

REPORT

Selwyn District Council

**Desk-based Ground Contamination
Assessment
Plan Change 7 Area**

Report prepared for:

Selwyn District Council

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1 Introduction

Tonkin and Taylor Ltd (T&T) have been engaged by the Selwyn District Council (SDC) to undertake a desk-based ground contamination investigation within the Plan Change 7 area. The Plan Change 7 area is located around the townships of Rolleston and Lincoln, Canterbury, hereafter referred to as 'Site 1' and 'Site 2' respectively.

The aim of the investigation was to establish the potential for historical activities to have resulted in ground contamination within the land proposed for rezoning, and how this may affect the zone change.

This work has been undertaken in accordance with our proposal of 10 November 2010.

1.1 Objectives and scope of work

We understand that SDC proposes to rezone land around Lincoln and Rolleston that is currently zoned as 'Living Z' or 'Deferred Living Z'. This rezoning is proposed in order to allow these areas to be used for standard residential activities. The area proposed for rezoning comprises 58 current land parcels.

We also understand that as part of the plan change process, SDC are required to demonstrate that ground contamination matters will not preclude the proposed use. This study was undertaken at the request of SDC in order to assess the potential for historical activities on the sites to have resulted in ground contamination, with the following scope of works:

- Identification all of the properties within the PC7 area (information provided to us by SDC)
- An Environment Canterbury (ECan) Listed Landuse Register (LLUR) search
- Undertaking of a site walkover inspection
- Review of historical aerial photographs
- Review of the SDC property files
- Review of selected historic certificates of title where required
- Preparation of this report.

Findings are reported for 'Site 1' (Rolleston) and 'Site 2' (Lincoln) in sections 2 and 3 respectively.

2 Site 1 – Rolleston

2.1 Site Description

Site 1 comprises a total of 6 Outline Development Plan (ODP) areas around the township of Rolleston, as shown on Figures 1, 2a, and 2b. Site 1 includes 30 current land parcels (list of parcels as provided by SDC in Appendix A) covering a total of approximately 242 hectares.

2.1.1 Site location and current land use

ODP area 1 contains 18 of the existing parcels, and is located southwest of Rolleston, between Main Road South (State Highway 1), Dunns Crossing Road, Burnham School Road and Brookside Road. These land parcels cover an area of approximately 63 hectares and are predominantly agricultural land.

ODP area 2 is a small (4.8 hectares), triangular-shaped area of agricultural land consisting of one existing parcel of land on Norman Kirk Drive, bound by Dick Roberts Place and Rolleston Drive on its southwest and east sides respectively.

ODP areas 3 and 4 are areas of approximately 50 and 7 hectares respectively, to the east of Rolleston township. Both areas are predominantly agricultural land with some residential buildings and together comprise 5 existing land parcels.

ODP areas 5 and 6 together contain 6 existing parcels of land. These are agricultural areas with some residential buildings and are located south of Rolleston, along Goulds Road. They have a combined area of approximately 117 hectares.

2.1.2 Site geology and hydrogeology

The underlying geology is described by Forsyth et al.¹ as grey alluvium of variable thickness, beneath plains or low level terraces.

Based on information in ECan's database, soils beneath Site 1 are stony, shallow silt loam (ODP areas 1, 5 and 6), shallow, sandy loam (ODP area 2) and deep, fine sandy loam (ODP 3 and 4).

ECan's well database shows a total of 22 wells on Site 1. The depth of these wells varies from 16m to 84m, used for irrigation, stock supply and domestic supply. The wells are privately owned, except for M36/0028 in ODP area 1 which is used by Land and Survey for groundwater monitoring. Groundwater levels in this well range between 7.9 and 16.3m below ground level. Based on local topography and location of surface water features, general groundwater flow direction is expected to be towards the southeast.

2.2 Site History

2.2.1 Aerial Photographs

Six sets of aerial photographs from New Zealand Aerial Mapping (1942, 1961, 1973, 1984 and 1994) and Terraview (2010) were reviewed to gain historical information for Site 1. The results are summarised in Table 1. Key features are shown on Figures 2a and b.

