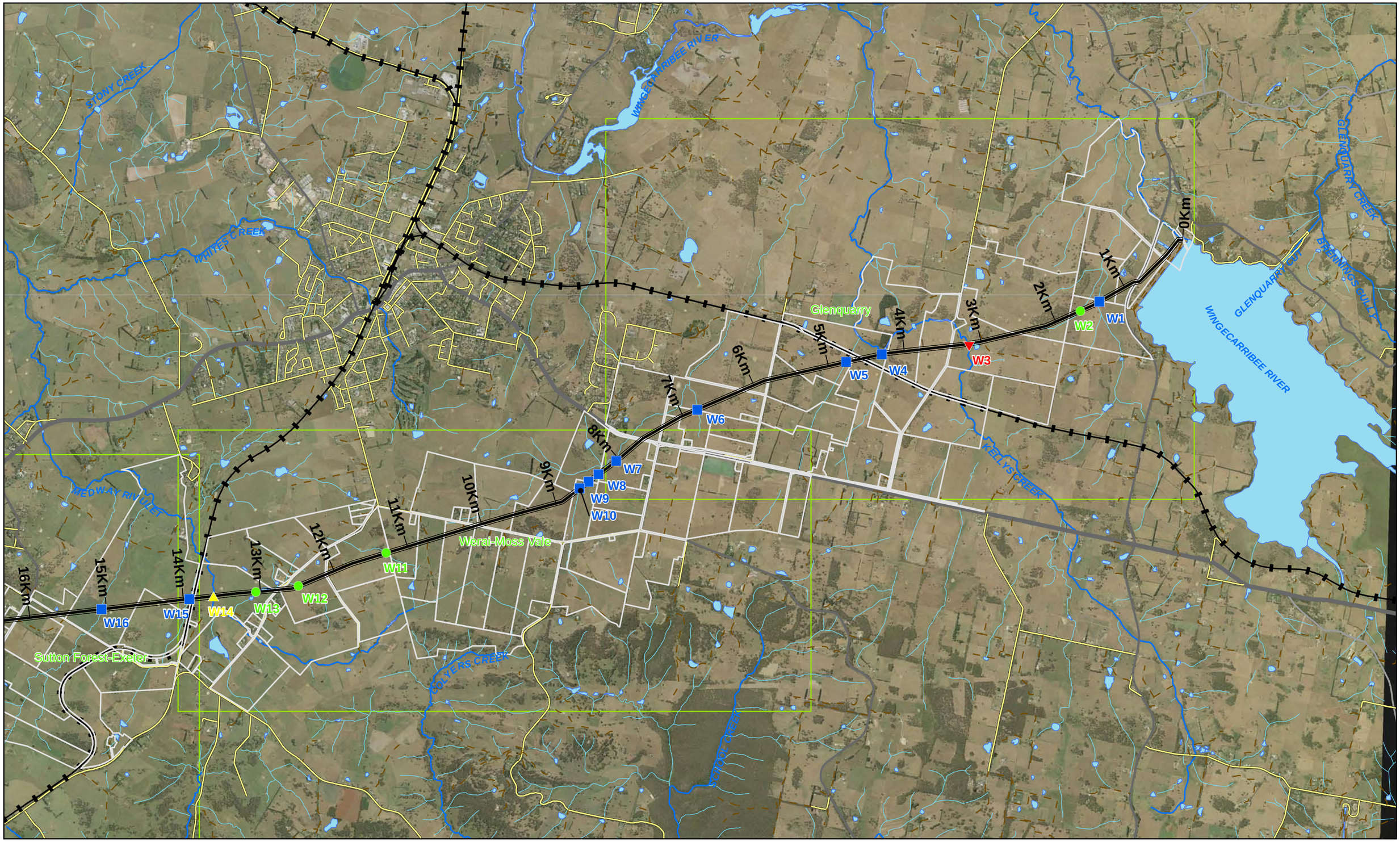
Appendix A

Figures A1 to A6 – Waterway Crossing Maps



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Proposed Route (29/11/2009)
- Properties Intersected By Corridor
- Natural Drainage Line
- River/Creek
- Railways
- PrimaryRoad
- ArterialRoad
- SubArterialRoad
- LocalRoad
- Track-Vehicular
- UrbanServiceLane
- GMC / WSC LGA Boundary
- Sector boundary
- HydroArea

Waterway Class

- Drainage Line
- Minor Creek
- Moderate Creek
- Major Creek/River

CLIENTS | PEOPLE | PERFORMANCE

Goulburn Mulwaree Council
Highlands Source Project

Waterway crossings
Sector: Werai - Glenquarry

Job Number	23-13312
Revision	0
Date	09 FEB 2010

Figure A1

G:\23\13312\GIS\ArcView\Wkspace\EAFigures\23_13312_EA_WaterwaysCrossings.mxd

Data Source: NSW Lands Dept: roadsegments, railways,hydroarea, hydroline - 2007; GMC: aerial imagery - 2008; GMC/WSC: Cadastral data - 2009. Created by: ccharalambou

Level 7, 16 Marcus Clarke Street Canberra ACT 2601 **T** 61 2 6113 3200 **F** 61 2 6113 3299 **E** cbrmail@ghd.com.au **W** www.ghd.com.au

1:45,000 (at A3)

0 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Proposed Route (29/11/2009)
- Properties Intersected By Corridor
- Natural Drainage Line
- River/Creek
- Railways
- PrimaryRoad
- ArterialRoad
- SubArterialRoad
- LocalRoad
- Track-Vehicular
- UrbanServiceLane
- GMC / WSC LGA Boundary
- Sector boundary
- HydroArea

Waterway Class

- Drainage Line
- Minor Creek
- Moderate Creek
- Major Creek/River

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Goulburn Mulwaree Council
Highlands Source Project

