along Alabama Road, to the south of the land.

7.3 Information Sources

7.3.1 Aerial Photographs

A search was undertaken for historic aerial photographs from three sources, MDC, the Marlborough Museum Archives (Archives), and New Zealand Aerial Mapping Limited (NZAM).

Aerial Photograph from January 1938, source NZAM

The site appears to be in crops in 1938. There is a residential dwelling in the same location as the current building. There appear to be some small horticultural gardens

within the residential plot along with a number of farm buildings. A small stream runs across the site from the back of the residential plot running towards the north-east.

The surrounding area also appears to be used for cropping. There may be some properties growing horticultural crops on a small scale.

Aerial Photograph from 1948, source MDC

The site still appears to be used for cropping in 1948. The residential dwelling and surrounding farm buildings are still on site. The horticultural crops observed on the plot next to the house appear to be gone.

Grains are being grown on the surrounding land. There may be some grazing to a lesser extent but there are no signs of stock yards, sheep dips or other features indicating livestock.

Aerial Photograph from October 1959, source NZAM

The site still appears to be used for grain crops in 1959. The residential dwelling and surrounding farm buildings are still on site. The stream is visible on the site.

Grains are being grown on the surrounding land. There may be some grazing to a lesser extent but again there are no indicators of livestock. Residential development is occurring further to the north and west of the site.

Aerial Photograph from May 1967, source MDC

The site still appears to be used for cropping in 1967. The residential dwelling and associated farm buildings are still on site. The stream is still visible on the site. There are sheep on Lot 3 DP 3620 but grazing does not appear to be a predominant use. There are no stock yards or sheep dips visible.

There appears to be some berry fruit farms to the north-west of the site along with horticultural crops. The sites to the east and west still appear to be used for cropping.

Aerial Photograph from March 1973, source NZAM

The site appears to be used for horticultural crops in 1973. Possibly some of the plots contain berry fruit (north-eastern and south-eastern corners). There are two sheds on the plot in the north-eastern corner plot of Sec 55 Opawa Dist. The residential dwelling and farm buildings are still on site. The stream now looks partly filled in.

There are still what appear to be berry fruit farms to the north-west of the site along with horticultural crops. The sites to the east and west still appear to be used for cropping.

Aerial Photograph from March 1986, source MDC

The majority of Sec 55 Opawa Dist is in horticultural crops in 1986. The north-western plot of Sec 55 Opawa Dist appears to be planted in berry fruit. Only part of Lots 2 and 3

DP 3620 are visible in this aerial but the land appears at least in part to be used for grazing sheep. There are no stock yards or sheep dips visible in this image.

The properties to the south are being used for live stock grazing and viticulture. None of the other surrounding properties are visible in this aerial.

Aerial Photograph from 1993, source Archives

The site is planted in horticultural crops. The residential dwelling and farm buildings are still on site. The stream is no longer visible.

The surrounding properties appear to be either in grains or horticultural crops.

Aerial Photograph from 2007, source MDC

Most of Sec 55 Opawa Dist appears to be used for horticultural crops. The remaining plot is planted in fruit trees. Between the south-eastern plot and the adjacent plot on Sec 55 Opawa Dist is a pile of timber and other debris. Around the residential dwelling and accompanying farm building is a lot of timber and what may be one or two waste pits. There is also a large shed surrounded by debris, possibly timber and metal on the western side of Lot 3 DP 3620.

To the north of the site the development of Tavera Street is underway. There is also a large industrial/commercial property beyond the north-west corner of the site. The land to the west appears to be used for horticultural crops, to the south are a number of vineyards and to the west is residential housing and a small area of land where horses are grazing.

7.3.2 Marlborough District Council Records

A search of the MDC files was conducted for properties within the site. Most records were from the last 30 years. The records contained building applications, of which only one referred to land use which was a 1977 building application for a Hay Barn on Sec 55 Opawa Dist.

7.3.3 Marlborough Museum Archives

Historic Photographs and Accounts

There were early 20th century photographs of farming activities around the broader Blenheim region. Due to the dry climate, and prior to widespread irrigation, grains were the main crop for the region. Photographs showed grains being harvested, stacked on fields and brought to town by horse and cart.

1969 Land Use Map

A Marlborough County Council (1969) land use map for the Blenheim and outlying areas had the SE land parcel marked as Mixed Farming, Sheep, Cropping, and Cattle. The surrounding properties and general area was also marked as Mixed Farming.

7.3.4 Site Visit

Most of the site was in grapevines or pasture at the time of the site visit in March 2011. A new residential dwelling had been built on Sec 55 Opawa Dist alongside the residential dwelling observed in the aerial photographs.

7.3.5 History Summary

Records from the early 1900s indicate that the area would originally have been used for cropping. The earliest aerial photograph, taken in 1937, indicates that cropping was still the main land use at that time. Subsequent photographs indicate cropping was the predominant use for SE until the late 1960s/early 1970s when horticultural crops where grown and are still grown on site.

7.4 Proposed Development

MDC propose the development of rural sites around Blenheim as potential residential land to accommodate residential growth. The aim for SE is for a gross residential density of 14 dwellings per hectare. The possible yield will be around 400 dwellings. The development would include low and medium density residential housing and green public open spaces. The average residential lot size will be sufficiently large that vegetable gardens may be established.

7.5 Risk Assessment

7.5.1 General

Risk to potential future residents within the SE land parcel can arise through exposure to chemical residues in the soil, as a result of the past use of chemicals on the land. The modes of exposure normally considered in a risk assessment are soil ingestion, dermal adsorption, inhalation of contaminated dust and consumption of home-grown produce.

Sampling in other regions in New Zealand indicate excessive chemical residues in soil are commonly associated with horticultural activities such as orchards, berry farms and market gardens and in localised areas on livestock farms with sheep dips.

An analysis of receptors and exposure pathways, assuming medium to low density residential housing, identifies the potential exposure routes as:

- Dermal contact with soil for residents or maintenance workers (eg excavation);
- Ingestion of soil by residents;
- Consumption of home grown produce by residents.

7.5.2 Land Use Contamination Potential

Cropping

Use of pesticides was not common practice with cropping in New Zealand. Some use of preemergent and post-emergent including herbicides for weed control in herbicides such as Simazine or Atrazine may have occurred in more recent times but these herbicides break down in the soil relatively quickly. It is unlikely that fungicides would have used to any extent given the dry Blenheim climate.

Horticultural Crops

There is the possibility of pesticide use on horticultural crops that may have been grown on any of the land parcels. Persistent organochlorines such as DDT and aldrin were used on certain crops and dieldrin was used on fruit, soil and seed. Use of these pesticides was popular in the 1950s and 1960s but effectively ceased in the late 1960s. The aerial photographs do not identify potential horticultural crops until the late 1960s/early 1970s. Therefore it is unlikely that persistent pesticides were used for a sufficient period of time to allow significant build-up in soil.

Berry Fruit

Possible berry fruit crops were identified in the 1973 aerial photograph. Organochlorines were not in popular use from the late 1960s onwards. Therefore, the build up of significant persistent organochlorines is not considered likely.

7.5.3 Hot Spot Contamination Potential

Fuel Storage and Spills

No fuel storage was observed in the aerial photographs, nor were there any records in the council files. However, it is not uncommon for bulk fuel to be stored on farms and there may be or have been above or below ground petroleum storage tanks. Leaks from tanks and their associated pipe work or spills on to unsealed ground occur, and it is recommended that if any underground tanks or hydrocarbon impacted soils are encountered during development, sampling of soils should be conducted and compared with MfE guidelines for residential land use.

Fires

It is not uncommon practice for farm waste to be burnt on site. Elevated heavy metals and polycyclic aromatic hydrocarbons in near surface soils are often associated with fire pit areas and soil sampling of any old burn pit areas is recommended.

Landfilling

Burial of farm waste on site was a common practice and has possibly occurred on the site near the residential dwellings on Sec 55 Opawa Dist. Often these landfill areas are small and contain reasonably benign waste. However, some farm waste may have been

disposed of such as chemical containers or other hazardous material and if uncovered during development would need to be assessed.

Farm buildings

Farm buildings were identified on the aerial photographs. Farm buildings tend to contain machinery and general farm stores (including possible agricultural chemicals). Elevated heavy metals and residual hydrocarbons are a possibility in the near surface as a result of leaching on to ground or spills, although high concentrations are not expected with the exception of mixing sheds where "hot-spots" are expected. Lead paint residue build-up around older buildings may also occur, and such locations should be investigated.

7.6 Conclusions and Recommendations

A desktop assessment has been carried out on the SE land parcel on the south-eastern outskirts of Blenheim township. Overall the area appears suitable for residential development with limited potential for contamination. The assessment found that the area was predominantly used for cropping until the late 1960s/early 1970s. Persistent pesticides residues in soil resulting from cropping and horticultural crops grown after the 1960s are not expected. However, potential chemical residue build up may have occurred in "hot-spot" areas from storage, spills or farm waste fires. Resultant chemical residues from these activities are persistent and can accumulate in soil in concentrations above that recommended for residential land use. It is therefore recommended that the following considerations are made prior to any residential development at the site:

- Further investigation into the possibility of fuel storage tanks on site. If underground tanks or hydrocarbon impacted soils are encountered during development, soil sampling is likely to be indicated to determine any residual hydrocarbon impact. Expert advice should be sought on how to proceed.
- Soil sampling "hot-spot" areas where evidence of waste fires or landfilling is encountered or around old sheds.

8.0 Growth Pocket - E1

8.1 Site Description

Growth Pocket E1 is one of the land parcels around the limits of Blenheim marked as a possible location for urban development (Figure 6). The site is situated to the east of Blenheim, covers 39 hectares and is bounded by rural land and the Opawa River to the north, Rowberrys Road and rural property to the east, the Opawa River to the south, and the Opawa River and residential properties to the west.

Currently the land is used for horticultural purposes, the majority being in grapevines and the remainder in horticultural crops. There are also residential dwellings and a number of farm buildings.

The site is situated on an area with minimal relief. Stormwater drainage is direct to soil or on-site drainage systems.

8.2 Environmental Setting

8.2.1 Geology and Hydrogeology

The site, like much of Blenheim, is located on Quaternary swamp deposits consisting of poorly consolidated silt, mud, peat and sand (Begg and Johnston, 2000).

A search of the MDC bore records using the council's online GIS Dekho site was conducted. There are seven bores registered on E1. Six of the wells are at depths of 25 to 30 m bgl and the depth of the seventh well is unknown. The bores are likely to be utilising the Wairau aquifer which is semi-confined to confined in this part of Wairau Plain (Rosen and White, 2001). The inferred groundwater flow direction in the region is eastwards towards Cloudy Bay.

8.2.2 Hydrology

The Opawa River runs southward along the north western border before turning westwards and looping in on itself heading back eastwards and running along the south-eastern and eastern border of E1. There are no tributaries of the Opawa River on site.

8.3 Information Sources

8.3.1 Aerial Photographs

A search was undertaken for historic aerial photographs from three sources, MDC, the Marlborough Museum Archives (Archives), and New Zealand Aerial Mapping Limited (NZAM).

Aerial Photograph from January 1938, source NZAM

The 1938 aerial photograph show the site is divided into smaller plots of which most appear to be used for cropping. The exception is the area to the north of Dillons Point Road between the road and the Opawa River (north-western part of the site), where it is possible that horticultural crops are being grown. There is also a large building, or building foundations, on this area. There are a couple of small sheds on the site but there do not appear to be any residential dwellings.

To the north, east and south of the site the main land use appears to be cropping. There appears to be some market gardens and orchards to the east and south-east across the Opawa River.

Aerial Photograph from 1948, source MDC

With the exception of the north-western section between Dillons Point Road and the river the site appears to be used for cropping in 1948. The north-western section looks fallow, and there is now a large stand of trees where the large building was standing.

The surrounding area is similar to that observed in the 1938 aerial photograph.

Aerial Photograph from 1959, source MDC

This 1959 aerial photograph does not cover the southern part of the site. The majority of what is visible appears to be used for cropping. There are sheep grazing on some of the plots. Part of the north-western section appears to be being used for cropping or horticultural crops whereas the remainder of it appears fallow with storage of soil or gravel in piles. The stand of trees are now gone revealing only the concrete foundations of the large building observed earlier on site.

Only properties to the north-west of the site are visible in this photograph. There is a mix of market gardens and glasshouses, with pasture and cropping land across the river.

Aerial Photograph from March 1967, source MDC

The majority of the site is being used for cropping in 1967, including most of the north-western section. Part of the north-western section is not being used for cropping, with evidence of vehicle movement apparently associated with stockpiles of soil or gravel. There are sheep grazing in some of the fields. These fields look to be recently harvested. Lot 4 DP 5854 is predominantly being used for cropping but at the very south is a residential dwelling and what appears to be a woolshed with accompanying stock yard. Lot 3 DP 5854 to the south of Lot 4 DP 5854 appears to be pasture land and has sheep grazing. There is a well worn path between the two lots.

Residential growth to the north-west across the river is occurring but there are still some market gardens and glasshouses.

Aerial Photograph from March 1974, source NZAM

The majority of the site is being used for cropping. The north-western section appears fallow but has signs of recent crop growth. There does not appear to be any livestock grazing but the woolshed and stock yards are still visible on Lot 4 Lot DP 5854.

To the north of the site across the river residential development continues, with less market gardening and glasshouse sites than previously observed. There is also considerable residential development to the south-west and west of the site. To the north, east and south the land is still rural and appears to be predominantly used for cropping.

Aerial Photograph from 1981, source MDC

This aerial covers only the north-western part of the site. This part of the site is predominantly being used for cropping. On the northern part of Lot 3 DP6564 are horticultural crops or possibly berry fruit. Lot 4 DP 5854, Lot 1 DP 10562 and part of Lot 1 DP 6444 have sheep grazing but there is evidence of recent crops on these lots. Lot 1 DP 6444 has a small stock yard.

Aerial Photograph from 1983, source Archives

The site now appears to be approximately 50% cropping, 45% horticultural crops and 5% berry fruit. A road has been put in between Lot 3 DP 5854 and 4 DP 5854 which is the current boundary between the two lots according to MDC records. This puts the residential dwelling on Lot 4 DP 5854 and the woolshed on Lot 3 DP 5854. The resolution is too poor to determine if livestock are still grazing on Lot 3 DP 5854.