¹ Forsyth, P.J., Barrell, D.J.A. and Jongens, R., 2008, Geology of the Christchurch Area, IGNS Map 16, 1:250,000

Table 1: Summary of historical aerial photographs

| Year | Run, Scale | Description |
|------|----------------------|--|
| 1942 | SN 224, 1:16,000 | <p>ODP1: Agricultural land, including cropping. Stands of trees are present along part of south-western and north-eastern boundaries. There is a small area of disturbed ground near north-eastern boundary.</p> <p>ODP2: Cropping.</p> <p>ODP3: Agricultural land, including cropping. A small shed is present in the centre of the area, and a paddock, residential dwelling and associated garden are present on the southern boundary. A small area of disturbed ground is visible north of the dwelling.</p> <p>ODP4: Cropping.</p> <p>ODP5: Agricultural land, including cropping and rough, undeveloped ground. A dwelling and two outbuildings surrounded by trees are present towards the eastern corner.</p> <p>ODP6: Agricultural land, including cropping. A small paddock enclosed by trees is present on north-western boundary.</p> |
| 1961 | SN 1408, 1:17,000 | <p>ODP1: There is a cluster of small buildings against southern boundary.</p> <p>ODP2: No significant change.</p> <p>ODP3: The small shed has been removed. The disturbed ground near the dwelling is no longer visible.</p> <p>ODP4: No significant change.</p> <p>ODP5: Rough ground is no longer present. A small fenced/hedge-lined yard is present north of the buildings and an area of disturbed ground extends approximately 200m to the northwest.</p> <p>ODP6: Rough ground is visible on the southern part of the area. A cluster of small buildings and a fenced paddock are present in the northern corner.</p> |
| 1974 | SN 2713, 1:25,000 | <p>ODP1: A residential building is present in the eastern corner.</p> <p>ODP2: No significant change.</p> <p>ODP3: No significant change.</p> <p>ODP4: No significant change.</p> <p>ODP5: The area of disturbed ground extending northwest from the yard has been removed.</p> <p>ODP6: Rough ground is no longer present. A shed is visible at the southern corner of the tree-enclosed paddock.</p> |
| 1984 | SN 8389, 1:25,000 | <p>ODP1: No significant change.</p> <p>ODP2: No significant change.</p> <p>ODP3: No significant change.</p> <p>ODP4: No significant change.</p> <p>ODP5: A track crosses the lot from the buildings to the northwest corner. A new building is present in centre of site.</p> <p>ODP6: A second shed is visible on the south-eastern edge of the tree-enclosed paddock.</p> |
| 1994 | SN 9381, 1:50,000 | <p>ODP1: No significant change.</p> <p>ODP2: No significant change.</p> <p>ODP3: A shed is present to the east of the dwelling.</p> <p>ODP4: No significant change.</p> |

| Year | Run, Scale | Description |
|------|-----------------|---|
| | | ODP5: Two sheds are present close to the building. The area containing the building and sheds is now surrounded by trees. ODP6: No significant change. |
| 2010 | Terraview image | ODP1: No significant change. ODP2: No significant change. ODP3: A new dwelling and two outbuildings are present on the southern boundary adjacent to the existing dwelling. Three sheds are present to the east of the dwellings. ODP4: No significant change. ODP5: The sheds in centre of the area have been removed and a large dwelling and garden area are now present. ODP6: One of the sheds on the edge of the paddock has been removed. There is a small area of disturbed ground in centre of site. Grazing stock are visible. |

2.2.2 Certificates of Title

To ascertain how long the identified sheep dip (see Section 2.2.6) within ODP area 6 may have been operating, a search of the available historical certificates of title (CTs) was undertaken for this parcel. Appendix B contains the certificates of title.

This revealed that RS 12514, RS 15710 and RS9522 (which form part of ODP areas 5 and 6) are in one title, and the original titles were created in 1917. The original and subsequent titles suggest that farming of some sort has been undertaken on this site since this date. As a consequence, the sheep dip may have been operating since at least 1870 and as such, a variety of agrochemicals may have been used in the dip and elsewhere on the property.

Certificates of title for the other parcels were not searched as the other information sources provided sufficient information.