Waterway crossings
Sector: Sutton Forest-Exeter

Job Number	23-13312
Revision	0
Date	09 FEB 2010

Figure A2

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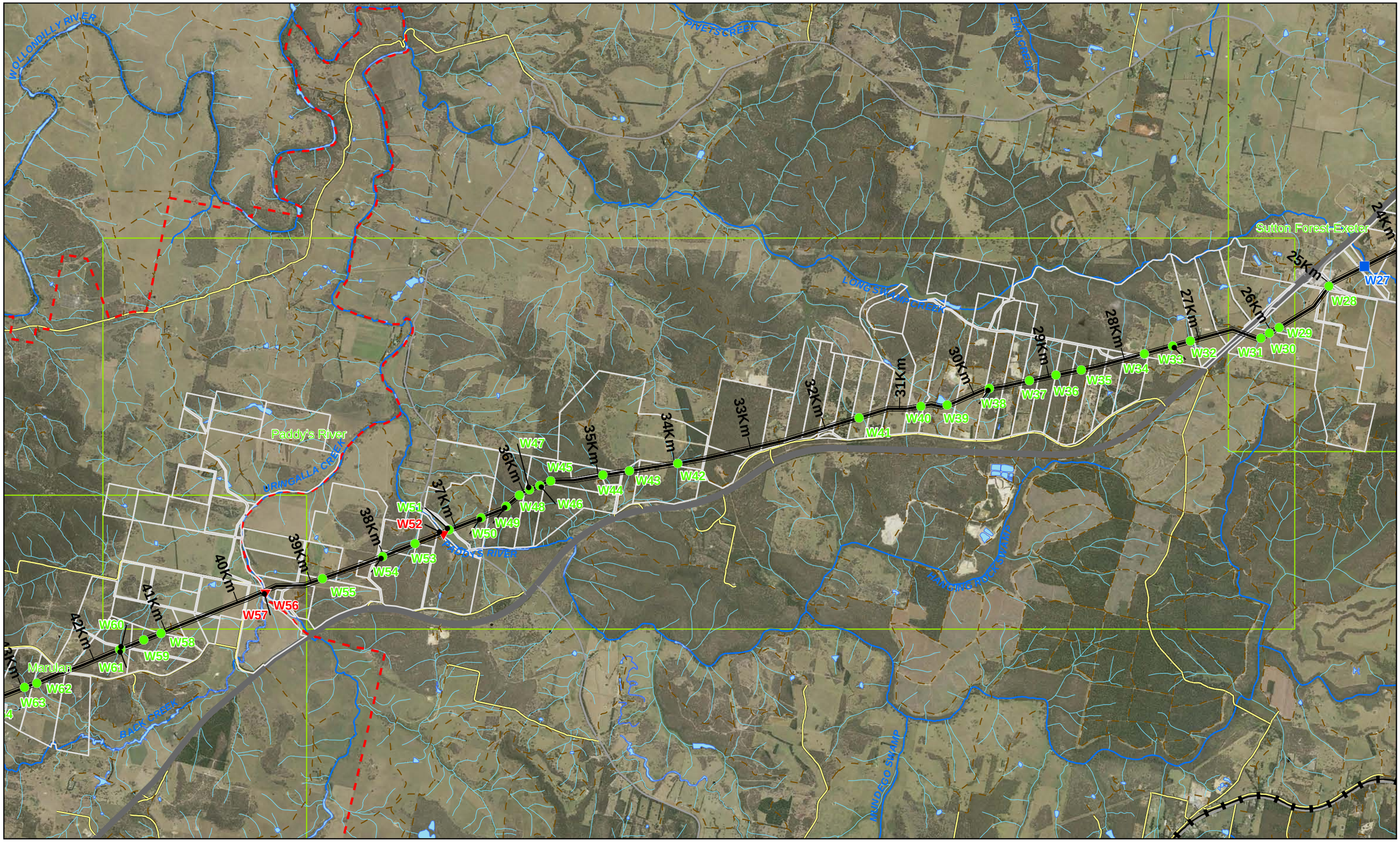
Data Source: NSW Lands Dept: roadsegments, railways,hydroarea, hydroline - 2007; GMC: aerial imagery - 2008; GMC/WSC: Cadastral data - 2009. Created by: ccharalambou

Level 7, 16 Marcus Clarke Street Canberra ACT 2601 **T** 61 2 6113 3200 **F** 61 2 6113 3299 **E** cbrmail@ghd.com.au **W** www.ghd.com.au



1:45,000 (at A3)

0 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Proposed Route (29/11/2009)
- Properties Intersected By Corridor
- Natural Drainage Line
- River/Creek
- Railways
- PrimaryRoad
- ArterialRoad
- SubArterialRoad
- LocalRoad
- Track-Vehicular
- UrbanServiceLane
- GMC / WSC LGA Boundary
- Sector boundary
- HydroArea

Waterway Class

- Drainage Line
- Minor Creek
- Moderate Creek
- Major Creek/River

CLIENTS | PEOPLE | PERFORMANCE

Goulburn Mulwaree Council
Highlands Source Project

Waterway crossings
Sector: Paddys River

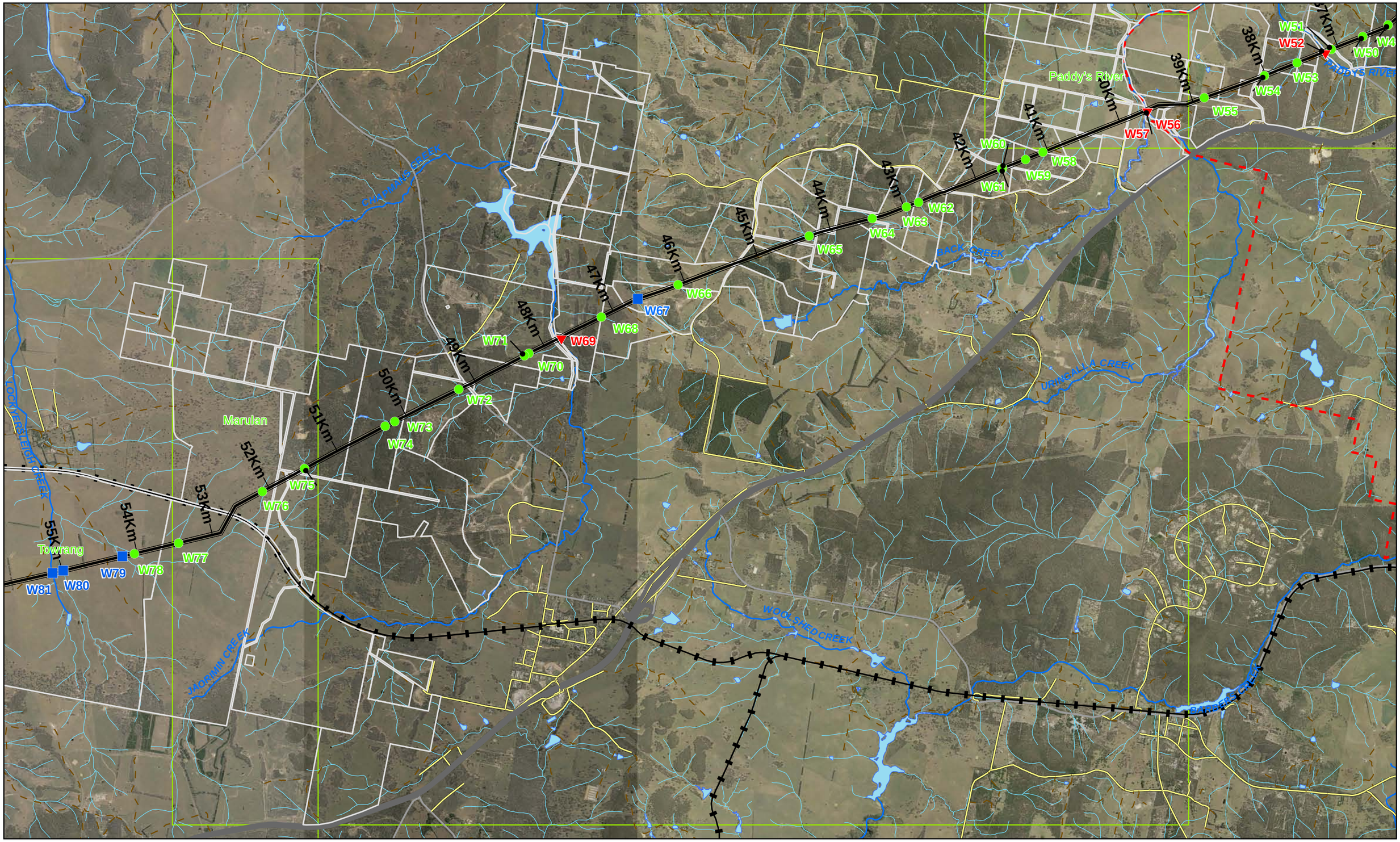
Job Number	23-13312
Revision	0
Date	09 FEB 2010