The surrounding land use also appears to be changing which now is planted in vineyards, berry fruit and horticultural crops.

Aerial Photograph from March 1986, source MDC

This is a 1986 aerial photograph of the north-western part of the site. This photograph shows a mix of berry fruit, horticultural crops and orchards. To the south of Lot 3 DP 6564 there are two new buildings and piles of soil. One of the buildings has trucks outside of it suggesting a commercial use, possibly a depot.

Aerial Photograph from 1993, source Archives

The resolution of the 1993 aerial is poor but the site appears to be planted in a mix of horticultural crops and grains. The north-western section in the region of the large foundations shows signs of heavy traffic movement indicating storage at the site, possibly gravel or soil. The woolshed and residential dwelling on the south-west of the site are now removed.

Aerial Photograph from 2007, source MDC

The 2007 aerial photograph shows the majority of the site is now covered in grapevines with smaller areas in fruit trees. Lot 3 DP 6564, Lot 1 DP 11340 and Lot 3 DP 5854 appear fallow. There is a large building to the south of Lot 4 DP 5854 with a lot of material stored outside such as drums and containers. There is a residential dwelling and a large farm building on Lot 1 DP 6444. Lot 3 DP 6564 also has a residential dwelling to the southern end of the site and there also appears to be a field with mobile homes. To the west of this site is a new residential building on Lot 2 DP 6564. Further west on the same lot is an industrial/commercial building with tractors parked in the yard.

8.3.2 Marlborough District Council Records

A search of the MDC files was conducted for properties within the E1 land parcel. Most records were from the last 30 years, with the majority containing building permit applications. There was some information pertaining to a 4,500 L underground petrol tank and 1,364 L above ground storage diesel tank that were removed in 1994 from Lot 2 DP 6564. There was no information whether or not any soil testing was done at the time of the tank removals.

8.3.3 Marlborough Museum Archives

Historic Photographs and Accounts

There were early 20th century photographs of farming activities around the broader Blenheim region. Due to the dry climate, and prior to widespread irrigation, grains were the main crop for the region. Photographs showed grains being harvested, stacked on fields and brought to town by horse and cart.

1969 Land Use Map

A Marlborough County Council (1969) land use map for the Blenheim and outlying areas had the E1 land parcel marked as Mixed Farming, Sheep, Cropping, and Cattle. The surrounding properties and general area was also marked as Mixed Farming.

8.3.4 Site Visit

Due to the size of the site, a walk over the individual properties was not practicable. However, the area was visited to get a feel for the current layout and land use. A brief site visit in March 2011 indicated that most of the site was in grapevines. A small nursery was noted on Rowberrys Road and Lot 3 DP6564 and Lot 1 DP 11340 were still being used for horticultural crops. The western part of Lot 2 DP 6564 contained a yard with a number of vehicles.

8.3.5 History Summary

Records from the early 1900s indicate that the greater Blenheim area was originally used for cropping and pasture. The earliest aerial photograph, taken in 1937, indicates that

cropping was still the main land use at that time. Subsequent photographs indicate cropping and pasture land were the predominant use of land at the site until the early to mid 1980s when orcharding and horticultural crops dominated.

Horticultural crops were grown intermittently on Lot 3 DP 6564 and Lot DP 11340 as the aerials from 1938 and 1959 suggest. There was also evidence of sheep grazing on some areas, and a woolshed and stock yard were observed in the 1960s and 70s aerials. A stock yard was also observed in the 1981 aerial. A large structure was on Lot 1 DP 11340 prior to 1937, of which the foundations still remain. The use of this building is unknown.

The dominant land use at the site over the last 10 years has been viticulture. Two commercial buildings have been built. One of these had a lot of machinery stored outside and the other a vehicle yard/depot. The vehicle yard/depot is known to have stored bulk hydrocarbons in the past.

8.4 Proposed Development

MDC propose the development of rural sites around Blenheim as residential land to accommodate residential growth. The aim for the E1 land parcel is for a gross residential density of 14 dwellings per hectare. The possible yield will be around 540 dwellings. The development would include low and medium density residential housing and green public open spaces. The average residential lot size will be sufficiently large that vegetable gardens may be established.

8.5 Risk Assessment

8.5.1 General

Risk to potential future residents within the E1 land parcel can arise through exposure to chemical residues in the soil, as a result of the past use of chemicals on the land. The modes of exposure normally considered in a risk assessment are soil ingestion, dermal adsorption, inhalation of contaminated dust and consumption of home-grown produce.

Sampling in other regions in New Zealand indicate excessive chemical residues in soil are commonly associated with horticultural activities such as orchards, berry farms and market gardens and in localised areas on livestock farms with sheep dips.

An analysis of receptors and exposure pathways, assuming medium to low density residential housing, identifies the potential exposure routes as:

- Dermal contact with soil for residents or maintenance workers (eg excavation);
- Ingestion of soil by residents;
- Consumption of home grown produce by residents.

8.5.2 Land Use Contamination Potential

Cropping

Use of pesticides was not common practice with cropping in New Zealand. Some use of preemergent and post-emergent including herbicides for weed control in herbicides such as Simazine or Atrazine may have occurred in more recent times but these herbicides break down in the soil relatively quickly. It is unlikely that fungicides would have used to any extent given the dry Blenheim climate.

Horticultural Crops

There is the possibility of pesticide use on horticultural crops that may have been grown. Persistent organochlorines such as DDT and aldrin were used on certain crops and dieldrin was used on fruit, soil and seed. Use of these pesticides was popular in the 1950s and 1960s but effectively ceased in the late 1960s. From the aerial photographs potential horticultural crops were identified at a couple of sites. However, given the short period of time these pesticides were potentially used, and the frequent turning of soils associated with cropping, it is unlikely that significant residues of persistent organochlorines are present from this land use. Similarly, there are not expected to be significant heavy metal residues.

Orchards and Berry Fruit

Orchards were identified post 1960s when organochlorines were no longer in popular use. Therefore the potential for build up of persistent organochlorines is unlikely.

Vineyards

Insecticides and fungicides are used on grapevines in New Zealand. However, modern pesticides including herbicides used in the industry tend not to be persistent, breaking down reasonably quickly in soil. Of more concern in the industry is the use of treated wooden poles to support the vines. A 2004 study for MDC investigated the impacts from chemical leaching from treated posts in vineyards in the Marlborough region (HortResearch, 2004). The results indicated that CCA leaches from treated posts over time, possibly leading to a gradual accumulation of CCA in the soil. The accumulation rate depends on the age of the posts and how often they have been replaced. Given the age of most of the vineyards within the land parcel the accumulation of CCA in soils around the posts is not expected to be significant (HortResearch, 2004).

8.5.3 Hot Spot Contamination Potential

Fuel Storage and Spills

MDC records indicated past bulk hydrocarbon storage on one of the properties within the site. Leaks can occur from tanks and their associated pipe work, or spills on to unsealed ground. It is recommended that the location of these tanks is investigated and soil sample results should be compared with MfE guidelines for residential land use.

Landfilling

Burial of farm waste on site was a common practice and often there are no obvious surface features to indicate where these areas may have been. Often these landfill areas are small and contain reasonably benign waste. However, some farm waste may have been disposed of such as chemical containers or other hazardous material and if uncovered during development would need to be assessed.

Sheep dips

Arsenic, DDT and dieldrin are associated with sheep dips. The historical aerial photographs did not identify any sheep dips but a potential woolshed and two stock yards were observed. Although no sheep dips were observed on the aerials it was common practice to have a sheep dip near the woolshed and yards. Since the woolshed was built some time in the 1950s/60s when persistent pesticides in sheep dip chemicals were in common use it would be prudent to investigate whether a sheep dip existed.

Farm buildings

Only a few farm buildings were identified on the aerial photographs. Farm buildings tend to contain machinery and general farm stores (including possible agricultural chemicals). Elevated heavy metals and residual hydrocarbons are a possibility in the near surface as a result of leaching on to ground or spills, although high concentrations are not expected with the exception of mixing sheds where “hot-spots” are expected. Lead paint residue build-up around older buildings may also occur, and such locations should be investigated.

8.6 Conclusions and Recommendations

A desktop assessment has been carried out on the E1 land parcels on the outskirts of Blenheim. Overall the area appears suitable for residential development with limited potential for contamination. The assessment found that the area was predominantly used for cropping until the 1980s. Viticulture began to dominate in the last 10 years. Persistent pesticides residues in soil resulting from cropping and current land uses are not expected. However, potential chemical residue build up may have occurred due to hydrocarbon or other chemical contamination from storage and spills, farm waste fires or sheep dips. Resultant chemical residues from these activities can be persistent and can accumulate in soil in concentrations above that recommended for residential land use. It is therefore recommended that the following considerations are made prior to any residential development at the site:

- Further investigation into possibility of a sheep dip on Lots 3 and 4 DP 5854.
- Investigate whether any sampling was conducted during the tank removal from Lot 2 DP 6564 and take samples for comparison with MfE hydrocarbon guidelines if not already done. Also potential fuel storage on other properties should be investigated.
- Investigate the type of industry in the building where foundations remain for contamination potential.

9.0 Growth Pocket - Marris

9.1 Site Description

Marris is one of the land parcels around the limits of Blenheim marked as possible locations for urban development (Figure 7). Marris is situated to the west of Blenheim, and is accessed off New Renwick Road. The site is bound by rural properties to the north, east and west and by residential properties along New Renwick Road to the south.

Currently the land is used for horticultural purposes, predominantly in grapevines with the remainder in horticultural crops and residential use.

Marris is situated on an area with minimal relief. Stormwater drainage is direct to soil or on site drainage systems.

9.2 Environmental Setting

9.2.1 Geology and Hydrogeology

The northern part of the Marris land parcel is situated on Quaternary swamp deposits consisting of poorly consolidated silt, mud, peat and sand (Begg and Johnston, 2000). The southern part of the land parcel is situated on poorly to moderately sorted Quaternary gravel with minor sand or silt underlying aggradational and degradational terraces.

A search of the MDC bore records using the council's online GIS Dekho site was conducted. There are 12 bores registered on the Marris land parcel varying in depth from 6 m bgl to 16 m bgl. The bores on the northern part of the site are likely to be utilising the Wairau aquifer which is unconfined in this part of Wairau Plain, and the Southern Valleys aquifer in the southern part of the site (Rosen and White, 2001). The inferred groundwater flow direction in the region is eastwards towards Cloudy Bay.

9.2.2 Hydrology

The Taylor River lies approximately 400 m to the south-east of the closest point from the site. Yelverton Stream, a tributary of the Taylor River, lies 270 m to the north of the site. A modified stream or drain runs along the northern border of the site.

9.3 Information Sources

9.3.1 Aerial Photographs

A search was undertaken for historic aerial photographs from three sources, MDC, the Marlborough Museum Archives (Archives), and New Zealand Aerial Mapping Limited (NZAM).

Aerial Photograph from January 1938, source NZAM

The majority of the Marris land parcel is being used for cropping or pasture in 1938. There are two small plots being used for horticultural crops (northern half of Lots 1 and 2 DP 414545) and one small plot with fruit trees (northern part of section Lot 4 DP 10015 to the east of current residential dwelling). There appears to be one or two residential dwellings on the land parcel and two small farm buildings. There are a number of natural drainage routes across the site running from south to north.

The surrounding properties are rural and the majority are being used for cropping or pasture.

Aerial Photograph from 1948, source MDC

The majority of the Marris land parcel is being used for cropping or pasture in 1948. There are still a few fruit trees on Lot 4 DP 10015 but it does not look like a commercial orchard. There is a possible horticultural crop on Lots 1 and 2 DP 413202.

The surrounding properties appear to have the same land uses that were observed in the earlier aerial photograph. There are now a few residential houses directly to the south along New Renwick Road.

Aerial Photograph from October 1959, source NZAM

The site appears to be either used for cropping or pasture in 1959. However, there are no signs of livestock or stock yards.

There is a small market garden to the south of the site but the remainder of the surrounding region appears to be used predominantly for cropping or pasture.

Aerial Photograph from December 1965, source NZAM

The 1965 aerial photograph shows that the predominant use of the site for cropping or pasture continues. Cattle or sheep are on Lots 3 and 4 DP 12097. There are no stock yards or sheep dips visible; however, the eastern part of the site is not visible in this aerial. There appears to be some commercial/industrial activities on Lot 4 DP 10015 extending up to the southern part of Lot 2 DP 414545. It is not clear whether the activities are related to agriculture, but there appears to have been some excavation works and there are a number of non-residential buildings on site.

Not many of the properties surrounding the Marris land parcel are visible in this aerial but those that are visible appear to be similar to that observed in the earlier aerial photographs, being predominantly cropping and pasture land.

Aerial Photograph from March 1973, source NZAM

In this 1973 aerial photograph the land use is very similar to that observed in the 1965 photograph, predominantly cropping or pasture. Cattle or sheep are still visible on Lots 3 and 4 DP 12097 and on part of Lot 4 DP 10015 and Lot 2 DP 414545. No stock yards

or sheep dips are visible in this image but the eastern part of the site is not covered by this photograph. There are still a number of large commercial looking buildings on Lot 4 DP 10015. The stream/drain running from Lot 4 DP 100015 northwards is now filled in.

There are more residential dwellings to the south of the site along New Renwick Road. The rest of the surrounding properties that are visible to the south and west still appear to be predominantly used for cropping and pasture.

Aerial Photograph from 1983, source Archives

The resolution is poor in this 1983 aerial photograph but the site now appears to be predominantly planted in vineyards and fruit trees. There are no signs of livestock on the land parcel.

Aerial Photographs from March/April 1986, MDC

The north-western part of the site is covered in either fruit trees or berry fruit in 1986. The north-eastern part of the site is being used for what appears to be a mix of cropping and horticultural crops. The majority of the southern part of the site is now in grapevines with the exception of the south-western plot which appears to be used for horticultural crops.

The land to the south of the site is visible in this aerial and is being used for a mixture of cropping and pasture.

Aerial Photograph from January 1993, source Archives

The site and surrounding properties appear to have the same land use in 1993 as observed in the 1986 aerial photograph.

Aerial Photograph from 2007, source MDC

The 2007 aerial photograph shows the site use to be similar to the current use. The majority of the land parcel is in grapevines with the exception of the north-eastern corner of the land parcel which is dominantly in pasture. Part of Lots 3 and 4 DP 12097 are covered in an orchard and Lots 1 and 2 DP 413202 contain a nursery and garden centre.

