Appendices

Appendix A

Davis Consulting Group Contaminated Land Experience

Davis Consulting Group Contaminated Land Experience

Glenn Davis is the director of Davis Consulting Group and has over 15 years post graduate experience working as an Environmental Scientist. Glenn has accumulated a significant volume of work experience in the contaminated land field undertaking preliminary site investigations (PSIs), detailed site investigations (DSIs) and remediation projects in New Zealand, Australia, Asia, the United Kingdom and Ireland. The following provides a summary of Glenn Davis's experience.

Davis Consulting Group (2007 – present): Principal Environmental Scientist – completed multiple preliminary and detailed site investigations in Otago and Southland predominantly for the land development industry. In addition to undertaking investigation and remedial work DCG advises the Southland Regional Council on contaminated land matters including the review of consultant reports and consent applications. Key projects DCG has undertaken include:

- Review of groundwater contamination associated with the former Invercargill gasworks site including the completion of a groundwater investigation and completion of an environmental risk assessment report to support a discharge consent application;
- Completion of site investigations on former landfills in Invercargill to consider the suitability of the sites for commercial/industrial development;
- Management of the removal of an underground fuel tank in Gore and subsequent groundwater investigation; and
- Completion of a number of detailed site investigations in the Te Anau area to consider the suitability of former farm land for residential development.

RPS Australia (2003 – 2006): Supervising Environmental Scientist managing multiple detailed site investigations in the land development industrial and operated as an environmental specialist for Chevron on Barrow Island monitoring and managing a number of large contaminated groundwater plumes.

URS Ireland (2001 – 2003): - Senior Environmental Scientist undertaking multiple PSIs and DSIs on services stations and train station throughout Ireland. Glenn was also involved in the design and operation of a number of large scale remediation projects, predominantly associated with the removal of hydrocarbon contaminated soil and recovery or hydrocarbons impacting groundwater.

ERM Australia (1998 – 2000) – Working as a project level environmental scientist Glenn completed in excess of 30 detailed site investigations and remedial projects on service stations, concrete batching plants, and transport depots.

Appendix B

Certificate of Title

COMPUTER FREEHOLD REGISTER
UNDER LAND TRANSFER ACT 1952

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **413072**
Land Registration District **Otago**
Date Issued 05 August 2008

Prior References

OT13A/734	OT15A/1076	OT17B/806
OT18B/1030	OT18B/991	OT18C/442

Estate Fee Simple
Area 101.5914 hectares more or less
Legal Description Lot 7 Deposited Plan 392663

Proprietors
Trojan Helmet Limited

Interests

Subject to a right to convey water in gross over part marked g-h DP 392663 to Arrow Irrigation Company Limited created by Transfer 828083 -21.4.1993 at 9.23 am

X14968 Irrigation Agreement (affects part formerly Section 105 Block VII Shotover SD)

Part formerly Section 105 Block VII Shotover Survey District is Subject to Section 8 Mining Act 1971

Part formerly Section 105 Block VII Shotover Survey District is Subject to Section 5 Coal Mines Act 1979

Subject to Part IV A Conservation Act 1987 (affects Part formerly part Section 102 Block VII Shotover Survey District - herein)

Subject to Section 11 Crown Minerals Act 1991 (affects Part formerly part Section 102 Block VII Shotover Survey District - herein)

X14880 Irrigation Agreement (affects part formerly Section 105 Block VII Shotover SD)

Subject to a right of way over part marked AD DP 392663 created by Transfer 746961.17 - 1.2.1990 at 9:51 am

Subject to a right to convey water over part marked aa-ab,ab-ac,ac-ad,ad-ae,ae-au DP 392663 and right to take & convey water over part marked A DP 392663 created by Transfer 749789 - 12.3.1990 at 9:29 am

Subject to a right to convey water over part marked aa-ab,ab-ac,ac-ad,ad-ae,af-ag,ag-ai,aj-i,i-ak,al-am,ae-af DP 392663,right to take & convey water over part marked A DP 392663 and right to store & convey water over part marked B DP 392663 created by Transfer 773822.1 - 27.2.1991 at 9:12 am

Appurtenant to part formerly part lot 1 DP 21438 are rights to convey water created by Transfer 773822.1 - 27.2.1991 at 9:12 am

Subject to a right to convey water over part marked aj-i,i-ak,al-am DP 392663 and right to store & convey water over part marked B DP 392663 created by Transfer 773822.2 - 27.2.1991 at 9:12 am

Subject to a right to convey water in gross over part marked k-l,m-n,v-w DP 392663 to The Arrow Irrigation Company Limited created by Transfer 825040 - 4.3.1993 at 9:30 am

Subject to a right to convey water in gross over part marked h-i,i-j,j-k DP 392663 to The Arrow Irrigation Company Limited created by Transfer 834732 - 23.7.1993 at 9:32 am

Subject to a right to convey water in gross over part marked o-p,q-y DP 392663 to Arrow Irrigation Company Limited created by Transfer 840451 - 13.10.1993 at 9:51 am

Appurtenant to part formerly CT OT17B/806 is a right to pump water,a right to convey electricity and rights to convey water created by Transfer 915672.3 - 6.9.1996 at 2:49 pm

The easements created by Transfer 915672.3 are subject to Section 243 (a) Resource Management Act 1991

Appurtenant to part formerly CT OT17B/806 is a right to take water created by Transfer 953679.6 - 31.8.1998 at 10:56 am

The easements created by Transfer 953679.6 are subject to Section 243 (a) Resource Management Act 1991

Land Covenant in Deed 964442.3 - 23.3.1999 at 12.55 pm (affects part formerly CT OT17B/806)

7898685.3 Surrender of the right of way marked A,B SO 23066 created by Transfer 746961.17 as to land in CTs OT15A/1076,OT15D/881,OT17B/806,OT18B/991,OT18C/442 - 5.8.2008 at 9:00 am

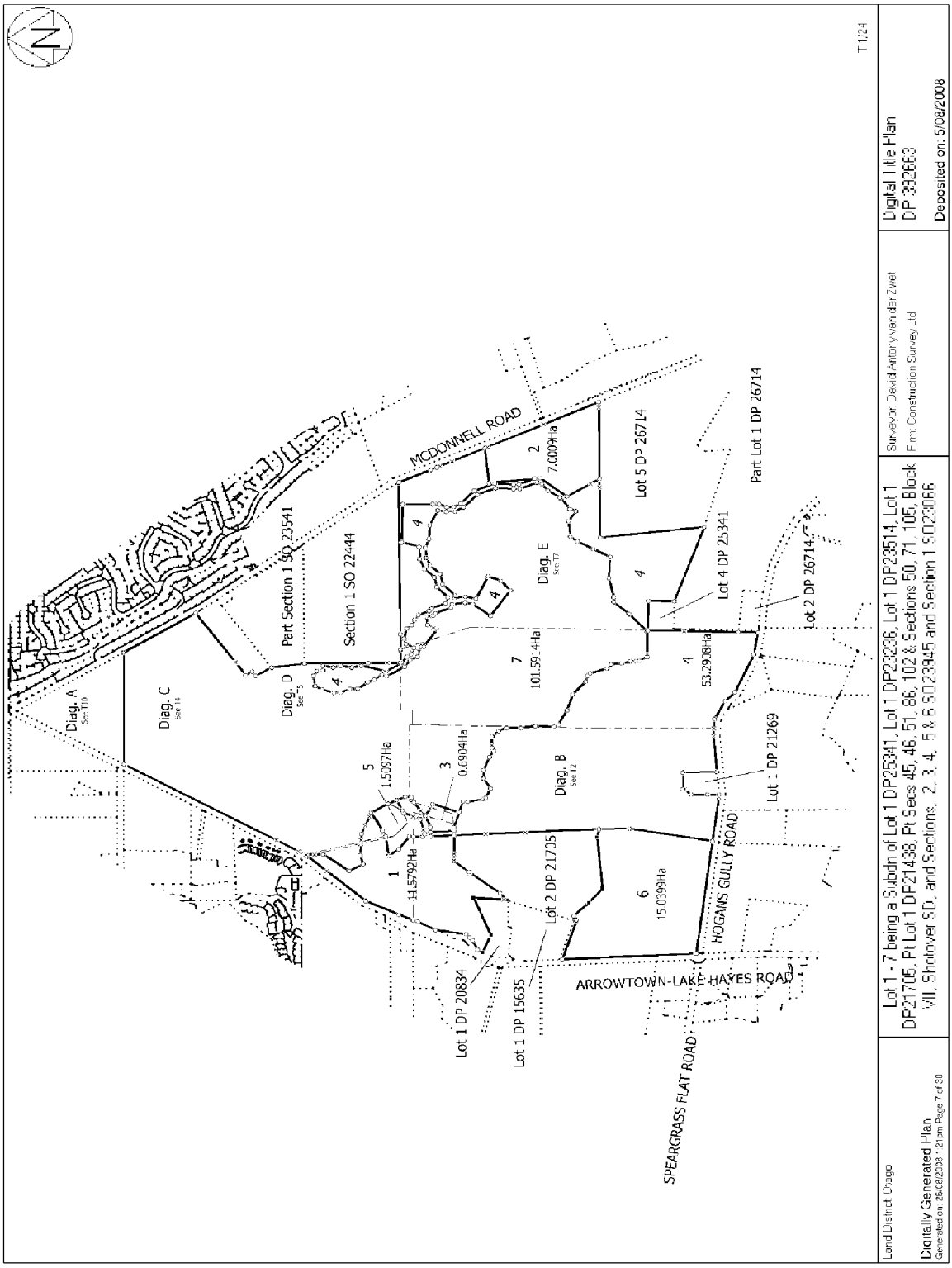
Subject to a right of way over part marked I,L DP 392663,right to convey telecommunications over part marked AB,AD,Q,AN DP 392663,right to convey electricity marked P,Q,R,AN DP 392663 and right to convey water marked AP,AQ,AR,AO,AN DP 392663 created by Easement Instrument 7898685.11 - 5.8.2008 at 9:00 am

The easements created by Easement Instrument 7898685.11 are subject to Section 243 (a) Resource Management Act 1991

8267348.1 Mortgage to Westpac New Zealand Limited - 28.8.2009 at 9:01 am

Subject to a right to convey electricity (in gross) over parts marked R, I, F, D, P, N, J, O & Q on DP 392663 and over parts marked A & B on DP 420440 and a right to transform electricity (in gross) over parts marked D, O & Q on DP 392663 and over part marked B on DP 420440 in favour of Aurora Energy Limited created by Easement Instrument 8735727.6 - 20.4.2011 at 2:52 pm

Subject to a right to convey water over part marked AQ on DP 392663 created by Easement Instrument 9136139.1 - 14.12.2012 at 1:49 pm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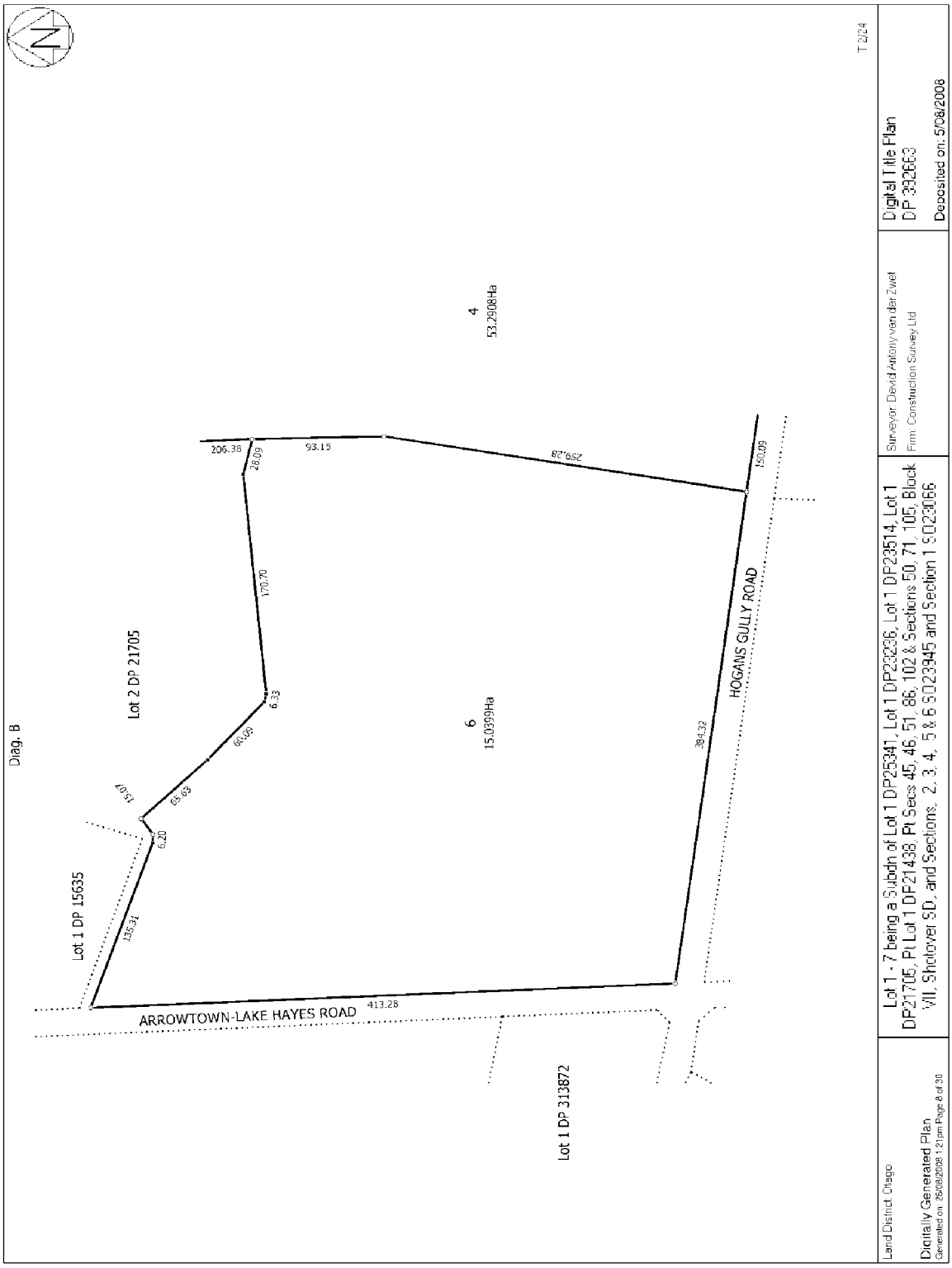
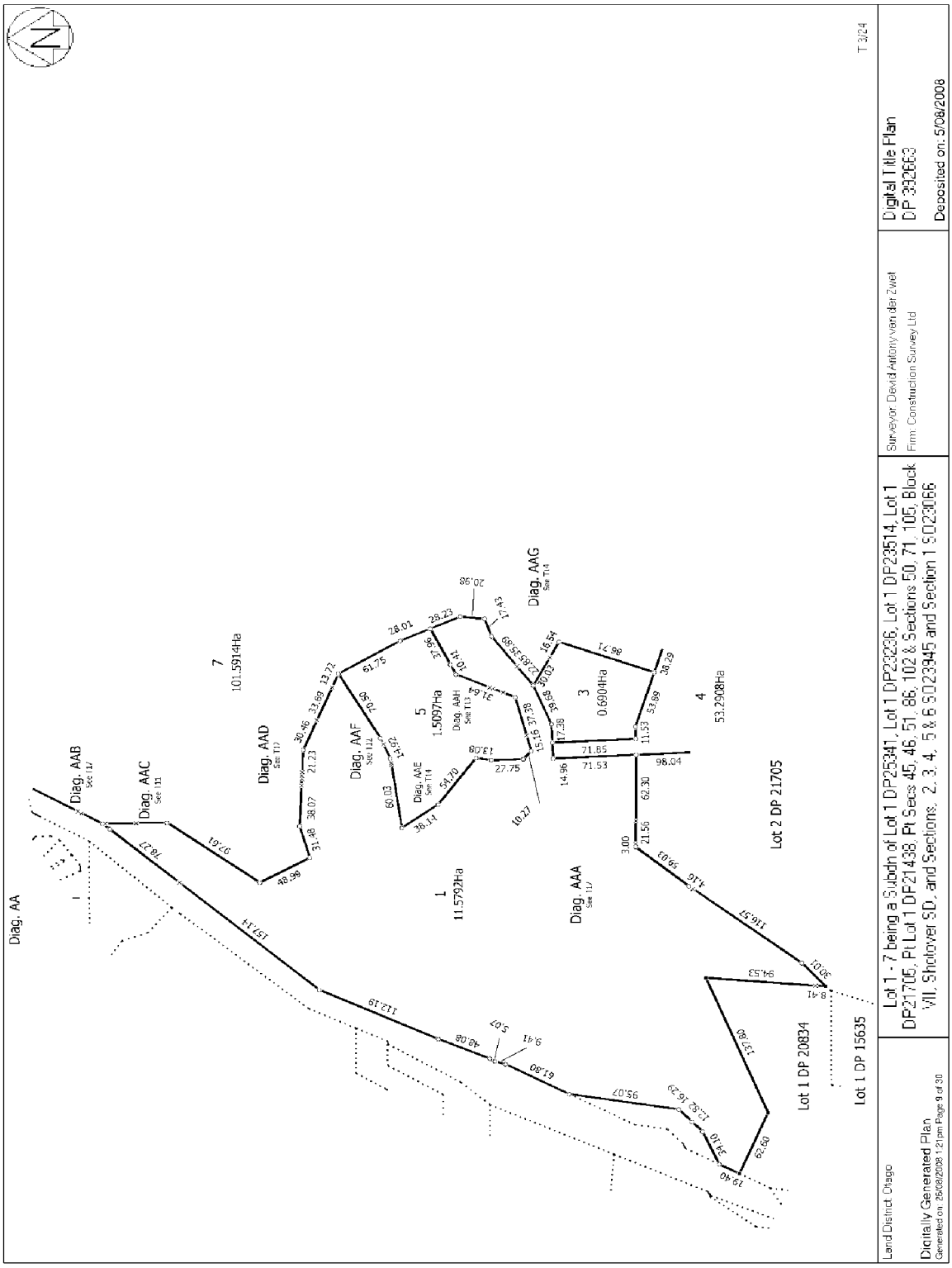
Part Section 1 SO 23541
Section 1 SO 22444
Diag. A
Diag. C
Diag. D
Diag. E
Diag. B
Lot 5 DP 26714
Lot 4 DP 25341
Part Lot 1 DP 26714
Lot 2 DP 26714
Lot 1 DP 21269
Lot 1 DP 20834
Lot 1 DP 15635
Lot 2 DP 21705
HOGANS GULLY ROAD
ARROWTOWN-LAKE HAYES ROAD
SPEARGRASS FLAT ROAD
1 11.5792Ha
2 7.0009Ha
3 0.6904Ha
4 53.2908Ha
5 1.5097Ha
6 15.0399Ha
7 101.5914Ha
Land District Otago
Digitally Generated Plan
Generated on 26/08/2008 1:21pm Page 7 of 30
Lot 1 - 7 being a Subdn of Lot 1 DP25341, Lot 1 DP23236, Lot 1 DP23514, Lot 1 DP21705, Pt Lot 1 DP21438, Pt Secs 45, 46, 51, 86, 102 & Sections 50, 71, 105, Block VII, Shotover SD, and Sections 2, 3, 4, 5 & 6 SO23945 and Section 1 SO23066
Surveyor: David Antony van der Zwet
Firm: Construction Survey Ltd
Digital Title Plan
DP 392663
Deposited on: 5/08/2008

