Tarcoola Quarries

Environmental Impact Assessment
Flood Assessment Addendum

August 2014

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1. Introduction

1.1 Purpose of this report

Tarcoola Turf and Quarries (TTQ) submitted a development application (DA13/0307) to Wagga Wagga City Council (Council) for the extension of the existing Tarcoola Quarry operations located at Lot 4 DP 740222, East Wagga Wagga. An Environmental Impact Statement accompanying the DA was placed upon public exhibition and a supplementary report was to revise the proposal and respond to government agency and community submissions in regards to the proposal. Additional clarification was sought by Council on a number of matters and a further supplementary report was prepared and issued in June 2014.

The assessments carried out in relation to flooding for the above reports were done so using a hydraulic flood model for Wagga Wagga provided by Council.

In July 2014, Council advised that a new flood model for Wagga Wagga was available and that the flooding baseline had therefore changed. Council required the assessments to be updated using the new flood model. Council also requested that floor levels of three dwellings identified in the original EIS be surveyed for comparison against modelled flood levels.

The purpose of this report is to document the findings of a hydraulic flood assessment undertaken during August 2014 in relation to the proposed operations at the Tarcoola Turf and Quarries site on the basis of data provided by WMA Water on behalf of Council.

The report provides an update to flood assessments previously carried out at the site using the latest available modelling data for the catchment.

1.2 Scope and limitations

The scope of works generally includes updating the Tarcoola Quarries flood study with new modelling data available to Council. The "Tarcoola Quarries flood study" refers to the flooding-related work encompassed by the following three documents:

- *Extension of Tarcoola Quarry Environmental Impact Statement Report (June 2013)*
- *Extension of Tarcoola Quarry Supplementary Report (November 2013)*
- *Extension of Tarcoola Quarry Additional Supplementary Information (June 2014).*

The new modelling information on which this study has been based was documented in the report *Wagga Wagga Detailed Flood Modelling Revision, Draft Final Report (March 2014)*, prepared by WMA Water on behalf of Council. The final report was not available at the time of this update.

The *Wagga Wagga Detailed Flood Modelling Revision, Draft Final Report* was limited to consideration of the 1% Annual Exceedance Probability (AEP) and 5% AEP flood events which is equivalent to a 100 year and 20 year flood events respectively. For this reason, the current update is limited to consideration of the same two events.

This report does not describe the existing Tarcoola Quarries operations nor the proposed extensions. These have been documented separately in the various Tarcoola Quarries reports referenced above.

The modelling carried out by WMA Water was done so using TUFLOW version 2012-05-AA-iDP-w64. For the purposes of consistency with the new Wagga Wagga flood model the same version of TUFLOW was used for this analysis.

1.3 Assumptions

The study was undertaken on the assumption that the provided hydraulic model and input hydrology was appropriate and represented the best available information in relation to flooding at Wagga Wagga.

2. Methodology

The flood modelling for this study was undertaken as follows:

1. Testing of provided hydraulic model
2. Existing flood model update (to incorporate site-specific topographic survey)
3. Flood model update for quarry extension.

Flood maps of the results are provided in the appendices to this report and include:

- Appendix A – Afflux Maps;
- Appendix B – Flood Hazard Maps; and
- Appendix C – Flood Depth Maps.

2.1 Testing of provided hydraulic model

The hydraulic model was provided together with peak flood surface results. The models were re-run to confirm that the results produced were the same as those provided.

Although simulated with the same TUFLOW model version, there were minor differences in the results obtained (generally less than 5 mm but up to 30 mm in localised locations).

The cause of the differences in level is unknown though there have been discrepancies reported in the past with earlier versions of TUFLOW producing different results when run on different PCs (reference TUFLOW website forum, August 2014).

The model simulations undertaken for the purposes of comparing baseline flooding with proposed site flooding (discussed in section 2.2 and 2.3) were for this reason simulated using the same PC to avoid similar discrepancies.

2.2 Existing flood model update

The hydraulic model provided by WMA Water was updated by incorporating topographic survey data for the Tarcoola quarry site.

The flood model was re-simulated with the survey data to re-define the baseline flooding. The baseline flooding incorporates both:

- Present day flooding, with the Tarcoola Quarries site in its current configuration and the existing flood protection levees around Wagga Wagga in their present state and;
- Future levee upgrade flooding, with the Tarcoola Quarries site in its current configuration and the flood protection levees around Wagga Wagga upgraded according to current Council plans.

The baseline scenarios have in common that the Tarcoola quarries site is as per the current quarry layout, even where future upgrades to the Wagga Wagga levees are considered.

The new flooding modelling provided by WMA Water considered the future upgrade of both the City Wagga Wagga Levee and the North Wagga Wagga Levees together, something that was not considered during the previous Council flood modelling (which separately considered the upgrade of the North Wagga Wagga and City Levees).

The revised modelling for Tarcoola Quarries therefore also incorporated consideration of both the present day Wagga Wagga Levee scenarios and the case where all relevant Wagga Wagga Levees were upgraded.

The scenarios listed in Table 2-1 were simulated. The terminology used in the table is summarised as follows:

Existing Wagga Levee refers to the City Levee and North Wagga Levees in their present day condition.

Design Wagga Levee refers to the City Levee and North Wagga Levee upgraded (raised) to their future design state as documented in the revised WMA Water Flood Study

Existing site refers to the quarry with its existing pit and processing plant configuration.

Table 2-1 Baseline model scenarios

Scenario number	Scenario reference code	AEP	Wagga Levee condition	Site condition
001	E-5pc	5%	Existing Wagga Levees	Existing site
002	E-1pc	1%	Existing Wagga Levees	Existing site
003	L-5pc	5%	Design Wagga Levees	Existing site
004	L-5pc	1%	Design Wagga Levees	Existing site

The results of the baseline flooding are presented in Section 3.1.

2.3 Flood model update for proposed quarry extension

The flood model was updated to incorporate the various proposed stages of the quarry extension, in particular the proposed pit configurations and associated levees. Details of the adopted pit configurations are provided in the Extension of Tarcoola Quarry Supplementary Report (November 2013).

2.3.1 Pit levee levels

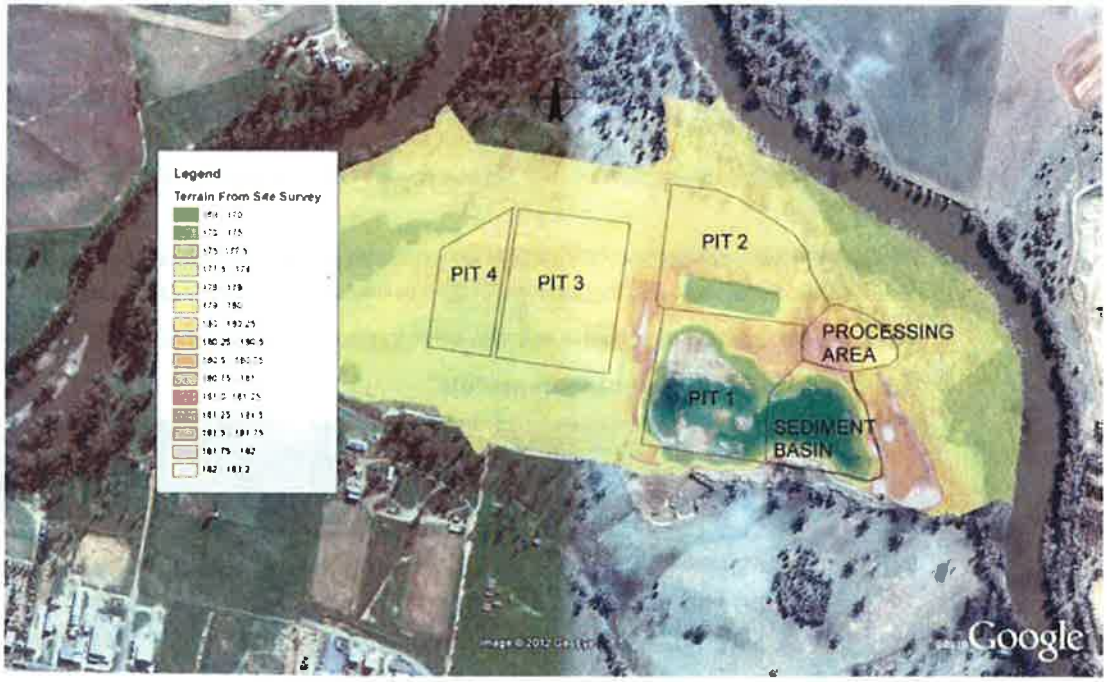
The levels of the pit levees were previously modelled at the 10% AEP level including an additional 0.5 m allowance for freeboard. However, the effect of incorporating the additional 0.5 m freeboard to the 10% AEP level actually raised the level to prevent flooding in the 5% AEP event and it was therefore proposed to reduce the height of the bunds by removing the allowance for freeboard from the proposal.

As an updated 10% flood event was not available for the revised Wagga Wagga flood modelling, an estimate of levee levels was made. A comparison of the 5% flood levels in the previous study and those for the current study indicated that the 5% flood levels at the site have increased as discussed in Section 3.1. The flood levees adopted in the revised modelling were therefore increased slightly in height to account for a probable increase in 10% flood levels, whilst removing the 0.5m allowance for freeboard.

The levels adopted based upon the final pit configuration presented in Figure 2-A were:

- 180.9 mAHD for pits 1 and 2 and
- 180.8 mAHD for pits 3 and 4.

Figure 2-A Quarry pit layout and existing topography



2.3.2 Scenarios modelled

The scenarios identified in Table 2-2 were simulated. The terminology used in the table is summarised as follows:

Existing Wagga Levee refers to the City Levee and North Wagga Levee in their present day condition.

Design Wagga Levee refers to the City Levee and North Wagga Levee upgraded (raised) to their future design state as documented in the revised WMA Water Flood Study

Quarry Pits 1 and 2 refers to the site with proposed quarry pits 1 and 2 to in place (built to the levels specified in section 2.3.1).

Quarry Pits 2 and 3 refers to the site with proposed quarry pits 2 and 3 in place (built to the levels specified in section 2.3.1).

Quarry Pits 3 and 4 refers to the site with proposed quarry pits 3 and 4 to in place (built to the levels specified in section 2.3.1).

Table 2-2 Proposed quarry extension model scenarios

Scenario number	Scenario reference code	AEP	Wagga Wagga Levee conditions	Site conditions
005	E-Q12-5pc	5%	Existing Wagga Levee	Quarry Pits 1 and 2
006	E-Q23-5pc	5%	Existing Wagga Levee	Quarry Pits 2 and 3
007	E-Q34-5pc	5%	Existing Wagga Levee	Quarry Pits 3 and 4
008	E-Q12-1pc	1%	Existing Wagga Levee	Quarry Pits 1 and 2
009	E-Q23-1pc	1%	Existing Wagga Levee	Quarry Pits 2 and 3
010	E-Q34-1pc	1%	Existing Wagga Levee	Quarry Pits 3 and 4
011	L-Q12-5pc	5%	Design Wagga Levee	Quarry Pits 1 and 2
012	L-Q23-5pc	5%	Design Wagga Levee	Quarry Pits 2 and 3
013	L-Q34-5pc	5%	Design Wagga Levee	Quarry Pits 3 and 4
014	L-Q12-1pc	1%	Design Wagga Levee	Quarry Pits 1 and 2
015	L-Q23-1pc	1%	Design Wagga Levee	Quarry Pits 2 and 3
016	L-Q34-1pc	1%	Design Wagga Levee	Quarry Pits 3 and 4

3. Results

3.1 Baseline flooding

An assessment of baseline flood conditions was undertaken to determine the effect of the revised hydraulic modelling would impact upon the flood depth or flood extent of design events at the Tarcoola Quarry site.

Flood depth and the extent of inundation based upon the current quarry footprint were calculated for both the existing Wagga Levee case and the Design Wagga Levee case and are present in the flood maps contained within Figures 29, 33, 37 and 41 (Appendix C)

Flood depths across the site and in the vicinity generally are:

- Between 150 mm to 350 mm lower than assessed in previous studies for in the 1% AEP event;
- Between 100 mm to 200 mm higher than assessed in previous studies for the 5% AEP event.