9.3.2 Marlborough District Council Records

A search of the MDC files was conducted for properties within the Marris land parcels. Most records were from the last 20 years, with the majority containing building permit applications. There was no information pertaining to issues regarding possible contamination. However, there was a note that the former Nursery had become a truck depot.

9.3.3 Marlborough Museum Archives

Historic Photographs and Accounts

There were early 20th century photographs of farming activities around the broader Blenheim region. Due to the dry climate, and prior to widespread irrigation, grains were the main crop for the region. Photographs showed grains being harvested, stacked on fields and brought to town by horse and cart.

1969 Land Use Map

A Marlborough County Council (1969) land use map for the Blenheim and outlying areas had the Marris land parcel marked as Mixed Farming, Sheep, Cropping, and Cattle. The surrounding properties and general area was also marked as Mixed Farming.

9.3.4 Site Visit

Due to the size of the site, a walk over the individual properties was not practicable. However, the area was visited to get a feel for the current layout and land use. A brief site visit in March 2011 indicated that most or the land was covered in grapevines, and the north-eastern corner of the land parcel had a mix of residential and pasture land and two commercial sites.

9.3.5 History Summary

Records from the early 1900s indicate that the site was used for growing grains and pasture. The earliest aerial photograph, taken in 1937, indicates that cropping was still the main land use at that time. Subsequent photographs indicate cropping and pasture were the predominant use till the late 1970s/early 1980s. In the 1980s and 1990s the majority of the site was in grapevines or orchards. For the last 10 years the site has been predominantly in grapevines. Aerial photographs indicated some horticultural crops were grown in the late 1930s and 1940s. Livestock was also observed in the early aerial photographs but no stock yards or sheep dips were identified in any of the aerial photographs.

9.4 Proposed Development

MDC propose the development rural sites around Blenheim as potential residential land to accommodate residential growth. The aim for the Marris land parcel is for low and medium density residential properties. The average residential lot size will be sufficiently large that vegetable gardens may be established.

9.5 Risk Assessment

9.5.1 General

Risk to potential future residents within the Marris land parcels can arise through exposure to chemical residues in the soil, as a result of the past use of chemicals on the

land. The modes of exposure normally considered in a risk assessment are soil ingestion, dermal adsorption, inhalation of contaminated dust and consumption of home-grown produce.

Sampling in other regions in New Zealand indicate excessive chemical residues in soil are commonly associated with horticultural activities such as orchards, berry farms and market gardens and in localised areas on livestock farms with sheep dips.

An analysis of receptors and exposure pathways, assuming medium to low density residential housing, identifies the potential exposure routes as:

- Dermal contact with soil for residents or maintenance workers (eg excavation);
- Ingestion of soil by residents;
- Consumption of home grown produce by residents.

9.5.2 Land Use Contamination Potential

Cropping

Use of pesticides was not common practice with cropping in New Zealand. Some use of preemergent and post-emergent including herbicides for weed control in herbicides such as Simazine or Atrazine may have occurred in more recent times but these herbicides break down in the soil relatively quickly. It is unlikely that fungicides would have used to any extent given the dry Blenheim climate.

Horticultural Crops

There is the possibility of pesticide use on horticultural crops that may have been grown on any of the land parcels. Persistent organochlorines such as DDT and aldrin were used on certain crops and dieldrin was used on fruit, soil and seed. Use of these pesticides was popular in the 1950s and 1960s but effectively ceased in the late 1960s. From the aerial photographs potential horticultural crops were identified at a couple of sites. However, given the timing and short period of time pesticides would have been used, and the frequent turning of soils associated with cropping, it is unlikely that significant residues of persistent organochlorines are present. Similarly, there are not expected to be significant heavy metal residues.

Orchards and Berry Fruit

Orchards were identified pre 1950s and post 1960s when organochlorines were not in popular use, therefore the potential for build up of persistent organochlorines is unlikely.

Vineyards

Insecticides and fungicides are used on grapevines in New Zealand. However, modern pesticides including herbicides used in the industry tend not to be persistent, breaking down reasonably quickly in soil. Of more concern in the industry is the use of treated wooden poles to support the vines. A 2004 study for MDC investigated the impacts from chemical leaching from treated posts in vineyards in the Marlborough region

(HortResearch, 2004). The results indicated that CCA leaches from treated posts over time, possibly leading to a gradual accumulation of CCA in the soil. The accumulation rate depends on the age of the posts and how often they have been replaced. Given the age of vineyards within the land parcel the accumulation of CCA in soils around the post is not expected to be significant (HortResearch, 2004).

9.5.3 Hot Spot Contamination Potential

Fuel Storage and Spills

No fuel storage was observed in the aerial photographs or during the site visit, nor were there any records in the council files. However, it is not uncommon for bulk fuel to be stored on farms or commercial buildings and there may be or have been above or below ground petroleum storage tanks. Leaks from tanks and their associated pipe work or spills on to unsealed ground occur, and it is recommended that, if any underground tanks or hydrocarbon impacted soils are encountered during development, sampling of soils should be conducted and compared with MfE guidelines for residential land use.

Landfilling

Burial of farm waste on site was a common practice and often there are no obvious surface features to indicate where these areas may have been. Often these landfill areas are small and contain reasonably benign waste. However, some farm waste may have been disposed of such as chemical containers or other hazardous material and if uncovered during development would need to be assessed.

Farm buildings

Farm buildings and possibly commercial buildings were identified on the aerial photographs. Farm buildings tend to contain machinery and general farm stores (including possible agricultural chemicals). Elevated heavy metals and residual hydrocarbons are a possibility in the near surface as a result of leaching on to ground or spills, although high concentrations are not expected with the exception of mixing sheds where “hot-spots” are expected. Lead paint residue build-up around older buildings may also occur, and such locations should be investigated.

9.6 Conclusions and Recommendations

A desktop assessment has been carried out on the Marris land parcel on the western outskirts of Blenheim. Overall the area appears suitable for residential development with limited potential for contamination. The assessment found that the area was predominantly used for cropping and pasture until the 1980s when viticulture and orchards began to dominate. The land is now predominantly planted in grapevines. Persistent pesticides residues in soil resulting from past and current land uses are not expected. However, potential chemical residue build up may have occurred in areas of land from hydrocarbon or other chemical impacts resulting from storage and spills, farm waste fires or sheep dips. Resultant chemical residues from these activities can be

persistent and can accumulate in soil in concentrations above that recommended for residential land use. It is therefore recommended that the following considerations are made prior to any residential development at the site:

- Further investigation into the possibility of fuel storage tanks associated with Lot 4 DP 10015.
- Soil sampling “hot-spot” areas where any waste fires have been, around storage sheds.
- If underground tanks or hydrocarbon impacted soils are encountered during development, soil sampling is likely to be indicated to determine any residual hydrocarbon impact. Expert advice should be sought on how to proceed.

10.0 Growth Pocket - David Street

10.1 Site Description

There are six areas, totalling 43.4 hectares, on the western outskirts of Blenheim centred around the David Street area which have been marked as possible locations for urban development (Figure 8). The sites are referred to in this report as parcels A to F. Parcel A is bounded to the north by residential dwellings, to the east by Battys Road, to the south by David Street and to the west by Severne Street. Parcel B is bounded to the north and east by residential properties to the south by rural land and to the west by Battys Road. Parcel C is bounded to the north by Middle Renwick Road, to the east by Severne Street, to the south by David Street and to the west by rural land. Parcel D is bounded to the north by David Street, to the east by Battys Road, to the south by Yelverton Stream and rural land and by rural land to the west. Parcels E and F are adjacent to each other and are bounded by residential properties to the north, a mix of residential, commercial and rural properties to the east, Yelverton Stream and rural property to the south, and Battys Road to the west.

The parcels of land are currently used for residential, rural and light commercial purposes. The majority of land is in pasture and lifestyle blocks.

The land parcels are on an area with minimal relief. Stormwater drainage is direct to soil or on site drainage systems. Not all properties within the land parcels are connected to a reticulated sewage system and for these properties waste water is to septic tanks and on-site effluent disposal systems.

10.2 Environmental Setting

10.2.1 Geology and Hydrogeology

The land parcels are situated on well sorted flood plain Quaternary gravels (Begg and Johnston, 2000).

A search of the MDC bore records using the council's online GIS Dekho site was conducted. There are a number of bores registered on the land parcels. Most bores are at a depth of between 6m and 20 m bgl which are likely to be utilising the Wairau aquifer which is unconfined to semi-confined in this part of Wairau Plain (Rosen and White, 2001). The inferred groundwater flow direction in the region is eastwards towards Cloudy Bay.

10.2.2 Hydrology

The Taylor River runs to the east of the site and at its closest point to Parcel F, the easternmost parcel, is approximately 230m south-east. Yelverton Stream is a tributary of the Taylor River and runs along the southern border of parcels D, E and F. To the north, on Parcel C, an unnamed tributary of the Taylor River originates. To the south-west

Doctors Creek lies at a distance of 800m from its closest point to Parcel D before joining a modified stream/drain which is a tributary of Yelverton Stream. There are no other significant surface water features within a kilometre of the site.

10.3 Information Sources

10.3.1 Aerial Photographs

A search was undertaken for historic aerial photographs from three sources, MDC, the Marlborough Museum Archives (Archives), and New Zealand Aerial Mapping Limited (NZAM).

Aerial Photograph from January 1938, source NZAM

Parcel A – The majority of the land parcel is being used for cropping. There is a small orchard and two small horticultural crop plots. There are a few residential dwellings and one industrial property.

Parcel B and C – The land parcel is being used for cropping and there are a couple of residential dwellings.

Parcel D - The land parcel is being used for cropping and there are a couple of residential dwellings. There is possibly one small area that is being used for horticultural crops.

Parcel E and F – The land parcels are being used for cropping.

Aerial Photograph from 1948, source MDC

Parcel A – The land parcel is still predominantly used for cropping. The small orchard is still visible. The industrial property is still there. There are now a few more residential dwellings in the area.

Parcel B – The land parcel is still being used predominantly for cropping.

Parcel C - The land parcel is still being used predominantly for cropping. There are now glasshouses just to the south-west of the site's boundary.

Parcel D - The land parcel is still being used predominantly for cropping.

Parcel E and F - The land parcels are still being used predominantly for cropping. There is a small area that appears to be in horticultural crops.

Aerial Photograph from 1951/1952, source Archives

Parcels A, B, C and D are a mix of pasture and cropping. Parcels E and F appear to be in pasture.

Aerial Photograph from October 1959, source NZAM

Parcel A – Most of the land parcel is being used for cropping. The small orchard is now gone. There may be some horticultural crops. The industrial site has now expanded in size and appears to be a sawmill.

Parcel B - The land parcel is still being used predominantly for cropping. There are now a few more residential dwellings on the land parcel.

Parcel C - The land parcel is still being used predominantly for cropping, there may be a small area in horticultural crops. There are now a few more residential dwellings on the land parcel.

Parcel D – The majority of the land parcel is being used for cropping but there are some areas that appear to be fallow and some small areas with horticultural crops.

Parcels E and F – The area is predominantly used for cropping with a small part of the site possibly in horticultural crops.

Aerial Photograph from December 1965, source NZAM

Parcel A – The parcel is still predominantly in cropping. There are now more residential properties and another small orchard. The industrial property remains and timber can be seen stored outside around the property. Council records identify this as having been a sawmill (see Section 10.3.2, below).

Parcel B – The land parcel is still predominantly cropping but now there are more houses and some horticultural crops. The northern section has vehicles on site and appears to be storing piles of soil or gravel.

Parcel C - The land use is still predominantly cropping. There also appears to be berry fruit and some horticultural crops.

Parcel D - The land parcel is still predominantly cropping and some horticultural crops. There is also some land that is either fallow or pasture. There are no livestock, stock yards or sheep dips visible.

Parcels E and F – The land parcels are still predominantly being used for cropping. There are some smaller areas with possible horticultural crops and possibly sheep on site. There are no stock yards or sheep dips visible.

Aerial Photograph from March 1973, source NZAM

Parcel A – Approximately half of the land parcel is now used for cropping. The remainder is being used for residential properties, horticultural crops, orchards, or industry (sawmill).

Parcel B – The site is predominantly in grains or fallow. The remainder of the site is divided into residential properties. The northern section appears to be used for storage still and is possibly being used for commercial purposes, perhaps garden supplies.

Parcel C – The site is predominantly being used for cropping with possible horticultural crops. There are now more residential dwellings on the land parcel.

Parcel D – The south-eastern corner of the land parcel is now in residential housing. The remainder of the site is in cropping and pasture. There are possibly sheep grazing. There is no sign of stock yards or sheep dips.

Parcels E and F – Over half the site appears fallow or between crops. There appears to be berry fruit growing on the north-western part of the land parcel.

Aerial Photograph from 1981, source MDC

This aerial photograph covers only part of the David Street land parcels.

Parcel A – Approximately 50% of the land parcel is being used for pasture. Sheep are grazing and stock yards in the middle of Parcel A are visible. There are a number of horticultural crops to the east of the land parcel. The sawmill is still operating and there is a lot of timber stored outside to the south of the site. The rest of the land parcel is residential property.

Parcel B – A lot of timber and other material is being stored outside on the northern property and there are a number of trucks on site.

Parcel C – The northern end of this land parcel is not visible in this aerial. The majority of the site appears to be used for grazing. There are some horticultural crops to the southern end of the land parcel. There are also some residential properties on the land parcel.

Parcel D – The western end of the land parcel is not shown on this aerial photograph. The rest of the site is either being used for grazing or cropping. There is a small stock yard to the rear of one of the residential dwellings.

Parcels E and F – There are at least two, perhaps three, residential dwellings on site. There is a stock yard on the southern lot on Battys Road. Sheep are grazing on two of the northern lots along Battys Road. The rest of the site appears to be used for pasture or is fallow.

Aerial Photograph from 1983, source Archives

Parcel A – Approximately half of the land parcel is being used for cropping. The remainder of the land parcel is being used for residential properties, horticultural crops, orchards, or industry.

Parcel B – Land use does not appear to have changed since the 1973 aerial photograph.

Parcel C – The site is predominantly being used for cropping with some horticultural crops and number of residential dwellings.