Identifier **413072**

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See T14
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See T12
Diag. AAG
See T14
Diag. AAH
See T13
Diag. AAA
See T17
7
101.5914Ha
5
1.5097Ha
1
11.5792Ha
3
0.6904Ha
4
53.2908Ha
Lot 2 DP 21705
Lot 1 DP 20834
Lot 1 DP 15635
T 3/24
Lot 1 - 7 being a Subdn of Lot 1 DP25341, Lot 1 DP223236, Lot 1 DP223514, Lot 1 DP21705, Pt Lot 1 DP21438, Pt Secs 45, 46, 51, 86, 102 & Sections 50, 71, 105, Block VII, Shotover SD, and Sections 2, 3, 4, 5 & 6 SO23945 and Section 1 SO23066
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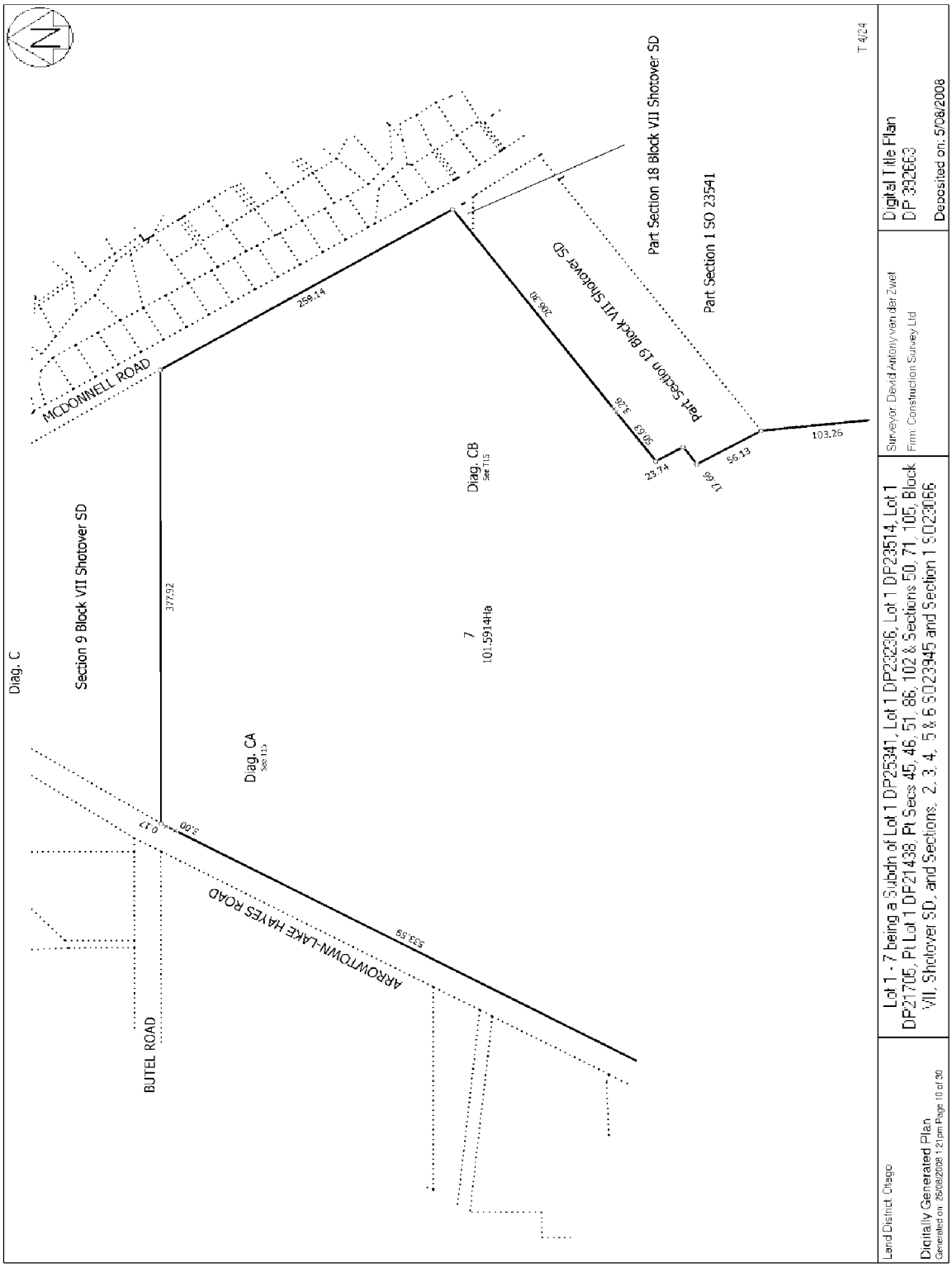

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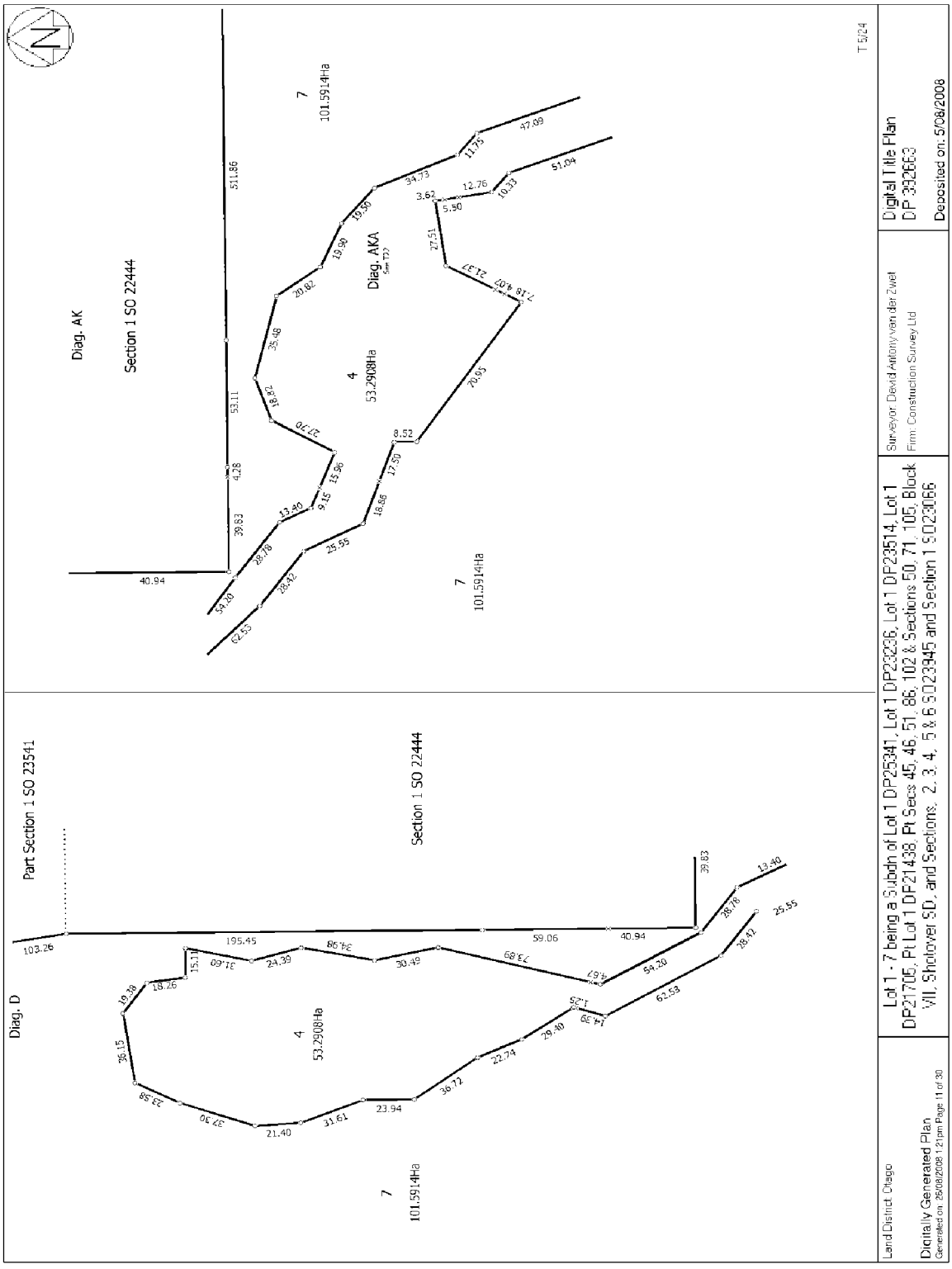

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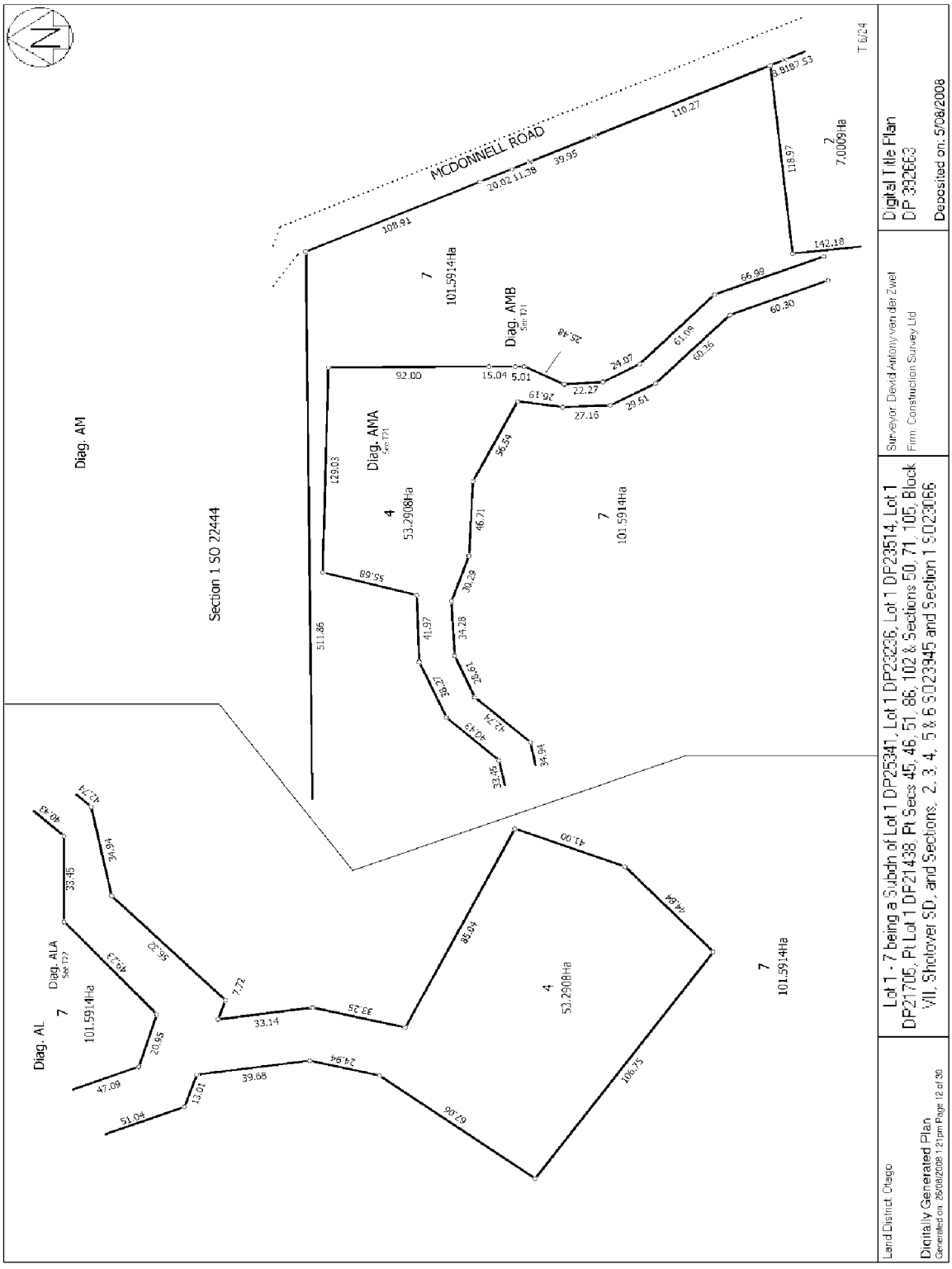

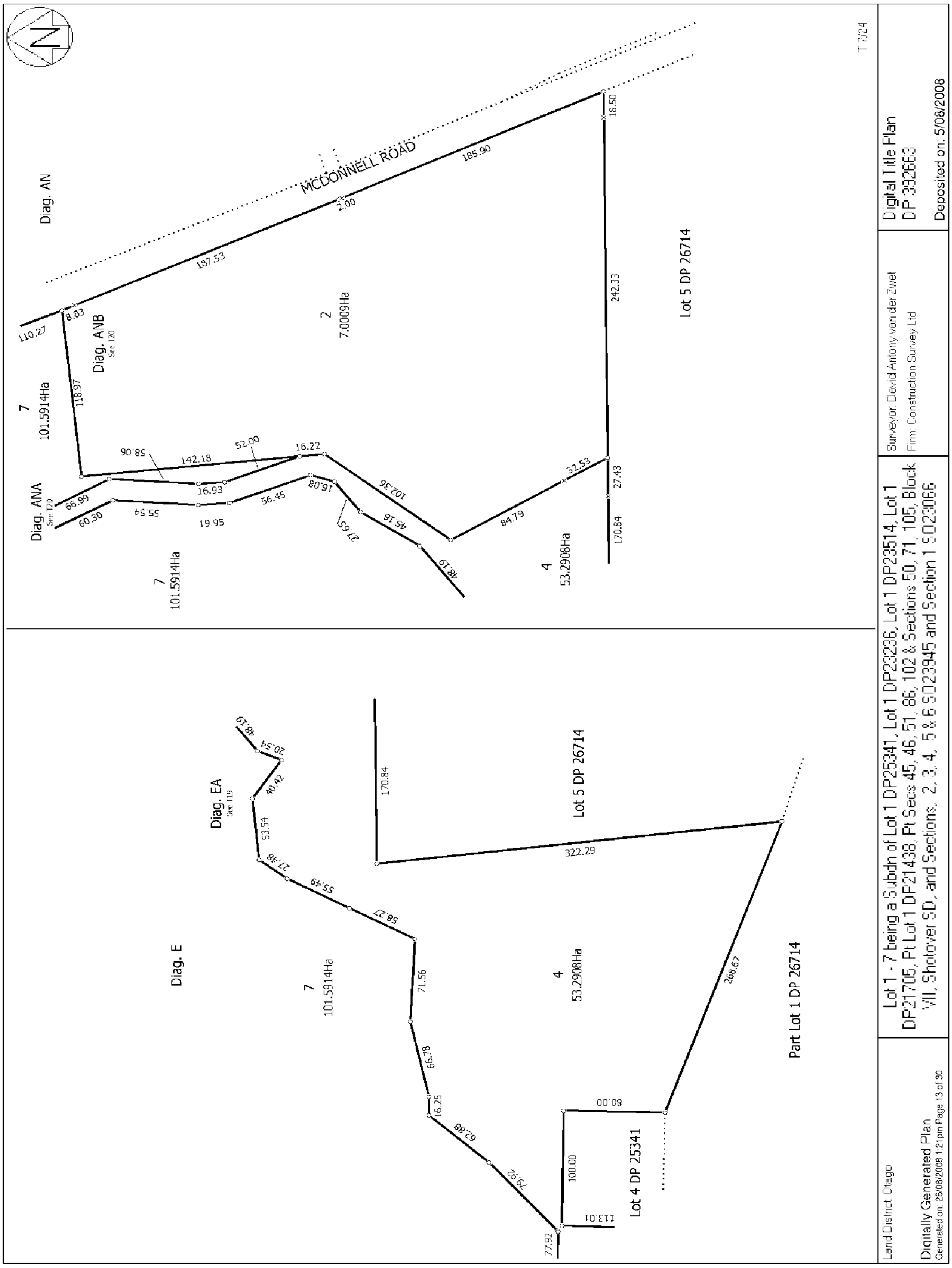

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Diag. ANB
Diag. ANA
Diag. EA
Diag. E
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7.0009Ha
7
101.5914Ha
4
53.2908Ha
Lot 5 DP 26714
Part Lot 1 DP 26714
Lot 4 DP 25341
T 7/24
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DP 392663
Deposited on: 5/08/2008
Surveyor: David Antony van der Zwet
Firm: Construction Survey Ltd
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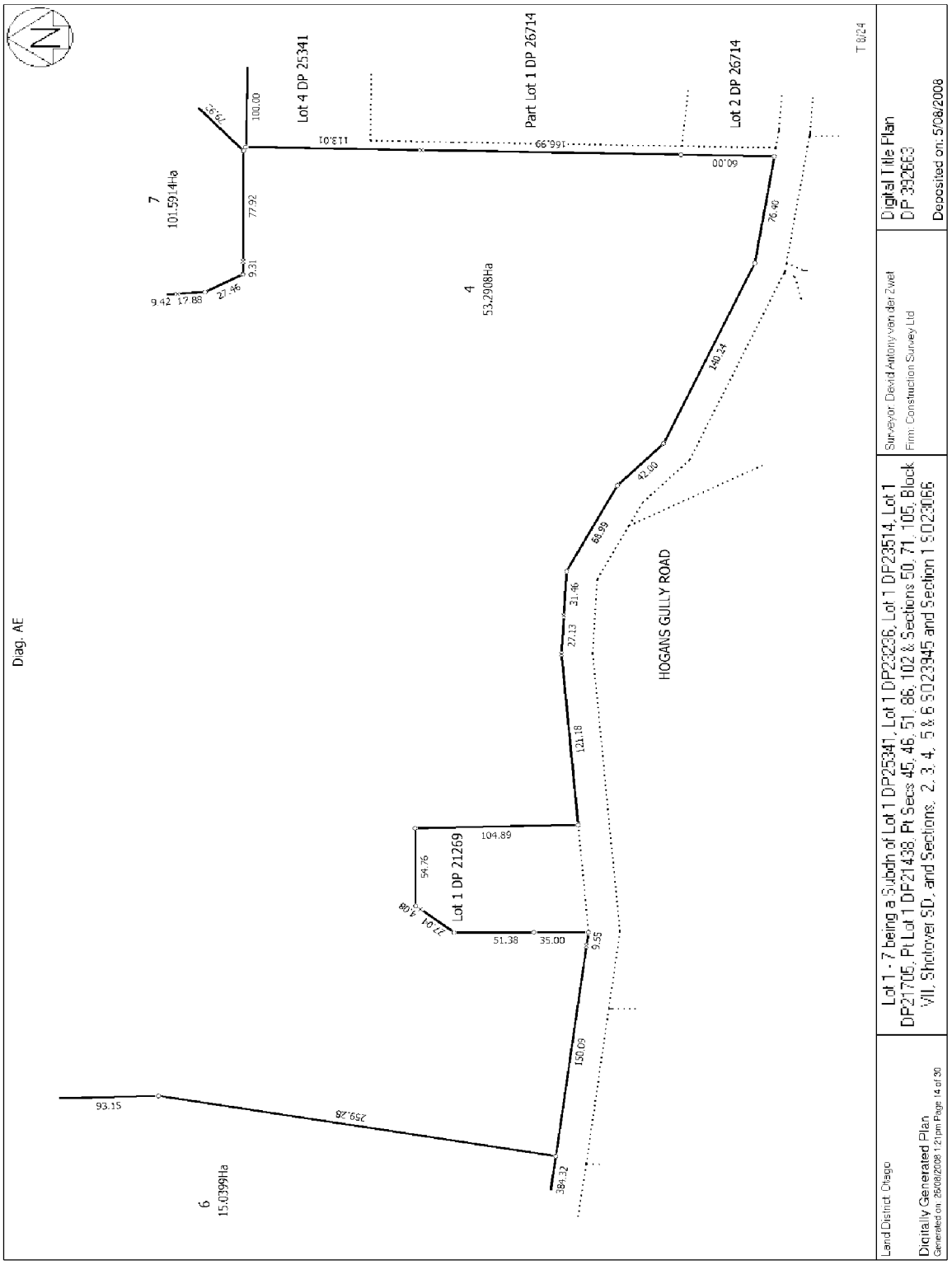