2.2.3 Previous investigations

In April 2010 Tonkin & Taylor Ltd carried out a desk study and limited soil investigation of ODP area 5². Soil samples were collected to assess if any contaminants existed in the site's soils. The conclusions of this study were:

- A dwelling existed on the site since at least 1942. A vegetable garden and underground storage tank (UST) were associated with the dwelling.
- The UST was removed in 2005 and is reportedly being used as an AST on the property to the south of Dynes Road (within ODP area 6 – formerly same owner). No soil sampling was undertaken following removal of the tank, but the former occupant stated that there was no evidence that the tank leaked.
- The property was used for cropping and sheep grazing, but no sheep dip existed on site. Sheep were either dipped on a mobile dip (onsite), or the dip on the property to the south of Dynes Road was used.

² 54 Dynes Road, Rolleston. Desk based ground contamination investigation with limited confirmatory sampling. April 2010. Ref 51664.

2.2.4 SDC property files

Property files relating to Site 1 held by SDC were reviewed on 26 November 2010. Relevant information is summarised in Table 2.

Table 2: Summary of SDC property files

| ODP Area | Summary of file information |
|----------|---|
| 1 | No relevant information. |
| 2 | No property file located. |
| 3 | 1990: Relocation of dwelling (Lot 2 DP 65668). 1994: Construction of hay barn (Lot 1 DP 65668). 1995: Construction of hay barn (Lot 1 DP 68746). 1996: Construction of dwelling and implement shed (Lot 1 DP 68746). 1997: Construction of farm building (Lot 1 DP 65668). 1998: Construction of dwelling with septic tank (Lot 1 DP 65668). |
| 4 | No relevant information. |
| 5 | 1980: Construction of farmhouse (RS 9522, 19792, 23251). 1998: Construction of farm storage shed (RS 9522, 19792, 23251). 2000: Alterations to dwelling including septic tank (RS 9522, 19792, 23251). |
| 6 | No relevant information. |

2.2.5 ECan listing

A search of ECan's Listed Land Use Register (LLUR) was requested. The register contains information about contaminated and potentially contaminated sites. A contaminated sites team member confirmed in a letter dated 7 December 2010 that RS 9522, in ODP area 5, appears on the LLUR as an "Unverified HAIL" site.

ECan records summarise the T&T 2010 report, noting that an underground fuel storage tank was removed in 2005, and was continued to be used as an aboveground fuel tank on a neighbouring property. Sampling of soil around the fill point of the former underground tank site in 2010 showed acceptable total petroleum hydrocarbons (TPH) and BTEX concentrations. A copy of the LLUR listing for Site 1 is attached as Appendix C.

2.2.6 Site inspection

A site visit was made by a Tonkin & Taylor Environmental Engineer on 16 December 2010. Given the size of the subject area, it was not possible to undertake a detailed walkover the land parcels, however all were viewed from the road to confirm the findings of the historical review.

For Site 1, the following were the significant findings of the site inspection:

- Farm sheds, above ground storage tanks (ASTs), sheep yards and possibly a sheep dip were observed on the northern edge of RS12514 and Lot 1 DP 8833, adjacent to Dynes Road (within ODP area 6).
- An AST was observed adjacent to the farmhouse located within ODP area 6 adjacent to East Maddisons Road (Lot 1 DP 327430).
- Remnants of the foundations of a domestic dwelling were present on Lot 1 DP11863 on the corner of Burnham School Road and Brookside Road.

- Cropping and grain storage was being undertaken within ODP area 3.
- The remainder of the sites appeared to be utilised for dry stock grazing.
- A number of farm buildings and implement sheds were observed throughout the ODP areas.

2.3 Summary of site history and potential for ground contamination

The walkover inspection as well as the historical titles, aerial photographs and SDC file showed that the majority of Site 1 was used for dry stock grazing and cropping since at least the earliest available records (late 1800s). These activities may have included application of agrochemicals to control insects, weeds and fungal diseases, as well as the storage and mixing of these chemicals and fuels. A sheep dip may have operated on at least one property.