This is considered to be a result of the revisions made to the Murrumbidgee River rating curve which is discussed in the revised Wagga Wagga Flood study report prepared by WMA Water.

The predicted flooding with the proposed quarry layout in place and for each quarry configuration is presented in the flood maps within Appendix C.

3.2 Flood levels

3.2.1 Afflux

The level of Afflux or change in flood levels associated with the revised flood modelling is similar in scale to the previous assessment and results in an increase of > 25 mm at surrounding properties for all modelled scenarios as shown in the Afflux maps presented in Appendix A.

The one exception is a small portion of the recreational paintball facility located south of the quarry receives an Afflux or marginally more than 25 mm when the quarry proceeds to Pit configuration 3 and 4 for 5% AEP flood events under all potential city levee configurations. This is consistent and a slight improvement to previously modelled results and the paintball facility is not considered a sensitive receiver and given that the flood heights will be greater than 2 m in a 10 year AEP event, the influence of an approximate 25 to 30 mm increase is not considered significant.

Five residential receivers in the vicinity of Tarcoola Quarry were previously identified as being potentially impacted by the proposal as shown on Figure 3-A. Surveys of the floor levels for all potentially affected residential properties have been undertaken to further define the potential impacts to residential receivers.

A summary of the worst case for afflux at each residence is provided in Table 3-1 for the 5% AEP event and in Table 3-2 for the 1% AEP event. The afflux maps for all scenarios are provided in Appendix A.

Actual flood levels are also shown and compared to floor levels.

Paper size A3

0 50 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Stage 1 boundary
- Stage 2 boundary
- Proposed pit layout
- Sediment pond
- Site office and weighbridge
- Residence
- Property boundary

Tarcoola Quarries
Tarcoola Quarries EIS

Job Number	23-14626
Revision	0
Date	04 Nov 2013

Residence locations

Figure 3-A

Suite 3, Level 1, 161-169 Bayliss Street Wagga Wagga NSW 2650 Australia T 61 2 6923 7400 F 61 2 6971 9565 E wgamail@ghd.com W www.ghd.com

Data source: Google Google Earth aerial imagery - extracted May 2013; NSW Government Property boundary - 2012. Created by rrobertson

Table 3-1 Afflux at each residence, 5% AEP

Residence	Floor Level (mAHD)	Worst case proposed scenario	Flood level baseline (mAHD)	Flood Level proposed (mAHD)	Afflux* (mm)
1	180.975	E-Q34-5pc	181.042	181.046	4
2	183.360	E-Q12-5pc	181.070	181.062	-8
3	182.160	E-Q34-5pc	181.055	181.052	-3
4	182.335	L-Q34-5pc	181.181	181.202	21
5	181.165	L-Q34-5pc	181.296	181.313	17

Table Notes

*1. * Where a positive value indicates an increase in flood level of the baseline and a negative value indicates a decrease*

2. Levels shown to 3 decimal places for comparative purposes.

Where the residence itself was not flooded, a flood level was taken on an alternative point on the lot at the side of the highest flood level.

Table 3-2 Afflux at each residence, 1% AEP

Residence	Floor Level (mAHD)	Worst case proposed scenario (for afflux)	Flood level baseline (mAHD)	Flood Level proposed (mAHD)	Afflux (mm)
1	180.975	L-Q34-1pc	181.902	181.901	-1
2	183.360	L-Q12-1pc	181.912	181.908	-4
3	182.160	L-Q34-1pc	181.908	181.906	-2
4	182.335	L-Q34-1pc	182.021	182.035	14
5	181.165	E-Q34-1pc	182.027	182.042	15

Table Notes

*1. * Where a positive value indicates an increase in flood level of the baseline and a negative value indicates a decrease*

2. Levels shown to 3 decimal places for comparative purposes.

The results indicate that the base floor level at Residence 1 and 5 (ground level) would be flooded for both 1% and 5% AEP flood events under both baseline and worst case proposed pit configurations. A small increase in flood level associated with the proposal will not result in any of the affected properties being flooded in a design flood event where they are not currently affected under baseline conditions.

It should be noted that the floor level included in the assessment for Residence 5 is the threshold of the ground floor of the building. It is understood that the principal habitable area of the dwelling may be the first floor at a height of 183.770 mAHD, which is located above all modelled flood levels. Details of all surveyed floor levels are provided in Appendix D.

3.2.2 Model confidence levels

The draft revised flood modelling report produced by WMA Water estimates the confidence in the modelled flood levels to be +- 250 mm, meaning that modelled flood levels could be up to 250 mm higher or lower than estimated by the model. The primary change to flood affectation to the properties therefore relates to a change in flood affectation within the confidence limits of the model. This could occur for a house not expected to be flooded above floor level for a baseline event but flooded above floor level in a proposed event based upon the range in confidence levels within the model.

Table 3-3 and Table 3-4 below takes into consideration whether or not the residence is expected to be flooded at each modelled AEP, inclusive of consideration of model accuracy.

Table 3-3 Residences flooded above floor level at 5% AEP

Residence	Potentially Flooded	
	5% AEP baseline	5% AEP proposed
1	Yes	Yes
2	No	No
3	No	No
4	No	No
5	Yes	Yes
Residence	Flooded in 5% AEP baseline, lower bound (-250 mm)	Flooded in 5% AEP proposed, lower bound (-250 mm)
1	No	No
2	No	No
3	No	No
4	No	No
5	No	No
Residence	Flooded in 5% AEP baseline, upper bound (+250 mm)	Flooded in 5% AEP proposed, upper bound (+250 mm)
1	Yes	Yes
2	No	No
3	No	No
4	No	No
5	Yes	Yes

Table 3-4 Residences flooded above floor level at 1% AEP

Residence	Potentially Flooded	
	1% AEP baseline	1% AEP proposed
1	Yes	Yes
2	No	No
3	No	No
4	No	No
5	Yes	Yes
Residence	Flooded in 1% AEP baseline, lower bound (-250 mm)	Flooded in 1% AEP proposed, lower bound (-250 mm)
1	Yes	Yes
2	No	No
3	No	No
4	No	No
5	Yes	Yes
Residence	Flooded in 1% AEP baseline, upper bound (+250 mm)	Flooded in 1% AEP proposed, upper bound (+250 mm)
1	Yes	Yes
2	No	No
3	No	No
4	No	No
5	Yes	Yes

The results in Table 3-3 and Table 3-4 use the modelled flood levels provided in Table 3-1 and Table 3-2. With consideration of +-250 mm in level, the tables indicate whether there is a change in whether or not the houses are flooded above floor level between the baseline and the proposed cases.

The results show that the susceptibility of the residences to flooding above floor levels is not sensitive to the confidence limits of +- 250 mm expected to apply in this study. There are no properties being flooded in a design flood event where they are not currently affected under baseline conditions based upon the model sensitivity.

3.2.3 Flood Extents and Hazard

As indicated in the previous assessments, there is no significant change in flood depth and hazard between the baseline and proposed cases. Flood hazard maps are provided in Appendix B and flood depths are presented in Appendix C for all modelled scenarios.

It is noted that flood hazard for the baseline condition for the site is high. Although this does not change as a result of the proposals, it is recommended that the applicant prepare a flood warning and evacuation plan for the site and make sure that this is implemented with appropriate provision for communication to staff and other users of the site.

4. Conclusion

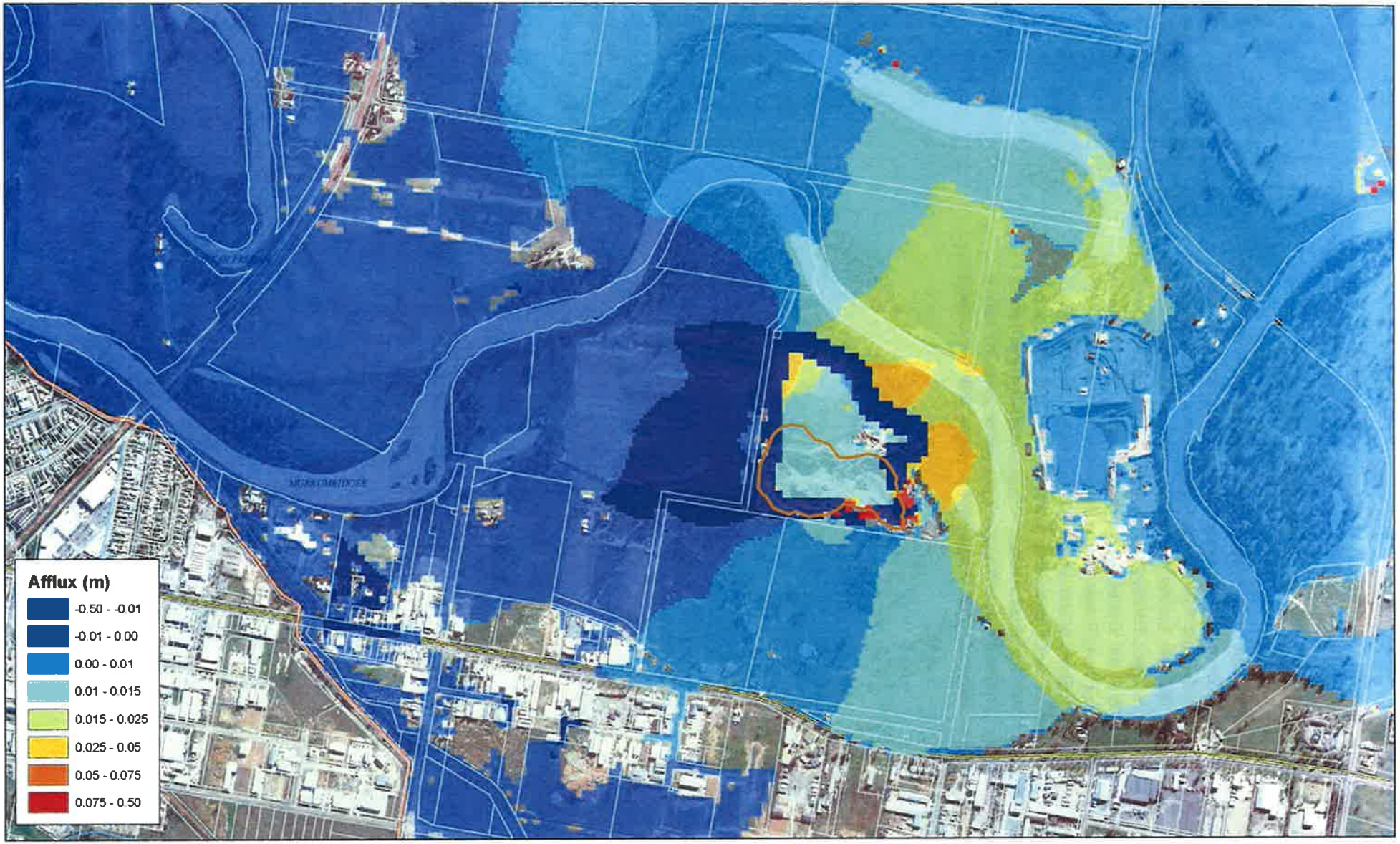
Using a revised flood model provided by Council together with surveyed residence floor levels, an assessment has been carried out to determine the potential impact of the proposed operations at Tarcoola Quarries on residences in the area.

Based on this assessment, no significant impact on flooding is expected for any of the residences within the vicinity of the proposed Tarcoola Quarries. There will be a maximum increase in flood level of 21 mm for the available 5% and 1% AEP flood events. The small change in flood levels will not increase the potential for flooding of habitable areas under any of the modelled design flood events.