Parcel D – Land use does not appear to have changed since the 1973 aerial photograph.

Parcels E and F – There is a residential dwelling and a couple of other buildings on the south-western plot, otherwise the remainder of the land appears to be used for cropping.

Aerial Photograph from January 1993, source Archives

Parcel A – Residential dwellings line the outside of the land parcel but the middle still remains in either pasture or cropping. The industrial site (sawmill) to the south-east corner is still in operation.

Parcel B – The northern part of the land parcel is residential. The northern lot still appears to have bulk supplies stored on site but the resolution is too poor to determine what is being stored.

Parcel C – The site is a mix of residential and small horticultural crop plots.

Parcel D – The land parcel is either predominantly in cropping or pasture. There is one possible horticultural crop and there are residential dwellings on a number of the lots.

Parcels E and F – There are two residential buildings on the land parcels and the rest is either in cropping or pasture use.

Aerial Photograph from 2007, source MDC

The 2007 aerial photograph shows the parcels similar to that presently observed on site.

Parcel A – The land parcel is a mix of residential, commercial, fallow, pasture or horticultural crops. The sawmill is no longer operating, but a commercial building remains on the property. There are stock yards visible in the aerial but no livestock were observed.

Parcel B – The northern property used for storage is still in use as a commercial site and appears to be storing timber amongst other things. The property directly to the south is mostly empty and looks like it is occasionally used for horse riding/jumping. The two most southern plots have residential dwellings on them but also appear to have scrap metal/machinery stored to the rear of the properties. Another residential dwelling appears to have a burial pit at the back of the property.

Parcel C – The land parcel is similar to that observed currently and is a mix of residential properties, horticultural crops and pasture. No livestock or stock yards were observed in the aerial.

Parcel D – Most of the lots have residential dwellings. Some of the lots have horticultural crops on them and one has an olive grove. There is also sheep grazing on one of the lots but there are no stock yards visible or other indications that the land is used permanently for grazing.

Parcels E and F – With the exception of two lots along Battys Road the rest of the site is either in low density residential use or in the process of being developed for residential use. One of the two lots along Battys Road is in pasture and the other is being used for horticultural crops. Sheep are grazing but there are no stock yards visible.

10.3.2 Marlborough District Council Records

A search of the MDC files was conducted for properties within the David Street land parcels. Most records were from the last 20 years, with the majority containing building permit applications.

Parcel A - There was some information on possible contamination from septic tanks. There was also some information on the former sawmill in Battys Road (Lots 1, 2 and 3 DP 356577). The sawmill operated between the 1950s and 2005. In January 2004 an environmental investigation was conducted that included soil sampling at the mill site (including sampling near a former tank that was removed from site). Three soil samples were above residential guidelines in the southern end of the mill site and one sample was over commercial guidelines in the north of the mill site. The report recommended removal of the top 200 mm of soil and replacement with clean fill in the southern part of the mill site where residential use was proposed. This was carried out in August 2005.

Parcel B – The file included information on the northern section of the land parcel where storage of material was observed in the aerial photographs (Lot 1 DP 4858). Originally the property was used for storage of wood for domestic use dating back to the late 1950s. Wood sawing was done on site with a bench type saw but most preparation was done off site. By 1995 the property was being used as a wood and coal yard.

Parcel C – The only item pertaining to land use was for a building application for a hay shed on Lot 50 DP 4858.

Parcel D – This file contained some information on possible contamination from septic tanks to Yelverton Stream.

Parcels E and F – The file contained building permits for hay sheds on a couple of the properties and a tunnel house on Pt Lot 3 DP 544. The tunnel house was not observed on the aerial photographs.

10.3.3 Marlborough Museum Archives

Historic Photographs and Accounts

There were early 20th century photographs of farming activities around the broader Blenheim region. Due to the dry climate, and prior to widespread irrigation, grains were the main crop for the region. Photographs showed grains being harvested, stacked in fields and brought to town by horse and cart

1969 Land Use Map

A Marlborough County Council (1969) land use map for the Blenheim and outlying areas had the David Street land parcels marked as Mixed Farming, Sheep, Cropping, and Cattle. The surrounding properties and general area was also marked as Mixed Farming.

10.3.4 Site Visit

Due to the size of the site, a walk over the individual properties was not practicable. However, the area was visited to get a feel for the current layout and land use. A brief site visit in March 2011 indicated that most plots were either in pasture or residential (lifestyle blocks). Exceptions to this included an olive grove in David Street, a sports centre where the former sawmill was located in Batty Street, and a couple of small retail businesses for second hand furniture and crafts.

10.3.5 History Summary

Records from the early 1900s indicate that the David Street area was used for growing cropping and pasture. The earliest aerial photograph, taken in 1938, indicates that cropping was still the main land use at that time. Subsequent photographs indicate cropping and pasture land were the predominant use for the majority of land within the parcels. A sawmill operated for approximately 50 years at the corner or Battys Road and David Street. With the exception of the sawmill, minor commercial activities occurred and some small horticultural crops and orchards/berry farms operated. One site also was used for coal storage. The remainder of land was used for residential dwellings.

Short term grazing of animals (most likely sheep only) has occurred on one or more of the parcels. A couple of stockyards were observed from the early 1980s onwards. No sheep dips were identified.

10.4 Proposed Development

MDC propose the development of rural sites around Blenheim as potential residential land to accommodate residential growth. The aim for the David Street land parcels is for low and medium density residential properties. The average residential lot size will be sufficiently large that vegetable gardens may be established.

10.5 Risk Assessment

10.5.1 General

A risk to potential future residents within the Renwick land parcels can arise through exposure to chemical residues in the soil, as a result of the past use of chemicals on the land. The modes of exposure normally considered in a risk assessment are soil ingestion, dermal adsorption, inhalation of contaminated dust and consumption of home-grown produce.

Sampling in other regions in New Zealand indicate excessive chemical residues in soil are commonly associated with horticultural activities such as orchards, berry farms and market gardens and in localised areas on livestock farms with sheep dips.

An analysis of receptors and exposure pathways, assuming medium to low density residential housing, identifies the potential exposure routes as:

- Dermal contact with soil for residents or maintenance workers (eg excavation);
- Ingestion of soil by residents;
- Consumption of home grown produce by residents.

10.5.2 Land Use Contamination Potential

Cropping

Use of pesticides was not common practice with cropping in New Zealand. Some use of preemergent and post-emergent including herbicides for weed control in herbicides such as Simazine or Atrazine may have occurred in more recent times but these herbicides break down in the soil relatively quickly. It is unlikely that fungicides would have used to any extent given the dry Blenheim climate.

Horticultural Crops

There is the possibility of pesticide use on horticultural crops that may have been grown on any of the land parcels. Persistent organochlorines such as DDT and aldrin were used on certain crops and dieldrin was used on fruit, soil and seed. Use of these pesticides was popular in the 1950s and 1960s but effectively ceased in the late 1960s. From the aerial photographs potential horticultural crops were identified at a couple of sites. However, given the short period of time these pesticides were used, and the frequent turning of soils associated with cropping, it is unlikely that significant pesticide residues are present.

Orchards and Berry Fruit

Orchards/berry fruit were identified on parcels A and C in the 1960s when organochlorines were in popular use. Insecticides such as Dieldrin and possibly DDT where used on some berry and fruit crops. Lead arsenate was also used on pip fruit. It is understood that there were most likely a mix of pip and stone fruit as well as berries on some of the properties during the 1960s therefore the potential for build up of persistent organochlorines and heavy metals in the soil. These areas have been marked on Figure 8.

10.5.3 Hot Spot Contamination Potential

Fuel Storage and Spills

No fuel storage was observed in the aerial photographs or during the site visit, nor were there any records in the council files (except for a tank removed from the sawmill). However, it is not uncommon for bulk fuel to be stored on farms and there may be or have been above or below ground petroleum storage tanks. Leaks from tanks and their associated pipe work or spills on to unsealed ground occur, and it is recommended that, if any underground tanks or hydrocarbon impacted soils are encountered during

development, sampling of soils should be conducted and compared with MfE guidelines for residential land use.

Fires

It is not uncommon practice for farm waste to be burnt on site. Elevated heavy metals and polycyclic aromatic hydrocarbons in near surface soils are often associated with fire pit areas and soil sampling of any old burn pit areas is recommended.

Landfilling

Burial of farm waste on site was a common practice and often there are no obvious surface features to indicate where these areas may have been. Often these landfill areas are small and contain reasonably benign waste. However, some farm waste may have been disposed of such as chemical containers or other hazardous material and if uncovered during development would need to be assessed.

Sheep dips

Arsenic, DDT and dieldrin are associated with sheep dips. The historical aerial photographs did not identify any sheep dips and the land was used predominantly for cropping during the 50s and 60s when the more persistent pesticides were in use.

Farm buildings

Some farm buildings were identified on the aerial photographs. Farm buildings tend to contain machinery and general farm stores (including possible agricultural chemicals). Elevated heavy metals and residual hydrocarbons are a possibility in the near surface as a result of leaching on to ground or spills, although high concentrations are not expected with the exception of mixing sheds where “hot-spots” are expected. Lead paint residue build-up around older buildings may also occur, and such locations should be investigated.

10.6 Conclusions and Recommendations

A desktop assessment has been carried out on six land parcels on the outskirts of Blenheim in the David Street area. Overall the area appears suitable for residential development with limited potential for contamination. The assessment found that the area was predominantly used for cropping and pasture and, to a lesser extent, horticultural crops and orchards/berries. Currently the land parcels are predominantly life style blocks or grazing land.

Persistent pesticides residues in soil resulting from cropping and current land uses are not expected. However, potential chemical residue build up may have occurred in areas of land containing sawmills, storage yards, horticultural crops, orchards, hydrocarbon or other chemical contamination from storage and spills, farm waste fires or sheep dips. Resultant chemical residues from these activities can be persistent and can accumulate in soil in concentrations above that recommended for residential land use. It is therefore

recommended that the following considerations are made prior to any residential development at the site:

- Soil sampling “hot-spot” areas where coal was stored (Lot DP 4858), where waste fires were located, and areas around storage sheds or where scrap metal/old machinery has been stored.
- Peer review of the environmental investigation for the sawmill to assess adequacy of investigation at the site including whether adequate sampling around the former fuel tank was conducted.
- Soil sampling within orchards/berry fruit sites that were operating during the 1950s and/or 1960s.

11.0 Conclusions and Recommendations

Most of the proposed development areas appear suitable for residential development with limited potential for contamination. However, this conclusion is based predominantly on aerial photographs and limited information from council files and further consideration and possible sampling of the following areas would be required to confirm this conclusion:

- Areas that were orchards prior to the 1970s;
- Glasshouses;
- Some stockyards that may have had associated sheep dips;
- Some industrial sites including contractors wards where hazardous material may have been stored;
- A small number of fuel storage tank locations;
- The former sawmill site;
- Burn areas.

12.0 References

Begg, J.G., Johnston, M.R. (compilers) 2000, *Geology of the Wellington area. Institute of Geological & Nuclear Sciences 1:250 000 geological map 10. 1 sheet + 64p. Lower Hutt, New Zealand*: Institute of Geological & Nuclear Sciences Limited.

HortResearch, 2004, *Results of an initial survey of the leaching from treated posts in vineyards in the Marlborough region, A Report to the Marlborough District Council*, The Horticulture and Food Research Institute of NZ Ltd.

Marlborough County Council, 1969, *Land Use Data 1969, Sheet No. 4*. Unpublished Map.

MDC, 2010, *Marlborough Urban Growth and Development, Wairau-Awatere Settlements, A Strategy for the Future – Statement of Proposal*, Marlborough District Council.

Figures

PARCEL BOUNDARIES AND LOCATION OF POTENTIAL "HOT-SPOT" AREAS

FILE NO. W01819100

Legend
Residential
RoadCentreline
Parcel

THOMSONS FORD ROAD

OLD WOOLSHED LOCATION?

OLD FARM SHED LOCATIONS

N2 (N-b)

FARM BUILDINGS AND STORAGE IN YARD

N1 (N-a)

OIL SPILL LOCATION

MODERN FIRE PIT REMNANTS

FORMER MARKET GARDENS?

OLD SHED OPENS TO N

FORMER MARKET GARDENS?

N2 (N-b)

OLD FARM SHED LOCATIONS

FORMER STOCKYARD

WAIPUNA STREET

OLD RENWICK ROAD

NOTTINGHILL DRIVE

WINDSOR CLOSE

MURPHYS ROAD

RUTLEDGE DRIVE

MAGNOLIA DRIVE

FUCHSIA PLACE

FARNHAM DRIVE

COLEMANS ROAD

THE WILLOWS

MOWAT STREET

GLENROY CRESCENT

MCCALLUM STREET

FULTON STREET

MCLAUCHLAN STREET

N

"POTENTIAL H.S.I.O. PARCEL BOUNDARIES AND LOCATION OF POTENTIAL "HOT-SPOTS" FILE NO. W018190100 DRAFT.

Legend
- Deferred Rural Residential
- Deferred Township Residential
- Industrial Zone
- Rural Residential Zone
- Township Residential Zone
- RoadCentreline
- Parcel

Tyrone Park

SH 6

BLICKS ROAD

HORTICULTURAL CROPS 1964?

GLASS HOUSES

A

INKERMAN STREET NORTH

BERRIES 1964?

TERRACE ROAD

CEP STREET

PASTURE AND CROPPING FORMER SHEEP YARDS

GLASSHOUSES 1973 AND AGAIN 1993 HORTICOP 1964

HORTICULTURAL CROPS 1964/73 AND MIXING SHED?

BERRIES? 1964

ALMA STREET NORTH

B

ORCHARDS 1964, 1973 AND 1983

Pak Lims Corner

HORTICULTURAL CROPS 1964?

HUDENARDE STREET

HORTICULTURAL PLOTS 1937?

HAMMOND ROAD

RIVER TERRACE

West of Terrace

HORTICULTURAL CROPS 1948?

HORTICULTURAL PLOTS 1948?