Figure A3

G:\23\13312\GIS\ArcView\Wkspace\EAFigures\23_13312_EA_WaterwaysCrossings.mxd

Data Source: NSW Lands Dept: roadsegments, railways,hydroarea, hydroline - 2007; GMC: aerial imagery - 2008; GMC/WSC: Cadastral data - 2009. Created by: ccharalambou

Level 7, 16 Marcus Clarke Street Canberra ACT 2601 **T** 61 2 6113 3200 **F** 61 2 6113 3299 **E** cbrmail@ghd.com.au **W** www.ghd.com.au



1:45,000 (at A3)

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Proposed Route (29/11/2009)
- Properties Intersected By Corridor
- Natural Drainage Line
- River/Creek
- Railways
- PrimaryRoad
- ArterialRoad
- SubArterialRoad
- LocalRoad
- Track-Vehicular
- UrbanServiceLane
- GMC / WSC LGA Boundary
- Sector boundary
- HydroArea

Waterway Class

- Drainage Line
- Minor Creek
- Moderate Creek
- Major Creek/River

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Goulburn Mulwaree Council
Highlands Source Project

Waterway crossings
Sector: Marulan

Job Number	23-13312
Revision	0
Date	09 FEB 2010

Figure A4

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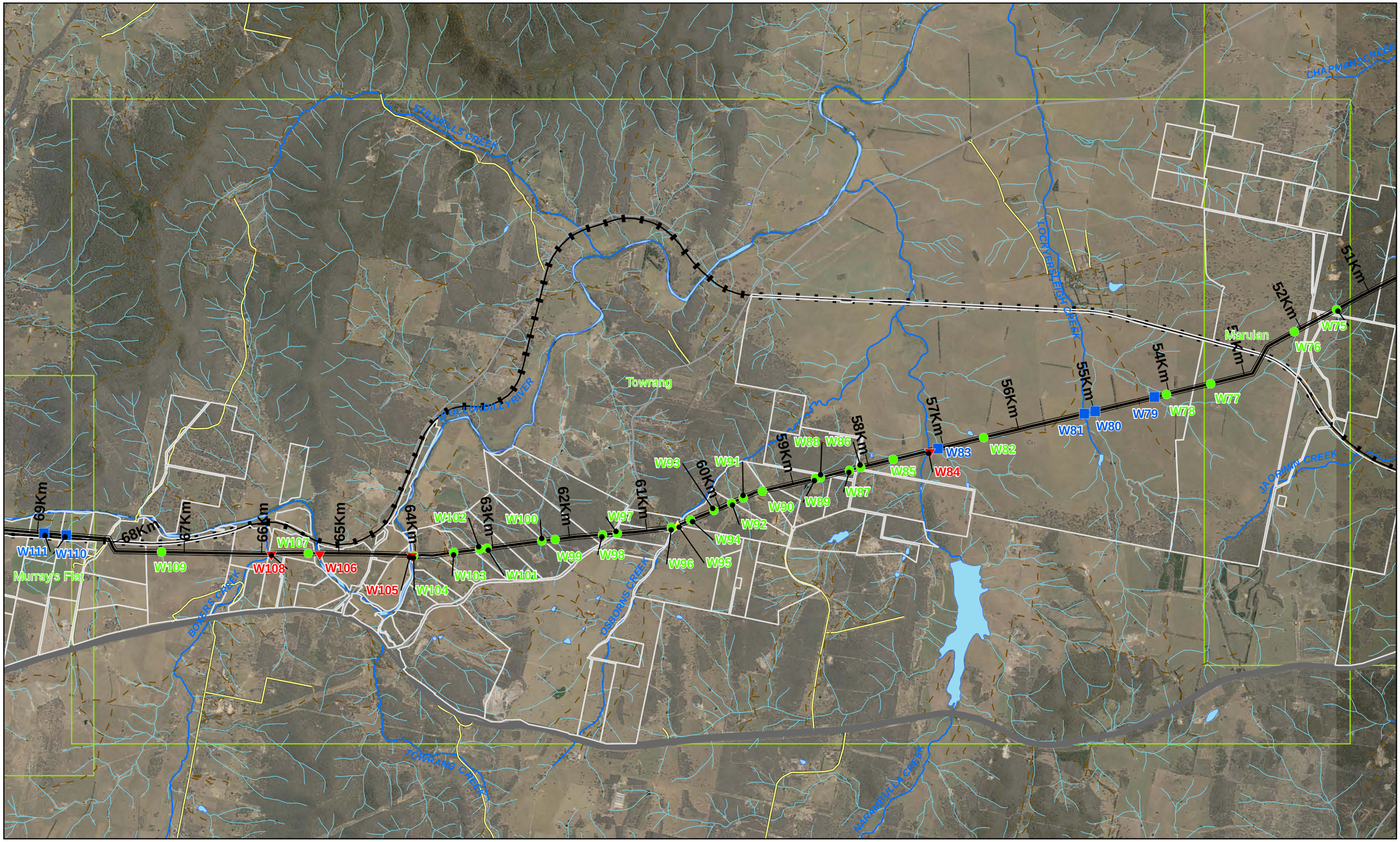
Data Source: NSW Lands Dept: roadsegments, railways,hydroarea, hydroline - 2007; GMC: aerial imagery - 2008; GMC/WSC: Cadastral data - 2009. Created by: ccharalambou

Level 7, 16 Marcus Clarke Street Canberra ACT 2601 **T** 61 2 6113 3200 **F** 61 2 6113 3299 **E** cbrmail@ghd.com.au **W** www.ghd.com.au



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Proposed Route (29/11/2009)
- Properties Intersected By Corridor
- Natural Drainage Line
- River/Creek
- Railways
- PrimaryRoad
- ArterialRoad
- SubArterialRoad
- LocalRoad
- Track-Vehicular
- UrbanServiceLane
- GMC / WSC LGA Boundary
- Sector boundary
- HydroArea

Waterway Class

- Drainage Line
- Minor Creek
- Moderate Creek
- Major Creek/River

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Goulburn Mulwaree Council
Highlands Source Project