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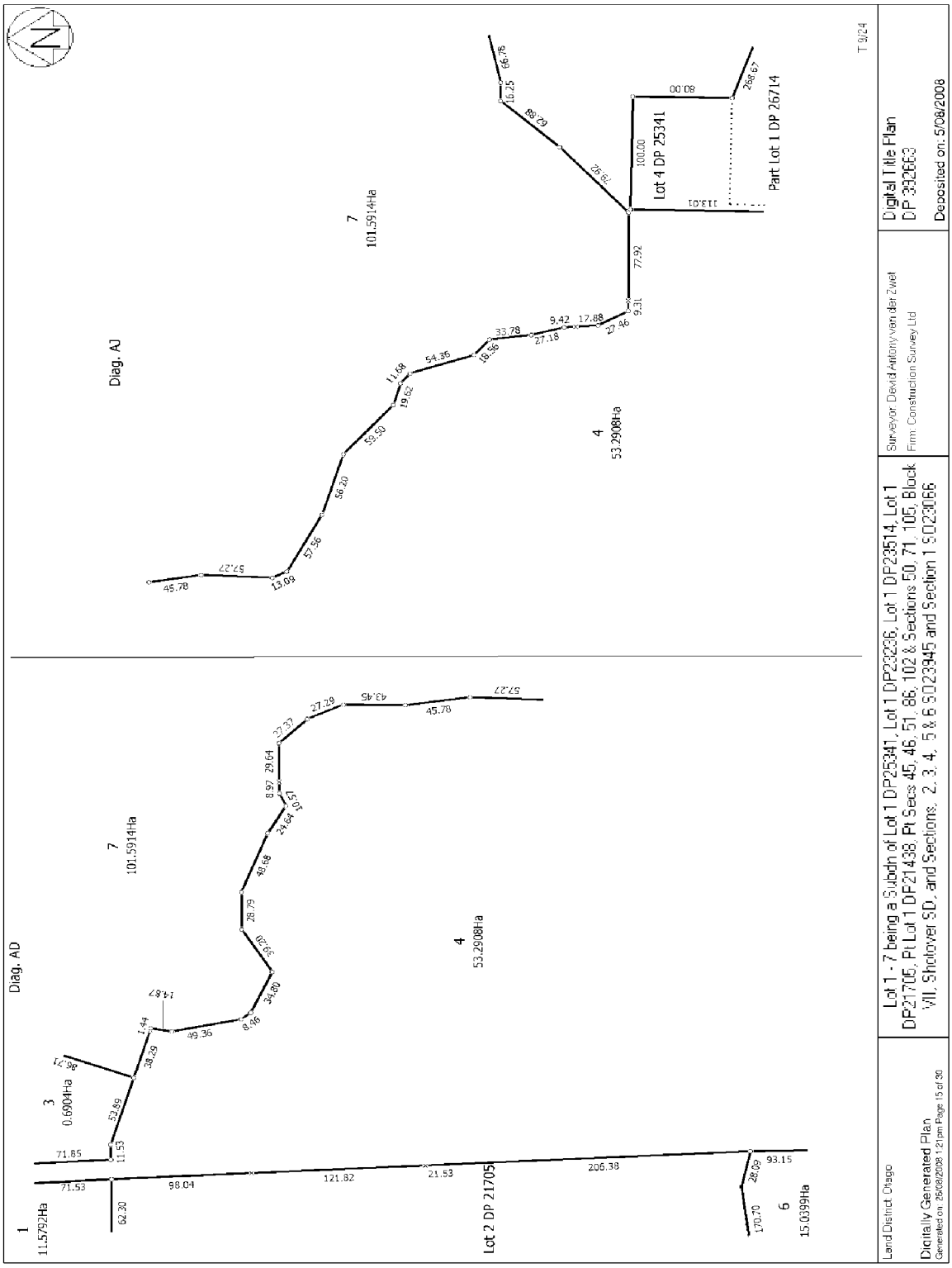

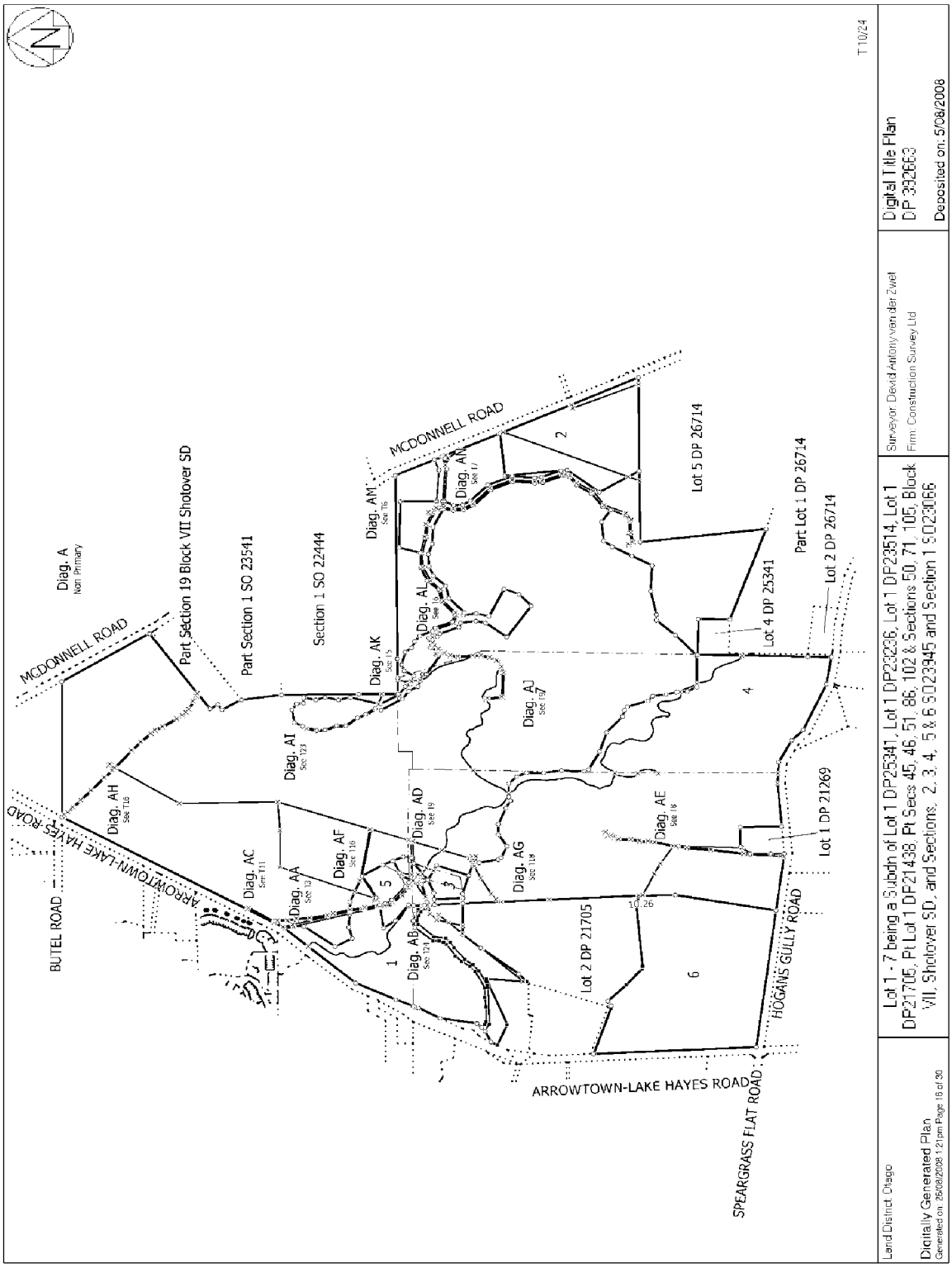
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Sec 15
Diag. AL
Sec 16
Diag. AI
Sec 123
Diag. AJ
Sec 17
Diag. AH
Sec T16
Diag. AC
Sec T11
Diag. AA
Sec 19
Diag. AF
Sec 116
Diag. AD
Sec 19
Diag. AG
Sec 118
Diag. AB
Sec 123
Diag. AE
Sec 18
BUTEL ROAD
ARROWTOWN-LAKE HAYES ROAD
Lot 5 DP 26714
Lot 4 DP 25341
Part Lot 1 DP 26714
Lot 2 DP 26714
Lot 1 DP 21269
Lot 2 DP 21705
HOGANS GULLY ROAD
SPEARGRASS FLAT ROAD
T 10/24
Land District Otago
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Lot 1 - 7 being a Subdn of Lot 1 DP25341, Lot 1 DP23236, Lot 1 DP23514, Lot 1 DP21705, Pt Lot 1 DP21438, Pt Secs 45, 46, 51, 86, 102 & Sections 50, 71, 105, Block VII, Shotover SD, and Sections 2, 3, 4, 5 & 6 SO23945 and Section 1 SO23066
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DP 392663
Deposited on: 5/08/2008

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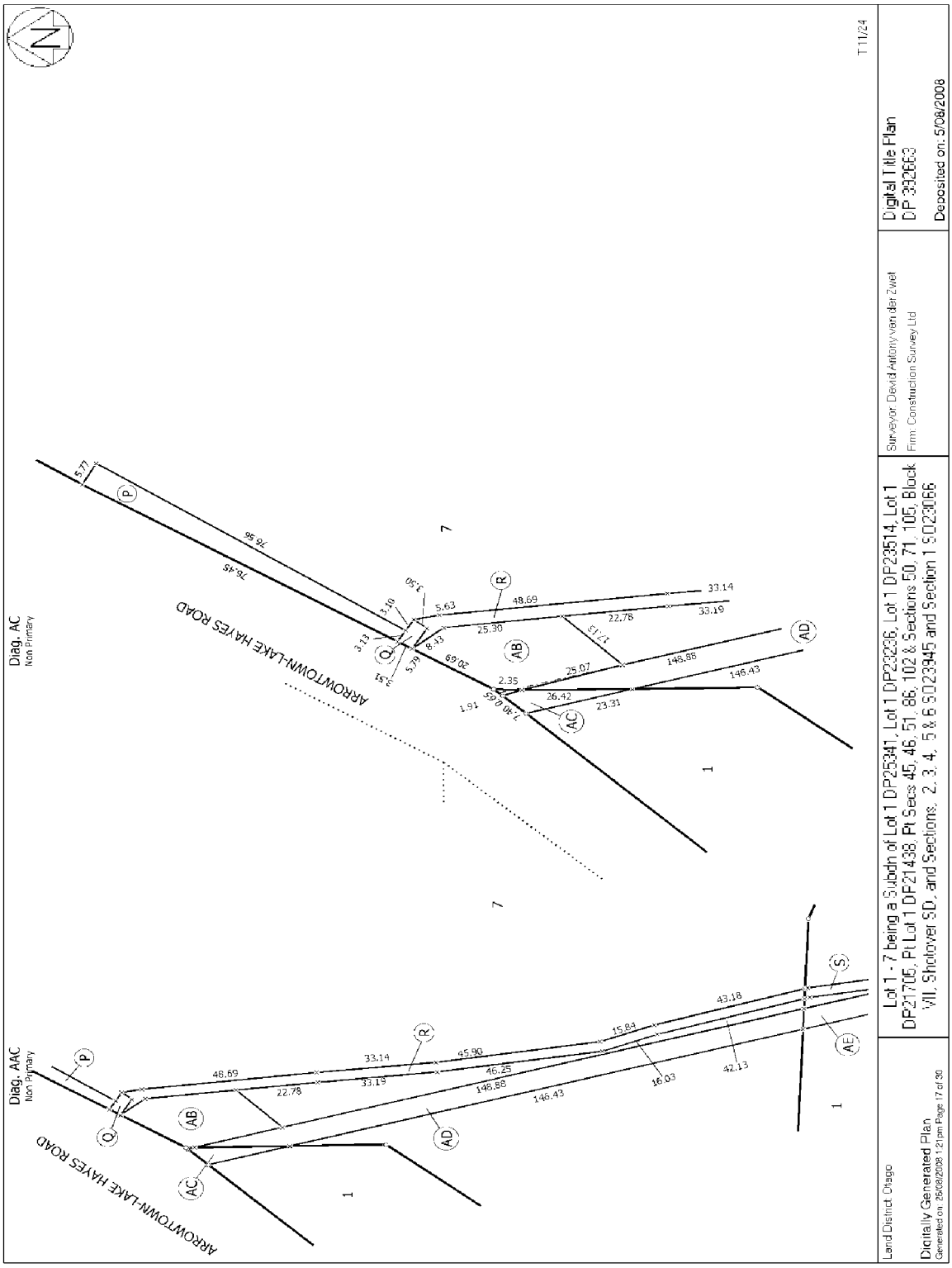

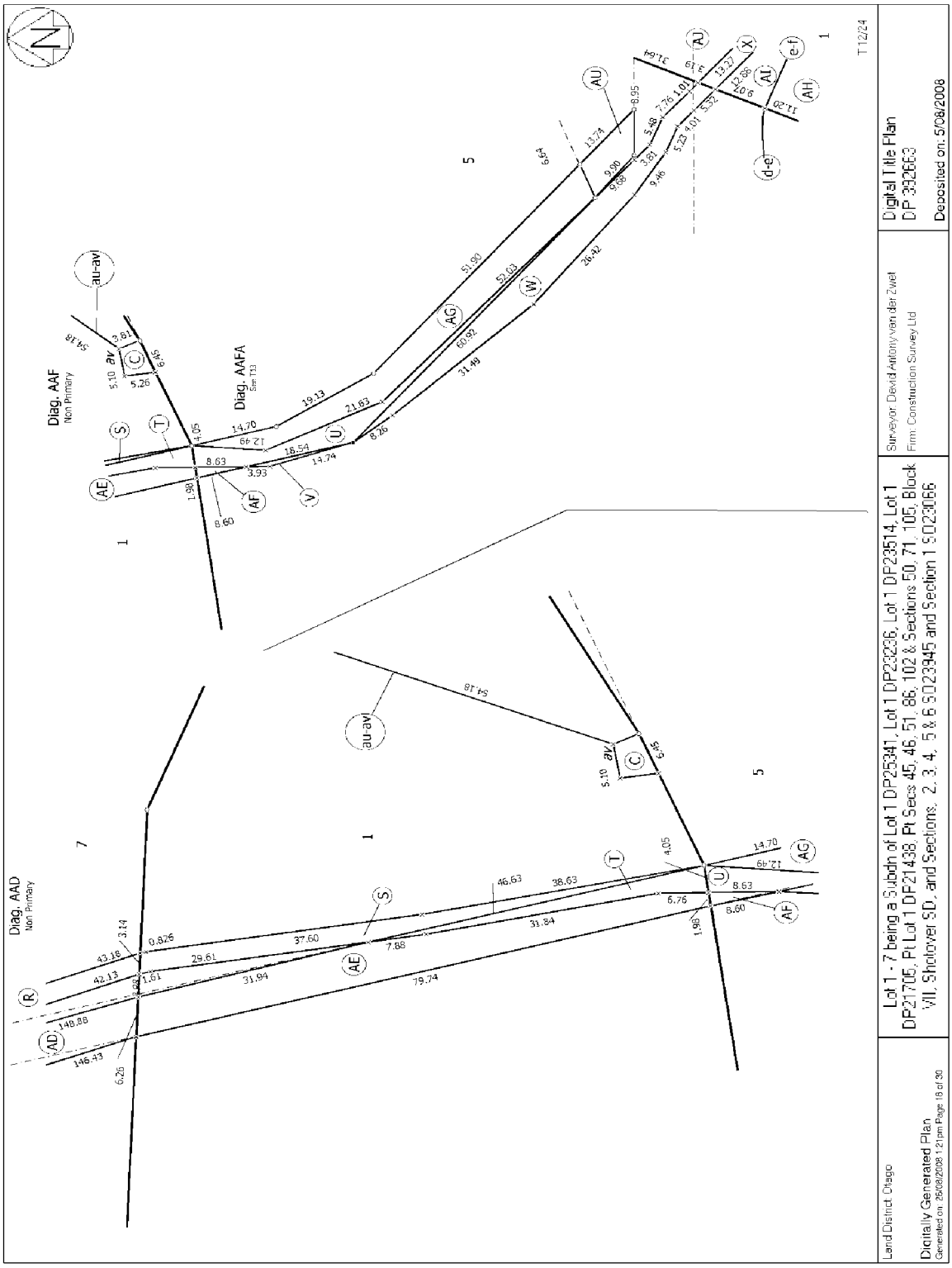
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Surveyor David Antony van der Zwet
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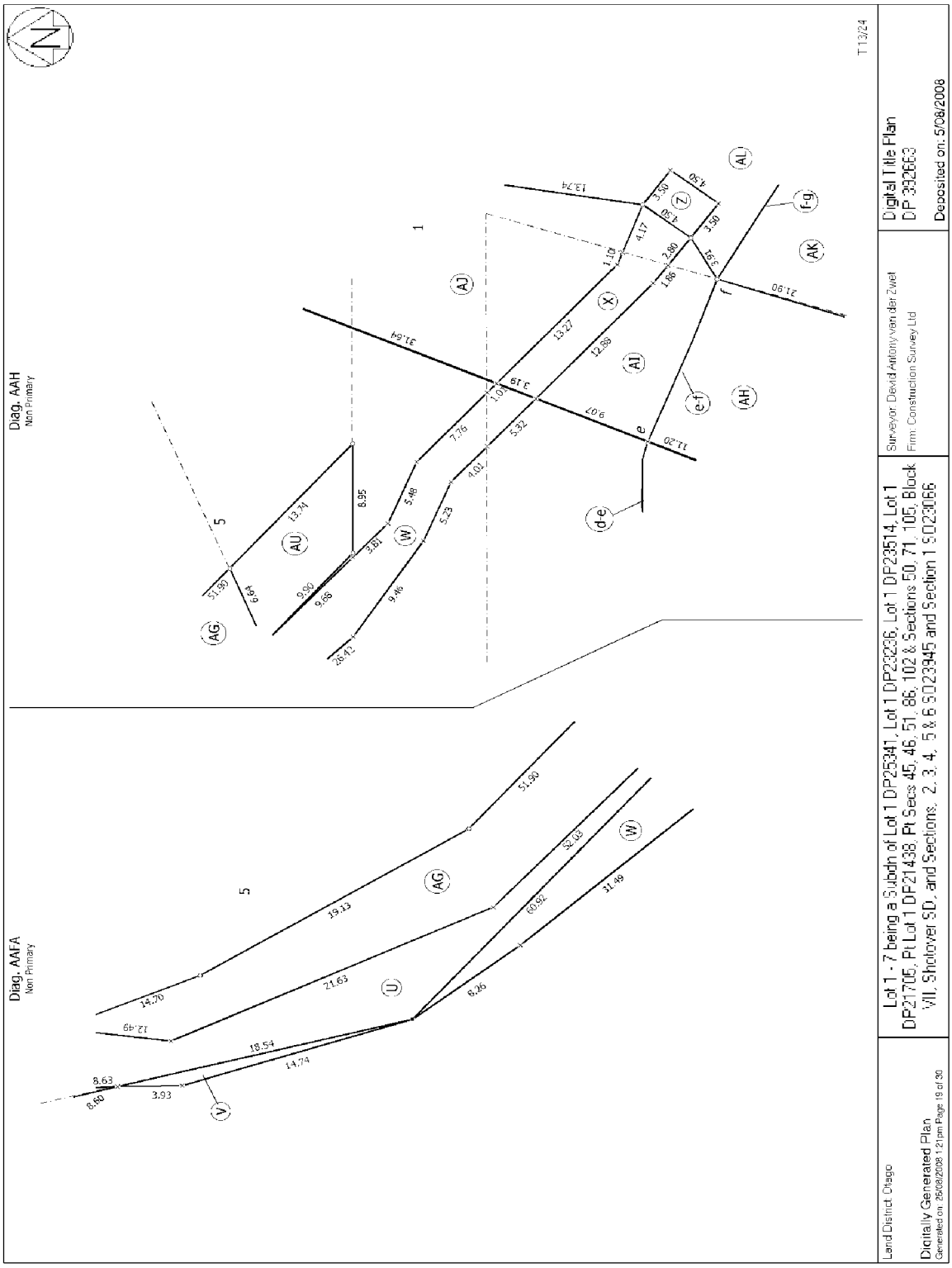
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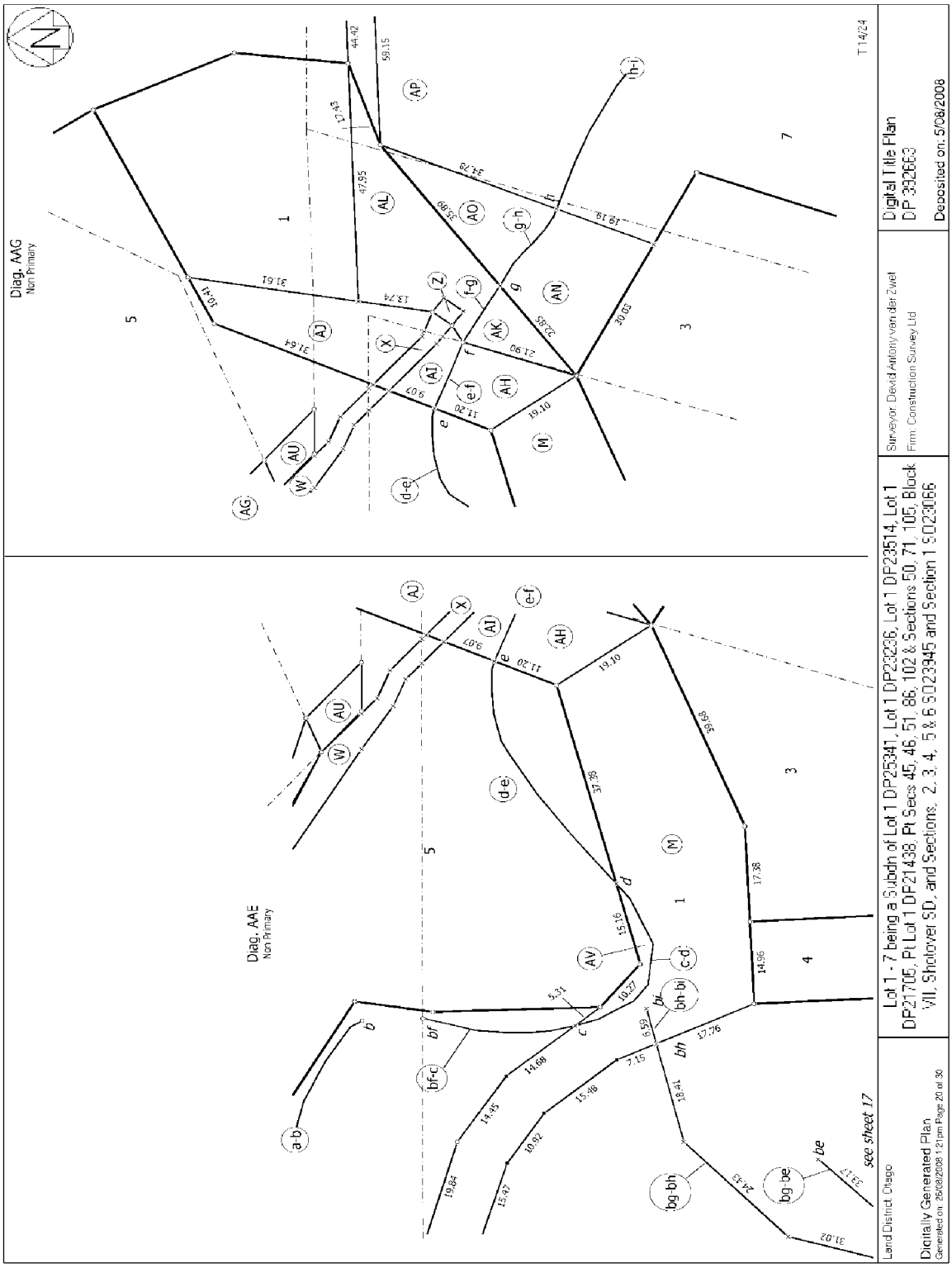