Appendices

Appendix A - Afflux Maps

Figure 1	Afflux 5 % Event, Existing Wagga Wagga Levee, Site Pits 1 and 2
Figure 2	Afflux 5 % Event, Existing Wagga Wagga Levee, Site Pits 2 and 3
Figure 3	Afflux 5 % Event, Existing Wagga Wagga Levee, Site Pits 3 and 4
Figure 4	Afflux 1 % Event, Existing Wagga Wagga Levee, Site Pits 1 and 2
Figure 5	Afflux 1 % Event, Existing Wagga Wagga Levee, Site Pits 2 and 3
Figure 6	Afflux 1 % Event, Existing Wagga Wagga Levee, Site Pits 3 and 4
Figure 7	Afflux 5 % Event, Future Wagga Wagga Levee, Site Pits 1 and 2
Figure 8	Afflux 5 % Event, Future Wagga Wagga Levee, Site Pits 2 and 3
Figure 9	Afflux 5 % Event, Future Wagga Wagga Levee, Site Pits 3 and 4
Figure 10	Afflux 1 % Event, Future Wagga Wagga Levee, Site Pits 1 and 2
Figure 11	Afflux 1 % Event, Future Wagga Wagga Levee, Site Pits 2 and 3
Figure 12	Afflux 1 % Event, Future Wagga Wagga Levee, Site Pits 3 and 4



Paper Size A3

0 45 90 180 270 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

NOTES

1. Afflux represents the difference in flood depth between the proposed case and the baseline case where a positive value represents an increase from baseline and a negative value indicates a decrease.

Tarcoola Quarries
Revised Flooding Assessment

Afflux 5 percent AEP Existing Wagga Site Pits 1 and 2

Job Number 23-14626-11
Revision A
Date 15 Aug 2014

Figure 1

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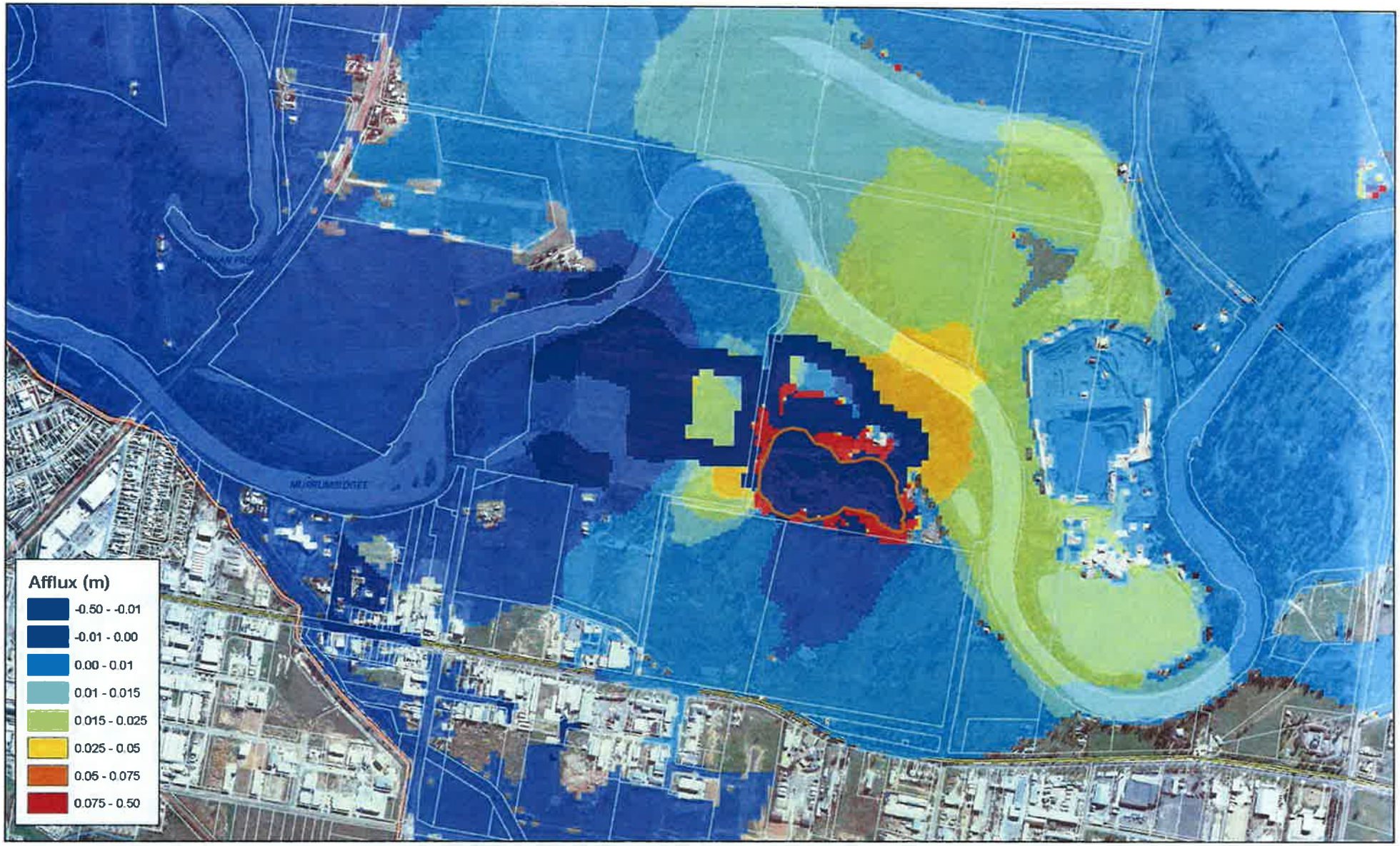
Data source: Data Custodian, Data Set Name/Title, Version/Date, Created by Initials

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com



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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

NOTES

1. Afflux represents the difference in flood depth between the proposed case and the baseline case where a positive value represents an increase from baseline and a negative value indicates a decrease.

Tarcoola Quarries
Revised Flooding Assessment

Afflux 5 percent AEP Existing Wagga Site Pits 2 and 3

Job Number 23-14626-11
Revision A
Date 15 Aug 2014

Figure 2

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Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: mdoherty

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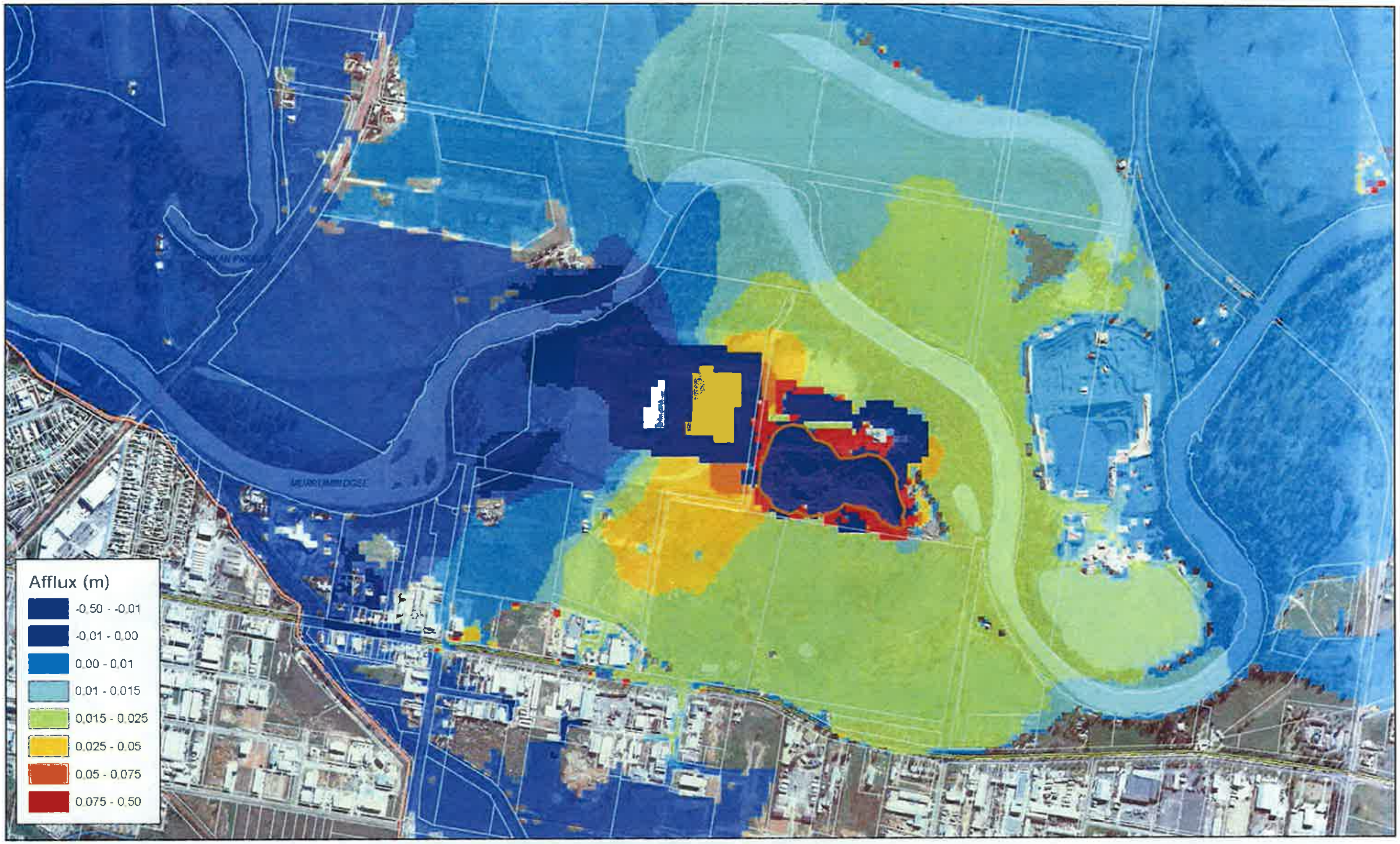

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

NOTES

1. Afflux represents the difference in flood depth between the proposed case and the baseline case where a positive value represents an increase from baseline and a negative value indicates a decrease.

Tarcoola Quarries
Revised Flooding Assessment

Afflux 5 percent AEP Existing Wagga Site Pits 3 and 4

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Figure 3

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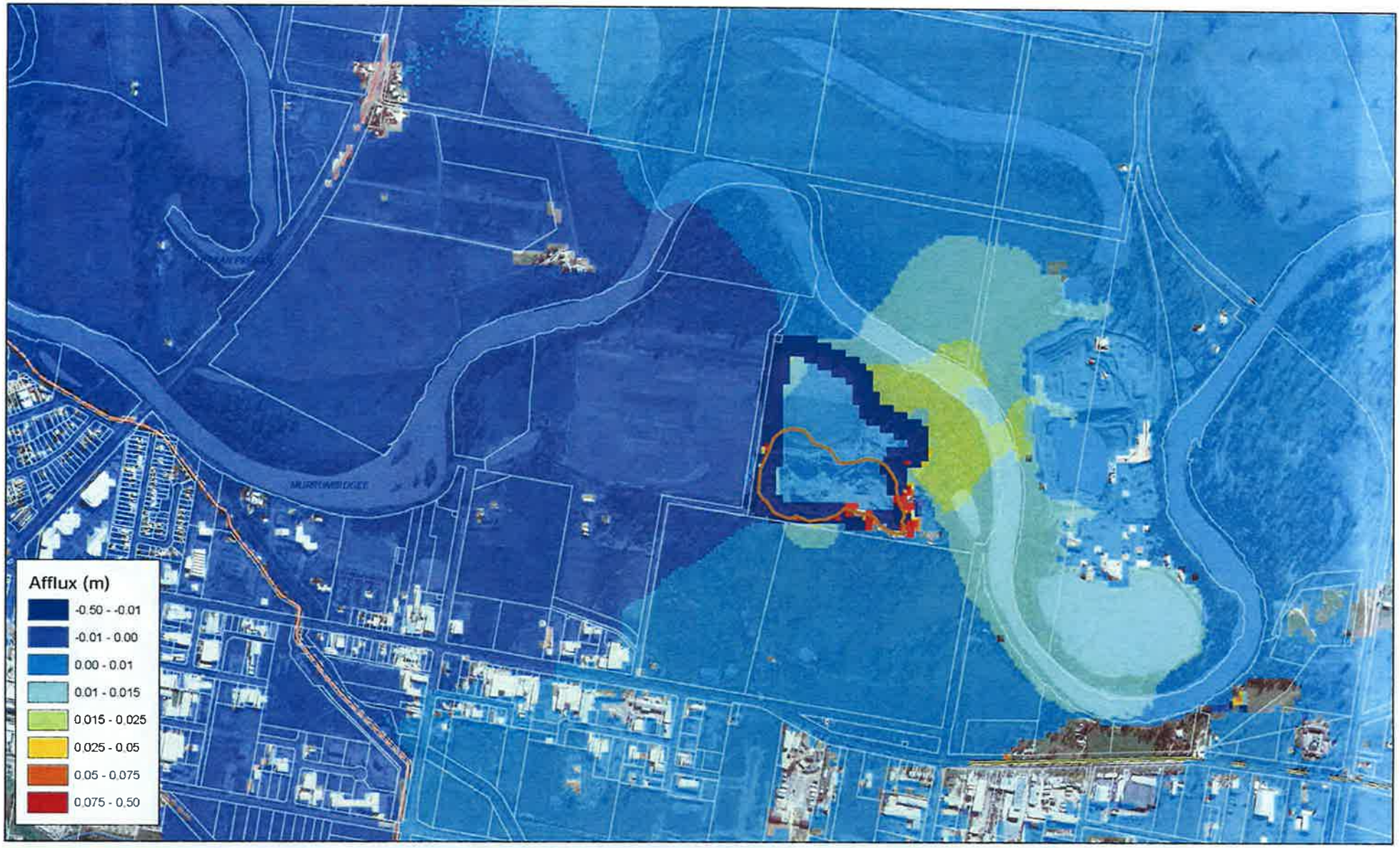

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

NOTES

1. Afflux represents the difference in flood depth between the proposed case and the baseline case where a positive value represents an increase from baseline and a negative value indicates a decrease.