Activities associated with these land uses do have potential to cause contamination of the ground, albeit at relatively low levels across the broad acre areas of the sites. Higher levels of contaminants may be found in localised areas around farm buildings, sheep dips, waste holes and wherever agrochemicals may have been stored or mixed.

A summary of potential land uses at Site 1 which may have resulted in ground contamination are summarised in Table 3.

Table 3: Summary of potential sources of contamination for site 1

| Activity | Potential contaminants | Likely extent and level |
|--|---|---|
| Cropping and dry stock grazing (broad acre areas) | Metals and organochlorine pesticides (OCP), including DDT (to control grass grub and other insects) | Low level over pasture cropping areas, predominantly within surface soils |
| Farm sheds, chemical storage sheds | Metals, OCP, petroleum hydrocarbons | Level depend on handling practices, typically localised around sheds and mixing/filling points, mostly constrained to surface soils |
| Sheep dips | Metals (copper, arsenic, chromium, zinc) and OCP | Limited to land surrounding dip, holding pens and location of chemical disposal if undertaken on site. Concentrations can be elevated. |
| AST or USTs | Petroleum hydrocarbons | Soils around the tanks, likely limited to surface soil in vicinity of AST, deeper soils may be affected near UST. Potentially elevated concentrations if tanks have leaked or if poor filling practices used. |
| Residential dwellings and other painted structures | Metals (principally lead, arsenic) and OCP if a vegetable garden present | Limited to surface soils adjacent to current or former structures, or within former vegetable gardens. |
| Waste disposal areas (possibly indicated by disturbed ground in the aerial photos) | Metals, OCP, petroleum hydrocarbons | Potentially elevated concentrations in waste and soil underlying waste. |

3 Site 2 – Lincoln

3.1 Site Description

Site 2 includes 6 Outline Development Plan (ODP) areas around the township of Lincoln as shown on Figures 3, 4a, and 4b. The site includes 28 existing land parcels (list of parcels as provided by SDC in Appendix A), covering a total of 352 hectares.

3.1.1 Site location and land use

Outline Development Plan (ODP) area 1 lies to the south of Lincoln, between Springs Road and LI Creek. This parcel covers an area of approximately 58 hectares (over 6 lots) and is predominantly agricultural (cropping and grazing) land. A reservoir is present towards the eastern end of ODP area 1. While this was not listed as a parcel involved in this study by SDC it has been included in this report because it is within the zone change boundary.

ODP area 2 contains 7 existing land parcels with a combined area of approximately 60 hectares of agricultural land (cropping and grazing) adjacent to Edward Street, Elsmere Road and LI Creek to the southeast of Lincoln township. The LI River runs through this area.

Six parcels are in ODP area 3 is to the east of Lincoln, between Birchs Road, Ellesmere Road and Edwards Road and cover approximately 159 hectares. It is agricultural land with some residential buildings.

ODP area 4 is north of the township and covers 10 existing parcels of land with an area of approximately 55 hectares adjacent to Birchs Road and Tancreds Road. Land use is agricultural with a few residential buildings.

Five parcels are in ODP area 5 to the southwest of Lincoln township, adjacent to Springs Road. These cover an area of approximately 12 hectares and are agricultural and residential land.

ODP area 6 is a single parcel covering an area of approximately 3.5 hectares of former horticultural land (crop and food research farm) on the northern edge of Lincoln township. There are also residential buildings in this area.

3.1.2 Site geology and hydrogeology

The underlying geology is described by Forsyth et al. as grey alluvium of variable thickness, beneath plains or low level terraces.

Based on information in ECan's database, soils beneath Site 2 are deep silt loam and deep silt loam on clay loam (ODP areas 1, 2 and 5) and moderate to deep silt loam on sandy loam (ODP areas 2, 3, 4 and 6).

ECan's well data shows over 50 wells within Site 2. The depth of these wells varies from 6m to 42m. The wells are used for irrigation, stock supply and domestic supply. The majority of the wells are privately owned. Groundwater level monitoring data from two investigation wells (M36/0512 in ODP and M36/0515 in ODP area 1) show groundwater depth ranges between 0.5m and 4.5m below ground level. Based on local topography and location of surface water features, general groundwater flow direction is expected to be towards the south.