Waterway crossings
Sector: Towrang

Job Number	23-13312
Revision	0
Date	09 FEB 2010

Figure A5

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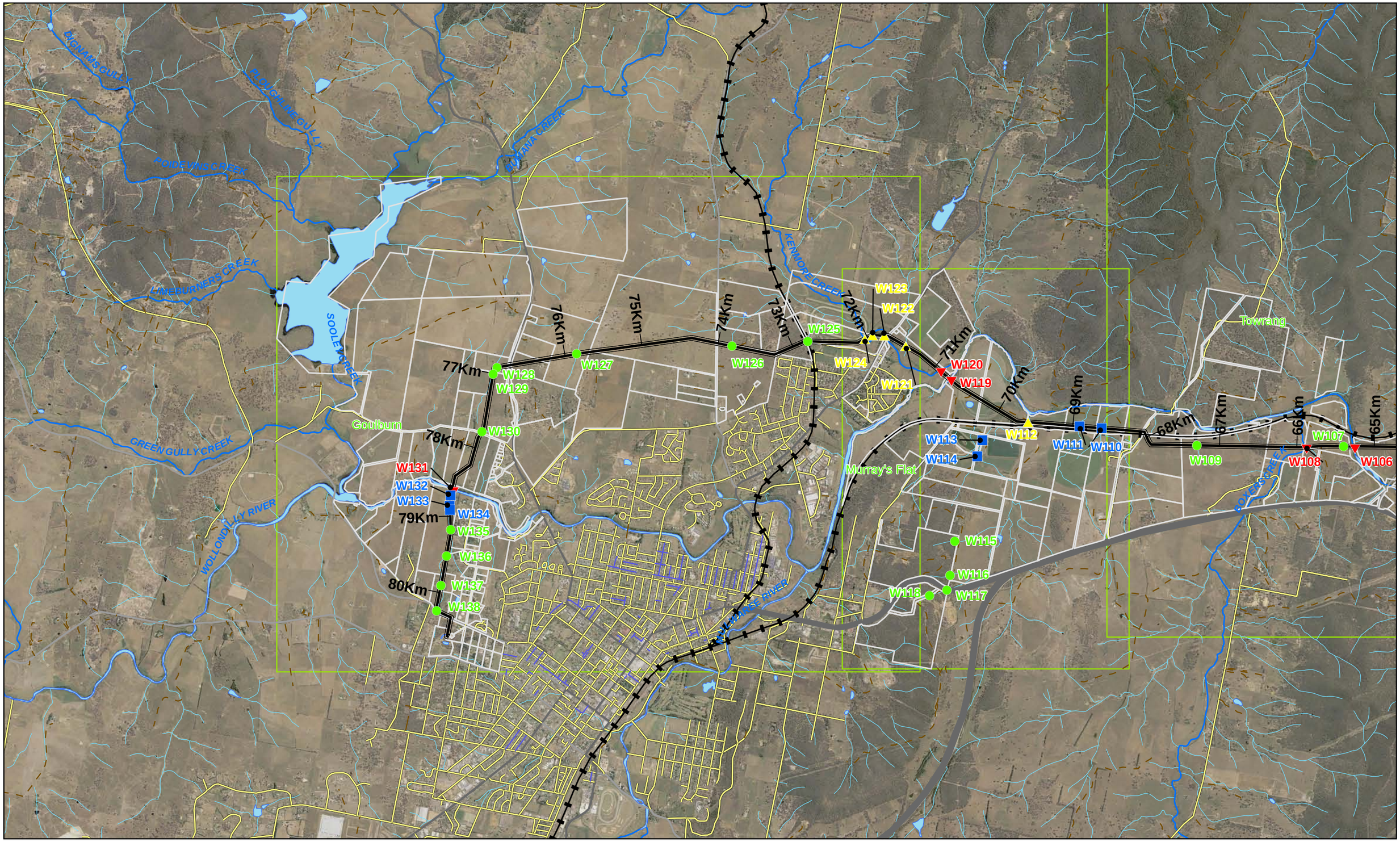
Data Source: NSW Lands Dept: roadsegments, railways,hydroarea, hydroline - 2007; GMC: aerial imagery - 2008; GMC/WSC: Cadastral data - 2009. Created by: ccharalambou

Level 7, 16 Marcus Clarke Street Canberra ACT 2601 **T** 61 2 6113 3200 **F** 61 2 6113 3299 **E** cbrmail@ghd.com.au **W** www.ghd.com.au



1:45,000 (at A3)

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Proposed Route (29/11/2009)
- Properties Intersected By Corridor
- Natural Drainage Line
- River/Creek
- Railways
- PrimaryRoad
- ArterialRoad
- SubArterialRoad
- LocalRoad
- Track-Vehicular
- UrbanServiceLane
- GMC / WSC LGA Boundary
- Sector boundary
- HydroArea

Waterway Class

- Drainage Line
- Minor Creek
- Moderate Creek
- Major Creek/River

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Goulburn Mulwaree Council
Highlands Source Project

Job Number 23-13312
Revision 0
Date 09 FEB 2010

Waterway crossings

Sector: Goulburn-Murrays Flat

Figure A6

G:\23\13312\GIS\ArcView\Wkspace\EAFigures\23_13312_EA_WaterwaysCrossings.mxd

Data Source: NSW Lands Dept: roadsegments, railways,hydroarea, hydroline - 2007; GMC: aerial imagery - 2008; GMC/WSC: Cadastral data - 2009. Created by: ccharalambou

Level 7, 16 Marcus Clarke Street Canberra ACT 2601 **T** 61 2 6113 3200 **F** 61 2 6113 3299 **E** cbrmail@ghd.com.au **W** www.ghd.com.au

Appendix B

Waterway Crossings Summary Table

Waterway ID	Waterway Name	Catchment Area (ha)	Stream Order	Class	Field Assessed	River Style	Condition
W1	Unnamed	404	2	Minor	Yes	Channelised Fill	Moderate
W2	Unnamed	55	1	Drainage Line	Yes	Valley Fill	Moderate
W3	Kellys Creek	2255	3	Major	Yes	Low Sinuosity Fine Grained	Moderate
W4	Unnamed	186	2	Minor	No	Valley Fill	Moderate
W5	Unnamed	166	1	Minor	No	Channelised Fill	Moderate
W6	Unnamed	186	1	Minor	Yes	Channelised Fill	Moderate
W7	Unnamed	153	Unmapped	Minor	Yes	Valley Fill	Moderate
W8	Unnamed	140	1	Minor	Yes	Valley Fill	Moderate
W9	Unnamed	138	1	Minor	Yes	Valley Fill	Moderate
W10	Unnamed	135	1	Minor	Yes	Valley Fill	Moderate
W11	Unnamed	55	1	Drainage Line	Yes	Channelised Fill	Moderate
W12	Unnamed	28	1	Drainage Line	No	Valley Fill	Moderate
W13	Unnamed	93	2	Drainage Line	Yes	Channelised Fill	Poor
W14	Medway Rivulet	868	3	Moderate	Yes	Low Sinuosity Fine Grained	Poor
W15	Unnamed	308	1	Minor	No	Channelised Fill	Poor
W16	Unnamed	352	2	Minor	Yes	Low Sinuosity Fine Grained	Moderate
W17	Unnamed	16	1	Drainage Line	Yes	Channelised Fill	Poor
W18	Unnamed	156	2	Minor	Yes	Channelised Fill	Poor
W19	Wells Creek	213	2	Minor	Yes	Channelised Fill	Poor

Waterway ID	Waterway Name	Catchment Area (ha)	Stream Order	Class	Field Assessed	River Style	Condition
W20	Unnamed	13	1	Drainage Line	Yes	Channelised Fill	Poor
W21	Unnamed	12	1	Drainage Line	Yes	Headwater	Moderate
W22	Black Bobs Creek	1142	3	Moderate	Yes	Low Sinuosity Fine Grained	Moderate
W23	Unnamed	16	1	Drainage Line	No	Valley Fill	Moderate
W24	Unnamed	24	1	Drainage Line	No	Valley Fill	Moderate
W25	Unnamed	27	1	Drainage Line	No	Valley Fill	Moderate
W26	Unnamed	23	1	Drainage Line	No	Valley Fill	Moderate
W27	Long Swamp Creek	255	1	Minor	Yes	Channelised Fill	Moderate
W28	Unnamed	12	1	Drainage Line	Yes	Headwater	Moderate
W29	Unnamed	48	1	Drainage Line	Yes	Valley Fill	Moderate
W30	Unnamed	17	1	Drainage Line	Yes	Headwater	Moderate
W31	Unnamed	24	1	Drainage Line	Yes	Headwater	Moderate
W32	Unnamed	22	1	Drainage Line	Yes	Valley Fill	Moderate
W33	Unnamed	11	1	Drainage Line	No	Valley Fill	Moderate
W34	Unnamed	5	1	Drainage Line	No	Headwater	Good
W35	Unnamed	12	1	Drainage Line	No	Headwater	Good
W36	Unnamed	9	1	Drainage Line	No	Headwater	Good
W37	Unnamed	4	1	Drainage Line	No	Headwater	Good