HIGH STREET

BOYCE STREET

NELSON PLACE

HARVEY PLACE

BRIDGE STREET

WILLIS PLACE

HAVELOCK STREET

INKERMAN STREET

ALMA STREET

KIRK STREET

BLENHEIM STREET

SH 6

East of Hammond Road

Te Whare Ra

OAK TREE LANE

ANGLESEA STREET

KOWHAI DRIVE

CLYDE STREET

MCALLISTER PLACE

MCISAAC PLACE

VORBACH PLACE

DELTA DRIVE

SH 63

HAWKESBURY ROAD

N

FIGURE 3: W2 LAND PARCEL BOUNDARY AND LOCATION OF POTENTIAL "HOT-SPOT" AREAS

FILE NO. W018.9100

Legend

Residential

RoadCentreline

Parcel

W2

FORMER RESIDENTIAL DWELLING

FORMER ORCHARDS

FORMER STOCKYARDS AND FARM BUILDINGS

NEW RENWICK ROAD

BATTYS ROAD

BURLEIGH ROAD

ALABAMA ROAD

EDITH STREET

RUDD CRESCENT

KARINA CRESCENT

ROBALAN PLACE

PAGE STREET

HOSPITAL ROAD

ARTHUR BAKER PLACE

MAXWELL ROAD

ARDSONA AVENUE

AERODROME ROAD

BEN MORVEN ROAD

WITHER ROAD

SERVICE LANE

WOODMOR ROAD

TAYLOR PASS ROAD

ROWAN PLACE

FOREST PARK DRIVE

ASHWOOD DRIVE

EUCKLAND DRIVE

FOREST DRIVE

TERRACE STREET

WESTERN PLACE

MARTIN TERRACE

HILLSIDE TERRACE

GINGKO PLACE

OLIVE COURT

ELMWOOD AVENUE

N

FIGURE 4: MIDDLE RENWICK ROAD / OUTER LIMITS PARCEL BOUNDARIES AND LOCATION OF POTENTIAL CONTAMINATION AREAS

FILE NO. W0181910O

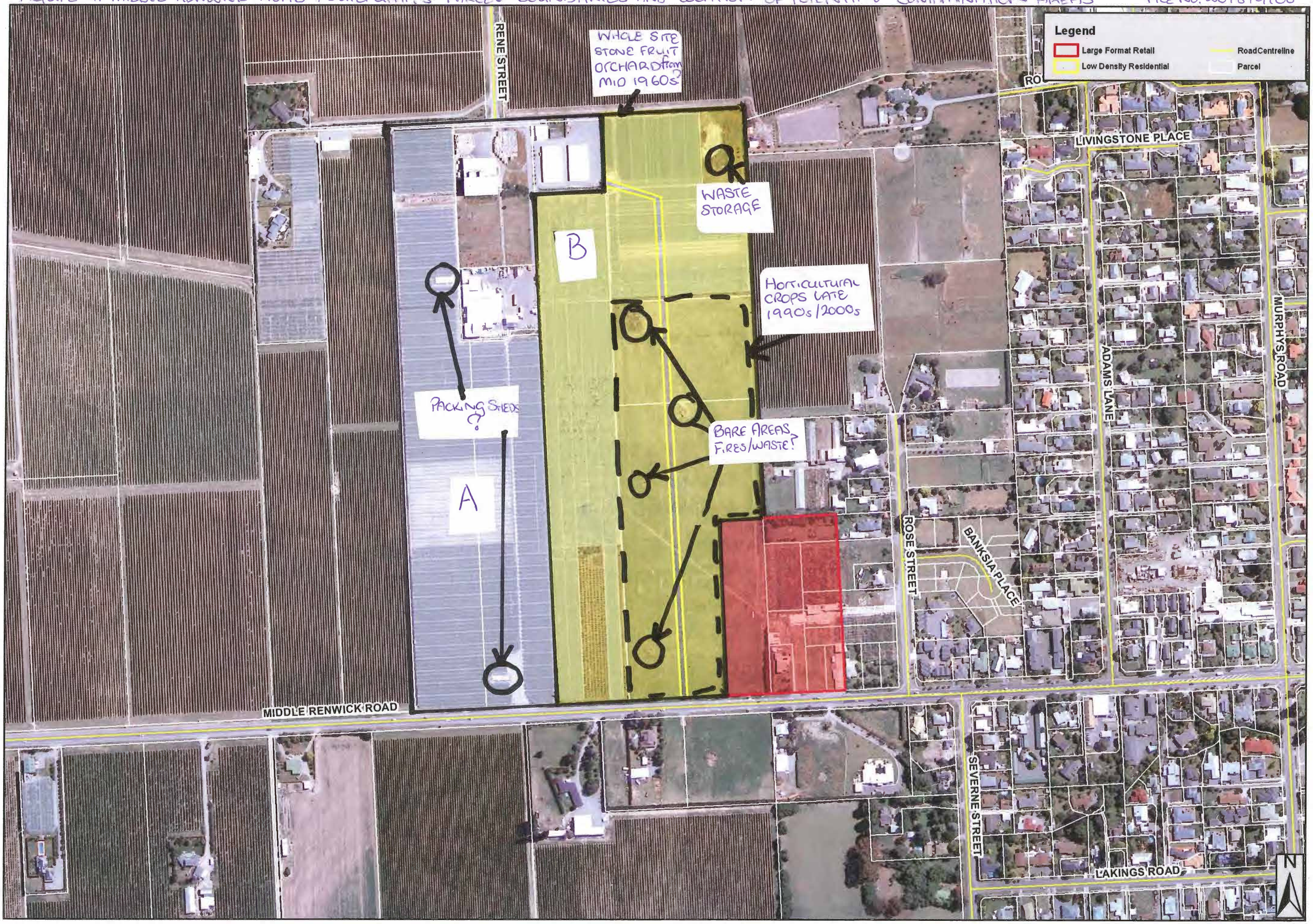


FIGURE 5: SE LAND PARCEL BOUNDARY AND LOCATION OF POTENTIAL "HOT-SPOT" AREAS

FILE NO. WO181910O

FIGURE 6: E1 LAND PARCEL BOUNDARY AND LOCATION OF POTENTIAL "HOTSPOT" AREAS FILE NO. W018190.00

Legend
Residential
RoadCentreline
Parcel

BUDGE STREET
ACCESSWAY
GASCOIGNE STREET
LUCAS STREET
HOLDAWAY STREET
TURNER PLACE
CRESSWELL LANE
MERLOT PLACE
SWAMP ROAD
ROWBERRYS ROAD
S POINT ROAD
PARK TERRACE
MAIN STREET
DUNBEATH STREET
KEISS STREET
KINROSS STREET
ELZY STREET
LYBSTER STREET
SH 1

HORTICULTURAL CROPS 1938/59
FOUNDATIONS FOR OLD BUILDING
OLD SHEDS
E1
HYDROCARBON STORAGE
FIELD WITH MOBIL HOMES
STOCKYARD 1981
SHED SURROUNDED BY OLD MACHINERY?
FARM SHEDS
E1
WOOLSHED
OLD SHEDS

N

FIGURE 7: MARRIS LAND PARCEL BOUNDARY AND LOCATION OF POTENTIAL "HOT-SPOTS"

FILE NO. W01819100

LOCATION OF POTENTIAL "HOT-SPOT" AREAS

FILE NO. W0181.9.00

MIDDLE RENWICK ROAD

LAKINGS ROAD

BOYCE STREET

FIFTH LANE

HILEY STREET

HIGH STREET

BANK STREET

BROOK STREET

PURKISS STREET

BARY STREET

SEQUOIA

CHARLES STREET

ARTHUR STREET

LEE STREET

VEVIAN PLACE

MONRO STREET

MEACHEN CRESCENT

DILLON STREET

LEEFIELD STREET

ACCESSWAY

BREWER STREET

STRATFORD STREET

ROGERS STREET

LEITRIM STREET

ELTHAM ROAD

BARRYS ROAD

COVENT GARDENS

A

B

C

D

E

F

HORTICULTURAL CROPS? 59/65

HORTICULTURAL CROP? 1959/65

OLD FARM BUILDING

HORTICULTURAL CROPS 59/65&73

ORCHARD 1965/73

HORTICULTURAL CROPS 38/59/65&73

COAL STORAGE.

HORTICULTURAL CROP? 1965

STOCK YARD 1981.

SAW MILL LATE 50s 2007

HORTICULTURAL CROPS 1938

BERRY FRUIT 1965.

BERRY FRUIT? 1965

ORCHARD 1938

SCRAP METAL ON SITE

HORTICULTURAL CROPS 1973

HORTICULTURAL CROP? 1965 BERRY FRUIT? 1973

HORTICULTURAL CROPS? 1973

HORTICULTURAL CROPS? 1959

HORTICULTURAL CROPS? 1973.

OLD SHEDS

OLD SHEDS

HORTICULTURAL CROPS? 1948

HORTICULTURAL CROPS? 1958/1965

STOCK YARD 1981

HORTICULTURAL CROPS? 1938

HORTICULTURAL CROPS 1959

Legend

Future Urban Residential 2

Large Lot Residential

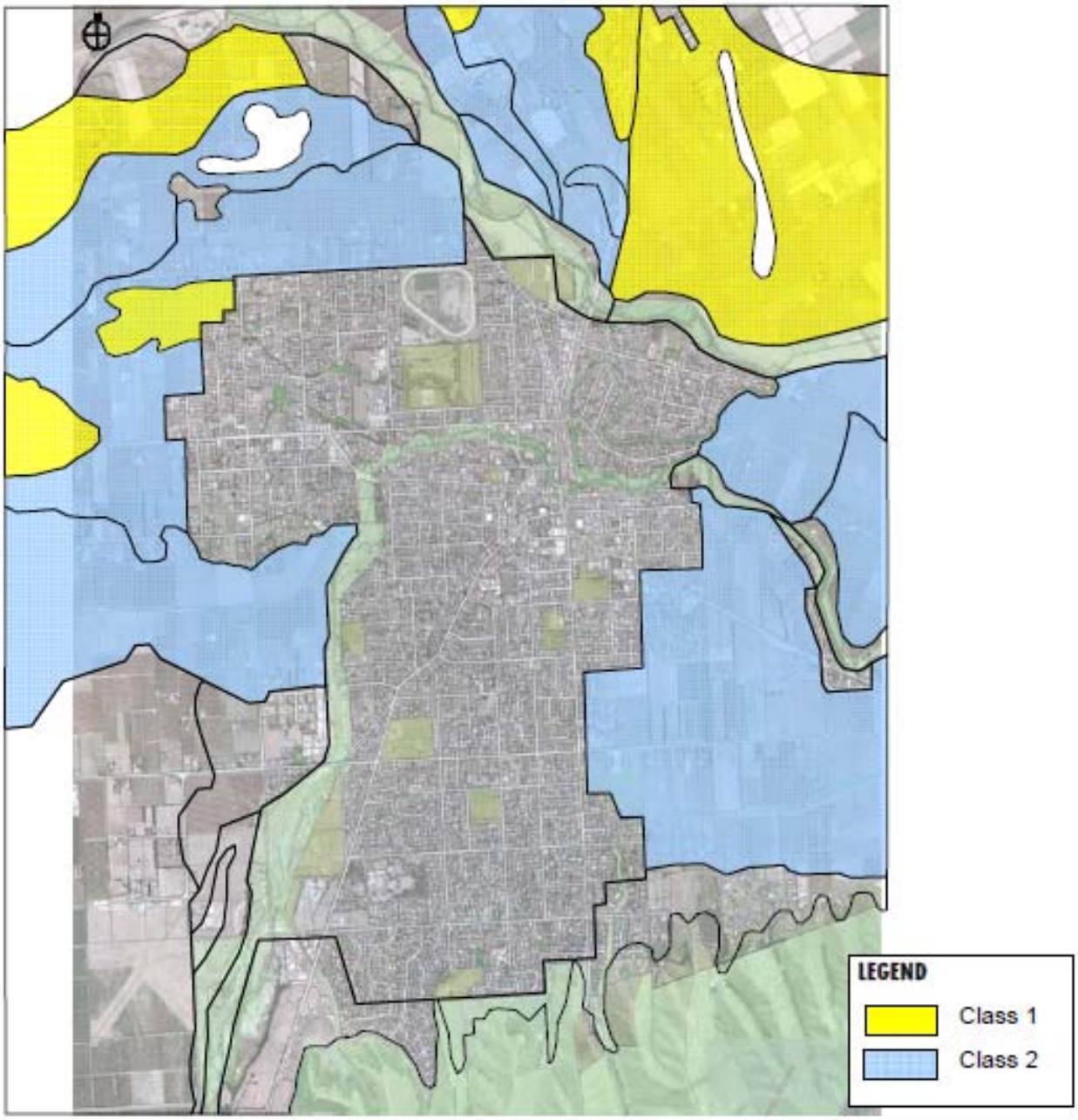
RoadCentreline

Parcel

Appendix 9

Versatile Soils

Land Use Classification



Land parcel size within Growth Areas 1-7

4
2
2
1
5
3
6
7
7
7

Legend

Land parcel

Growth Area

Rural 3 Zone Land Parcel

< 2 ha

2.000001 - 3 ha

3.000001 - 4 ha

4.000001 - 5 ha

5.000001 - 6 ha

> 6 ha

N

1:10,000

Date: 4/06/2013 (Map created for A3 - Hmu)