3.2 Site History

3.2.1 Aerial Photographs

Six sets of aerial photographs, from New Zealand Aerial Mapping (1942, 1962/3, 1973, 1984 and 1994) and Terraview (2010), were reviewed to gain historical information for Site 2. The results are summarised in Table 4. Key features are shown on Figures 4a and 4b.

Table 4: Summary of historical aerial photographs

| Year | Run, Scale | Description |
|--------|----------------------|---|
| 1942 | SN 224, 1:16,000 | <p>ODP1: Agricultural land, including cropping. Two tracks cross the western part of the area running approximately northeast-southwest. A railway runs northwest-southeast, crossing the eastern area. A stream marks the eastern boundary.</p> <p>ODP2: Agricultural land, including cropping. A large dwelling and numerous small outbuildings are present towards the northern side of the area. A stream crosses the site north-south and a second stream forms the western boundary. Two small buildings are present on the eastern boundary.</p> <p>ODP3: Agricultural land, including cropping. A dwelling with a garden, two large barns and an orchard are present in the south-central area. A circular structure, possibly a water tank, is present immediately to the southwest of the buildings. A second dwelling with many small outbuildings is present in the northwest corner. A track runs southeast for approximately 700m from these buildings to a small shed. A third dwelling and a shed are present on the eastern boundary. Two small sheds are present in the centre of fields towards the southeast side of the area.</p> <p>ODP4: Agricultural land, including cropping. Two dwellings with gardens, an outbuilding and a small orchard are present on the eastern side. A barn is present in the centre of the area, close to an area of disturbed land, possibly with another building. A second dwelling with gardens and a shed is present on the northern boundary.</p> <p>ODP5: Agricultural land, including cropping. A dwelling, garden and two small sheds are present on the eastern boundary.</p> <p>ODP6: Agricultural land, likely cropping. Two small sheds are present to the northern end. A further small shed is present on the eastern boundary.</p> |
| 1962/3 | SN 1408, 1:17,000 | <p>ODP1: A small shed is present on the western boundary.</p> <p>ODP2: A dwelling with two outbuildings is present on the northern boundary.</p> <p>ODP3: The small outbuildings around the dwelling in the south-central area have been replaced with three larger barns. The orchard, circular structure and two sheds in the central fields have been removed.</p> <p>ODP4: Numerous more small buildings are present around the two dwellings on the eastern side, and the orchard has been removed. Three further dwellings with small gardens are present along the eastern boundary.</p> <p>ODP5: No significant change.</p> <p>ODP6: Only one small shed remains at the northern end, around a small, square, fenced area. Four buildings are present in the south.</p> |
| 1973 | SN 2634, 1:25,000 | <p>ODP1: The railway appears vegetated and no longer used. A second shed is present on the western boundary. A large cluster of farm buildings is present in the centre of the area.</p> <p>ODP2: A further dwelling is present on the northern boundary with small garden, garage and shed. A shed is present towards the southern corner.</p> <p>ODP3: Further sheds are present around the buildings in the northwest corner.</p> |

| Year | Run, Scale | Description |
|------|----------------------|--|
| | | <p>ODP4: Wooden structures, possibly related to a sheep-dip, are present immediately west of the cluster of buildings located on the eastern boundary. Grazing stock are visible in the western corner. A small shed is present to the south of the main cluster of buildings. Three circular structures, possibly tanks, are located around the dwelling on the northern boundary.</p> <p>ODP5: Three dwellings are now present along the eastern boundary.</p> <p>ODP6: The square, fenced area at the north appears to be a small pond/reservoir. Two large sheds are present immediately south of the reservoir. A further small shed is present in the cluster of buildings at the south.</p> |
| 1984 | SN 8389, 1:25,000 | <p>ODP1: Two additional small sheds are present on the western boundary.</p> <p>ODP2: Three sheds are present immediately west of the existing buildings towards the north of the area. A dwelling and two sheds are present in the western corner.</p> <p>ODP3: A shed is present towards the eastern boundary, and another shed has been added to the cluster of buildings in the south-central area.</p> <p>ODP4: No significant change.</p> <p>ODP5: No significant change.</p> <p>ODP6: No significant change.</p> |
| 1994 | SN 9381, 1:50,000 | <p>ODP1: A large reservoir is present towards the western end of the area.</p> <p>ODP2: No significant change.</p> <p>ODP3: No significant change.</p> <p>ODP4: Two further dwellings with gardens are present along the eastern boundary.</p> <p>ODP5: A fourth dwelling with garden is present along the eastern boundary.</p> <p>ODP6: The pond/reservoir at northern end has been removed or filled.</p> |
| 2010 | Terraview image | <p>ODP1: No significant change.</p> <p>ODP2: The shed towards the south has been removed. Silage storage on northern boundary.</p> <p>ODP3: Grazing stock are visible on central areas.</p> <p>ODP4: No significant change.</p> <p>ODP5: No significant change.</p> <p>ODP6: No significant change.</p> |