Tarcoola Quarries
Revised Flooding Assessment

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Date 15 Aug 2014

Afflux 1 percent AEP Existing Wagga Site Pits 1 and 2

Figure 4

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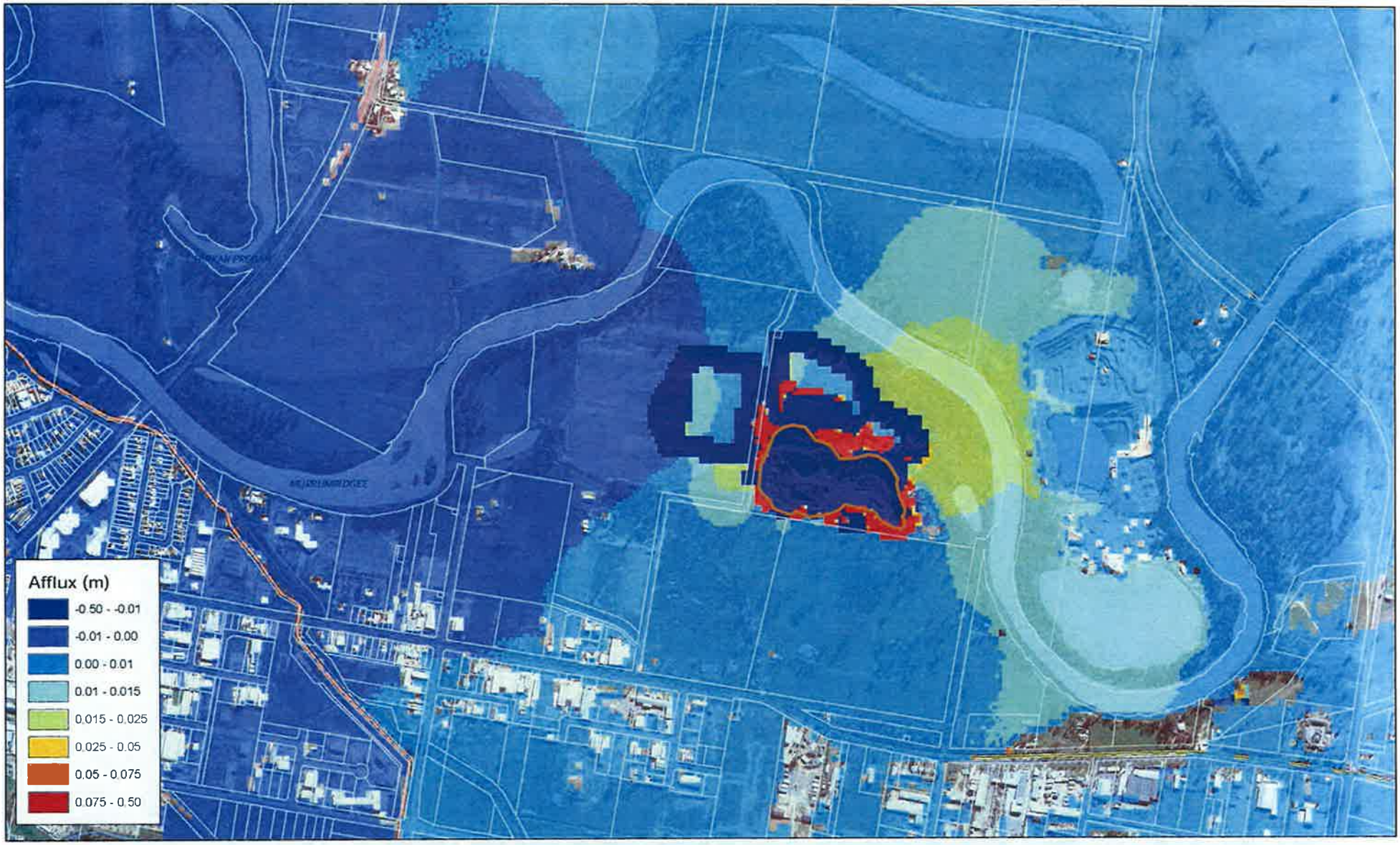

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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LEGEND

City levee

Existing Quarry Levee

NOTES

1. Afflux represents the difference in flood depth between the proposed case and the baseline case where a positive value represents an increase from baseline and a negative value indicates a decrease.

Tarcoola Quarries
Revised Flooding Assessment

Afflux 1 percent AEP Existing Wagga Site Pits 2 and 3

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Revision A
Date 15 Aug 2014

Figure 5

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: initialsley

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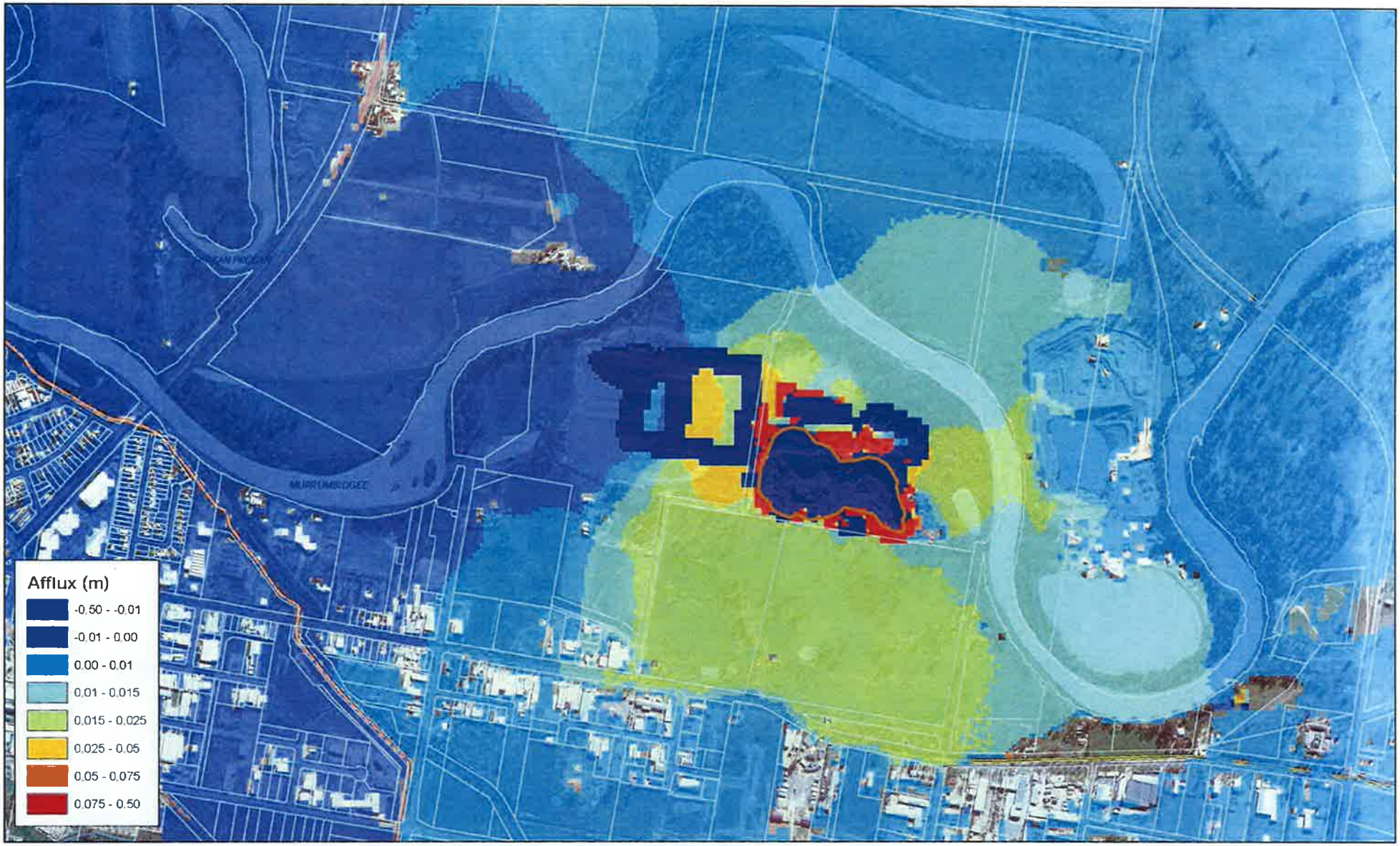

Paper Size A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

NOTES

1. Afflux represents the difference in flood depth between the proposed case and the baseline case where a positive value represents an increase from baseline and a negative value indicates a decrease.