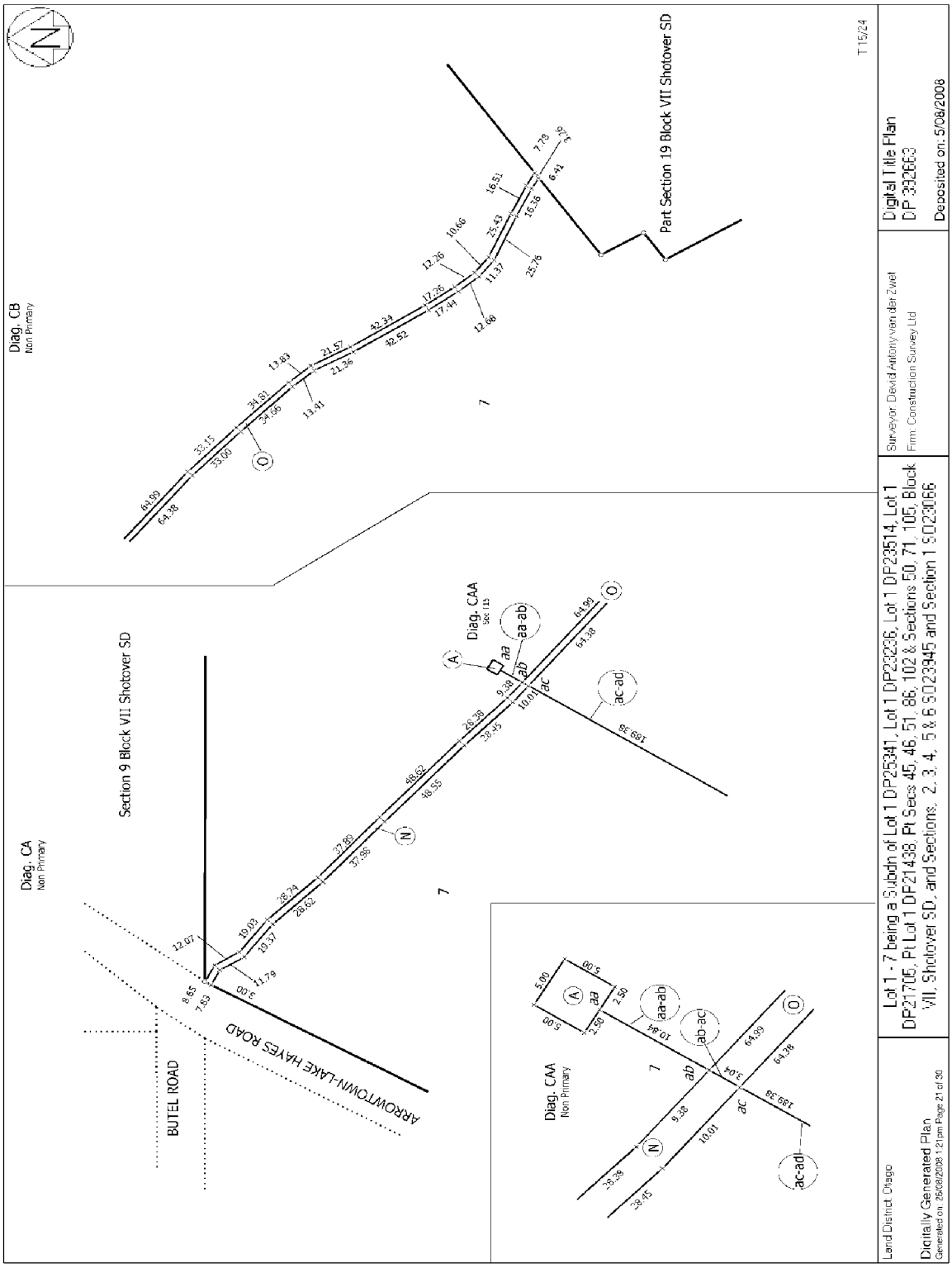
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ARROWTOWN-LAKE HAYES ROAD
Diag. CAA
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Land District: Otago
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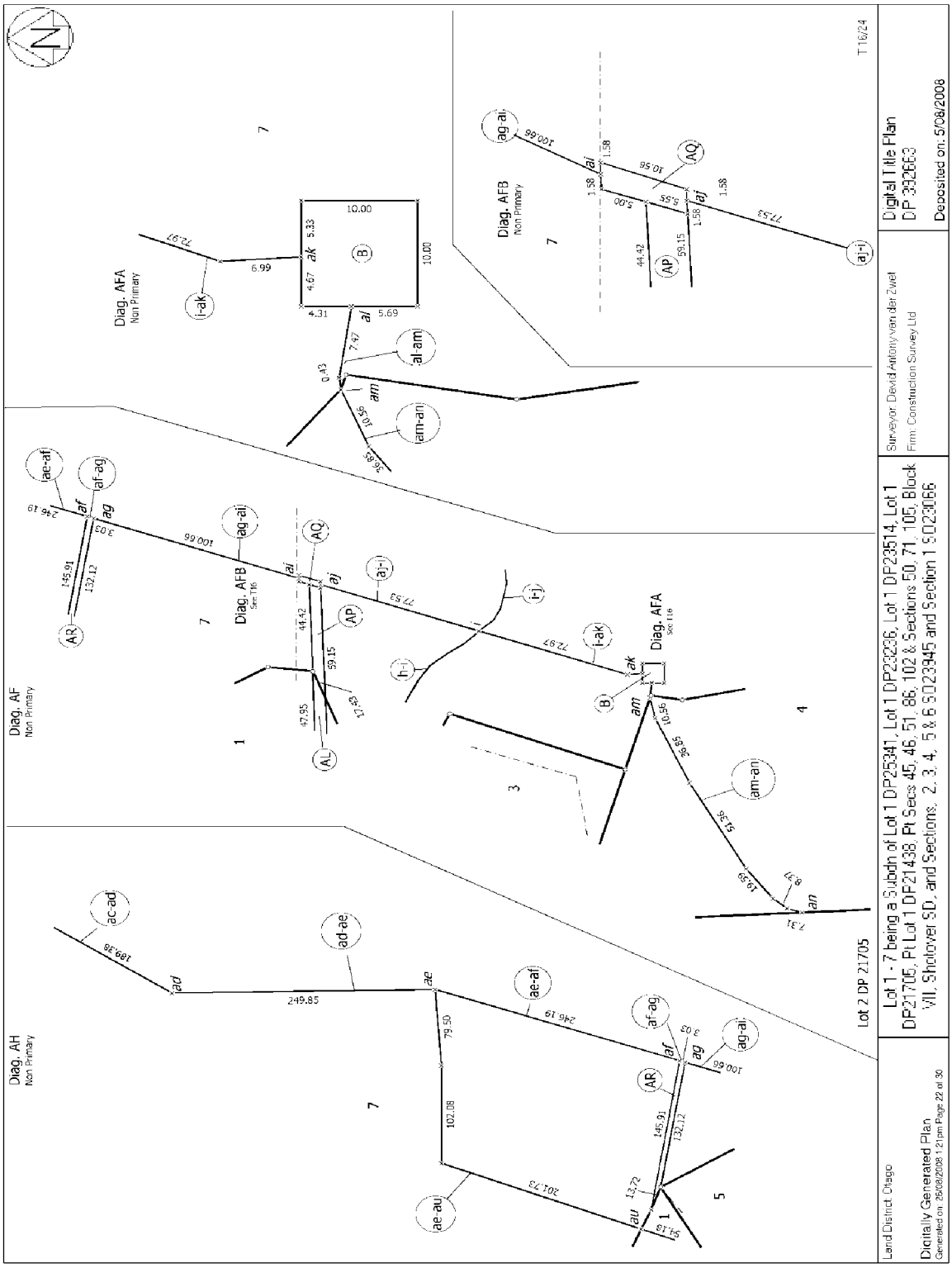
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Land District Otago
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Generated on 26/08/2008 1:21pm Page 22 of 30
Surveyor David Antony van der Zwet
Firm Construction Survey Ltd
Digital Title Plan
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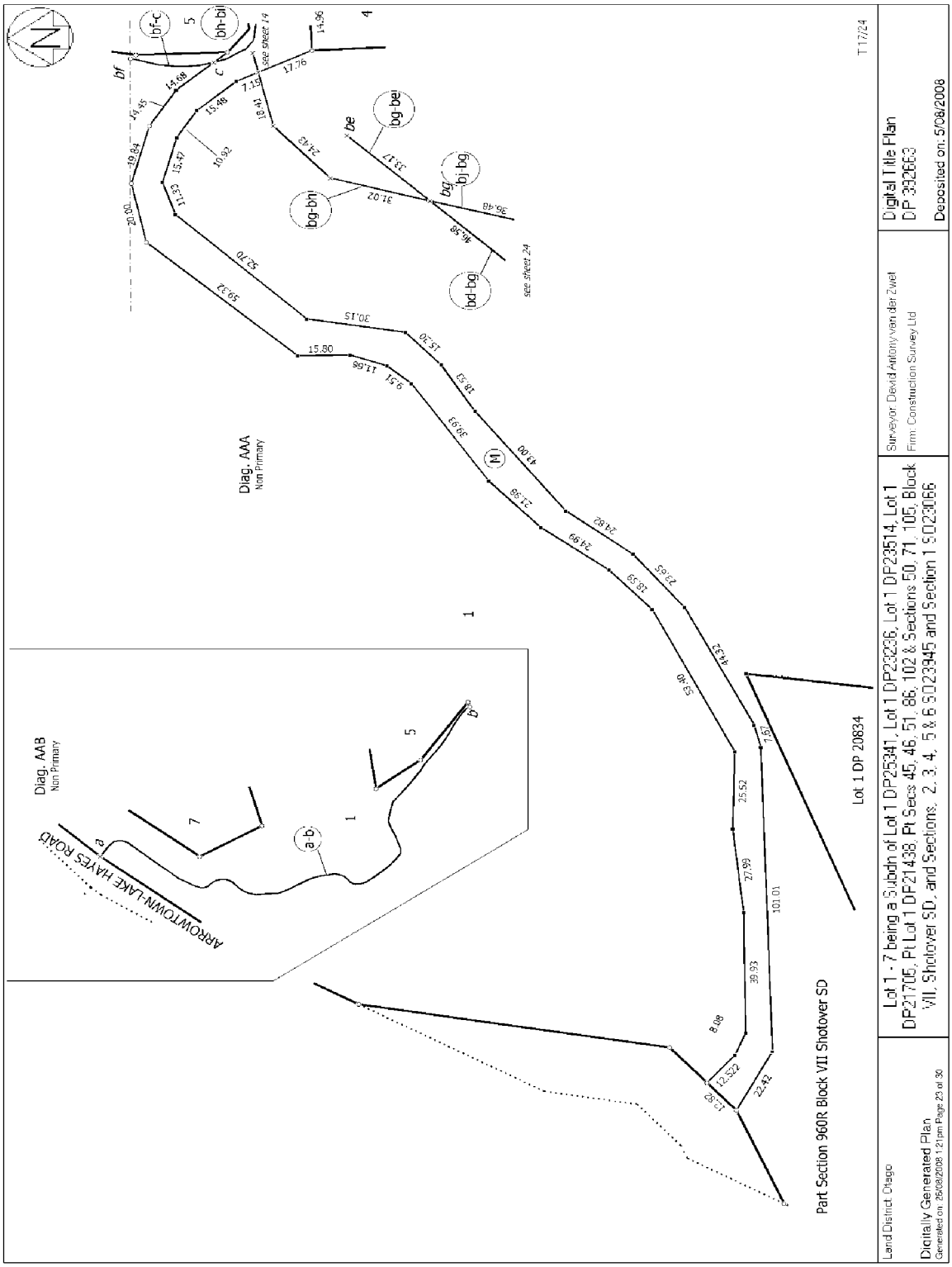

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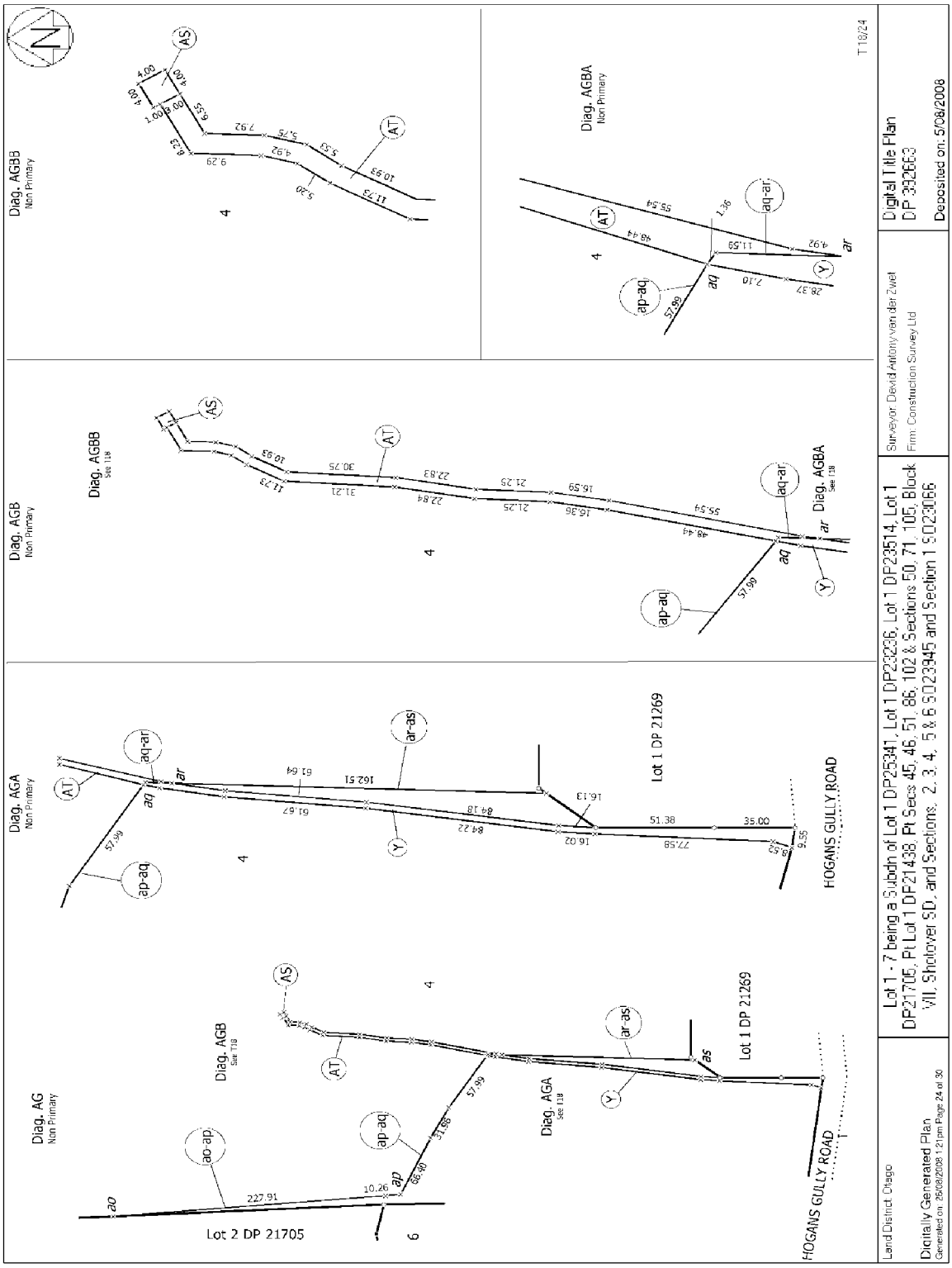