Waterway ID	Waterway Name	Catchment Area (ha)	Stream Order	Class	Field Assessed	River Style	Condition
W38	Unnamed	9	1	Drainage Line	No	Headwater	Good
W39	Unnamed	90	2	Drainage Line	No	Valley Fill	Moderate
W40	Unnamed	63	1	Drainage Line	No	Valley Fill	Moderate
W41	Unnamed	20	1	Drainage Line	No	Valley Fill	Moderate
W42	Unnamed	64	2	Drainage Line	No	Valley Fill	Good
W43	Unnamed	21	1	Drainage Line	No	Valley Fill	Good
W44	Unnamed	24	2	Drainage Line	No	Valley Fill	Good
W45	Unnamed	1	1	Drainage Line	No	Headwater	Good
W46	Unnamed	1	1	Drainage Line	No	Headwater	Good
W47	Unnamed	1	1	Drainage Line	No	Headwater	Good
W48	Unnamed	2	1	Drainage Line	No	Headwater	Good
W49	Unnamed	1	1	Drainage Line	No	Headwater	Good
W50	Unnamed	3	1	Drainage Line	No	Headwater	Moderate
W51	Unnamed	12	2	Drainage Line	Yes	Valley Fill	Moderate
W52	Paddys River	10702	5	Major	Yes	Bedrock Controlled Fine Grained	Moderate
W53	Unnamed	45	2	Drainage Line	Yes	Valley Fill	Moderate
W54	Unnamed	3	1	Drainage Line	Yes	Headwater	Good
W55	Unnamed	11	1	Drainage Line	No	Valley Fill	Moderate
W56	Uringalla Creek	5169	5	Major	Yes	Low Sinuosity Fine Grained	Moderate

Waterway ID	Waterway Name	Catchment Area (ha)	Stream Order	Class	Field Assessed	River Style	Condition
W57	Back Creek	5169	5	Major	Yes	Low Sinuosity Fine Grained	Moderate
W58	Unnamed	11	1	Drainage Line	No	Headwater	Good
W59	Unnamed	4	1	Drainage Line	No	Headwater	Good
W60	Unnamed	6	1	Drainage Line	No	Headwater	Good
W61	Unnamed	8	1	Drainage Line	No	Headwater	Good
W62	Unnamed	5	1	Drainage Line	Yes	Headwater	Moderate
W63	Unnamed	99	2	Drainage Line	Yes	Valley Fill	Good
W64	Unnamed	12	1	Drainage Line	Yes	Headwater	Good
W65	Unnamed	67	2	Drainage Line	Yes	Channelised Fill	Moderate
W66	Unnamed	6	1	Drainage Line	No	Headwater	Moderate
W67	Unnamed	184	3	Minor	No	Valley Fill	Moderate
W68	Unnamed	10	1	Drainage Line	Yes	Headwater	Moderate
W69	Jaorimin Creek	2370	4	Major	Yes	Bedrock Controlled Sand	Good
W70	Unnamed	10	2	Drainage Line	Yes	Headwater	Good
W71	Unnamed	3	1	Drainage Line	Yes	Headwater	Good
W72	Unnamed	11	1	Drainage Line	Yes	Valley Fill	Moderate
W73	Unnamed	93	2	Drainage Line	No	Headwater	Moderate
W74	Unnamed	16	1	Drainage Line	No	Headwater	Moderate
W75	Unnamed	13	2	Drainage Line	No	Headwater	Good

Waterway ID	Waterway Name	Catchment Area (ha)	Stream Order	Class	Field Assessed	River Style	Condition
W76	Unnamed	19	1	Drainage Line	No	Valley Fill	Moderate
W77	Unnamed	93	1	Drainage Line	No	Valley Fill	Moderate
W78	Unnamed	10	1	Drainage Line	Yes	Valley Fill	Moderate
W79	Unnamed	427	3	Minor	Yes	Channelised Fill	Poor
W80	Unnamed	314	4	Minor	Yes	Valley Fill	Moderate
W81	Lockyersleigh Creek	125	2	Minor	Yes	Channelised Fill	Moderate
W82	Unnamed	8	1	Drainage Line	Yes	Valley Fill	Moderate
W83	Unnamed	144	3	Minor	Yes	Valley Fill	Moderate
W84	Narambulla Creek	4125	4	Major	Yes	Chain of Ponds	Moderate
W85	Unnamed	19	2	Drainage Line	Yes	Valley Fill	Moderate
W86	Unnamed	6	1	Drainage Line	Yes	Valley Fill	Moderate
W87	Unnamed	9	1	Drainage Line	No	Valley Fill	Moderate
W88	Unnamed	7	1	Drainage Line	No	Headwater	Moderate
W89	Unnamed	45	2	Drainage Line	No	Valley Fill	Moderate
W90	Unnamed	6	1	Drainage Line	No	Headwater	Moderate
W91	Unnamed	21	1	Drainage Line	No	Valley Fill	Moderate
W92	Unnamed	15	1	Drainage Line	No	Valley Fill	Moderate
W93	Unnamed	7	1	Drainage Line	Yes	Headwater	Moderate

Waterway ID	Waterway Name	Catchment Area (ha)	Stream Order	Class	Field Assessed	River Style	Condition
W94	Unnamed	33	1	Drainage Line	Yes	Headwater	Moderate
W95	Osborns Creek	630	3	Moderate	Yes	Confined	Moderate
W96	Unnamed	15	1	Drainage Line	Yes	Valley Fill	Moderate
W97	Unnamed	40	2	Drainage Line	Yes	Valley Fill	Moderate
W98	Unnamed	6	1	Drainage Line	Yes	Headwater	Good
W99	Unnamed	23	1	Drainage Line	No	Headwater	Good
W100	Unnamed	7	1	Drainage Line	No	Headwater	Good
W101	Unnamed	32	2	Drainage Line	No	Valley Fill	Moderate
W102	Unnamed	14	1	Drainage Line	No	Valley Fill	Moderate
W103	Unnamed	12	1	Drainage Line	No	Valley Fill	Moderate
W104	Unnamed	7	1	Drainage Line	Yes	Headwater	Good
W105	Wollondilly River	162620	5+	Major	Yes	Bedrock Controlled Fine Grained	Moderate
W106	Wollondilly River	161575	5+	Major	Yes	Bedrock Controlled Fine Grained	Moderate
W107	Unnamed	11	1	Drainage Line	Yes	Valley Fill	Moderate
W108	Boxers Creek	2921	5	Major	Yes	Channelised Fill	Poor
W109	Unnamed	17	1	Drainage Line	No	Valley Fill	Moderate
W110	Unnamed	149	3	Minor	Yes	Valley Fill	Moderate
W111	Unnamed	139	2	Minor	Yes	Channelised Fill	Poor
W112	Unnamed	702	3	Moderate	Yes	Low Sinuosity Fine Grained	Poor