Tarcoola Quarries
Revised Flooding Assessment

Job Number 23-14626-11
Revision A
Date 15 Aug 2014

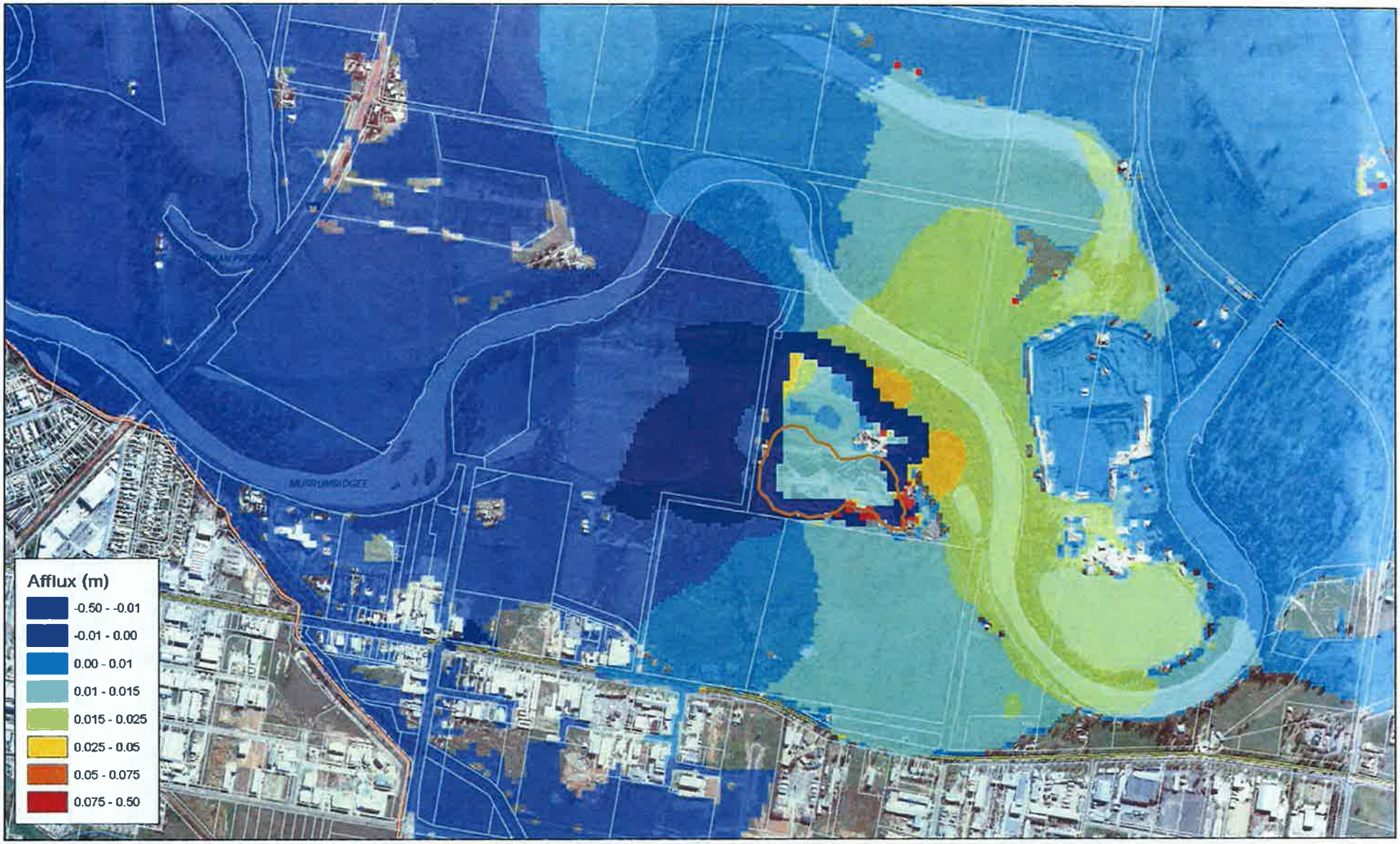
Afflux 1 percent AEP Existing Wagga Site Pits 3 and 4

Figure 6

G:\23\14626\GIS\Maps\Fig_6_2014_100yr_Afflux (m)_Wagga Wagga.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: nclasley

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com



Paper Size A3

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Metres

Map Projection Transverse Mercator
Horizontal Datum GDA 1994
Grid GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

NOTES

1. Afflux represents the difference in flood depth between the proposed case and the baseline case where a positive value represents an increase from baseline and a negative value indicates a decrease.

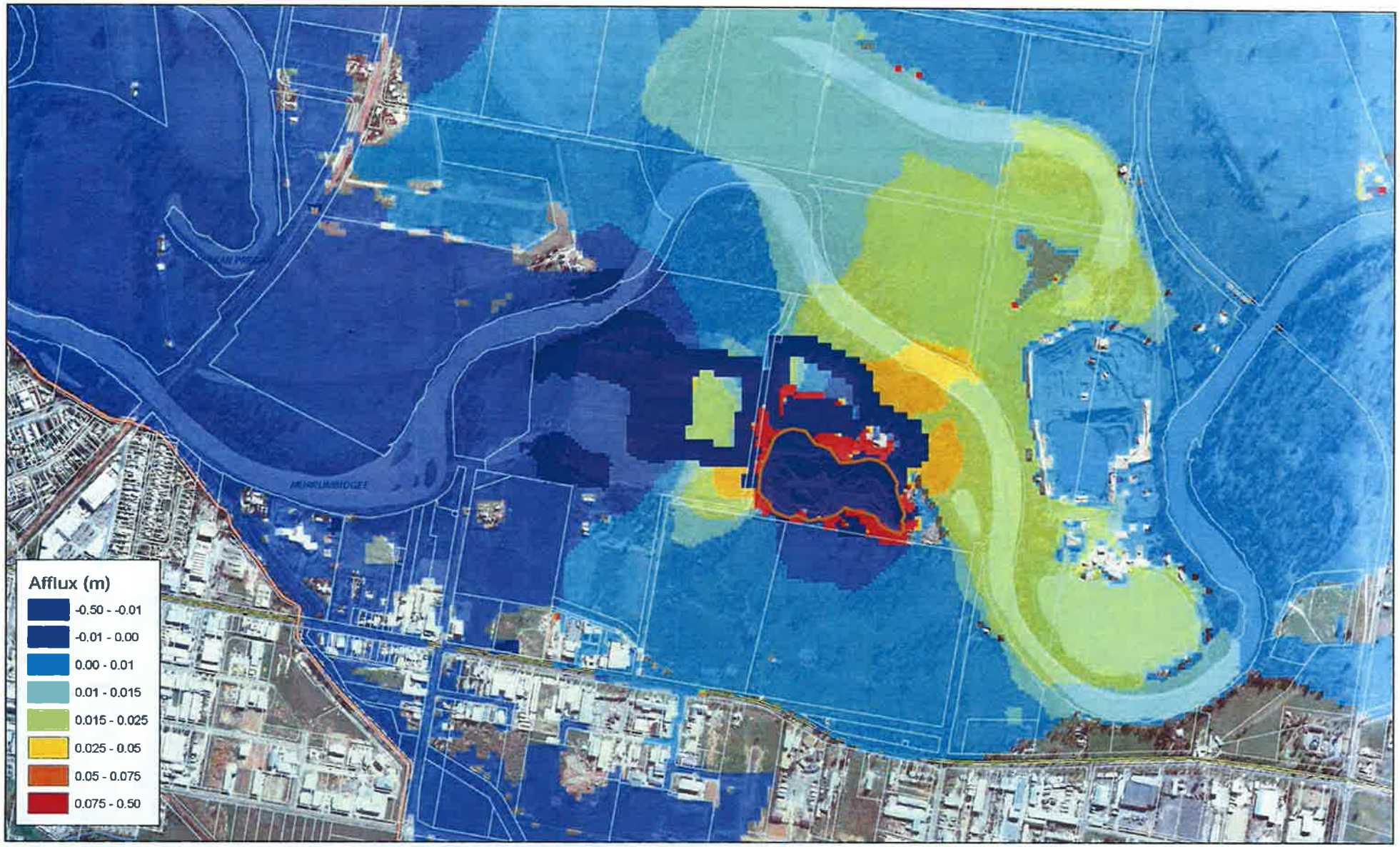
Tarcoola Quarries
Revised Flooding Assessment

Job Number 23-14626-11
Revision A
Date 15 Aug 2014

Afflux 5 percent AEP Future Wagga Site Pits 1 and 2

Figure 7

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com



Paper Size A3

0 45 90 180 270 360

Metres

Map Projection Transverse Mercator
Horizontal Datum GDA 1994
Grid GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

NOTES

1. Afflux represents the difference in flood depth between the proposed case and the baseline case where a positive value represents an increase from baseline and a negative value indicates a decrease.

Tarcoola Quarries
Revised Flooding Assessment

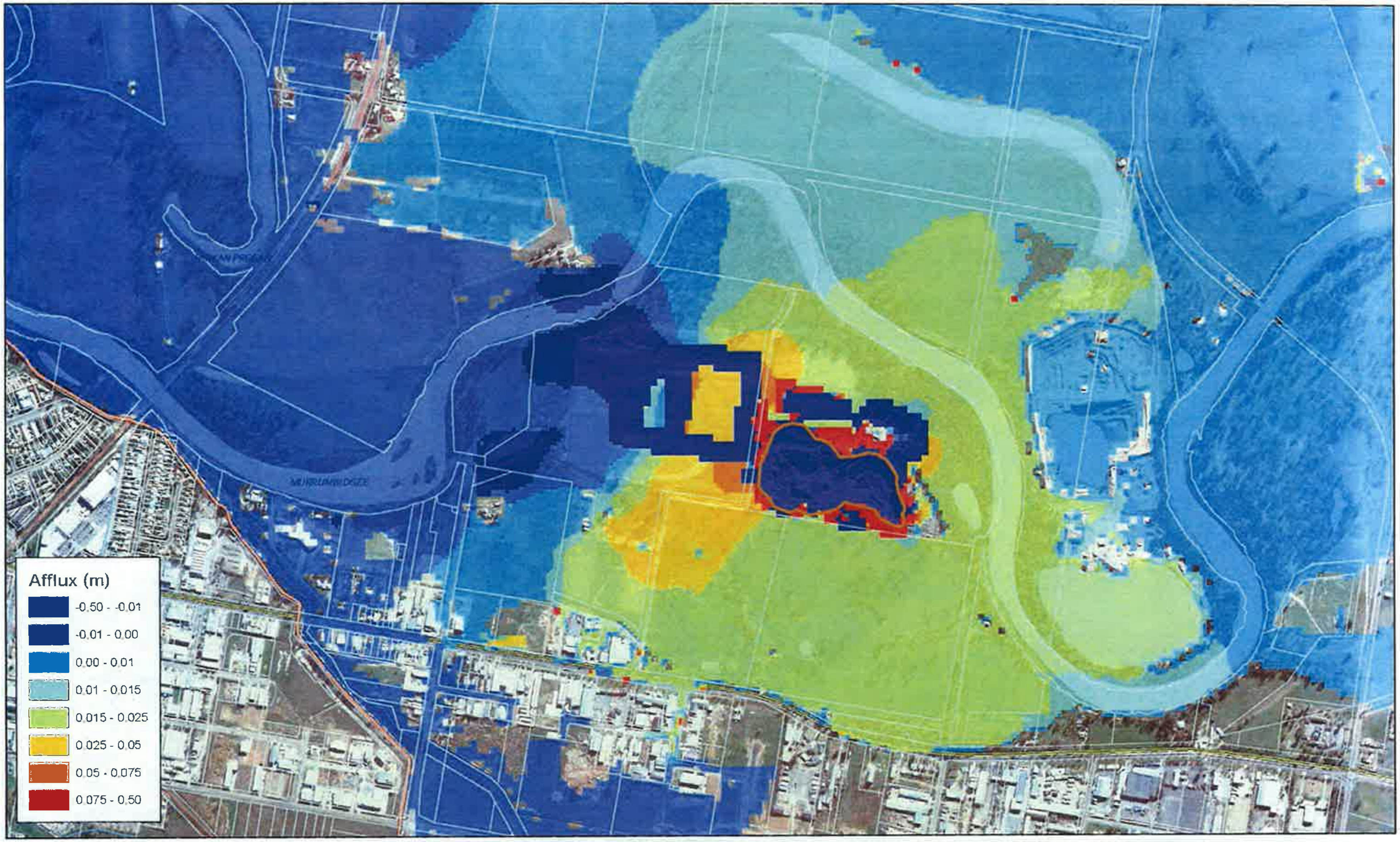
Job Number 23-14626-11
Revision A
Date 15 Aug 2014

Afflux 5 percent AEP Future Wagga
Site Pits 2 and 3

Figure 8

Data source: Data Custodian, Data Set Name/Title, Version/Date Created by initialery

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com



Paper Size A3

0 45 90 180 270 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

LEGEND

City levee

Existing Quarry Levee

NOTES

1. Afflux represents the difference in flood depth between the proposed case and the baseline case where a positive value represents an increase from baseline and a negative value indicates a decrease.