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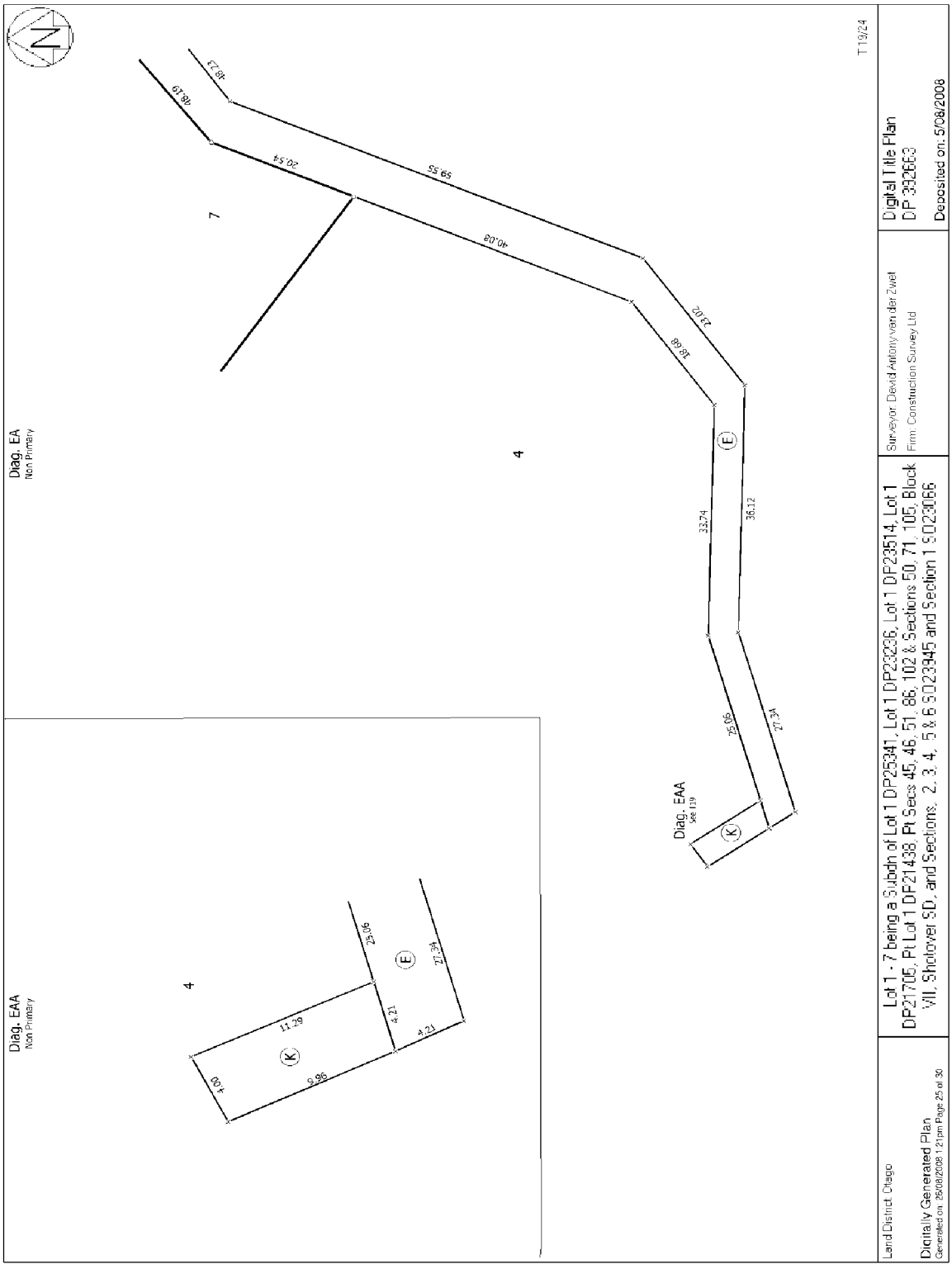

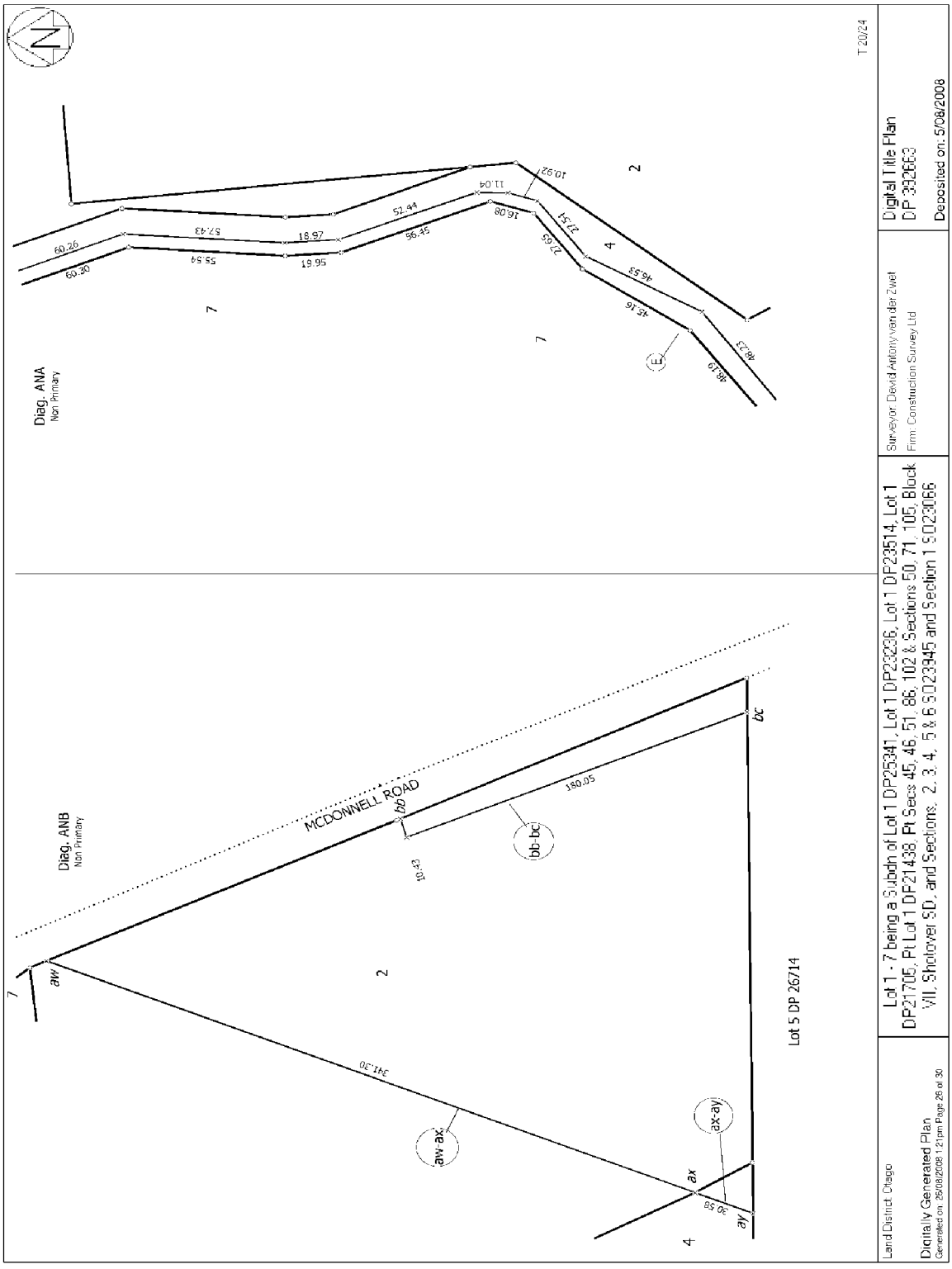
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Surveyor: David Antony van der Zwet
Firm: Construction Survey Ltd
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Deposited on: 5/08/2008
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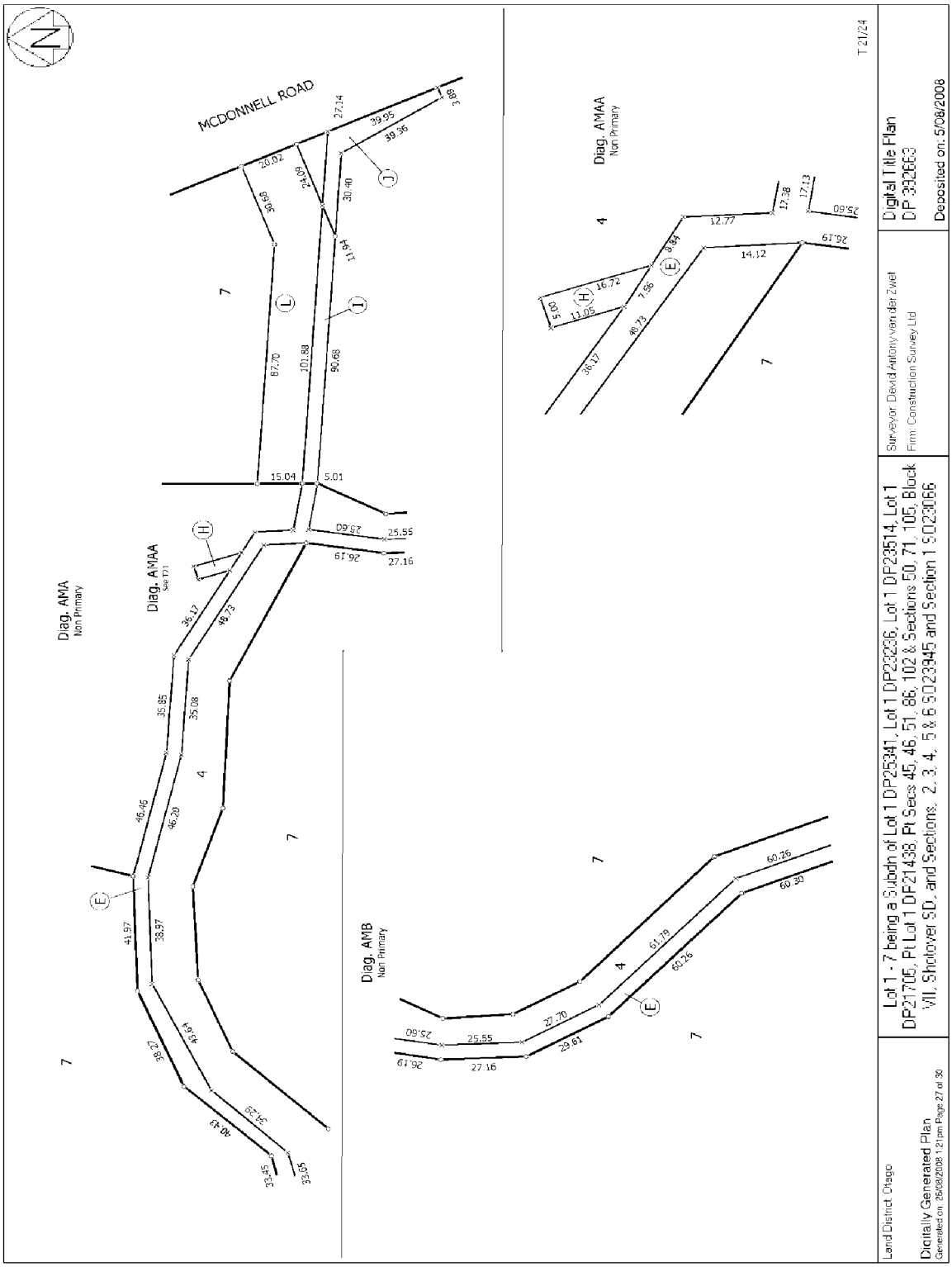
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Surveyor David Antony van der Zwet
Firm Construction Survey Ltd
Digital Title Plan
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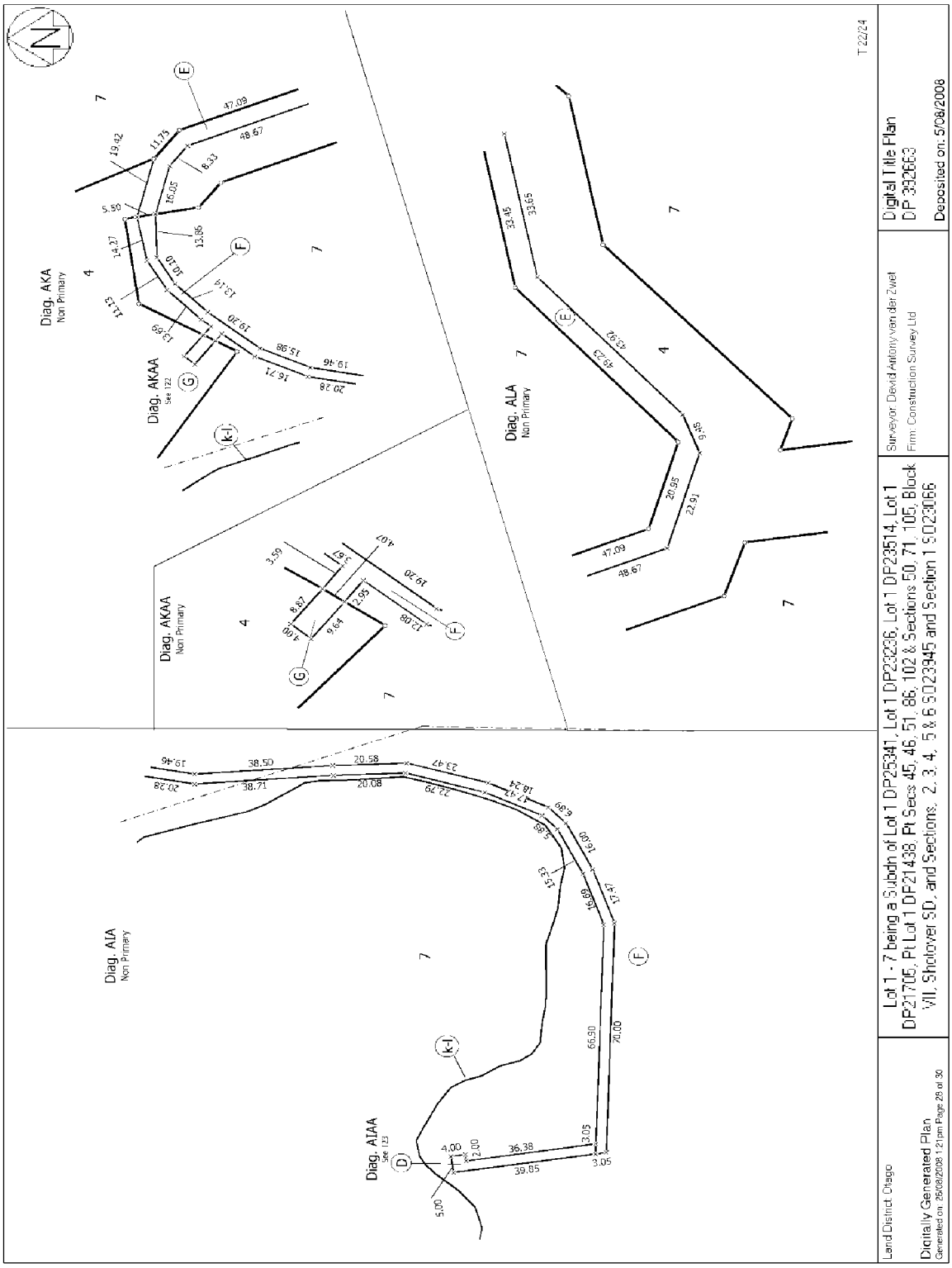
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Firm Construction Survey Ltd
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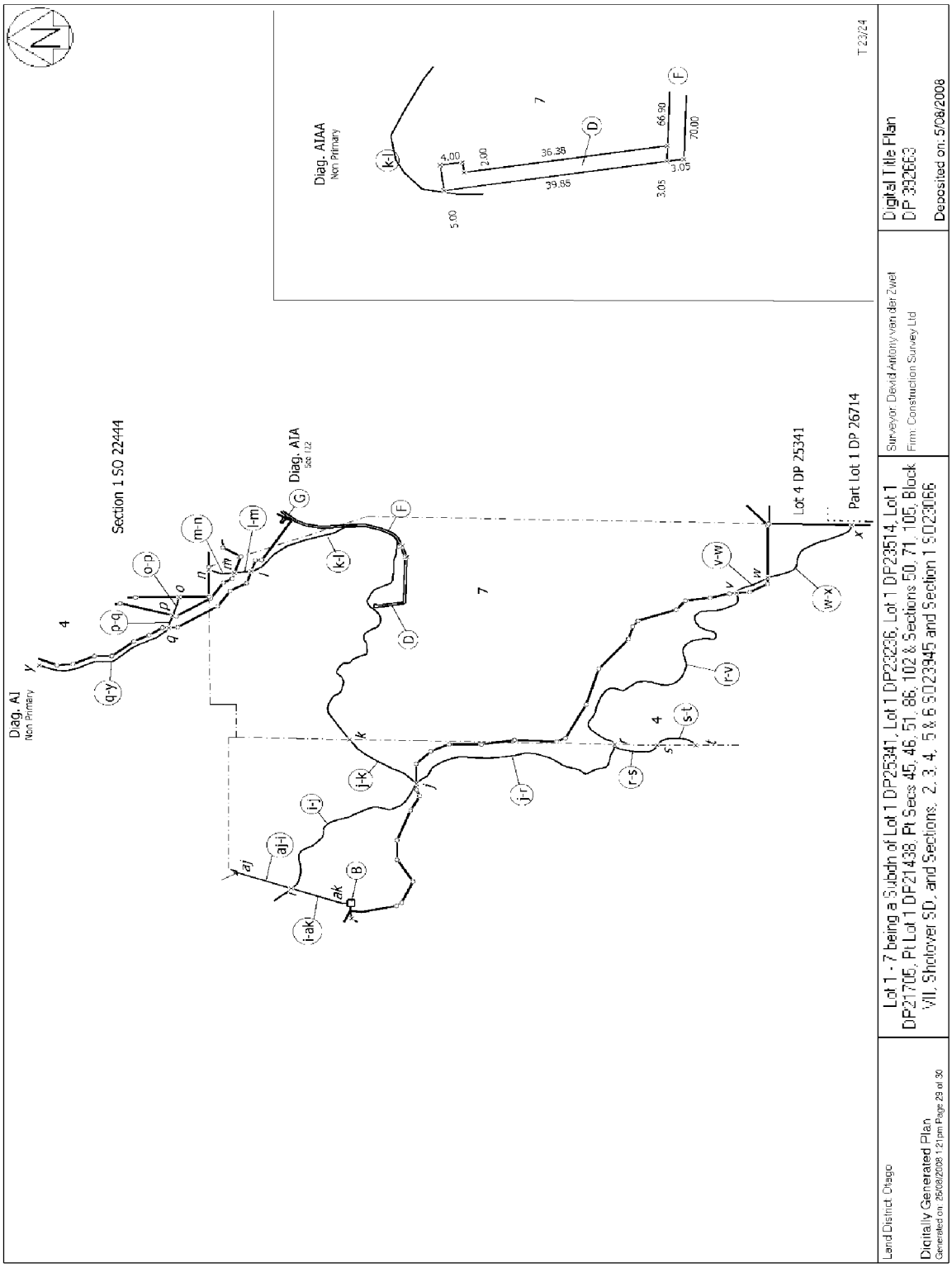

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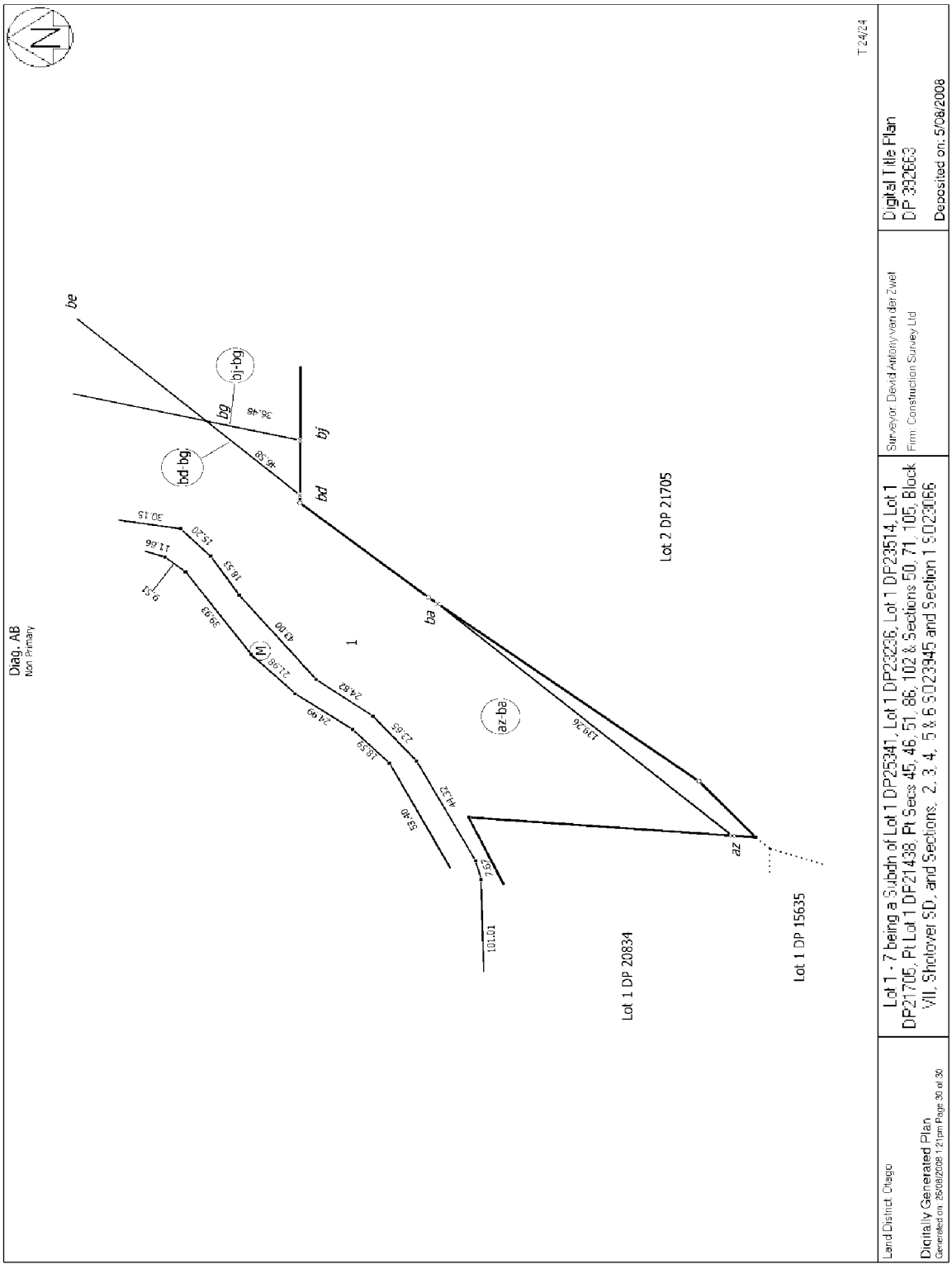