Appendix 10

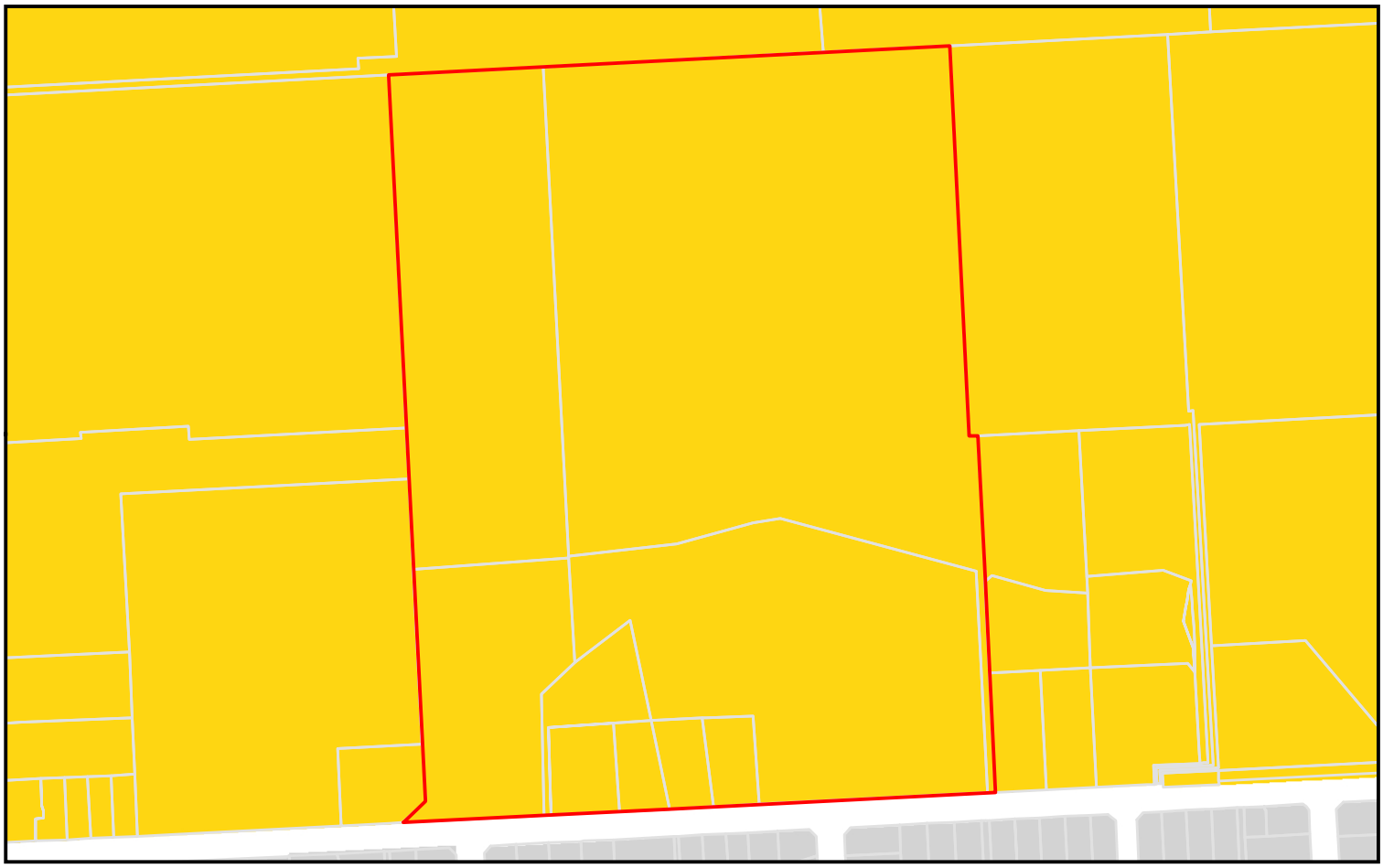
Appendix 10
Plan Change 64

Current Zoning

Legend

Plan Change Area | Parcel | Urban Residential Two Zone | Rural Three Zone | road

N



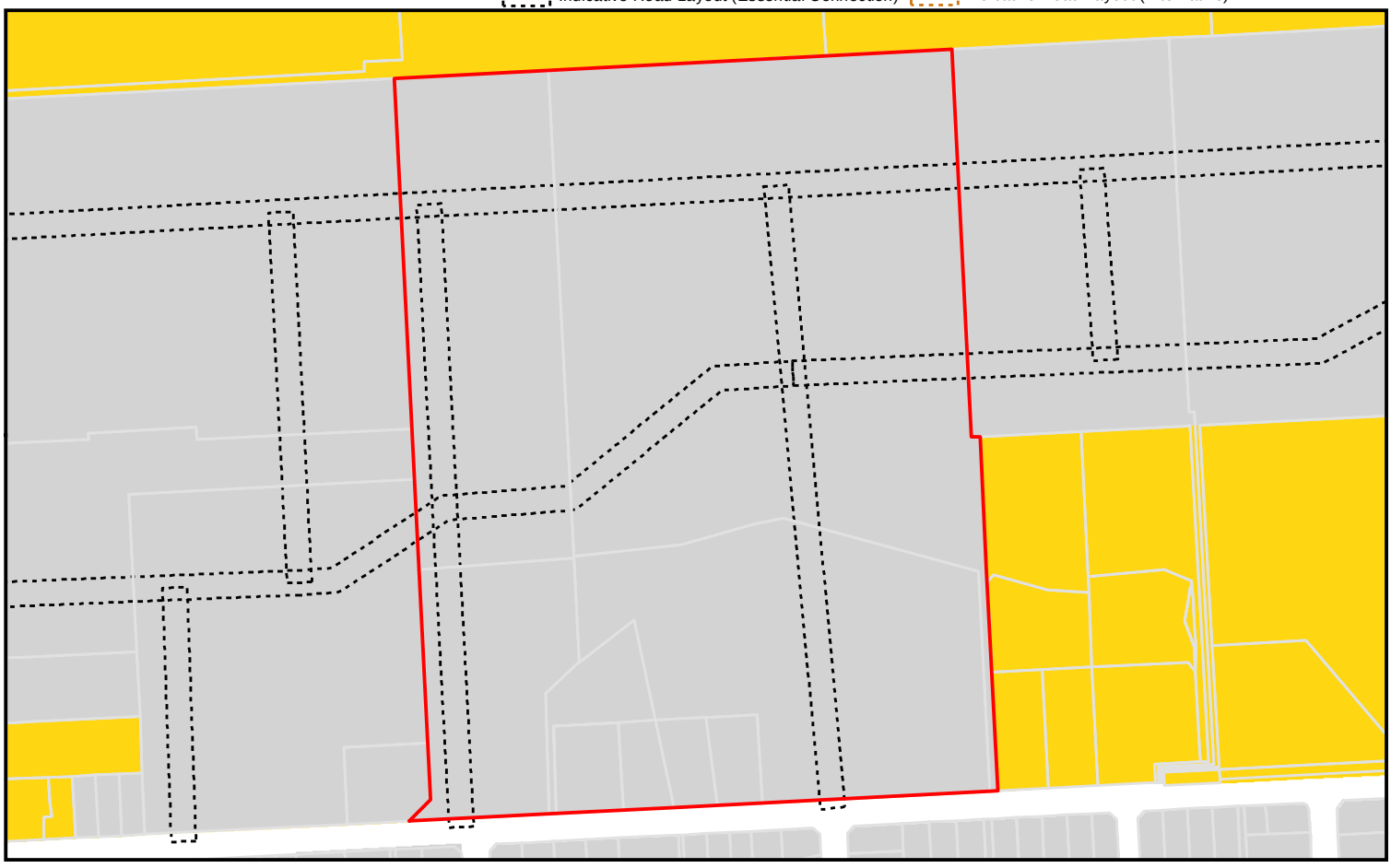
Proposed Zoning

5/06/2013

Legend

Plan Change Area | Parcel | Urban Residential Two Zone | Rural Three Zone | road

Indicative Road Layout (Essential Connection) | Indicative Road Layout (Alternative)



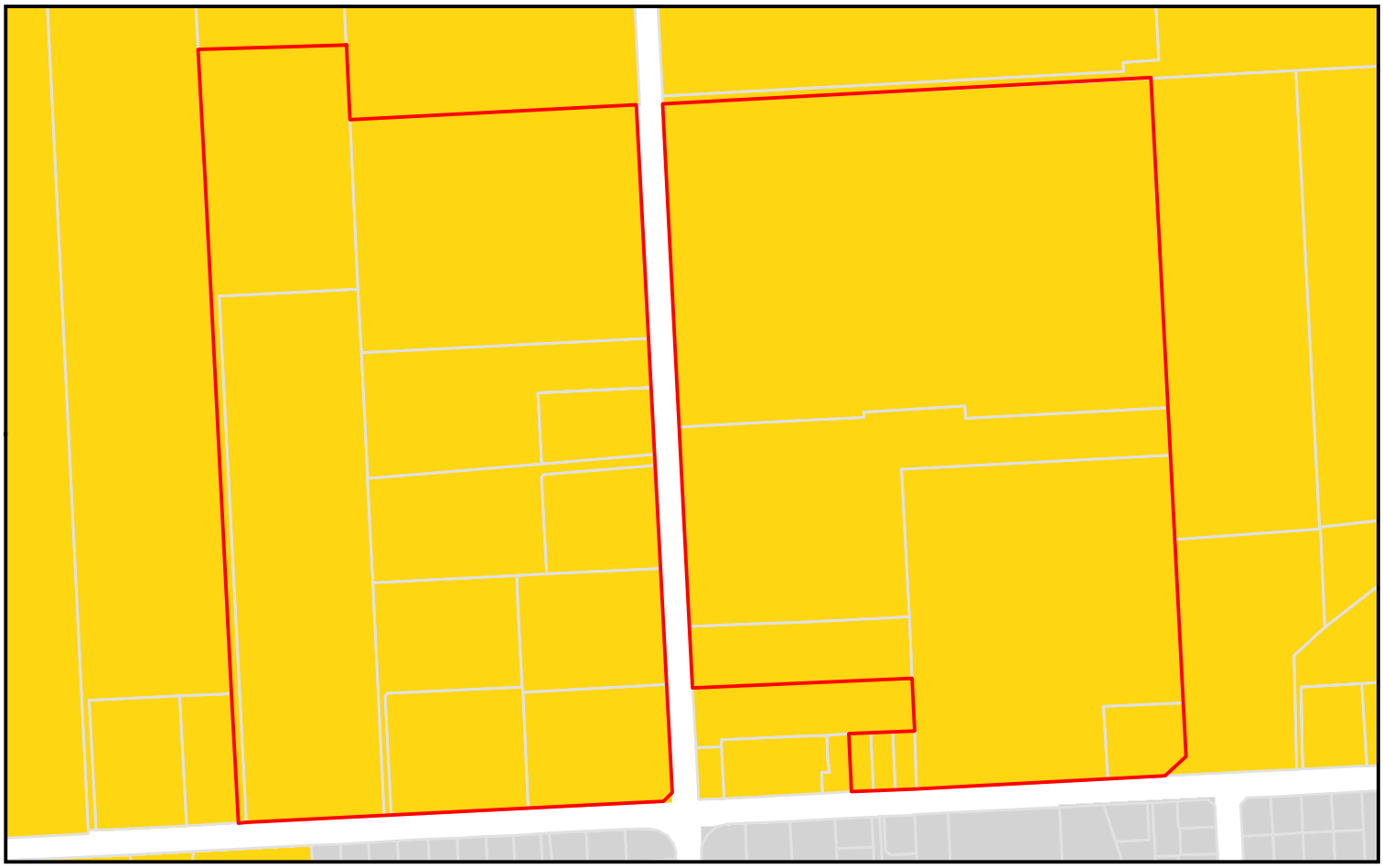
Appendix 10
Plan Change 65

N

Current Zoning

Legend

Plan Change Area | Parcel | Urban Residential Two Zone | Rural Three Zone | road



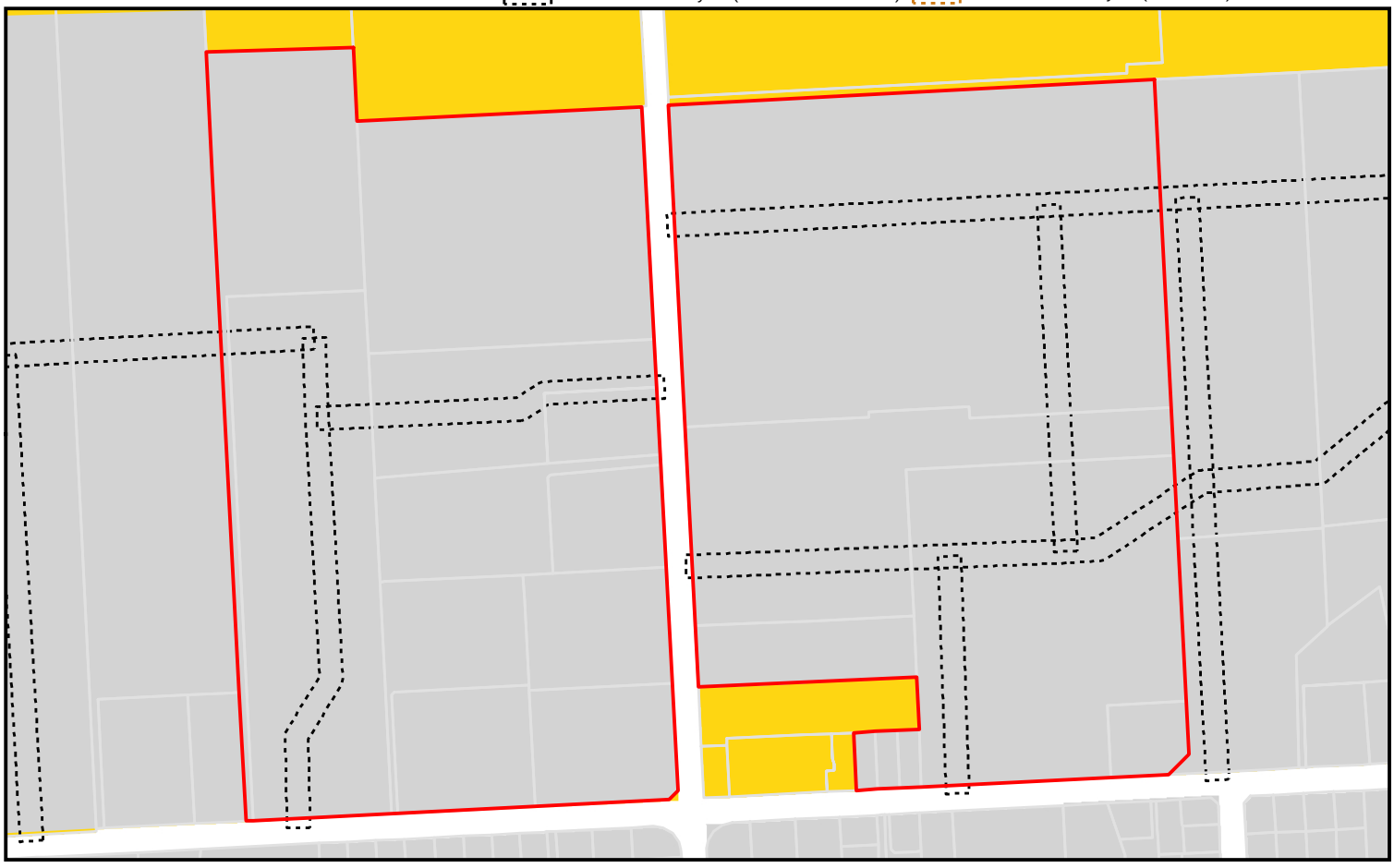
Proposed Zoning

5/06/2013

Legend

Plan Change Area | Parcel | Urban Residential Two Zone | Rural Three Zone | road

Indicative Road Layout (Essential Connection) | Indicative Road Layout (Alternative)