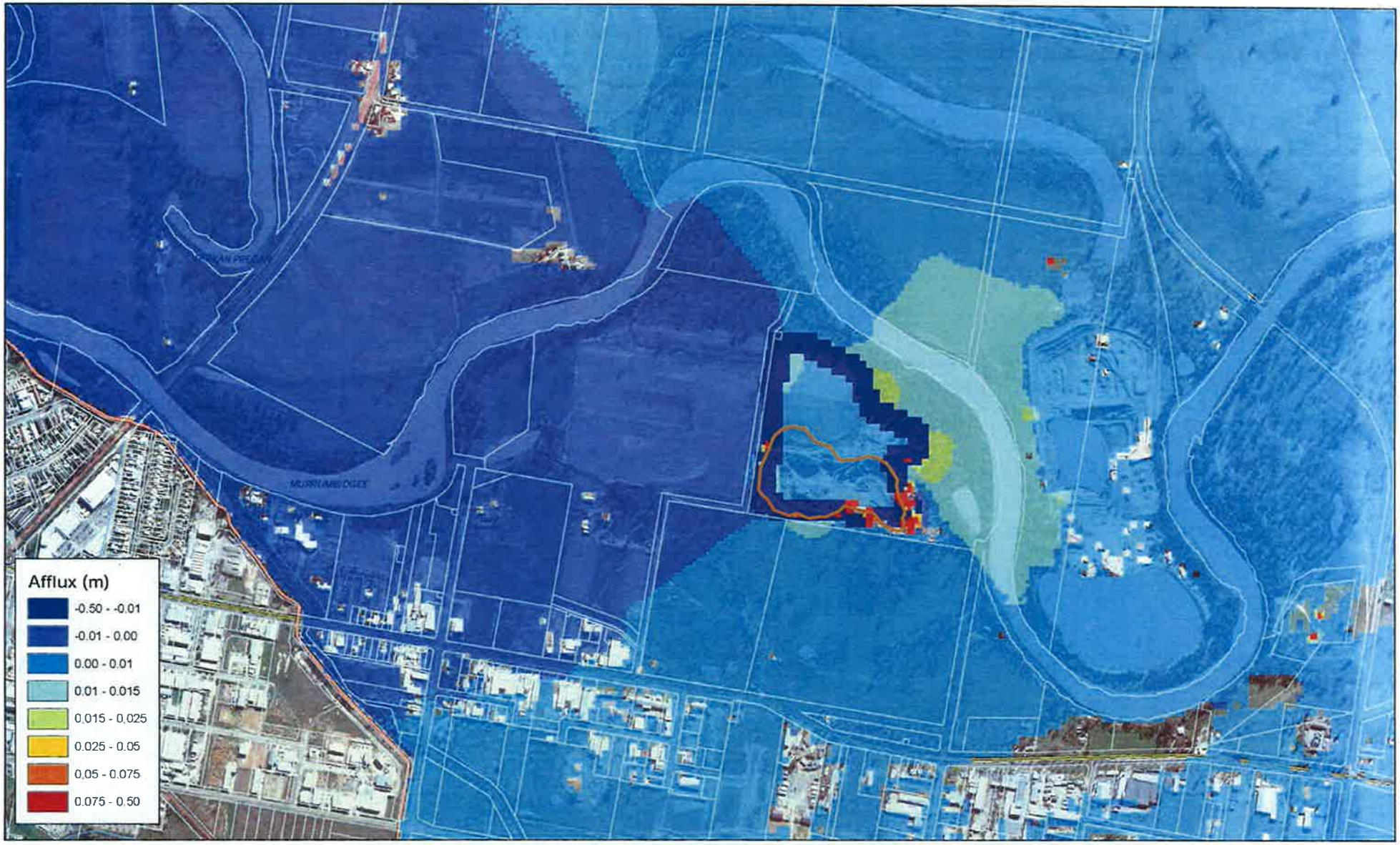
Tarcoola Quarries
Revised Flooding Assessment

Afflux 5 percent AEP Future Wagga
Site Pits 3 and 4

Job Number	23-14626-11
Revision	A
Date	15 Aug 2014

Figure 9

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com



Paper Size A3

0 45 90 180 270 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

NOTES

1. Afflux represents the difference in flood depth between the proposed case and the baseline case where a positive value represents an increase from baseline and a negative value indicates a decrease.

Tarcoola Quarries
Revised Flooding Assessment

Afflux 1 percent AEP Future Wagga
Site Pits 1 and 2

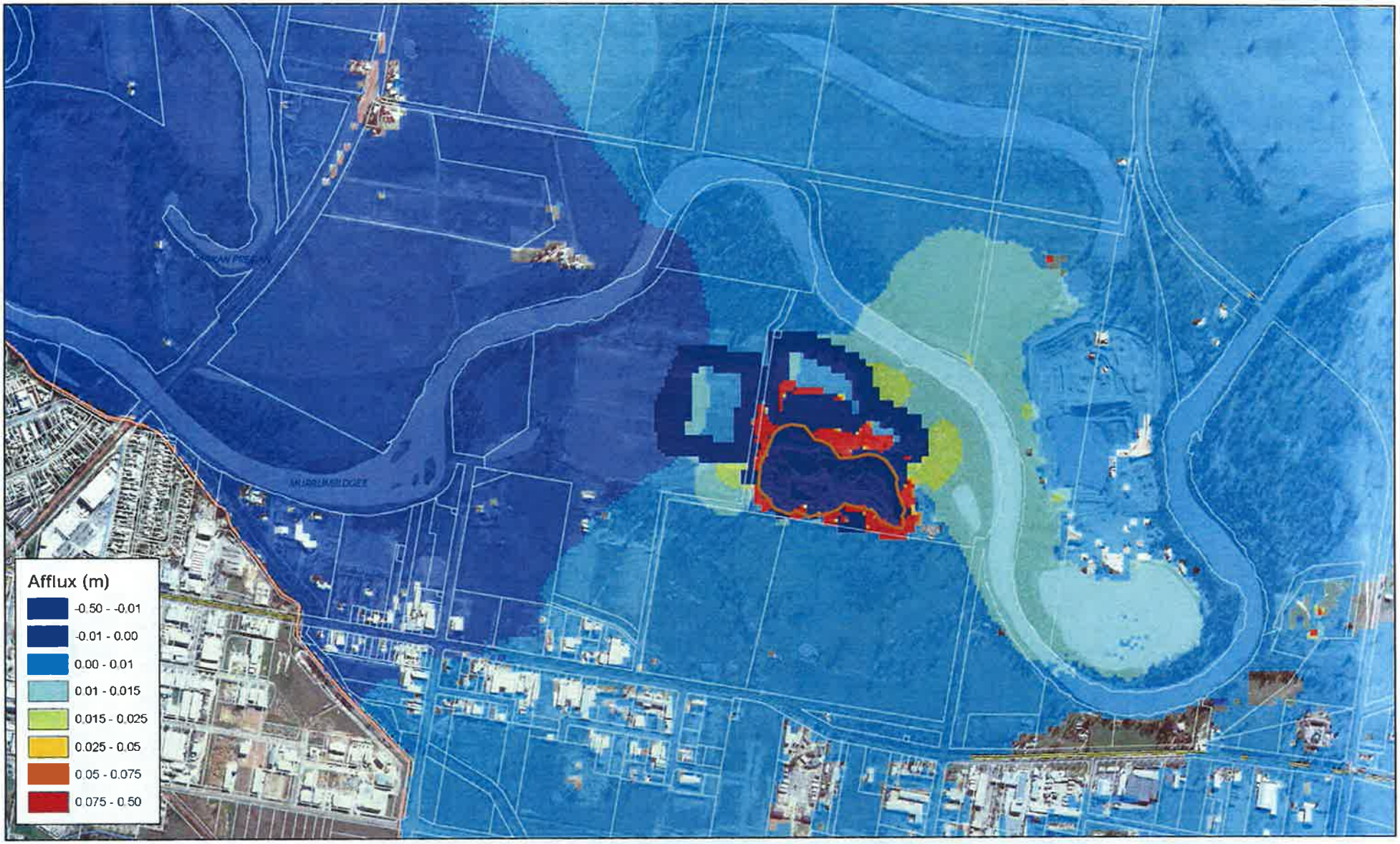
Job Number	23-14626-11
Revision	A
Date	15 Aug 2014

Figure 10

G:\23\14626\GIS\Mxd\Fig_10_2014_100yr_Afflux (m)_Wagga Wagga.mxd

Data source: Data Custodian; Data Set Name/Title, Version/Date. Created by: ncoakley

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com



Paper Size A3

0 45 90 180 270 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

NOTES

1. Afflux represents the difference in flood depth between the proposed case and the baseline case where a positive value represents an increase from baseline and a negative value indicates a decrease.

Tarcoola Quarries
Revised Flooding Assessment

Afflux 1 percent AEP Future Wagga Site Pits 2 and 3

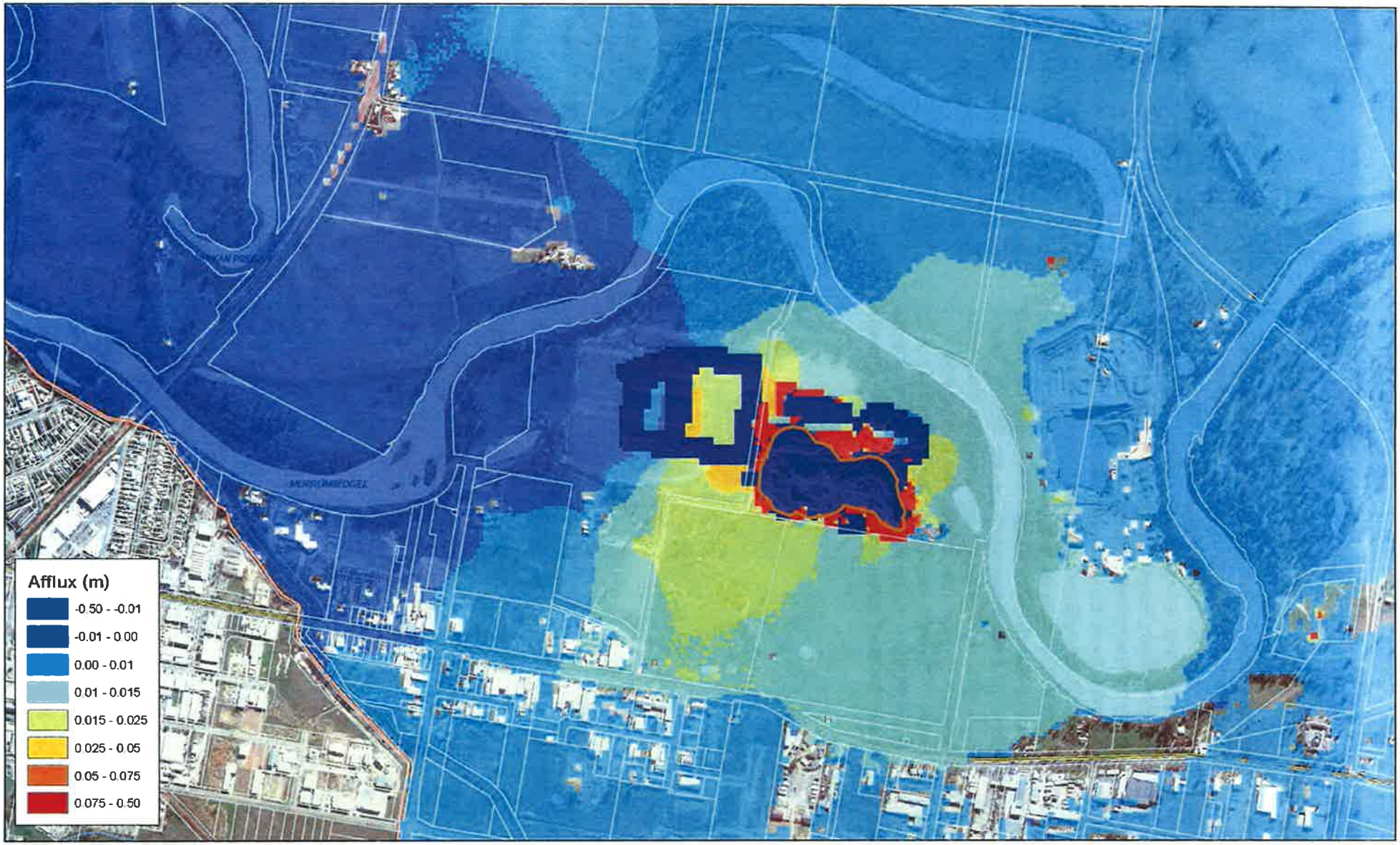
Figure 11

Job Number	23-14626-11
Revision	A
Date	15 Aug 2014

G:\23\14626\GIS\Maps\Fig 11_2014_100y_Afflux (m)_Wagga Wagga.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created By: nclailey

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com



Paper Size A3

0 45 90 180 270 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

NOTES

1. Afflux represents the difference in flood depth between the proposed case and the baseline case where a positive value represents an increase from baseline and a negative value indicates a decrease