3.2.2 Certificates of Title

A search of the available historical certificates of title (CTs) for Lot 1 DP 388824 within Site 2 was undertaken to ascertain the period orchards were likely on site. Appendix D contains the certificates of title.

The historic titles showed that this parcel was sold to Lincoln Grange Ltd (later renamed Lincoln Grange Orchards Ltd) in 1984. This correlates with the aerial photographs which show shelter belts being established in the 1984 photograph. As a result, it is possible that organochlorine pesticides as well as metal based chemicals were used to control pests during the orchard operation on this land parcel.

No other titles were searched as sufficient information was available from other sources.

3.2.3 Previous investigations

In 2006, Tonkin & Taylor Ltd undertook a ground contamination assessment of the former Crop and Food Research Farm, located on North Belt, Lincoln³. The ODP area 6 includes part of the Research Farm. Results from soil samples collected within the portion covered by ODP area 6 showed some elevated levels of metals (primarily lead related to a former dwelling). A remedial action plan was developed and is being implemented as part of the community centre construction. Following this remedial work, all known areas of contamination will have been removed from the Research Farm, and the remaining soils will be below residential guidelines.

3.2.4 SDC property files

Property files relating to Site 2 held by SDC were reviewed on 26 November 2010. Relevant information is summarised in Table 5.

Table 5: Summary of SDC property files

| ODP Area | Summary of file information |
|----------|--|
| 1 | No property file located. |
| 2 | 1950s: Construction of dwelling (Lot 2 DP 372809). House existing since prior to 1965 (Lot 1 DP 16901). 1975: Construction of dwelling (Lot 96 DP 354488). 1993: Construction of dwelling, sleep-out and septic tank (Lot 1 DP 63828). 2010: Dwelling and pool removed (Lot 96 DP 354488). |
| 3 | 1979: Construction of implement storage shed (Lot 2 DP 33700). 2001: Construction of implement storage shed (Lot 2 DP 33959). 2002: Construction of house and farm building (Lot 2 DP 33959). 2003: Granting of domestic dwelling consents (Lot 2 DP 65371). |
| 4 | 1950s: Construction of dwelling (Lot 2 DP 56631). 1990: Construction of dwelling and commercial greenhouse (Lot 1 DP 16901). 2001: Construction of pool (Lot 2 DP 56631). 2002: Extension to commercial greenhouse (Lot 1 DP 16901). 2006/7: Construction of dwelling (Lot 4 DP 374083). 2009: Construction of farm building (Lot 4 DP 374083). |
| 5 | 1986: Replacement of garden shed (Lot 2 DP 22861). 1989: Construction of dwelling (Lot 1 DP 54824). 1994: Construction of garage and septic tank (Lot 1 DP 26815). 1994: Installation of septic tank (unknown date of construction of dwelling) (Lot 2 DP 22861). |
| 6 | 2009: Construction of Lincoln Playcentre (Lot 1 DP 301682). |

³ Tonkin & Taylor Ltd. Ground Contamination Investigation Crop & Food Research Farm - North Belt. 2006. Prepared for SDC. Ref 51201.

3.2.5 ECan listing

A search of ECan's Listed Land Use Register (LLUR) was requested. A copy of the LLUR listing for Site 2 is attached as Appendix E. The register contains information about contaminated and potentially contaminated sites. A contaminated sites team member confirmed in a letter dated 8 December 2010 that two areas in Site 2 appear on the LLUR:

- Lot 1 DP 301682 (in ODP Area 6) is categorised as "verified HAIL".