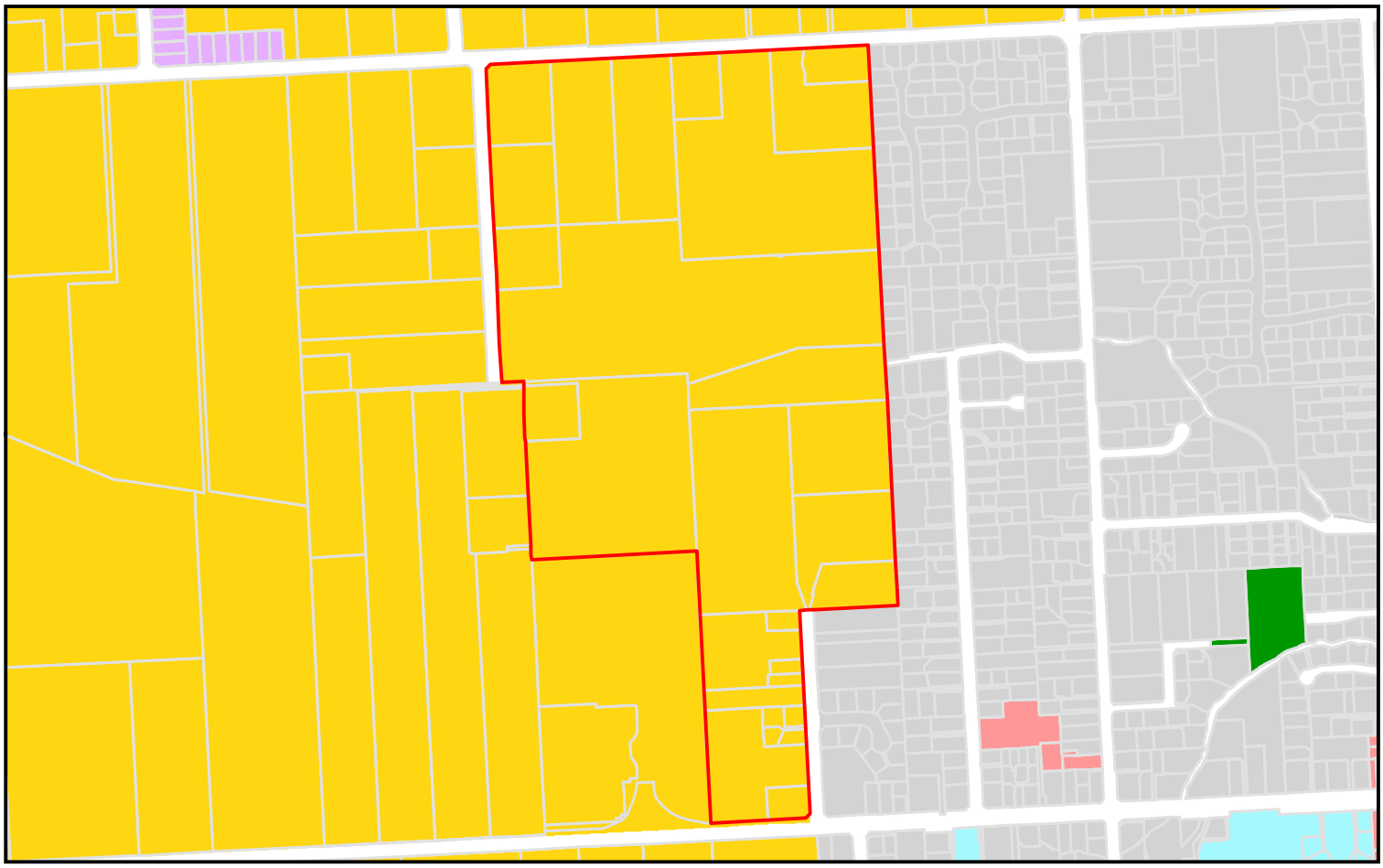
Appendix 10
Plan Change 66

Current Zoning

N

Legend

Plan Change Area | Parcel | Urban Residential Two Zone | Rural Three Zone | road



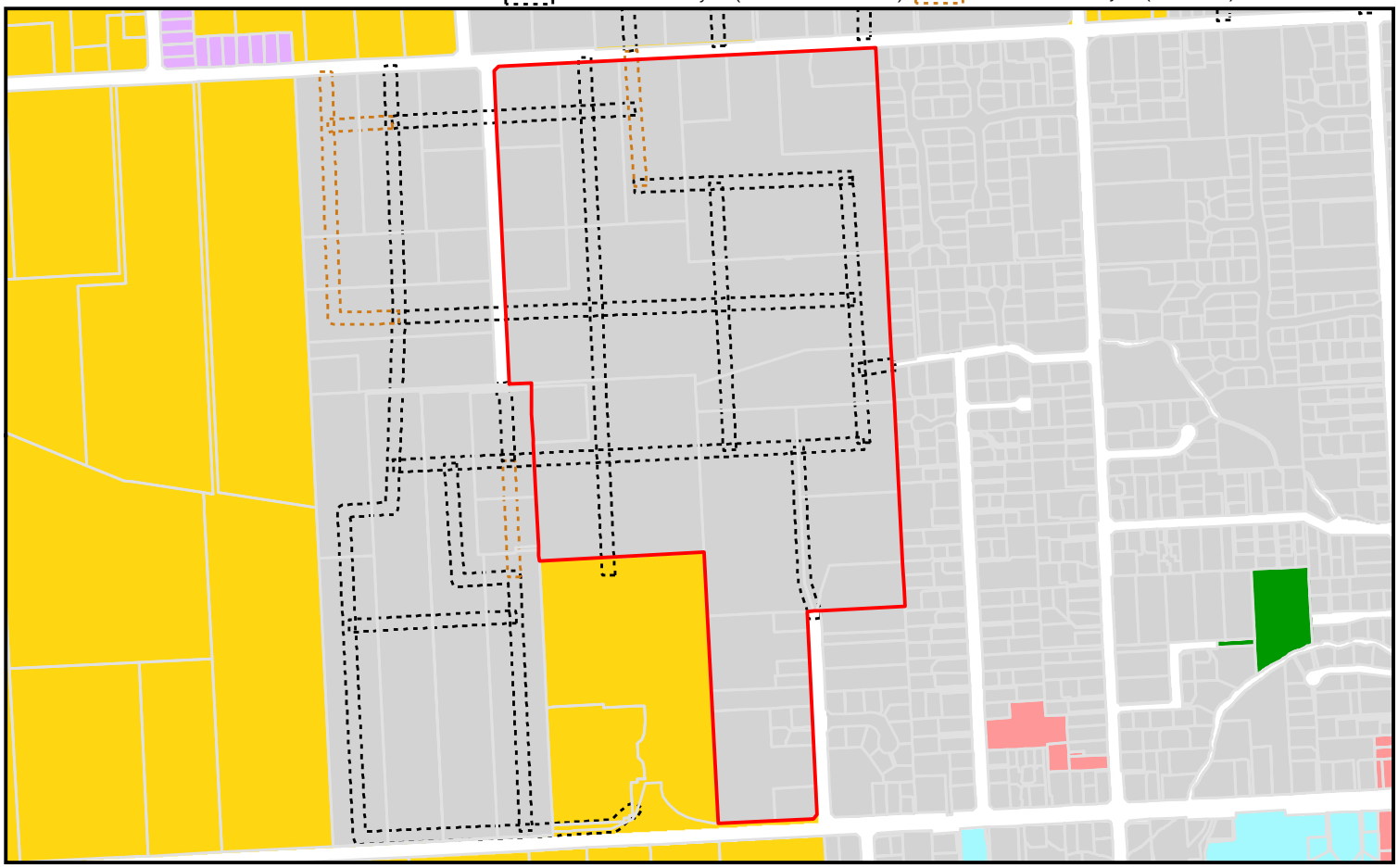
Proposed Zoning

5/06/2013

Legend

Plan Change Area | Parcel | Urban Residential Two Zone | Rural Three Zone | road

Indicative Road Layout (Essential Connection) | Indicative Road Layout (Alternative)



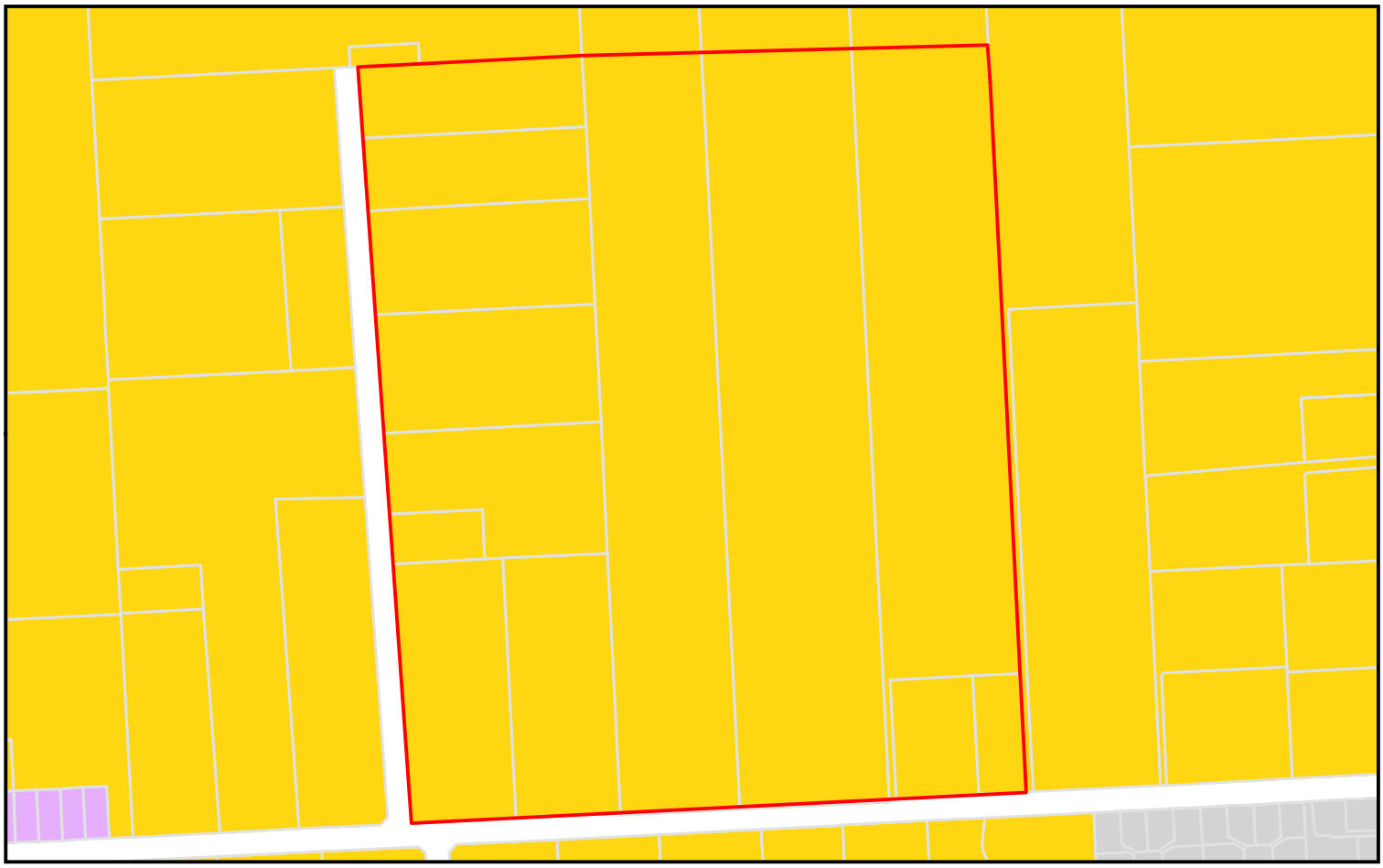
Appendix 10
Plan Change 67

N

Current Zoning

Legend

Plan Change Area | Parcel | Urban Residential Two Zone | Rural Three Zone | road



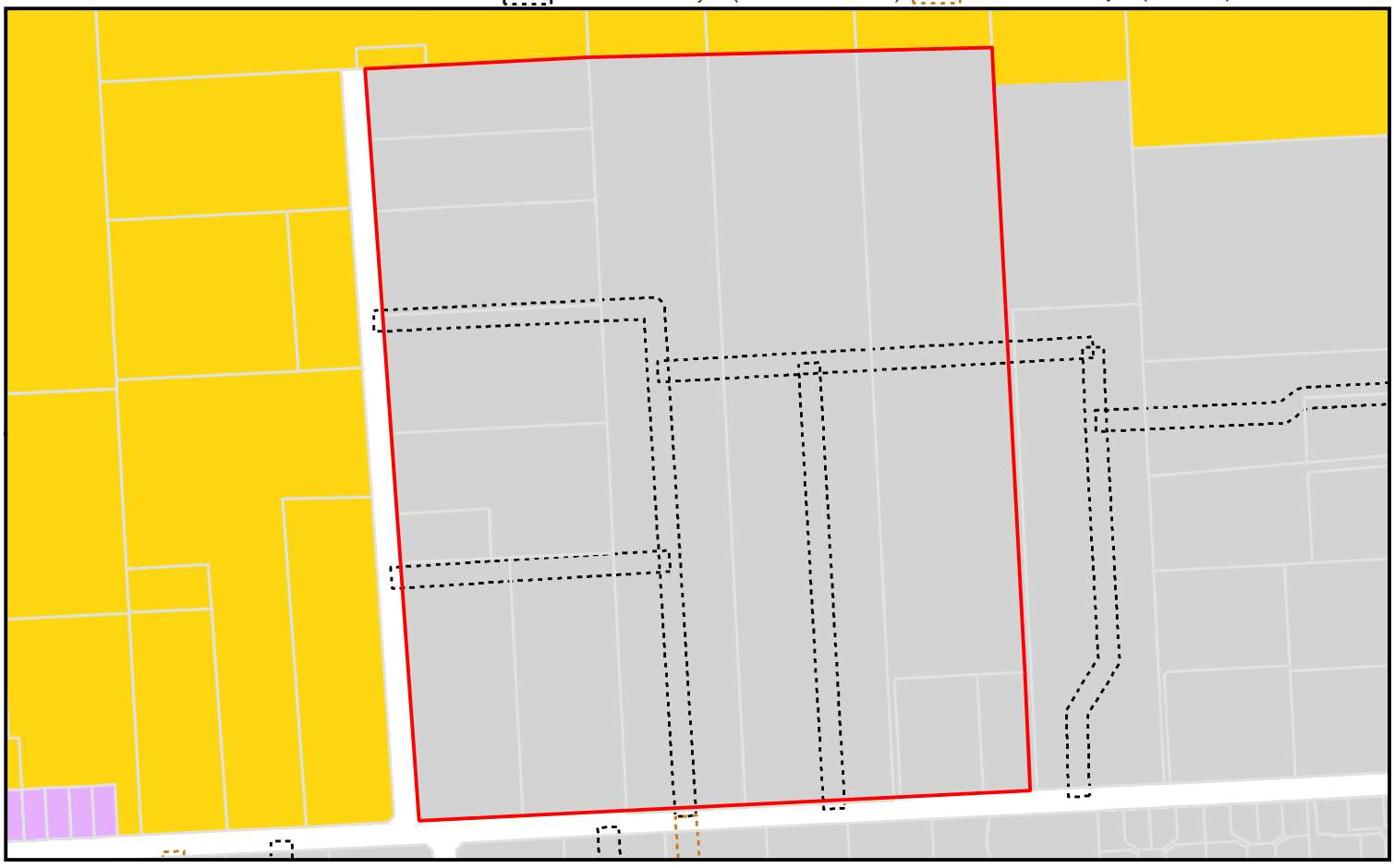
Proposed Zoning

5/06/2013

Legend

Plan Change Area | Parcel | Urban Residential Two Zone | Rural Three Zone | road

Indicative Road Layout (Essential Connection) | Indicative Road Layout (Alternative)