Appendix C

Soil Profile Logs

SOIL PROFILE LOGS

PROJECT NUMBER: 15063 FIELD STAFF: Fiona R DATE: 6/10/2015
SITE NAME: The Hills Area A METHOD: Spade WEATHER: Fine and windy

Sample Location	Coordinates		Sample Depth (m)	Sample ID	Soil Lithology
1	-44.959081	168.819712	0-0.1	AA#1	Greyish brown clayey SILT with organic matter
2	-44.959689	168.819634	0-0.1	AA#2	Greyish brown clayey SILT with organic matter
3	-44.960321	168.819609	0-0.1	AA#3	Greyish brown clayey SILT with organic matter
4	-44.959072	168.820658	0-0.1	AA#4	Greyish brown clayey SILT with organic matter
5	-44.959735	168.820629	0-0.1	AA#5	Greyish brown clayey SILT with organic matter
6	-44.960376	168.820611	0-0.1	AA#6	Greyish brown clayey SILT with organic matter
7	-44.959061	168.821671	0-0.1	AA#7	Greyish brown clayey SILT with organic matter
8	-44.959706	168.821687	0-0.1	AA#8	Greyish brown clayey SILT with organic matter
9	-44.96038	168.821695	0-0.1	AA#9	Yellowish brown clayey SILT with schist gravels
10	-44.960439	168.822622	0-0.1	AA#10	Greyish brown clayey SILT with organic matter
11	-44.959768	168.822719	0-0.1	AA#11	Greyish brown clayey SILT with organic matter
12	-44.959137	168.82282	0-0.1	AA#12	Greyish brown clayey SILT with organic matter
13	-44.959666	168.824346	0-0.1	AA#13	Greyish brown clayey SILT with organic matter
14	-44.960319	168.824145	0-0.1	AA#14	Greyish brown clayey SILT with organic matter
15	-44.960925	168.823987	0-0.1	AA#15	Greyish brown clayey SILT with organic matter

Appendix D

Bore Search Information

Land-use and Site Contamination Request - McDonnell Road / 37 Hogans Gully Road

Appendix E

Laboratory Certificates and Chain of Custody

Hill Laboratories
BETTER TESTING BETTER RESULTS

R J Hill Laboratories Limited
1 Clyde Street
Private Bag 3205
Hamilton 3240, New Zealand

Tel +64 7 858 2000
Fax +64 7 858 2001
Email mail@hill-labs.co.nz
Web www.hill-labs.co.nz

ANALYSIS REPORT

Client:	Davis Consulting Group Limited	**Lab No:**	1485293 SPv1
Contact:	Fiona Rowley	**Date Registered:**	07-Oct-2015
	C/- Davis Consulting Group Limited	**Date Reported:**	19-Oct-2015
	PO Box 2450	**Quote No:**	
	Wakatipu	**Order No:**	
	QUEENSTOWN 9349	**Client Reference:**	The Hills Area A+B 15063
		Submitted By:	Fiona Rowley

Sample Type: Soil

Sample Name:		AA#2 (0.1) 06-Oct-2015 10:50 am	AA#4 (0.1) 06-Oct-2015 11:00 am	AA#5 (0.1) 06-Oct-2015 11:05 am	AA#8 (0.1) 06-Oct-2015 11:20 am	AA#11 (0.1) 06-Oct-2015 11:35 am
Lab Number:		1485293.2	1485293.4	1485293.5	1485293.8	1485293.11
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	-	9	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	-	0.17	-	-	-
Total Recoverable Chromium	mg/kg dry wt	-	9	-	-	-
Total Recoverable Copper	mg/kg dry wt	-	13	-	-	-
Total Recoverable Lead	mg/kg dry wt	-	16.2	-	-	-
Total Recoverable Nickel	mg/kg dry wt	-	8	-	-	-
Total Recoverable Zinc	mg/kg dry wt	-	53	-	-	-
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	-	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	< 0.010	-	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	< 0.010	-	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	< 0.010	-	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	-	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	< 0.010	-	< 0.010	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	< 0.010	-	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	-	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.010	-	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	< 0.010	-	< 0.010	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	< 0.010	-	< 0.010	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	0.138	-	0.150	0.073	0.043
2,4'-DDT	mg/kg dry wt	< 0.010	-	0.011	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt	0.060	-	0.066	0.018	0.013
Dieldrin	mg/kg dry wt	< 0.010	-	< 0.010	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt	< 0.010	-	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	< 0.010	-	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	< 0.010	-	< 0.010	< 0.010	< 0.010
Endrin	mg/kg dry wt	< 0.010	-	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	< 0.010	-	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	< 0.010	-	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	< 0.010	-	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	< 0.010	-	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	< 0.010	-	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	< 0.010	-	< 0.010	< 0.010	< 0.010

Sample Type: Soil						
Sample Name:		AA#14 (0.1) 06-Oct-2015 11:50 am	A Dup #1 06-Oct-2015 11:01 am	A Dup #2 06-Oct-2015 2:06 pm	AB#2 (0.1) 06-Oct-2015 1:45 pm	AB#5 (0.1) 06-Oct-2015 2:00 pm
Lab Number:		1485293.14	1485293.16	1485293.17	1485293.19	1485293.22
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	-	10	10	-	-
Total Recoverable Cadmium	mg/kg dry wt	-	0.15	0.15	-	-
Total Recoverable Chromium	mg/kg dry wt	-	9	10	-	-
Total Recoverable Copper	mg/kg dry wt	-	13	9	-	-
Total Recoverable Lead	mg/kg dry wt	-	16.6	18.2	-	-
Total Recoverable Nickel	mg/kg dry wt	-	8	8	-	-
Total Recoverable Zinc	mg/kg dry wt	-	55	45	-	-
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	-	-	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	< 0.010	-	-	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	< 0.010	-	-	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	< 0.010	-	-	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	-	-	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	< 0.010	-	-	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	< 0.010	-	-	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	-	-	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.010	-	-	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	< 0.010	-	-	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	< 0.010	-	-	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	< 0.010	-	-	< 0.010	< 0.010
2,4'-DDT	mg/kg dry wt	< 0.010	-	-	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt	< 0.010	-	-	< 0.010	< 0.010
Dieldrin	mg/kg dry wt	< 0.010	-	-	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt	< 0.010	-	-	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	< 0.010	-	-	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	< 0.010	-	-	< 0.010	< 0.010
Endrin	mg/kg dry wt	< 0.010	-	-	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	< 0.010	-	-	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	< 0.010	-	-	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	< 0.010	-	-	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	< 0.010	-	-	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	< 0.010	-	-	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	< 0.010	-	-	< 0.010	< 0.010

Sample Name:		AB#6 (0.1) 06-Oct-2015 2:05 pm	AB#7 (0.1) 06-Oct-2015 2:15 pm	AB#8 (0.1) 06-Oct-2015 2:20 pm	AB#9 (0.1) 06-Oct-2015 2:25 pm	AB-Battery 06-Oct-2015 2:10 pm
Lab Number:		1485293.23	1485293.24	1485293.25	1485293.26	1485293.27
Individual Tests						
Dry Matter	g/100g as rcvd	-	80	77	81	-
pH*	pH Units	-	-	-	-	5.2
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	10	-	-	-	12
Total Recoverable Cadmium	mg/kg dry wt	0.14	-	-	-	< 0.10
Total Recoverable Chromium	mg/kg dry wt	11	-	-	-	11
Total Recoverable Copper	mg/kg dry wt	9	-	-	-	10
Total Recoverable Lead	mg/kg dry wt	18.6	-	-	-	22
Total Recoverable Nickel	mg/kg dry wt	9	-	-	-	9
Total Recoverable Zinc	mg/kg dry wt	48	-	-	-	49
Multiresidue Pesticides in Soil samples by GCMS						
Acetochlor	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Alachlor	mg/kg dry wt	-	< 0.006	< 0.006	< 0.006	-
Aldrin	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	-
Atrazine	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-

Sample Type: Soil						
Sample Name:		AB#6 (0.1) 06-Oct-2015 2:05 pm	AB#7 (0.1) 06-Oct-2015 2:15 pm	AB#8 (0.1) 06-Oct-2015 2:20 pm	AB#9 (0.1) 06-Oct-2015 2:25 pm	AB-Battery 06-Oct-2015 2:10 pm
Lab Number:		1485293.23	1485293.24	1485293.25	1485293.26	1485293.27
Multiresidue Pesticides in Soil samples by GCMS						
Atrazine-desethyl	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Atrazine-desisopropyl	mg/kg dry wt	-	< 0.015	< 0.016	< 0.015	-
Azaconazole	mg/kg dry wt	-	< 0.004	< 0.004	< 0.004	-
Azinphos-methyl	mg/kg dry wt	-	< 0.015	< 0.016	< 0.015	-
Benalaxyl	mg/kg dry wt	-	< 0.004	< 0.004	< 0.004	-
Bendiocarb	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Benodanil	mg/kg dry wt	-	< 0.015	< 0.016	< 0.015	-
alpha-BHC	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	-
beta-BHC	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	-
delta-BHC	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	-
gamma-BHC (Lindane)	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	-
Bifenthrin	mg/kg dry wt	-	< 0.004	< 0.004	< 0.004	-
Bitertanol	mg/kg dry wt	-	< 0.015	< 0.016	< 0.015	-
Bromacil	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Bromophos-ethyl	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Bromopropylate	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Bupirimate	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Buprofezin	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Butachlor	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Captafol	mg/kg dry wt	-	< 0.04	< 0.04	< 0.04	-
Captan	mg/kg dry wt	-	< 0.015	< 0.016	< 0.015	-
Carbaryl	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Carbofenothion	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Carbofuran	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Carboxin	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
cis-Chlordane	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	-
trans-Chlordane	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	-
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	-	< 0.04	< 0.04	< 0.04	-
Chlorfenvinphos	mg/kg dry wt	-	< 0.011	< 0.011	< 0.011	-
Chlorfluazuron	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Chlorothalonil	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Chlorpropham	mg/kg dry wt	-	< 0.015	< 0.016	< 0.015	-
Chlorpyrifos	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Chlorpyrifos-methyl	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Chlortoluron	mg/kg dry wt	-	< 0.015	< 0.016	< 0.015	-
Chlozolinate	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Coumaphos	mg/kg dry wt	-	< 0.015	< 0.016	< 0.015	-
Cyanazine	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Cyfluthrin	mg/kg dry wt	-	< 0.009	< 0.010	< 0.009	-
Cyhalothrin	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Cypermethrin	mg/kg dry wt	-	< 0.018	< 0.019	< 0.018	-
Cyproconazole	mg/kg dry wt	-	< 0.015	< 0.016	< 0.015	-
Cyprodinil	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
2,4'-DDD	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	-
4,4'-DDD	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	-
2,4'-DDE	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	-
4,4'-DDE	mg/kg dry wt	-	< 0.010	< 0.010	0.012	-
2,4'-DDT	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	-
4,4'-DDT	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	-
Total DDT Isomers	mg/kg dry wt	-	< 0.06	< 0.06	< 0.06	-
Deltamethrin (including Tralomethrin)	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Demeton-S-methyl	mg/kg dry wt	-	< 0.015	< 0.016	< 0.015	-
Diazinon	mg/kg dry wt	-	< 0.004	< 0.004	< 0.004	-

Sample Type: Soil						
Sample Name:		AB#6 (0.1) 06-Oct-2015 2:05 pm	AB#7 (0.1) 06-Oct-2015 2:15 pm	AB#8 (0.1) 06-Oct-2015 2:20 pm	AB#9 (0.1) 06-Oct-2015 2:25 pm	AB-Battery 06-Oct-2015 2:10 pm
Lab Number:		1485293.23	1485293.24	1485293.25	1485293.26	1485293.27
Multiresidue Pesticides in Soil samples by GCMS						
Dichlobenil	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Dichlofenthion	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Dichlofluanid	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Dichloran	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03	-
Dichlorvos	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	-
Dicofol	mg/kg dry wt	-	< 0.04	< 0.04	< 0.04	-
Dicrotophos	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Dieldrin	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	-
Difenoconazole	mg/kg dry wt	-	< 0.011	< 0.011	< 0.011	-
Dimethoate	mg/kg dry wt	-	< 0.015	< 0.016	< 0.015	-
Dinocap	mg/kg dry wt	-	< 0.09	< 0.09	< 0.09	-
Diphenylamine	mg/kg dry wt	-	< 0.015	< 0.016	< 0.015	-
Disulfoton	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Diuron	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Endosulfan I	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	-
Endosulfan II	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	-
Endosulfan sulphate	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	-
Endrin	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	-
Endrin aldehyde	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	-
Endrin ketone	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	-
EPN	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Esfenvalerate	mg/kg dry wt	-	< 0.011	< 0.011	< 0.011	-
Ethion	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Etrimfos	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Famphur	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Fenamiphos	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Fenarimol	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Fenitrothion	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Fenpropathrin	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Fenpropimorph	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Fensulfothion	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Fenthion	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Fenvalerate	mg/kg dry wt	-	< 0.011	< 0.011	< 0.011	-
Fluazifop-butyl	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Fluometuron	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Flusilazole	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Fluvalinate	mg/kg dry wt	-	< 0.006	< 0.006	< 0.006	-
Folpet	mg/kg dry wt	-	< 0.015	< 0.016	< 0.015	-
Furalaxyl	mg/kg dry wt	-	< 0.004	< 0.004	< 0.004	-
Haloxyfop-methyl	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Heptachlor	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	-
Heptachlor epoxide	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	-
Hexachlorobenzene	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	-
Hexaconazole	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Hexazinone	mg/kg dry wt	-	< 0.004	< 0.004	< 0.004	-
Hexythiazox	mg/kg dry wt	-	< 0.04	< 0.04	< 0.04	-
Imazalil	mg/kg dry wt	-	< 0.04	< 0.04	< 0.04	-
Indoxacarb	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Iodofenphos	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
IPBC (3-Iodo-2-propynyl-n-butylcarbamate)	mg/kg dry wt	-	< 0.04	< 0.04	< 0.04	-
Isazophos	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Isofenphos	mg/kg dry wt	-	< 0.004	< 0.004	< 0.004	-
Kresoxim-methyl	mg/kg dry wt	-	< 0.004	< 0.004	< 0.004	-
Leptophos	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-

Sample Type: Soil						
Sample Name:		AB#6 (0.1) 06-Oct-2015 2:05 pm	AB#7 (0.1) 06-Oct-2015 2:15 pm	AB#8 (0.1) 06-Oct-2015 2:20 pm	AB#9 (0.1) 06-Oct-2015 2:25 pm	AB-Battery 06-Oct-2015 2:10 pm
Lab Number:		1485293.23	1485293.24	1485293.25	1485293.26	1485293.27
Multiresidue Pesticides in Soil samples by GCMS						
Linuron	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Malathion	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Metalaxyl	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Methacrifos	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Methamidophos	mg/kg dry wt	-	< 0.04	< 0.04	< 0.04	-
Methidathion	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Methiocarb	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Methoxychlor	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	-
Metolachlor	mg/kg dry wt	-	< 0.006	< 0.006	< 0.006	-
Metribuzin	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Mevinphos	mg/kg dry wt	-	< 0.015	< 0.016	< 0.015	-
Molinate	mg/kg dry wt	-	< 0.015	< 0.016	< 0.015	-
Myclobutanil	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Naled	mg/kg dry wt	-	< 0.04	< 0.04	< 0.04	-
Nitrofen	mg/kg dry wt	-	< 0.015	< 0.016	< 0.015	-
Nitrothal-isopropyl	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Norflurazon	mg/kg dry wt	-	< 0.015	< 0.016	< 0.015	-
Omethoate	mg/kg dry wt	-	< 0.04	< 0.04	< 0.04	-
Oxadiazon	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Oxychlordane	mg/kg dry wt	-	< 0.004	< 0.004	< 0.004	-
Oxyfluorfen	mg/kg dry wt	-	< 0.004	< 0.004	< 0.004	-
Paclobutrazol	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Parathion-ethyl	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Parathion-methyl	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Penconazole	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Pendimethalin	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Permethrin	mg/kg dry wt	-	< 0.003	< 0.003	< 0.003	-
Phorate	mg/kg dry wt	-	< 0.015	< 0.016	< 0.015	-
Phosmet	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Phosphamidon	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Pirimicarb	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Pirimiphos-methyl	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Prochloraz	mg/kg dry wt	-	< 0.04	< 0.04	< 0.04	-
Procymidone	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Prometryn	mg/kg dry wt	-	< 0.004	< 0.004	< 0.004	-
Propachlor	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Propanil	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03	-
Propazine	mg/kg dry wt	-	< 0.004	< 0.004	< 0.004	-
Propetamphos	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Propham	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Propiconazole	mg/kg dry wt	-	< 0.006	< 0.006	< 0.006	-
Prothiofos	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Pyrazophos	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Pyrifenox	mg/kg dry wt	-	< 0.011	< 0.011	< 0.011	-
Pyrimethanil	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Pyriproxyfen	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Quintozene	mg/kg dry wt	-	< 0.015	< 0.016	< 0.015	-
Quizalofop-ethyl	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Simazine	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Simetryn	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Sulfentrazone	mg/kg dry wt	-	< 0.04	< 0.04	< 0.04	-
Sulfotep	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
TCMTB [2-(thiocyanomethylthio) benzothiazole,Busan]	mg/kg dry wt	-	< 0.015	< 0.016	< 0.015	-
Tebuconazole	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-

Sample Type: Soil						
Sample Name:		AB#6 (0.1) 06-Oct-2015 2:05 pm	AB#7 (0.1) 06-Oct-2015 2:15 pm	AB#8 (0.1) 06-Oct-2015 2:20 pm	AB#9 (0.1) 06-Oct-2015 2:25 pm	AB-Battery 06-Oct-2015 2:10 pm
Lab Number:		1485293.23	1485293.24	1485293.25	1485293.26	1485293.27
Multiresidue Pesticides in Soil samples by GCMS						
Tebufenpyrad	mg/kg dry wt	-	< 0.004	< 0.004	< 0.004	-
Terbacil	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Terbufos	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Terbumeton	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Terbuthylazine	mg/kg dry wt	-	< 0.004	< 0.004	< 0.004	-
Terbuthylazine-desethyl	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Terbutryn	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Tetrachlorvinphos	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Thiabendazole	mg/kg dry wt	-	< 0.04	< 0.04	< 0.04	-
Thiobencarb	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Thiometon	mg/kg dry wt	-	< 0.015	< 0.016	< 0.015	-
Tolylfluanid	mg/kg dry wt	-	< 0.004	< 0.004	< 0.004	-
Triadimefon	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Triazophos	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Trifluralin	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-
Vinclozolin	mg/kg dry wt	-	< 0.008	< 0.008	< 0.008	-

Sample Name:		Composite of AA#1 (0.1) + AA#2 (0.1) + AA#3 (0.1)	Composite of AA#4 (0.1) + AA#5 (0.1) + AA#6 (0.1)	Composite of AA#7 (0.1) + AA#8 (0.1) + AA#9 (0.1)	Composite of AA#10 (0.1) + AA#11 (0.1) + AA#12 (0.1)	Composite of AA#13 (0.1) + AA#14 (0.1) + AA#15 (0.1)
Lab Number:		1485293.28	1485293.29	1485293.30	1485293.31	1485293.32
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	12	22	12	10	8
Total Recoverable Cadmium	mg/kg dry wt	0.17	0.22	0.14	0.13	0.20
Total Recoverable Chromium	mg/kg dry wt	13	13	10	11	11
Total Recoverable Copper	mg/kg dry wt	18	18	11	11	15
Total Recoverable Lead	mg/kg dry wt	18.2	21	14.8	12.7	12.5
Total Recoverable Nickel	mg/kg dry wt	14	14	10	10	11
Total Recoverable Zinc	mg/kg dry wt	71	74	51	55	58

Sample Name:		Composite of AB#1 (0.1) + AB#2 (0.1) + AB#3 (0.1)	Composte of AB#4 (0.1) + AB#5 (0.1) + AB#6 (0.1)	Composite of AB#7 (0.1) + AB#8 (0.1) + AB#9 (0.1)		
Lab Number:		1485293.33	1485293.34	1485293.35		
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	10	11	11	-	-
Total Recoverable Cadmium	mg/kg dry wt	0.11	0.13	0.11	-	-
Total Recoverable Chromium	mg/kg dry wt	10	11	9	-	-
Total Recoverable Copper	mg/kg dry wt	10	10	10	-	-
Total Recoverable Lead	mg/kg dry wt	18.2	19.2	17.7	-	-
Total Recoverable Nickel	mg/kg dry wt	9	9	8	-	-
Total Recoverable Zinc	mg/kg dry wt	45	54	44	-	-

Analyst's Comments

It has been noted that the method performance for Iprodione for ONOP analysis is not acceptable therefore we are unable to report this compound at this present time.