Tarcoola Quarries
Revised Flooding Assessment

Afflux 1 percent AEP Future Wagga
Site Pits 3 and 4

Job Number 23-14626-11
Revision A
Date 15 Aug 2014

Figure 12

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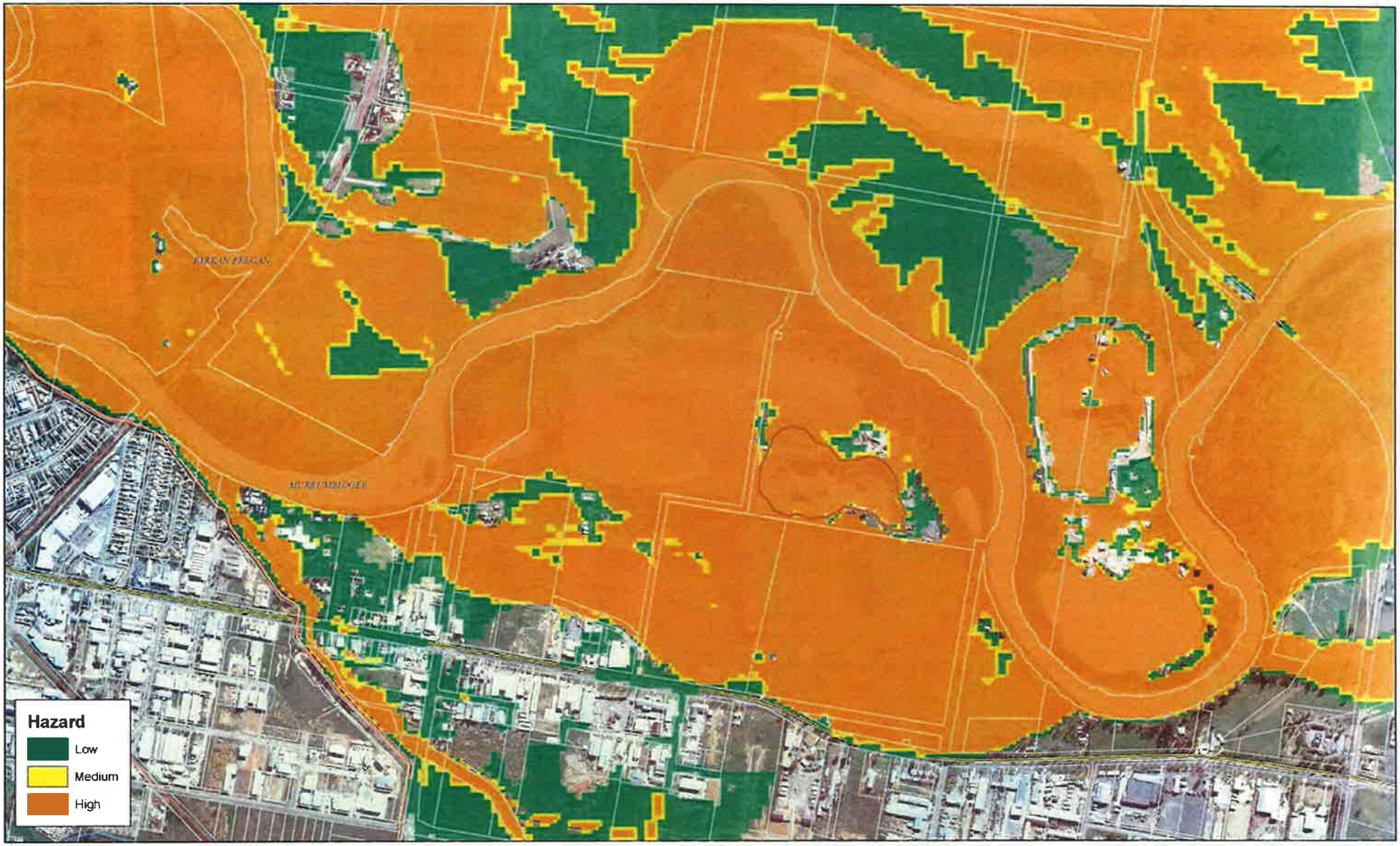
Appendix B – Flood Hazard Maps

Figure 13 Hazard 5% Event, Existing Wagga Levees, Existing Site
Figure 14 Hazard 5% Event, Existing Wagga Levees, Site Pits 1 and 2
Figure 15 Hazard 5% Event, Existing Wagga Levees, Site Pits 3 and 4
Figure 16 Hazard 5% Event, Existing Wagga Levees, Site Pits 3 and 4
Figure 17 Hazard 1% Event, Existing Wagga Levees, Existing Site
Figure 18 Hazard 1% Event, Existing Wagga Levees, Site Pits 1 and 2
Figure 19 Hazard 1% Event, Existing Wagga Levees, Site Pits 3 and 4
Figure 20 Hazard 1% Event, Existing Wagga Levees, Site Pits 3 and 4
Figure 21 Hazard 5% Event, Future Wagga Levees, Future Site
Figure 22 Hazard 5% Event, Future Wagga Levees, Site Pits 1 and 2
Figure 23 Hazard 5% Event, Future Wagga Levees, Site Pits 3 and 4
Figure 24 Hazard 5% Event, Future Wagga Levees, Site Pits 3 and 4
Figure 25 Hazard 1% Event, Future Wagga Levees, Future Site
Figure 26 Hazard 1% Event, Future Wagga Levees, Site Pits 1 and 2
Figure 27 Hazard 1% Event, Future Wagga Levees, Site Pits 3 and 4
Figure 28 Hazard 1% Event, Future Wagga Levees, Site Pits 3 and 4



Paper Size A3

0 45 90 180 270 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

Tarcoola Quarries
Revised Flooding Assessment

Job Number 23-14626-11
Revision A
Date 18 Aug 2014

Hazard 5 percent AEP Existing Wagga Levee
Existing Tarcoola Site

Figure 13

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: mcbasey

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com

Paper Size A3

0 45 90 180 270 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

GHD

Tarcoola Quarries
Revised Flooding Assessment

Hazard 5 percent AEP Existing Wagga Levee
Site Pits 1 and 2

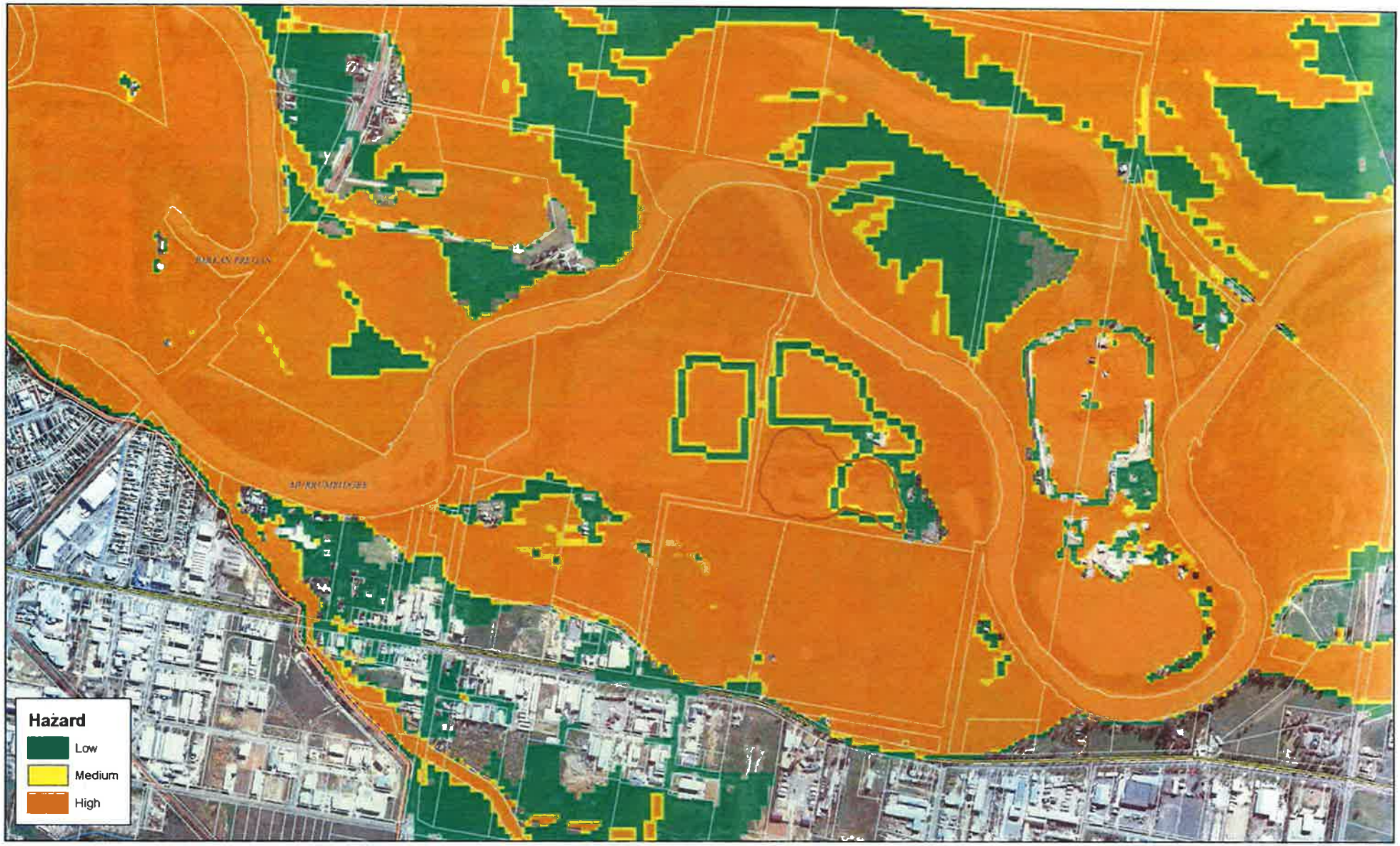
Figure 14

Job Number	23-14626-11
Revision	A
Date	18 Aug 2014

N:\AUSyd\Projects\23\14626\GIS\Maps\Fig_14_2014_20yr_Hazard_Wagga Wagga.mxd

Data source: Data Custodian; Data Set Name/Title, Version/Date. Created by: nclasley

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com



Paper Size A3

0 45 90 180 270 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

Tarcoola Quarries
Revised Flooding Assessment

Hazard 5 percent AEP Existing Wagga Levee
Site Pits 2 and 3

Figure 15

Job Number	23-14626-11
Revision	A
Date	18 Aug 2014

Data source: Data Custodian, Data Set name/Title, Version/Date. Created by: mcallery

160 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com

Paper Size A3

0 45 90 180 270 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

Tarcoola Quarries
Revised Flooding Assessment

Hazard 5 percent AEP Existing Wagga Levee
Site Pits 3 and 4

Figure 16

Job Number	23-14626-11
Revision	A
Date	18 Aug 2014

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com

Paper Size A3

0 45 90 180 270 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

GHD

Tarcoola Quarries
Revised Flooding Assessment

Job Number 23-14626-11
Revision A
Date 18 Aug 2014

Hazard 1 percent AEP Existing Wagga Levee
Existing Tarcoola Site

Figure 17

N:\AUSydney\Projects\23\14626\GIS\Maps\Fig_17_2014_100yr_Hazard_Wagga Wagga.mxd

Data source: Data Custodian, Data Set Name/File, Version/Date Created by author/y

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com

Paper Size A3

0 45 90 180 270 360

Metres

Map Projection Transverse Mercator
Horizontal Datum GDA 1994
Grid GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