Waterway ID	Waterway Name	Catchment Area (ha)	Stream Order	Class	Field Assessed	River Style	Condition
W113	Unnamed	482	3	Minor	Yes	Channelised Fill	Poor
W114	Unnamed	480	3	Minor	Yes	Channelised Fill	Poor
W115	Unnamed	17	1	Drainage Line	No	Headwater	Good
W116	Unnamed	16	1	Drainage Line	Yes	Headwater	Good
W117	Unnamed	19	1	Drainage Line	Yes	Headwater	Moderate
W118	Unnamed	4	1	Drainage Line	Yes	Headwater	Good
W119	Wollondilly River	153469	5+	Major	Yes	Bedrock Controlled Fine Grained	Moderate
W120	Kenmore Creek	2145	3	Major	Yes	Low Sinuosity Fine Grained	Moderate
W121	Unnamed	691	3	Moderate	Yes	Channelised Fill	Moderate
W122	Kenmore Creek	1388	3	Moderate	Yes	Low Sinuosity Fine Grained	Moderate
W123	Kenmore Creek	1386	3	Moderate	Yes	Low Sinuosity Fine Grained	Poor
W124	Kenmore Creek	1385	3	Moderate	Yes	Valley Fill	Poor
W125	Unnamed	17	1	Drainage Line	Yes	Valley Fill	Moderate
W126	Unnamed	17	1	Drainage Line	Yes	Valley Fill	Moderate
W127	Unnamed	37	1	Drainage Line	No	Channelised Fill	Moderate
W128	Unnamed	64	1	Drainage Line	Yes	Valley Fill	Moderate
W129	Unnamed	64	1	Drainage Line	Yes	Valley Fill	Moderate
W130	Unnamed	37	1	Drainage Line	Yes	Valley Fill	Moderate
W131	Wollondilly River	72382	1	Major	Yes	Bedrock Controlled Fine Grained	Moderate

Waterway ID	Waterway Name	Catchment Area (ha)	Stream Order	Class	Field Assessed	River Style	Condition
W132	Unnamed	138	2	Minor	Yes	Valley Fill	Moderate
W133	Unnamed	130	2	Minor	Yes	Valley Fill	Moderate
W134	Unnamed	120	2	Minor	Yes	Valley Fill	Moderate
W135	Unnamed	99	2	Drainage Line	Yes	Valley Fill	Moderate
W136	Unnamed	66	1	Drainage Line	Yes	Headwater	Moderate
W137	Unnamed	41	1	Drainage Line	Yes	Headwater	Moderate
W138	Unnamed	20	1	Drainage Line	Yes	Valley Fill	Moderate

Appendix C

Description of Major and Moderate Waterways

Waterway Crossing – W3	
Waterway	Kellys Creek
Waterway Classification	Major Waterway
Stream Type	Low Sinuosity Fine Grained
Land Use	Grazing
Catchment Area	Approx 2255 ha
Stream Order	Third
Flow Frequency	Perennial
Site Inspection	
Date	19/01/10
Valley Confinement	Unconfined
Valley Width	100 – 150 m
Channel Dimensions	3 – 5 m width, 1 m depth
Channel Sinuosity	Low
Channel Stability	Stable channel, limited potential to adjust laterally due to cohesive banks
Banks	Grassed, stable
Instream Features	Pools and runs
Floodplain	Modified pasture land with abandoned channel
Contextual Notes	Juncus and pasture grasses exist in creek

Upstream View

Aerial View (GIS) Scale 1:1500

Waterway Crossing – W52	
Waterway	Paddys River
Waterway Classification	Major Waterway
Stream Type	Bedrock Controlled Fine Grained
Land Use	Grazing
Catchment Area	Approx 10702 ha
Stream Order	
Flow Frequency	Perennial
Site Inspection	
Date	20/01/10
Valley Confinement	Partly Confined
Valley Width	80 – 100 m
Channel Dimensions	5 – 10 m width, 1 m depth
Channel Sinuosity	Low
Channel Stability	Channel is stable. Limited potential to adjust due to cohesive banks and bedrock base.
Banks	Vegetated banks composed of silt.
Instream Features	Pools, riffles and small bars.
Floodplain	Modified grazing land containing a back swamp.
Contextual Notes	Willows within riparian zone.

Upstream View

Downstream View

Waterway Crossing – W56	
Waterway	Uringalla Creek
Waterway Classification	Major Waterway
Stream Type	Low Sinuosity Fine Grained
Land Use	Grazing
Catchment Area	Approx 5169 ha
Stream Order	
Flow Frequency	Perennial
Site Inspection	
Date	20/01/10
Valley Confinement	Unconfined
Valley Width	80 – 100 m
Channel Dimensions	10 – 15 m width, 1 - 2 m depth
Channel Sinuosity	Low
Channel Stability	Channel is stable with cohesive soils and flow dissipation through reeds area provides adequate resistance to erosion.
Banks	Stable, graded banks colonised by grasses.
Instream Features	Small pools.
Floodplain	Modified grazing land/cropping.
Contextual Notes	Crossing located at confluence of Uringalla and Back Creek.

Upstream View

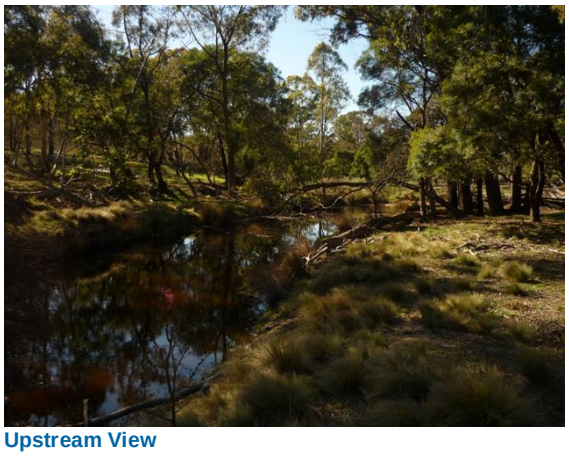
Downstream View

Waterway Crossing – W57	
Waterway	Back Creek
Waterway Classification	Major Waterway
Stream Type	Low Sinuosity Fine Grained
Land Use	Grazing
Catchment Area	Approx 5169 ha
Stream Order	Fifth
Flow Frequency	Perennial
Site Inspection	
Date	20/01/10
Valley Confinement	Unconfined
Valley Width	80 – 100 m
Channel Dimensions	10 m width, 1 m depth
Channel Sinuosity	Low
Channel Stability	Channel is stable with cohesive soils and flow dissipation through reeds area provides adequate resistance to erosion.
Banks	Stable, graded banks colonised by grasses.
Instream Features	Featureless trapezoidal channel.
Floodplain	Modified grazing land/cropping.
Contextual Notes	Crossing located at confluence of Uringalla and Back Creek.