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	4, 16-17, 23, 27-35
Soil Prep Dry & Sieve for Agriculture	Air dried at 35°C and sieved, <2mm fraction.	-	27

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	4, 16-17, 23, 27-35
Multiresidue Pesticides in Soil samples by GCMS	Sonication extraction, GC-MS analysis. Tested on as received sample, then results corrected to a dry weight basis using the separate Dry Matter result.	0.003 - 0.06 mg/kg dry wt	24-26
Organochlorine Pesticides Screening in Soil	Sonication extraction, SPE cleanup, dual column GC-ECD analysis (modified US EPA 8082).. Tested on dried sample	0.010 - 0.04 mg/kg dry wt	2, 5, 8, 11, 14, 19, 22
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	24-26
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	4, 16-17, 23, 27-35
Composite Environmental Solid Samples*	Individual sample fractions mixed together to form a composite fraction.	-	1-15, 18-26
pH*	1:2 (v/v) soil : water slurry followed by potentiometric determination of pH.	0.1 pH Units	27

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

Carole Rodgers-Carroll BA, NZCS
Client Services Manager - Environmental Division

Job No: 148 5293

Date Recv: 07-Oct-15 05:34

Received by: Jennifer Singlewood

3114852934

COMPOSITE SAMPLES		
Analysis	**ID**	**Date**
Heavy Metals Composite 1	AA#1(0.1)	6/10/2015
	AA#2(0.1)	
	AA#3(0.1)	
Heavy Metals Composite 2	AA#4(0.1)	
	AA#5(0.1)	
	AA#6(0.1)	
Heavy Metals Composite 3	AA#7(0.1)	
	AA#8(0.1)	
	AA#9(0.1)	
Heavy Metals Composite 4	AA#10(0.1)	
	AA#11(0.1)	
	AA#12(0.1)	
Heavy Metals Composite 5	AA#13(0.1)	
	AA#14(0.1)	
	AA#15(0.1)	
Heavy Metals Composite 6	AB#1(0.1)	
	AB#2(0.1)	
	AB#3(0.1)	
Heavy Metals Composite 7	AB#4(0.1)	
	AB#5(0.1)	
	AB#6(0.1)	
Heavy Metals Composite 8	AB#7(0.1)	
	AB#8(0.1)	
	AB#9(0.1)	

INDIVIDUAL SAMPLES		
Analysis	**ID**	**Date**
Heavy Metals and pH	AB-Battery	6/10/2015
Heavy Metals	ADUP#2	
Heavy Metals	ADUP#1	
OCP	AA#2(0.1)	
OCP	AA#5(0.1)	
OCP	AA#8(0.1)	
OCP	AA#11(0.1)	
OCP	AA#14(0.1)	
OCP	AB#2(0.1)	
OCP	AB#5(0.1)	
Heavy Metals	AA#4(0.1)	
Heavy Metals	AB#6(0.1)	
Multi residue pesticides	AB#7(0.1)	
Multi residue pesticides	AB#8(0.1)	
Multi residue pesticides	AB#9(0.1)	

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Web www.hill-labs.co.nz

Job Information Summary

Client:	Davis Consulting Group Limited	**Lab No:**	1485293
Contact:	Fiona Rowley	**Date Registered:**	07-Oct-2015 12:56 pm
	C/- Davis Consulting Group Limited	**Priority:**	High
	PO Box 2450	**Quote No:**	
	Wakatipu	**Order No:**	
	QUEENSTOWN 9349	**Client Reference:**	The Hills Area A+B 15063
		Add. Client Ref:	
		Submitted By:	Fiona Rowley
		Charge To:	Davis Consulting Group Limited
		Target Date:	15-Oct-2015 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	AA#1 (0.1) 06-Oct-2015 10:45 am	Soil	GSoil300	Composite Environmental Solid Samples
2	AA#2 (0.1) 06-Oct-2015 10:50 am	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
3	AA#3 (0.1) 06-Oct-2015 10:55 am	Soil	GSoil300	Composite Environmental Solid Samples
4	AA#4 (0.1) 06-Oct-2015 11:00 am	Soil	GSoil300	Composite Environmental Solid Samples; Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
5	AA#5 (0.1) 06-Oct-2015 11:05 am	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
6	AA#6 (0.1) 06-Oct-2015 11:10 am	Soil	GSoil300	Composite Environmental Solid Samples
7	AA#7 (0.1) 06-Oct-2015 11:15 am	Soil	GSoil300	Composite Environmental Solid Samples
8	AA#8 (0.1) 06-Oct-2015 11:20 am	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
9	AA#9 (0.1) 06-Oct-2015 11:25 am	Soil	GSoil300	Composite Environmental Solid Samples
10	AA#10 (0.1) 06-Oct-2015 11:30 am	Soil	GSoil300	Composite Environmental Solid Samples
11	AA#11 (0.1) 06-Oct-2015 11:35 am	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
12	AA#12 (0.1) 06-Oct-2015 11:40 am	Soil	GSoil300	Composite Environmental Solid Samples
13	AA#13 (0.1) 06-Oct-2015 11:45 am	Soil	GSoil300	Composite Environmental Solid Samples
14	AA#14 (0.1) 06-Oct-2015 11:50 am	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
15	AA#15 (0.1) 06-Oct-2015 11:55 am	Soil	GSoil300	Composite Environmental Solid Samples
16	A Dup #1 06-Oct-2015 11:01 am	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
17	A Dup #2 06-Oct-2015 2:06 pm	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
18	AB#1 (0.1) 06-Oct-2015 1:40 pm	Soil	GSoil300	Composite Environmental Solid Samples
19	AB#2 (0.1) 06-Oct-2015 1:45 pm	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
20	AB#3 (0.1) 06-Oct-2015 1:50 pm	Soil	GSoil300	Composite Environmental Solid Samples
21	AB#4 (0.1) 06-Oct-2015 1:55 pm	Soil	GSoil300	Composite Environmental Solid Samples
22	AB#5 (0.1) 06-Oct-2015 2:00 pm	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
23	AB#6 (0.1) 06-Oct-2015 2:05 pm	Soil	GSoil300	Composite Environmental Solid Samples; Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
24	AB#7 (0.1) 06-Oct-2015 2:15 pm	Soil	GSoil300	Composite Environmental Solid Samples; Multiresidue Pesticides in Soil samples by GCMS
25	AB#8 (0.1) 06-Oct-2015 2:20 pm	Soil	GSoil300	Composite Environmental Solid Samples; Multiresidue Pesticides in Soil samples by GCMS
26	AB#9 (0.1) 06-Oct-2015 2:25 pm	Soil	GSoil300	Composite Environmental Solid Samples; Multiresidue Pesticides in Soil samples by GCMS
27	AB-Battery 06-Oct-2015 2:10 pm	Soil	GSoil300	pH; Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
28	Composite of AA#1 (0.1) + AA#2 (0.1) + AA#3 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
29	Composite of AA#4 (0.1) + AA#5 (0.1) + AA#6 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
30	Composite of AA#7 (0.1) + AA#8 (0.1) + AA#9 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
31	Composite of AA#10 (0.1) + AA#11 (0.1) + AA#12 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
32	Composite of AA#13 (0.1) + AA#14 (0.1) + AA#15 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
33	Composite of AB#1 (0.1) + AB#2 (0.1) + AB#3 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
34	Composte of AB#4 (0.1) + AB#5 (0.1) + AB#6 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
35	Composite of AB#7 (0.1) + AB#8 (0.1) + AB#9 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	4, 16-17, 23, 27-35
Soil Prep Dry & Sieve for Agriculture	Air dried at 35°C and sieved, <2mm fraction.	-	27
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	4, 16-17, 23, 27-35
Multiresidue Pesticides in Soil samples by GCMS	Sonication extraction, GC-MS analysis. Tested on as received sample, then results corrected to a dry weight basis using the separate Dry Matter result.	0.003 - 0.06 mg/kg dry wt	24-26
Organochlorine Pesticides Screening in Soil	Sonication extraction, SPE cleanup, dual column GC-ECD analysis (modified US EPA 8082).. Tested on dried sample	0.010 - 0.04 mg/kg dry wt	2, 5, 8, 11, 14, 19, 22
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	24-26
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	4, 16-17, 23, 27-35
Composite Environmental Solid Samples	Individual sample fractions mixed together to form a composite fraction.	-	1-15, 18-26
pH	1:2 (v/v) soil : water slurry followed by potentiometric determination of pH.	0.1 pH Units	27

DCL Assessment – McDonnell Land

Rezoning Submission to the District Plan, Preliminary and Detailed Site Investigation

For

Trojan Helmet Ltd

October 2015

Davis Consulting Group Limited
Arrow Lane,
Arrowtown 9302
03 409 8664
Document ID: 15063C

Rezoning Submission to the District Plan

Preliminary and Detailed Site Investigation

Document Status

Version	Purpose of Document	Prepared By	Reviewer	Review Date
A	Draft for Internal Review	FR	GD	19 Oct 2015
B	FINAL for Client Review	FR	GD	20 Oct 2015
O	Final Report	FR	GD	22 Oct 2015

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

EXECUTIVE SUMMARY

Trojan Helmet Limited (THL) has prepared a submission to the district plan that seeks to rezone a parcel of land on McDonnell Road from the current rural general zone to rural lifestyle. The proposed site has had a long history of pastoral activity that may have received applications of pesticides and fertilisers. The proposal would result in subdivision, landuse change and earthworks activities that may trigger the National Environment Standard for Assessing and Managing Contaminants in Soil (NES).

In order to support the submission, THL commissioned Davis Consulting Group to consider the potential effect of historical activities on the soil quality of the site and undertake a review of risks to human health to meet the provisions of the NES.

The scope of work completed during the Preliminary Site Investigation (PSI) and Detailed Site Investigation (DSI) included the following:

- Review of the site history including a review of the property file, certificate of title and historic aerial photographs;
- Completion of a site inspection to examine the condition of the property;
- Collection of soil samples across the site and analysis for heavy metals and organochlorine pesticides; and
- Consideration of the risk to human health based on the detected soil contaminant concentrations and proposed landuse of the site.

Based on the findings of the Preliminary Site Investigation and Detailed Site Investigation, the following conclusions are made:

- The THL submission seeks to rezone the site from rural general to a rural lifestyle zoning;
- A review of the historical and current landuse of the site identified a range of potentially hazardous activities that could have impacted the soil quality including the application of pesticides and fertilisers, and storage of old batteries;
- Soil sampling was undertaken across the site to support the assessment with a total of 10 soil samples collected;
- The soil samples were analysed for persistent organochlorine pesticides and heavy metals that are associated with the historical application of pesticides and fertilisers and storage of batteries;

- The analytical results show that pesticide concentrations are either below the laboratory limit of reporting or well below the adopted soil guideline values; and
- Most of the heavy metal results returned concentrations that are considered to representative of background levels.

In summary, DCG concludes the site is suitable for activities that may be undertaken under the proposed rural lifestyle zoning and it is highly unlikely there is a risk to human health associated with the proposed rezoning of the site.

1.0 INTRODUCTION

1.1 Purpose

Trojan Helmet Limited (THL) has prepared a submission to the district plan that seeks to rezone a parcel of land on McDonnell Road from the current rural general zone to rural lifestyle. The proposed site has had a long history of pastoral activity that may have received applications of pesticides and fertilisers. The proposal would result in subdivision, landuse change and earthworks activities that may trigger the National Environment Standard for Assessing and Managing Contaminants in Soil (NES).

In order to support the submission, THL commissioned Davis Consulting Group to consider the potential effect of historical activities on the soil quality of the site and undertake a review of risks to human health to meet the provisions of the NES.

DCG's experience in the provision of contaminated land services is provided in Appendix A.

1.2 Scope of Work

The scope of work completed during the Preliminary Site Investigation (PSI) and Detailed Site Investigation (DSI) included the following:

- Review of the site history including a review of the property file, certificate of title and historic photographs;
- Completion of a site inspection to examine the condition of the property;
- Collection of soil samples across the site and analysis for heavy metals and organochlorine and multi residue pesticides;
- Consideration of the risk to human health based on a comparison of the adopted risk based soil guidelines values and detected soil contaminant concentrations; and
- Preparation of a PSI/DSI report in accordance with the requirements of the Contaminated Land Management Guidelines (CLMG) No. 1.

1.3 Limitations

The findings of this report are based on the Scope of Work outlined above. DCG performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental science profession. No warranties, express or implied, are made. Subject to the Scope of Work, DCG's assessment is limited strictly to identifying the risk to human health based on the historical activities on the site. The confidence in the findings is limited by the Scope of Work.

The results of this assessment are based upon site inspections conducted by DCG personnel, information from interviews with people who have knowledge of site conditions. All conclusions and recommendations regarding the properties are the professional opinions of DCG personnel involved with the project, subject to the qualifications made above. While normal assessments of data reliability have been made, DCG assumes no responsibility or liability for errors in any data obtained from regulatory agencies, statements from sources outside DCG, or developments resulting from situations outside the scope of this project.

2.0 SITE LOCATION AND DESCRIPTION

2.1 Site Location and Description of the Activity

The site is located alongside McDonnell Road and has the following legal description lot 2 DP 392663 and lot 7 DP 392663 (see Figure 1). The total area of the site is 8.4 hectares and is situated south of Arrowtown. Figure 2 presents the layout of the proposed activity contained within the THL submission.

According to the Queenstown Lakes District Council (QLDC) District Plan, the property lies within the Rural General Zone.

Coordinates for the property are E 2181791, N 5575158 NZMG.

Figure 1: Site Location Plan

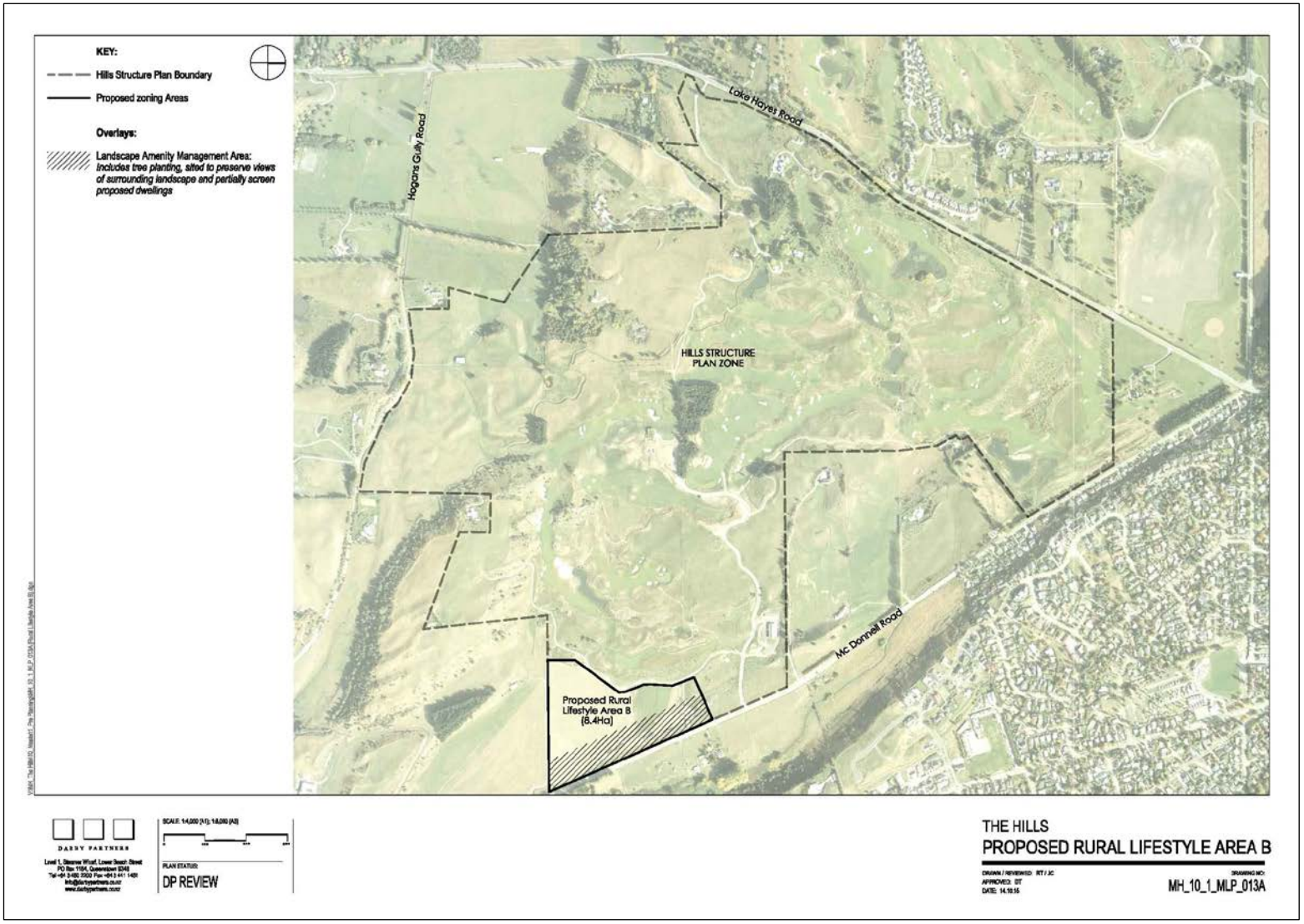

Figure 2: Proposed Rural Lifestyle Area A – Prepared by Darby Partners

2.2 Site History

Historic photographs obtained from the Lakes District Museum (accessed 15/10/2015) indicate the property was used for pastoral activity from circa 1910 (see Plate 1). A second historical photograph taken in 1954 (see Plate 2) indicates the area continued to be under pastoral management at this time.

DCG understands the site was part of the Bob Jenkins Farm in the 1930s. The property was subsequently purchased in the 1940s by brothers Jack and Lawson Summer who then sold it on to Jim Monk (McDonald, 2010). The current owners, Trojan Helmet Limited, purchased the property in circa 1992 and the site has been used for grazing since this time. The Historic Certificate of Title is provided in Appendix B.