ECan indicate that a 5000L underground diesel tank was installed at this lot in the 1960s and used until approximately 1993. It was removed in 1999 at which time two soil samples were taken from the tank pit. TPH was below the most conservative MfE soil acceptance criteria for industrial/commercial use.

In addition, this lot is listed by ECan as being used for market gardens, orchards or glasshouses between the 1950s and 2000. This listing is based on one sample showing elevated levels of cadmium, and another showing elevated levels of lead and zinc. However, ECan reports that soil testing in 2006 (by T&T, see section 3.2.3) adequately characterised the northernmost 80% of the site and that this area is suitable for future residential use. In addition, the south-western corner (approximately 5% of the total area) was shown to be suitable for the childcare centre proposed to be built at that time. The remainder of the site required minor remedial works and these are discussed in Section 3.2.3.

- Pt Lot 1 DP 9172, Lot 1 DP 16901, Lot 1 DP 63828, Lot 96 DP 354488 and Lot 1 DP 388824 (all adjoining lots in ODP area 2) are identified as having former HAIL activity.

ECan indicate that these lots were used as market gardens, orchards or glasshouses between the 1990s and 2006. ECan report that three rounds of soil sampling in 2007 demonstrated that hazardous substances were present at the site, but were below guidelines for residential site use. The investigation data were not available for review.

The ECan letter also summarises soil and groundwater investigations carried out on Lot 6 DP 374333 (ODP area 1) in 2008. According to ECan, some cropping had previously occurred on the site and a former railway passed through it, but results of testing showed heavy metals, total DDT, polycyclic aromatic hydrocarbons (PAH) and TPH were all below residential land use criteria. The data and criteria were not provided.

Finally, ECan note in their letter that the proposed Lincoln University Landfill is located within 75m of ODP area 5. However, necessary consents to start operation of the landfill are still on hold and no landfilling activity has yet occurred at this location.

3.2.6 Site walkover inspection

A site visit was made by a Tonkin & Taylor Environmental Engineer on 16 December 2010. Given the size of the subject area, it was not possible to undertake a detailed walkover the land parcels, however, all were viewed from the road to confirm the findings of the historical review.

For Site 2, the significant findings of the site inspection were:

- ODP area 1 forms part of the Lincoln University Dairy Farm.
- ODP area 2 still had some shelter belts present, but no orchard activities were occurring. The land appeared to be used for cropping and grazing.
- Cropping and grazing was the predominant use for ODP area 3, with a cluster of buildings present in the central southern portion of the area. These consisted of a dwelling, farm sheds and sheep yards. It is possible that a sheep dip may be present in this location.

- Cropping and horticultural activities were being undertaken within ODP area 4 and storage silos were noted as well as horse stables.
- Cropping and horticultural activities were also noted on ODP area 5.

3.3 Summary of historical information and potential for ground contamination

The walkover inspection and file review showed that the majority of Site 2 was used for dry stock grazing and cropping as well as small portions of horticulture and dairying.

Records reveal that these activities have likely been undertaken in the area since the mid to late 1800's, most likely commencing with stock grazing and then progressing to more diversified uses such as cropping, dairying and orchards. Overall the ODP areas in Site 2 are representative of pastoral farming and cropping land uses on the lower Canterbury plains.

Activities associated with these land uses do have potential to cause contamination of the ground, albeit at relatively low levels across the broad acre areas of the sites. Higher levels of contaminants may be found in localised areas around farm buildings, sheep dips, waste disposal pits and wherever agrochemicals/fuels may have been stored or mixed.

A summary of potential land uses at Site 2 which may have resulted in ground contamination, and the likely nature and extent, is summarised in Table 3.