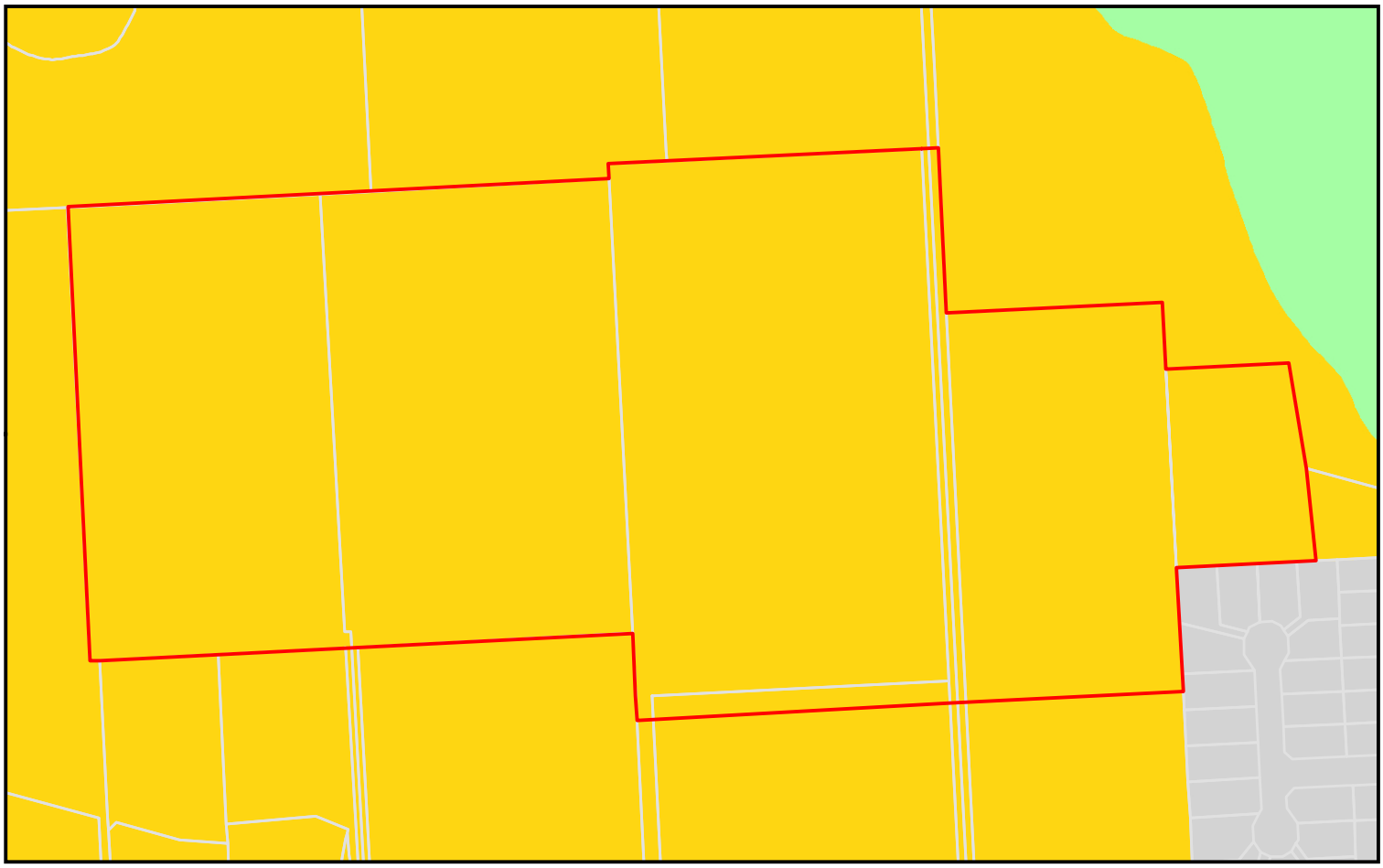
Appendix 10
Plan Change 68

Current Zoning

N

Legend

Plan Change Area | Parcel | Urban Residential Two Zone | Rural Three Zone | road



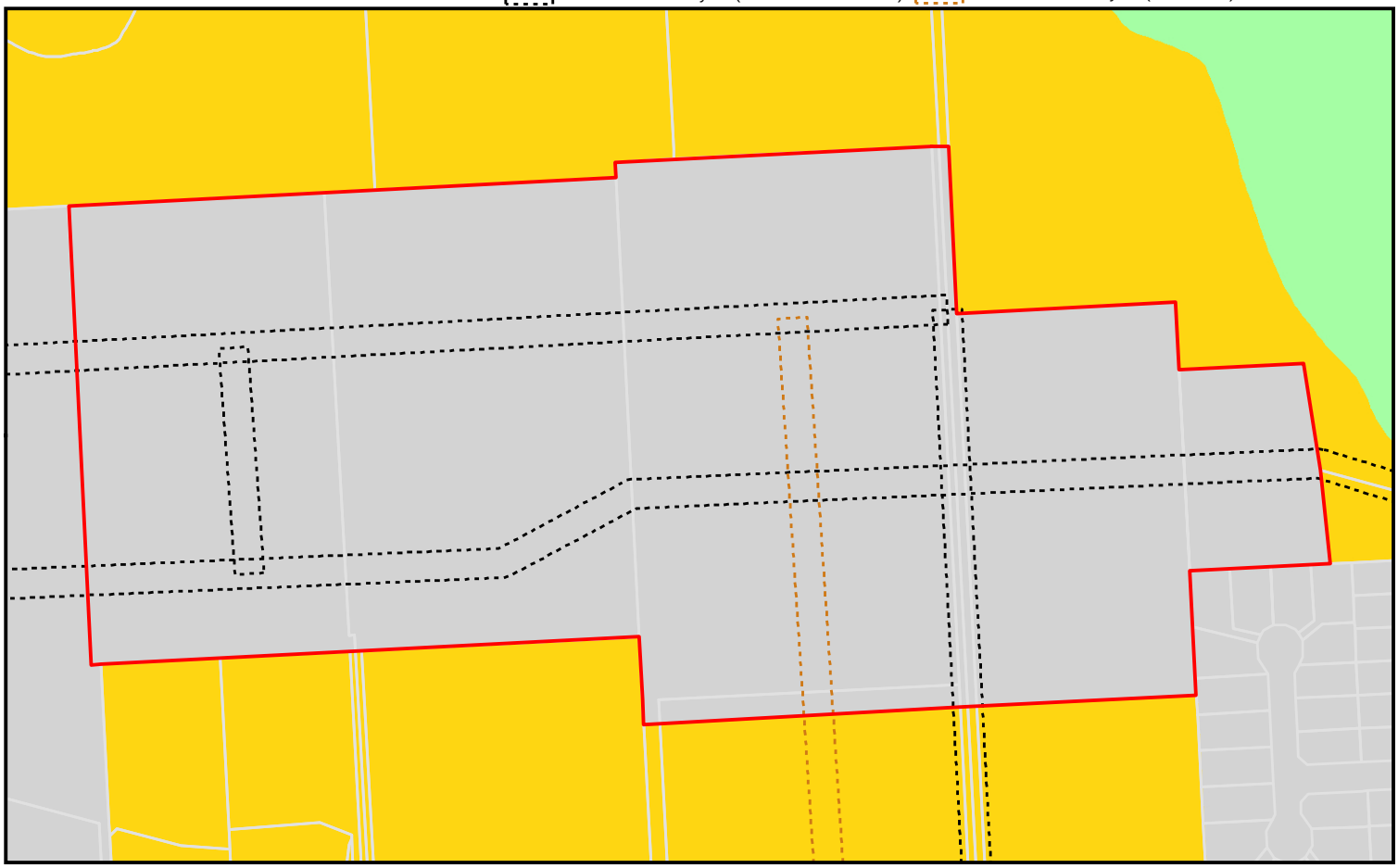
Proposed Zoning

5/06/2013

Legend

Plan Change Area | Parcel | Urban Residential Two Zone | Rural Three Zone | road

Indicative Road Layout (Essential Connection) | Indicative Road Layout (Alternative)



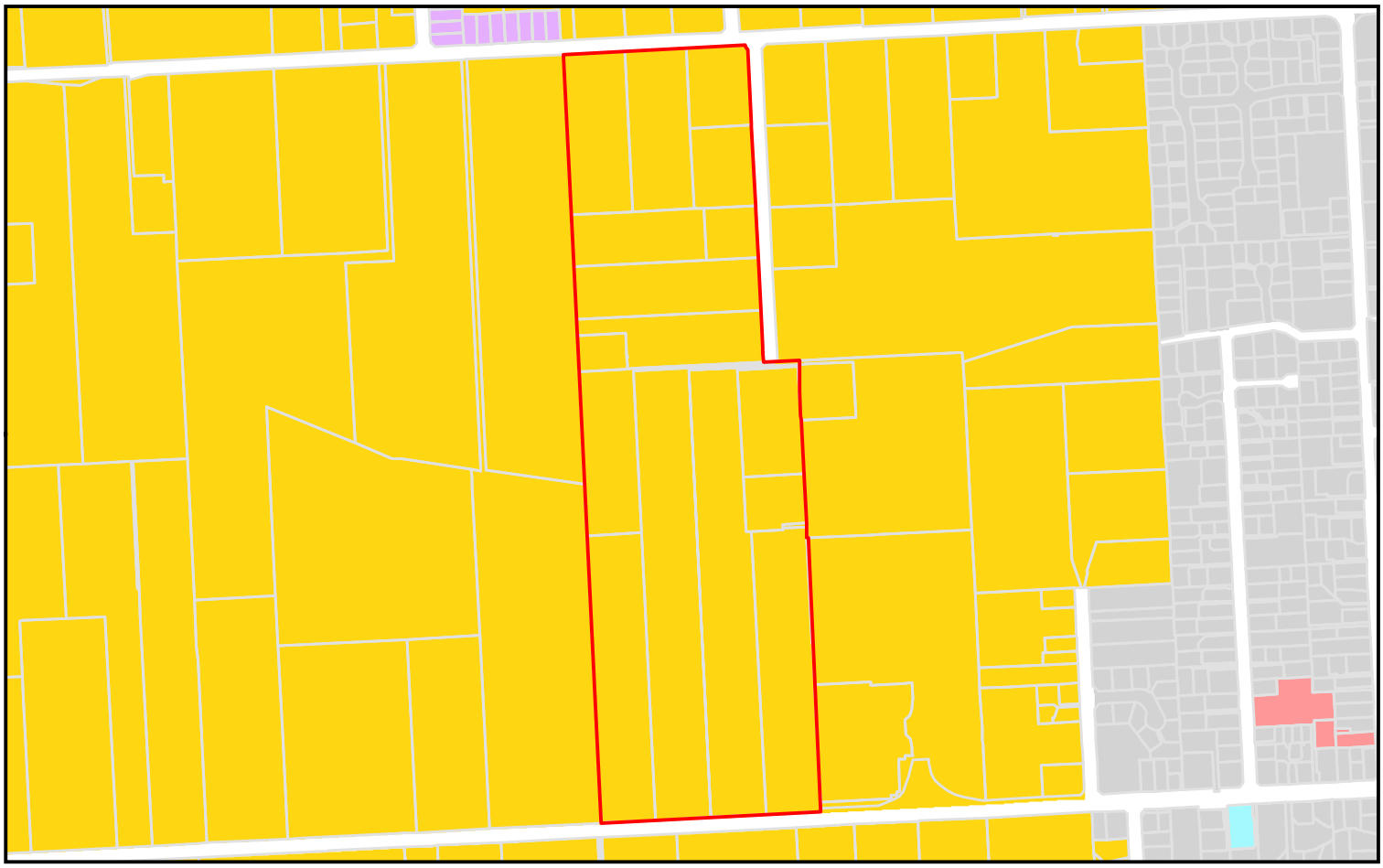
Appendix 10
Plan Change 69

Current Zoning

N

Legend

Plan Change Area | Parcel | Urban Residential Two Zone | Rural Three Zone | road



Proposed Zoning

5/06/2013

Legend

Plan Change Area | Parcel | Urban Residential Two Zone | Rural Three Zone | road

Indicative Road Layout (Essential Connection) | Indicative Road Layout (Alternative)