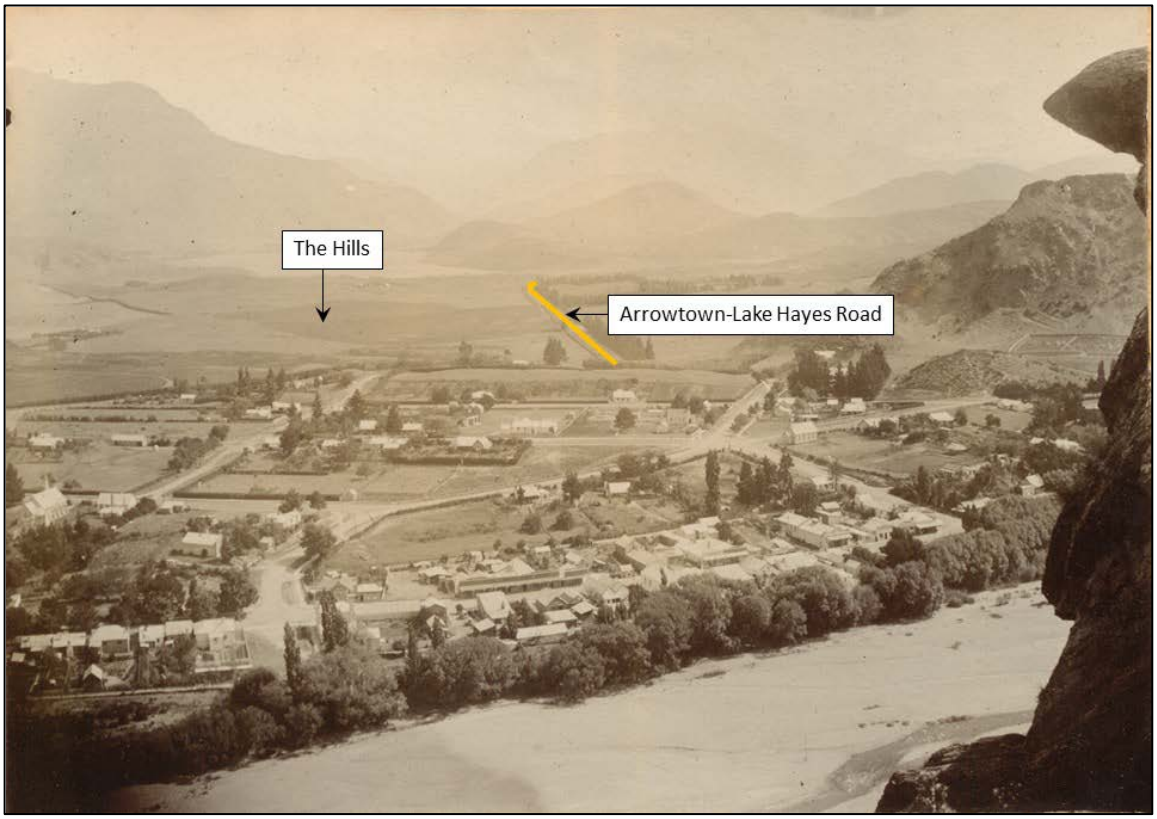

Plate 1: Looking southwest over Arrowtown towards Lake Hayes 1910

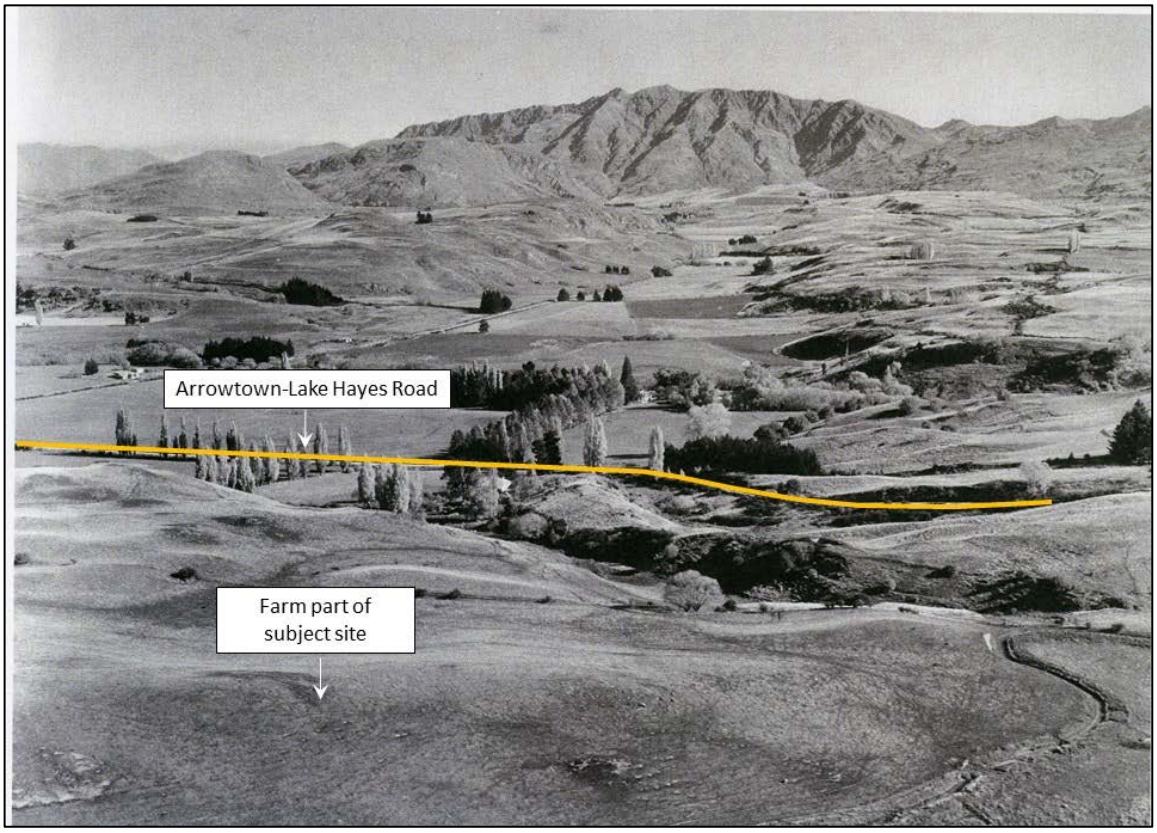

Plate 2: Looking West from above The Hills site, 1954

2.3 Site Condition and Surrounding Environment

Figure 2 presents a site plan showing the current layout of the site.

The site currently contains golf activities including a driving range, a bunker and putting greens. Also included are two storage areas marked on Figure 2 as storage area 'A' and 'B'.

Storage area 'A' contains old tyres, old batteries, empty drums, old pellets, plastic hosing, a trailer, machinery parts, concrete blocks and road cones.

Storage area 'B' contains a small former cattle yard currently being used as a shed to store firewood. Surrounding the shed are wood piles, tractor and car tyres, empty oil drums, machinery parts, wooden stakes, pellets and plastic hosing. Also included in the storage 'B' area are gravel piles, concrete blocks, a boat, a trailer and a campervan. Located on the western side of the storage 'B' area is a screened storage area and contains oil drums, scrap metal, machinery parts, plastic hosing and tubs, plants, warratahs and a container.

There was no sign of stains across the storage areas however the batteries were being stored inappropriately uncovered, on pellets and grass. The batteries have the potential to contaminate surface soil. The former cattle yard appears to be small in size and most likely only used as a

management area to put cattle on transport trucks. Plates 1 - 4 present photos taken of each storage area.

According to the QLDC Webmaps (http://maps.qldc.govt.nz/qldcviewer/) the property is currently zoned rural general along with properties to the north, south and west. Neighbouring to the east is a special zone. The site's western edge is located within a 'probably low risk' liquefaction area (QLDC Webmaps).

Figure 3: Site Layout Plan

Plate 1: Storage Area 'A'

Plate 2: Storage Area 'B' including former cattle shed and gravel piles.

Plate 3: Screened storage area within Storage Area 'B'

Plate 4: Looking across the golf activity area including golf greens, bunker and the rough

2.4 Geology and Hydrogeology

The subject site is situated on a glacial till (Turnbull, 2000). According to the QLDC Webmap, the site's western boundary is within the 'probably low risk' of liquefaction zone. The surface soils were described during the collection of soil samples; see Appendix C for the soil profile logs.

2.4.1 Hydrogeology

The site investigation did not include a groundwater assessment. The site is located within the Wakatipu Basin aquifer system however it is not situated above any identified aquifers. The Mid Mill Creek Aquifer is situated approximately 1 km west of the subject site and north of Lake Hayes (ORC, 2014). The depth to groundwater on the site is unknown.

The location of groundwater bores within a 1 kilometre radius of the site (held by the ORC) is provided in Appendix D. A total of 7 consented bores have been installed within 1 kilometre of the site. The wells have been installed for a variety of purposes and are summarised as follows:

- 3 wells are used for domestic purposes;
- 2 wells are used for geological investigation, and
- 2 wells are for scheme use.

2.4.2 Hydrology

No surface water was observed during the site visit. The closest surface water is an unnamed tributary of the Arrow River located approximately 130 m to the east of the property boundary.

2.5 Additional Site Information

The CLMG No 1 requires information associated with fuel storage facilities, spill loss history, recorded discharges and onsite and offsite disposal locations. DCG requested a search of the Otago Regional Council (ORC) records, and examined the Queenstown Lakes District Council (QLDC) records, for Landuse and Site Contamination Status, Resource Consents, and Resource Management Act (RMA) incidents for the site. The ORC stated the following.

There are no records held on the Otago Regional Council's "Database of Selected Landuses" for the above site. The database identifies sites where activities have occurred that are known to have the potential to contaminate land. The record of a property in the database does not necessarily imply contamination. Similarly, the absence of available information does not necessarily mean that the property is uncontaminated; rather no information exists on the database.

Reference should be made to the Ministry for the Environment's Hazardous Activities and Industries List. If any of these activities have occurred on the above site, then it may be considered potentially contaminated. As a golf course, the site could have been subject to persistent pesticide use.

Property files were obtained from the QLDC eDocs webpage (https://edocs.qldc.govt.nz/) for Lot 2 and 7 DP 392663. The property file held information regarding consents ranging from 1992 - 2015 for building a house, erecting statues, earthworks for golf course development, permits for marquees, building a green keepers workshop, construction of the club house, residential platforms and installation of a water pump. There is also consent to hold an annual NZPGA pro am golf tournament for the period of 10 years. Golf courses are listed as a HAIL activity.

The following provides a summary of information that the CLMG No. 1 (MfE, 2003a) indicates should be included in a DSI report:

- Presence of Drums – Empty oil and soil wetting agent drums were found onsite.
- Wastes – In storage area 'A' included wastes such as empty drums, car batteries, pellets and tyres. In storage area 'B' includes tyres, empty containers of 'Turf Gard' oil, pellets and scrap metal (see Figure 2).
- Fill Materials – There is some gravel storage on the site.
- Odours – No odours were noted.
- Flood Risk – According to QLDC Hazard map the site is not at risk of flooding;
- Surface Water Quality – There are no surface water bodies located on the site.
- Site boundary condition – The boundary is fenced along McDonnell Road and along the south. The northern and western boundaries are not physically marked in the field as they are part of The Hills golf course.
- Visible Signs of Contamination – No obvious stains or signs of contamination were present during the site visit.
- Local Sensitive Environments –The next closest sensitive environment is the Arrow River located 740 m east of the property boundary.

2.6 Contaminants Commonly Associated with the Landuse

Based on the Contaminated Land Management Guidelines Schedule B and our understanding of used to support pastoral activities and golf course maintenance, the hazardous substances that have been utilised on the property include a range of organochlorine and organophosphate pesticides and heavy metals associated with the application of fertilisers and pesticides for historical pastoral activities and the maintenance of the golf driving range and greens.

The laboratory suite adopted for soil samples collected from housing sites and activity areas will address historic farming and agriculture use in addition to herbicides and pesticides used in the maintenance of the golf course. Soil samples are also tested for heavy metals that may be associated with the application of the fertilisers and the storage of batteries.

3.0 SAMPLING AND ANALYSIS PLAN

3.1 Data Quality Objectives

The data quality objectives (DQOs) of the DSI were to:

- Characterise the nature of any contamination associated with the historical landuse of the site; and
- Determine the risk of any soil contamination encountered onsite to human health, based on the proposed residential landuse of the site.

3.2 Sampling and Analysis Plan

The sampling and analysis plan was designed to address the specific objectives, namely to gain an understanding of contaminants associated with historic farming and golf course maintenance. The sampling approach was a combination of systematic and judgemental with 6 samples collected over an 80 m by 100 m grid, 3 sample collected from the putting greens and 1 sample collected adjacent old batteries. Figure 4 presents the location of each sample collected. The sample IDs and coordinates can be found in the soil profile log Appendix D.

A total of 10 surface soil samples were collected on site from 0 – 10 cm, with a further sample also collected for duplicate purposes. The sampling depth for these sample sites was considered appropriate due to the nature of the potential contaminants present such as pesticides and heavy metals, which generally bind strongly to soils, and people living on the site will predominantly be exposed to surface soils. Soil samples from the rough area were composited into groups of three for the analysis of heavy metals. From each set of three samples one sample was analysed for organochlorine pesticides. The sample collected from adjacent to the battery storage (AB-Battery) was analysed for heavy metals. The 3 samples collected from the putting greens were composited for metals and individually analysed for multi-residue pesticides.

The soil sample and analysis summary table is located in Appendix E.

Figure 4: Sample Location Plan

3.3 Soil Sampling Methodology

Soil sampling was undertaken with the use of a spade. The following procedures were applied during the soil sampling process to gain representative samples:

- Field personnel wore a fresh pair of nitrile gloves between sampling events.
- Soil samples were transferred to 250 mL glass jars with teflon lids as supplied by Hill Laboratories.
- All soil samples were unambiguously marked in a clear and durable manner to permit clear identification of all samples in the laboratory.

3.4 Analytical Parameters

The laboratory analytical suite determined for the site investigation is in recognition of our understanding of the current and historical use of the subject site. DCG understands the site has had a history of agricultural activity and more recently a golf course. Based on these activities the following substances were included in the analytical suite:

- Organochlorine pesticides (including 4,4-DDE, 2,4-DDT and Dieldrin);
- Multi-residue Pesticides; and
- Heavy metals.

The laboratory methods utilised for the analysis are provided in the laboratory report (see Appendix E).

3.5 Soil Sample Field and Laboratory QA/QC

The field QA/QC procedures performed during the soil sampling are listed as follows:

- Use of standardised field sampling forms and methods;
- Samples were transferred under chain of custody procedures;
- All samples were labelled to show point of collection, project number, and date;
- Headspace in sample jars was avoided; and
- The threads on the sampling jars were cleaned to avoid Volatile Organic Compound (VOC) loss.

All soil samples were couriered on ice to Hill Laboratories. Hill Laboratories is IANZ accredited for the analysis of heavy metals and pesticides. Hills conduct internal QA/QC in accordance with IANZ requirements.

3.6 Soil Guideline Values

Soil guideline values (SGVs) selected for application on this project are provided in Table 1. The selection of these guidelines is consistent with the principles of the Contaminated Land Management Guidelines No. 2: Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2003b).

The heavy metal and organochlorine pesticide SGVs adopted for the site assessment were based on either the NES Soil Contaminant Standards (MfE, 2012) or Schedule B (1) Guideline on the Investigation Levels for Soil and Groundwater (NEPC, 2013). Guidelines for rural residential landuse have been adopted for the site.

Table 1: Soil Guidelines

Analyses	Guideline
Heavy Metals and Organochlorine and Multi-residue pesticides	1. Soil Contaminant Standards *in* New Zealand 'Users' Guide: NES for Assessing & Managing Contaminants in Soil to Protect Human Health 2012 (MfE, 2012). 2. Guideline on the Investigation Levels for Soil and Groundwater *in* National Environment Protection (Assessment of Site Contamination) Measure 1999 - Volume # 2 (NEPC, 2013).

3.7 Soil Analytical Result Review

Following the receipt of laboratory data, a detailed review of the data was performed to determine its accuracy and validity. All laboratory data was checked for analytical and typographical errors.

Once the data quality was established the soil data was checked against the Sampling Program DQOs.

4.0 INVESTIGATION RESULTS

4.1 Analytical Results

The soil sample locations are provided in Figure 4.

4.1.1 Organochlorine (OCP) and Multiresidue Pesticide Results

The OCP and multiresidue pesticide results are provided in the laboratory report (see Appendix E). In summary the results show the following:

- DDT was detected in soil sample AB9 at a concentration of 0.012 mg/kg and well below the NES soil contaminant standard for rural residential use of 45 mg/kg; and
- All other OCP and multiresidue pesticide levels reported returned concentrations below the laboratory limit of reporting.

In summary the results indicate that pesticide use on the site has been very light and accumulations have not occurred in the soil that present a risk to human health.

4.1.2 Heavy Metal Results

The heavy metal results are presented in Table 3 and the laboratory certificates are provided in Appendix E. In summary the results show the following:

- All heavy metal results are below the adopted contaminant standard for rural residential activities, and
- The heavy metals detected are consistent with local background concentrations.

Table 2: Heavy Metal Results (mg/kg)

Sample Type	Composite			Individual	
Heavy Metals	AB#1 AB#2 AB#3	AB#4 AB#5 AB#6	AB#7 AB#8 AB#9	AB-Battery	Guideline
Arsenic	10	11	11	12	17[1]
Cadmium	0.11	0.13	0.11	< 0.10	0.8[1]
Chromium	10	11	9	11	>10,000[1]
Copper	10	10	10	10	>10,000[1]
Lead	18.2	19.2	17.7	22	160[1]
Nickel	9	9	8	9	400[2]
Zinc	45	54	44	49	7,400[2]

< denotes concentration below laboratory detection limits
[1] Soil Contaminant Standards in New Zealand 'Users' Guide: NES for Assessing & Managing Contaminants in Soil to Protect Human Health 2012 (MfE, 2012).
[2] National Environment Protection (Assessment of Site Contamination) Measure 2013 Volume 2 (NEPC, 2013).

4.2 QA/QC Results

4.2.1 Field Duplicates

One field duplicate soil sample was collected during the site investigation and analysed to review the reproducibility of the laboratory analysis. The duplicates and the corresponding sample results are presented in Table 4 below.

Table 3: Duplicate Percentage Differences

	A Dup #2	AB#6	% Difference
Arsenic	10	10	0
Cadmium	0.15	0.14	6.8
Chromium	10	11	9.5
Copper	9	9	0
Lead	18.2	18.6	2.2
Nickel	8	9	11.8
Zinc	45	48	6.5

An acceptable percentage difference between duplication samples is less than 30 to 50 % (MfE, 2011). The highest relative percentage difference between the six samples was 11.8 % (for nickel), which is considered acceptable for soil analysis. The QA/QC analysis indicates the sampling and analysis undertaken was reproducible.

4.2.2 Laboratory Procedures

Hills Laboratories did not complete specific in-house QA/QC analysis such as spike recoveries or laboratory duplicates during the processing of the soil samples. The Chain of Custody form and the Hill Laboratory results are provided in Appendix E.

5.0 CONCLUSION

Based on the findings of the PSI and DSI, the following conclusions are made:

- The THL submission seeks to rezone the site from rural general to a rural lifestyle zoning;
- A review of the historical and current landuse of the site identified a range of potentially hazardous activities that could have impacted the soil quality including the application of pesticides and fertilisers, and storage of old batteries;
- Soil sampling was undertaken across the site to support the assessment with a total of 10 soil samples collected;
- The soil samples were analysed for persistent organochlorine pesticides, organophosphate pesticides and heavy metals that are associated with the historical application of pesticides and fertilisers and storage of batteries;
- The analytical results show that pesticide concentrations are either below the laboratory limit of reporting or well below the adopted soil guideline values; and
- Most of the heavy metal results returned concentrations that are considered to representative of background levels.

In summary, DCG concludes the site is suitable for activities that may be undertaken under the proposed rural lifestyle zoning and it is highly unlikely there is a risk to human health associated with the proposed rezoning of the site.

6.0 REFERENCES

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