Table 3 Summary of potential ground contamination within Site 2

| Activity | Potential contaminants | Likely extent and level |
|--|---|---|
| Cropping and dry stock grazing (broad acre areas) | Metals and organochlorine pesticides (OCP), including DDT (to control grass grub and other insects) | Low level over pasture cropping areas, predominantly within surface soils. |
| Orchard areas | Metals and OCP (insect and fungal control) | Low levels of orchard areas, localised hotspots at ends of rows and mixing/disposal areas. |
| Farm sheds, chemical storage sheds | Metals, OCP petroleum hydrocarbons | Level depends on handling practices, typically localised around sheds and mixing/filling points, mostly constrained to surface soils. |
| Sheep dips | Metals (copper, arsenic, zinc) and OCP | Limited to land surrounding dip, holding pens and location of chemical disposal if undertaken on site. Concentrations can be elevated. |
| AST or USTs associated with farm buildings | Hydrocarbons | Soils around the tanks, likely limited to surface soil in vicinity of ASTs, deeper soils may be affected near USTs. Potentially elevated concentrations if tanks have leaked or if poor filling practices used. |
| Railway line | Hydrocarbons, metals and PAHs | Along and under lines where oil or fuel may have been dumped or leaked. |
| Residential dwellings and other painted structures | Metals (principally lead and arsenic) and OCP if a vegetable garden present | Limited to surface soils adjacent to current or former structures, or within former vegetable gardens. |

4 Conclusions

The land around Rolleston and Lincoln that is proposed for rezoning to residential land is currently used, and has been since the 1800s, for agricultural activities. These activities include cropping, stock grazing, orchards and dairy farming. Associated with these activities are farm buildings, implement sheds, sheep dips, chemical and fuel storage sheds and residential dwellings. All of these structures and features are typical of this type of land use, and occur across much of the Canterbury Region.

As a result of this long history of agricultural landuse, some level of contaminants should be expected in the soils of the zone change areas. General application of agrochemicals (such as DDT) to control insect, weed and fungal growth is likely to have caused low and relatively consistent levels of agrochemicals across the farmed areas. Higher and more variable levels of contamination may be present in surface soil around the farm buildings, from the storage, spillage, mixing and handling of these chemicals. Elevated concentrations of contaminants are also likely present in surface and deeper soil around areas used for sheep dipping (permanent sheep dip structures and locations of mobile dipping).

In addition to the presence of agrochemicals, most farms have on site fuel storage, whether in an above, or below ground storage tank (AST or UST). These may have leaked, or spills may have occurred during the filling or transfer of fuel. As a result, the soils under or around the tanks or filling points may be contaminated with petroleum hydrocarbons.

Many farms may have had, or still have, small waste pits for disposing of animal waste and on farm refuse. Localised contamination of the surrounding soils, and potentially groundwater may be caused by these pits.

Given the age of many of the farm buildings and dwellings in the zone change area(s), it is likely that many of these are, or were, painted with a lead based paint. Therefore lead contamination of surface soils adjacent to these buildings should also be expected.

Whilst the various activities and structures on the proposed zone change land may have caused contamination of the ground, the levels and type of contamination is expected to be typical of this type of land use. This type of land is commonly developed for residential use within Canterbury and in other regions around New Zealand, and it would be unusual for ground contamination to preclude the development of this type of land.

No information was found that indicated the proposed zone change area had special characteristics that would result in ground contamination at higher levels, or greater extents than typical agricultural land use. Consequently, there are proven methods from remediating or managing the type and levels of contaminants that are commonly found in the soils with this sort of land use history.

As all sites within the PC7 area (Sites 1 and 2) have potential for some level of ground contamination, we would recommend that soil sampling should be undertaken to confirm the levels and nature of contaminants present in the soils. The sampling should aim to characterise the broad acre contamination as well as that in the vicinity of farm buildings, dwellings, waste pits or other discrete features. This could be undertaken at the subdivision consent stage. All investigations should be undertaken in accordance with the Ministry for the Environment's various Contaminated Land Management Guidelines. This approach is consistent with the proposed National Environmental Standards for Soil Contamination (currently in draft).

5 Applicability

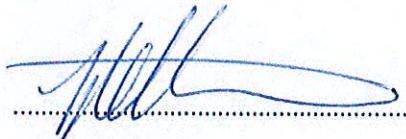
This report has been prepared for the benefit of Selwyn District Council with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

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