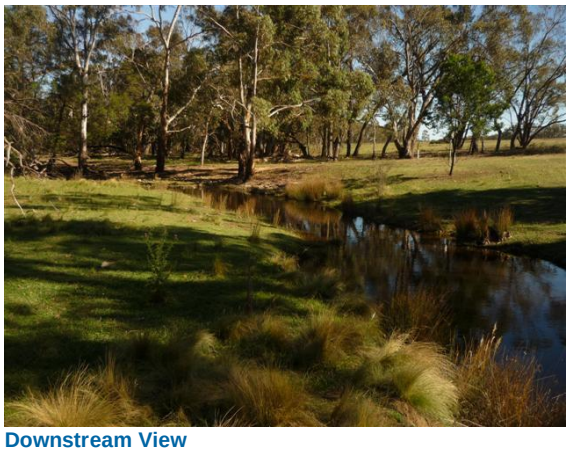
Upstream View

Downstream View

Waterway Crossing – W69	
Waterway	Jaorimin Creek
Waterway Classification	Major Waterway
Stream Type	Bedrock Controlled Sand
Land Use	Forest
Catchment Area	Approx 2370 ha
Stream Order	Fourth
Flow Frequency	Perennial
Site Inspection	
Date	20/01/10
Valley Confinement	Partly Confined
Valley Width	30 – 50 m
Channel Dimensions	< 5 m width, 0.5 m depth
Channel Sinuosity	Low
Channel Stability	Channel is in good condition and currently stable at crossing point.
Banks	Sandy silts colonised with native grasses.
Instream Features	Shallow pools, sand/gravel riffles.
Floodplain	Disturbed native woodland.
Contextual Notes	Rock crossing downstream of pipeline crossing point maintaining upstream bed levels causing shallow pooling. Channel downstream of ford exhibits eroding banks.



Upstream View



Downstream View

Waterway Crossing – W84	
Waterway	Narumbulla Creek
Waterway Classification	Major Waterway
Stream Type	Chain of Ponds
Land Use	Grazing
Catchment Area	Approx 4125 ha
Stream Order	4
Flow Frequency	Perennial
Site Inspection	
Date	21/01/10
Valley Confinement	Unconfined
Valley Width	150 – 200 m
Channel Dimensions	15 m width, 0.5 m depth
Channel Sinuosity	Low
Channel Stability	Ponds are stable
Banks	Banks are low, vertical in parts and are grassed.
Instream Features	Ponds.
Floodplain	Modified grazing pastures.
Contextual Notes	Ad-hoc ford located at downstream extent of pond.

Upstream View

Downstream View

Waterway Crossing – W105	
Waterway	Wollondilly River
Waterway Classification	Major Waterway
Stream Type	Bedrock Controlled Fine Grained
Land Use	Grazing
Catchment Area	Approx 162620 ha
Stream Order	5+
Flow Frequency	Perennial
Site Inspection	
Date	21/01/10
Valley Confinement	Partly Confined
Valley Width	100 - 120 m
Channel Dimensions	70 m width, >5 m depth (at bankfull)
Channel Sinuosity	Low
Channel Stability	Channel is stable.
Banks	Banks are fairly steep and are largely devoid of vegetation at the crossing (except for grass and some Juncus).
Instream Features	Large deep pool at crossing.
Floodplain	Grassed, featureless floodplain.
Contextual Notes	Banks at crossing site exhibit rock protection of existing buried services.

Upstream View

Downstream View

Waterway Crossing – W106	
Waterway	Wollondilly River
Waterway Classification	Major Waterway
Stream Type	Bedrock Controlled Fine Grained
Land Use	Grazing
Catchment Area	Approx 161575 ha
Stream Order	5+
Flow Frequency	Perennial
Site Inspection	
Date	21/01/10
Valley Confinement	Partly Confined
Valley Width	100 – 120 m
Channel Dimensions	60 m width, 3 m depth (at bankfull)
Channel Sinuosity	Low
Channel Stability	Channel is stable and well vegetated with grasses.
Banks	Graded, stable banks.
Instream Features	Riffle zones at crossing point with low flow channel up to 5 m wide.
Floodplain	Modified grazing.
Contextual Notes	Banks at crossing site exhibit rock protection of existing buried services.

Upstream View

Downstream View

Waterway Crossing – W108	
Waterway	Boxers Creek
Waterway Classification	Major Waterway
Stream Type	Channelised Fill
Land Use	Grazing
Catchment Area	Approx 2921 ha
Stream Order	Fifth
Flow Frequency	Perennial
Site Inspection	
Date	22/01/10
Valley Confinement	Confined
Valley Width	20 – 30 m
Channel Dimensions	20 – 30 m width, 1 – 1.5 m depth
Channel Sinuosity	Low
Channel Stability	Channel is in poor condition with eroding banks.
Banks	Near vertical banks composed of sandy clay. Poorly vegetated and generally unstable.
Instream Features	Featureless channel incised to bedrock.
Floodplain	N/A.
Contextual Notes	Livestock access unrestricted.

Upstream View

Downstream View

Waterway Crossing – W119	
Waterway	Wollondilly River
Waterway Classification	Major Waterway
Stream Type	Bedrock Controlled Fine Grained
Land Use	Agriculture
Catchment Area	Approx 153469 ha
Stream Order	5+
Flow Frequency	Perennial
Site Inspection	
Date	21/01/10
Valley Confinement	Partly Confined
Valley Width	100 – 130 m
Channel Dimensions	70 m width, 5 m depth (at bankfull)
Channel Sinuosity	Low
Channel Stability	Channel is stable.
Banks	Stable banks are graded and well vegetated.
Instream Features	Crossing point located at downstream extent of pool and upstream of a riffle zone. Pool is 0.5 m deep at crossing point.
Floodplain	Grazing/pasture.
Contextual Notes	Juncus on banks and riffle zone. Rock causeway on riffle zone.

Upstream View

Downstream View

Waterway Crossing – W120	
Waterway	Kenmore Creek
Waterway Classification	Major Waterway
Stream Type	Low Sinuosity Fine Grained
Land Use	Grazing
Catchment Area	Approx 2145 ha
Stream Order	3
Flow Frequency	Perennial
Site Inspection	
Date	21/01/10
Valley Confinement	Unconfined
Valley Width	30 m
Channel Dimensions	20 m width, 3 - 4 m depth
Channel Sinuosity	Low
Channel Stability	Channel is stable.
Banks	Banks are graded, grassed and stable.
Instream Features	Trapezoidal channel with 3 m wide low flow channel.
Floodplain	Flat, featureless.
Contextual Notes	Entrenched channel within floodplain deposits of Wollondilly River.

Upstream View

Aerial View (GIS)

Waterway Crossing – W131	
Waterway	Wollondilly River
Waterway Classification	Major Waterway
Stream Type	Bedrock Controlled Fine Grained
Land Use	Grazing
Catchment Area	Approx 72382 ha
Stream Order	
Flow Frequency	Perennial
Site Inspection	
Date	21/01/10
Valley Confinement	Partly Confined
Valley Width	120 – 160 m
Channel Dimensions	25 – 30 m width, 2 – 3 m depth (at bankfull)
Channel Sinuosity	Low
Channel Stability	Channel is stable.
Banks	Banks are near vertical but well vegetated with grasses.
Instream Features	Pool extends upstream and downstream of crossing point.
Floodplain	Flat, featureless with pasture grasses.
Contextual Notes	Pool is a product of back up from weir downstream.

Upstream View

Downstream View

Waterway Crossing – W14	
Waterway	Medway Rivulet
Waterway Classification	Moderate Waterway
Stream Type	Low Sinuosity Fine Grained
Land Use	Grazing
Catchment Area	Approx 868 ha
Stream Order	Third
Flow Frequency	Ephemeral
Site Inspection	
Date	19/01/10
Valley Confinement	Unconfined
Valley Width	40 – 50 m
Channel Dimensions	10 m width, 1 – 2 m depth
Channel Sinuosity	Low
Channel Stability	Channel is moderately unstable due to minimal riparian vegetation and cattle access.
Banks	Banks are steep and moderately unstable.
Instream Features	Trapezoidal channel with small pools.
Floodplain	Highly modified grazing land.
Contextual Notes	

Upstream View

Downstream View

Waterway Crossing – W22	
Waterway	Black Bobs Creek
Waterway Classification	Moderate Waterway
Stream Type	Low Sinuosity Fine Grained
Land Use	Grazing
Catchment Area	Approx 1142 ha
Stream Order	Third
Flow Frequency	Ephemeral
Site Inspection	
Date	19/01/10
Valley Confinement	Unconfined
Valley Width	30 m
Channel Dimensions	3 – 5 m width, 1 m depth
Channel Sinuosity	Low.
Channel Stability	Channel is stable. Limited potential to adjust due to cohesive grassed banks.
Banks	Sandy clay banks are steep and undercut in locations.
Instream Features	Small pools (dry at time of inspection).
Floodplain	Flat floodplain with pasture grasses.
Contextual Notes	

Upstream View

Downstream View

Waterway Crossing – W95	
Waterway	Osborns Creek
Waterway Classification	Moderate Waterway
Stream Type	Confined
Land Use	Grazing
Catchment Area	Approx 630 ha
Stream Order	Third
Flow Frequency	Ephemeral
Site Inspection	
Date	22/01/10
Valley Confinement	Confined
Valley Width	30 m
Channel Dimensions	5 – 10 m wide at channel base.
Channel Sinuosity	Low
Channel Stability	Channel is stable due to high bedrock control.
Banks	Banks are steep, well vegetated and composed of bedrock.
Instream Features	Shallow pools separated by riffles composed of angular cobbles.
Floodplain	N/A.
Contextual Notes	Dense, native vegetation upstream and downstream of crossing point.

Upstream View

View Northeast Along Alignment

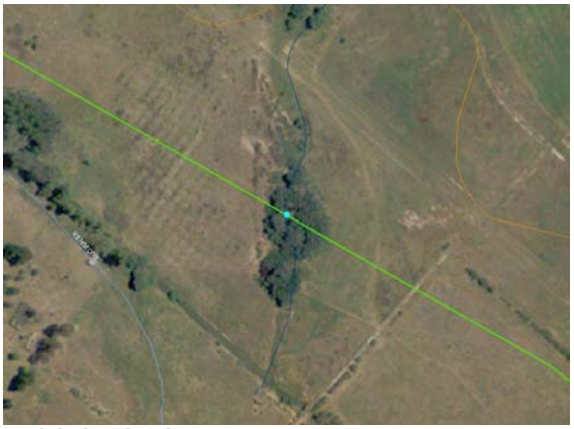
Waterway Crossing – W112	
Waterway	Unnamed tributary of Wollondilly River
Waterway Classification	Moderate Waterway
Stream Type	Low Sinuosity Fine Grained
Land Use	Agriculture
Catchment Area	Approx 702 ha
Stream Order	Third
Flow Frequency	Ephemeral
Site Inspection	
Date	22/01/10
Valley Confinement	Unconfined
Valley Width	80 – 100 m
Channel Dimensions	10 m width, 1.5 m depth
Channel Sinuosity	Low
Channel Stability	Channel is in poor condition due to railway culvert scour however is relatively stable.
Banks	Banks are well vegetated with grass and reeds at crossing point.
Instream Features	A large scour pool exists downstream of the railway culvert as a result of constraining processes from the culvert.
Floodplain	Agricultural fields.
Contextual Notes	Crossing of the creek is located adjacent to and downstream of the railway.

Aerial View (GIS)

Downstream View

Waterway Crossing – W121	
Waterway	Unnamed tributary of Kenmore Creek
Waterway Classification	Moderate Waterway
Stream Type	Channelised Fill
Land Use	Grazing, pasture
Catchment Area	Approx 691 ha
Stream Order	Third
Flow Frequency	Ephemeral
Site Inspection	
Date	22/01/10
Valley Confinement	Unconfined
Valley Width	60 m
Channel Dimensions	20 – 40 m width, depth (unknown)
Channel Sinuosity	Low
Channel Stability	Well vegetated and apparently stable.
Banks	Not inspected.
Instream Features	Not inspected.
Floodplain	Grazing/Agriculture.
Contextual Notes	Not inspected.

Aerial View (GIS) 8000



Aerial View (GIS) 1500

Waterway Crossing – W122	
Waterway	Kenmore Creek
Waterway Classification	Moderate Waterway
Stream Type	Low Sinuosity Fine Grained
Land Use	Grazing
Catchment Area	Approx 1388 ha
Stream Order	Third
Flow Frequency	Ephemeral
Site Inspection	
Date	21/01/10
Valley Confinement	Unconfined
Valley Width	50 – 70 m
Channel Dimensions	5 m width, 1 m depth
Channel Sinuosity	Low
Channel Stability	Channel is stable and well vegetated with grasses and non-native Willows and Hawthorn.
Banks	Banks are well vegetated with grass.
Instream Features	Small Pools.
Floodplain	Grazing land adjacent to racecourse track.
Contextual Notes	The pipe crossing of the creek is located adjacent and immediately upstream of a road.

Upstream View

Aerial View (GIS)

Waterway Crossing – W123	
Waterway	Kenmore Creek
Waterway Classification	Moderate Waterway
Stream Type	Low Sinuosity Fine Grained
Land Use	Adjacent to racecourse
Catchment Area	Approx 1386 ha
Stream Order	Third
Flow Frequency	Ephemeral
Site Inspection	
Date	22/01/10
Valley Confinement	Unconfined
Valley Width	50 – 70 m
Channel Dimensions	1 m width, 0.5 m depth
Channel Sinuosity	Low
Channel Stability	Channel is stable and well vegetated with grasses and non-native Willows and Hawthorn.
Banks	Banks are composed of clays and well vegetated with grasses.
Instream Features	Featureless box shaped channel.
Floodplain	Pasture land adjacent to racecourse track.
Contextual Notes	

Aerial View (GIS)

Downstream View

Waterway Crossing – W124	
Waterway	Kenmore Creek
Waterway Classification	Moderate Waterway
Stream Type	Valley Fill
Land Use	Adjacent to racecourse track
Catchment Area	Approx 1385 ha
Stream Order	Third
Flow Frequency	Ephemeral
Site Inspection	
Date	22/01/10
Valley Confinement	Unconfined
Valley Width	40 m
Channel Dimensions	N/A
Channel Sinuosity	N/A
Channel Stability	N/A
Banks	N/A
Instream Features	Flat Valley Fill.
Floodplain	Land adjacent to racecourse track.
Contextual Notes	Location of proposed crossing is immediately downstream of the exit of a large culvert that runs beneath the racecourse track after exiting a dam in the middle of the racecourse. Flow regulation by dam is thought to limit the potential for scour and channel development.

Upstream View

Aerial View (GIS)

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Document Status

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