GHD

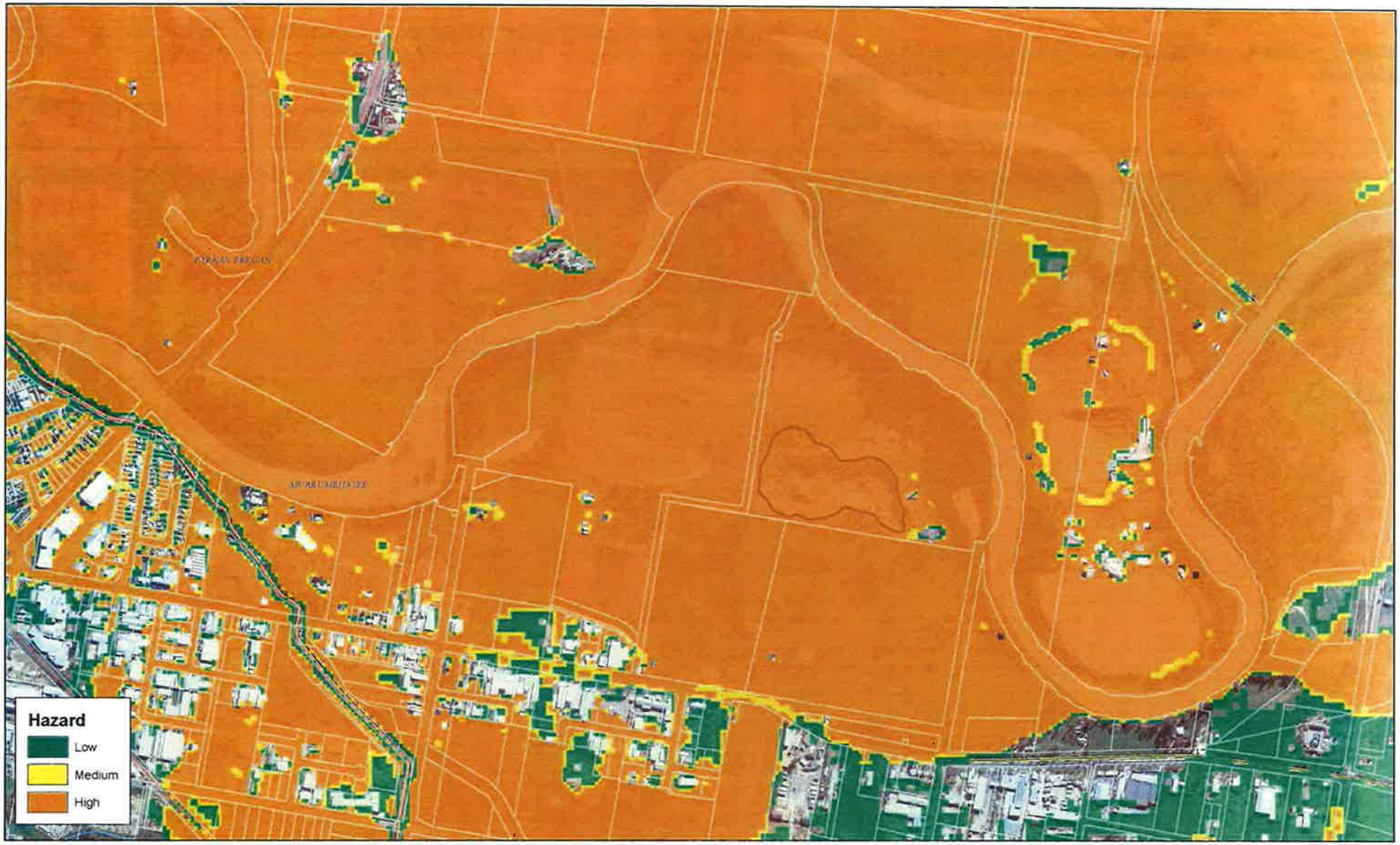
Tarcoola Quarries
Revised Flooding Assessment

Hazard 1 percent AEP Existing Wagga Levee
Site Pits 1 and 2

Figure 18

Job Number	23-14626-11
Revision	A
Date	18 Aug 2014

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com



Paper Size A3

0 45 90 180 270 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

Tarcoola Quarries
Revised Flooding Assessment

Job Number 23-14626-11
Revision A
Date 18 Aug 2014

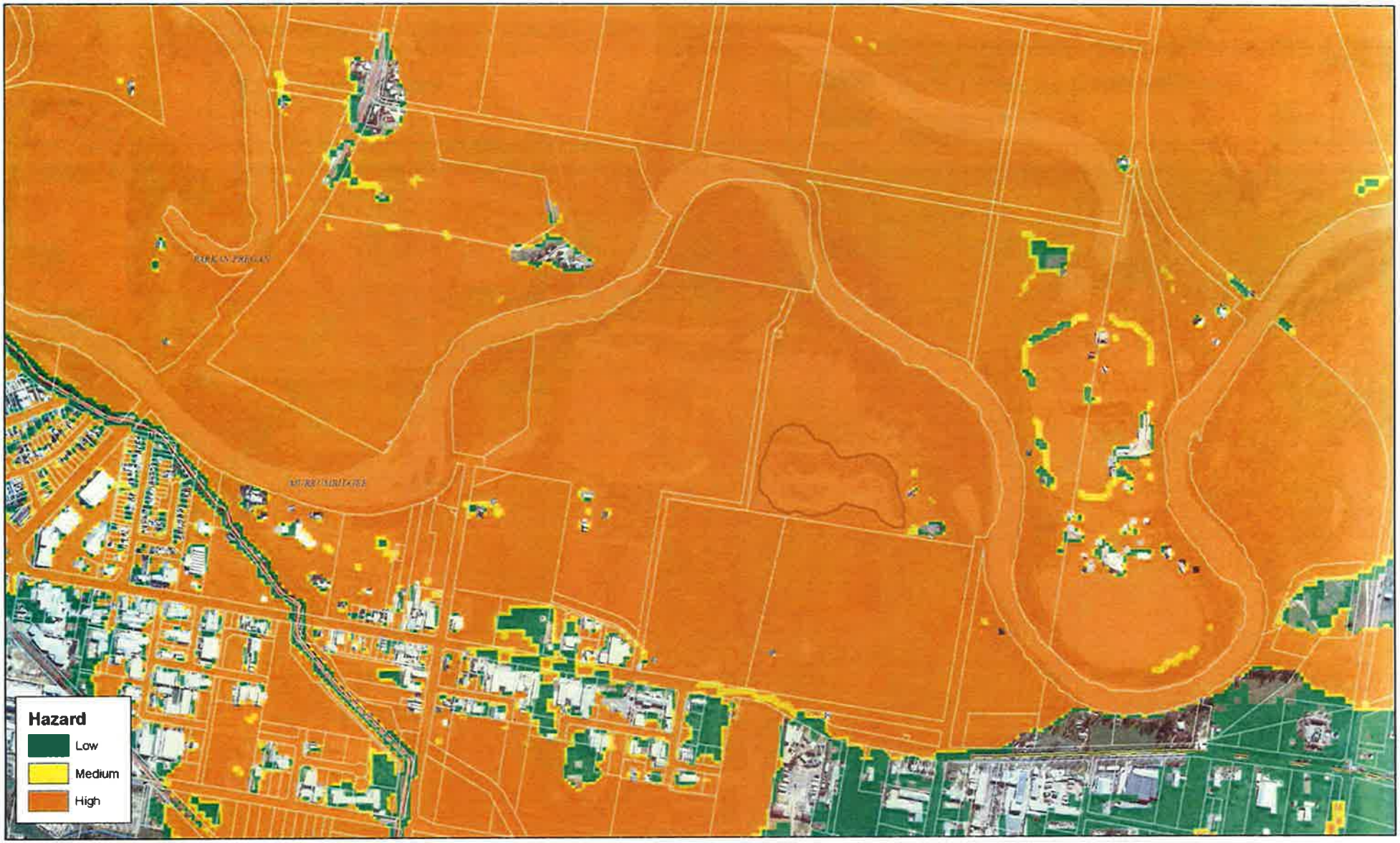
Hazard 1 percent AEP Existing Wagga Levee
Site Pits 2 and 3

Figure 19

N:\AU\Sydney\Projects\23\14626\GIS\Maps\Fig_19_2014_100yr_Hazard_Wagga Wagga.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: nctolley

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com



Paper Size A3

0 45 90 180 270 360

Metres

Map Projection Transverse Mercator
Horizontal Datum GDA 1994
Grid GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

Tarcoola Quarries
Revised Flooding Assessment

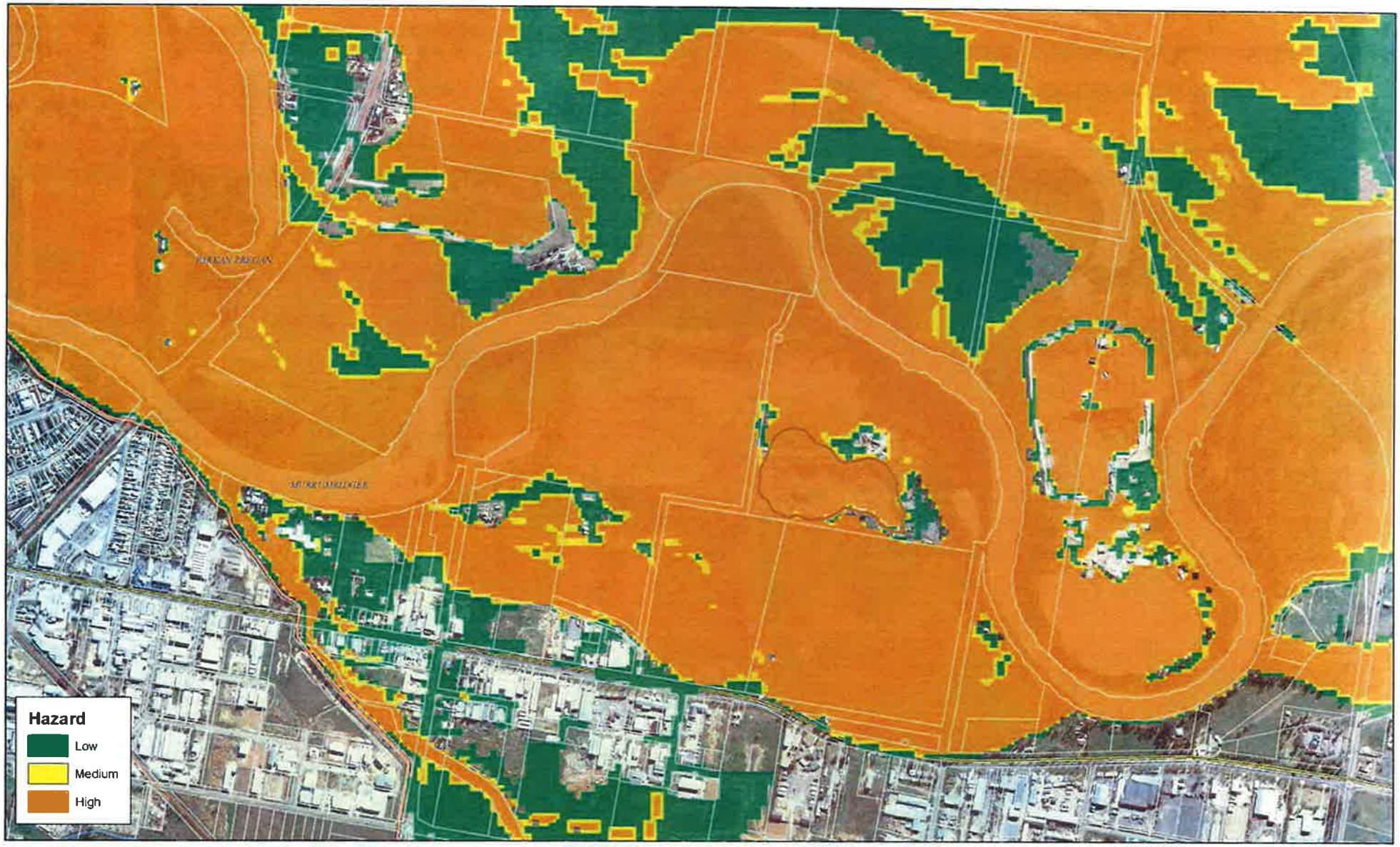
Job Number 23-14626-11
Revision A
Date 18 Aug 2014

Hazard 1 percent AEP Existing Wagga Levee
Site Pits 3 and 4

Figure 20

Data source: Data Custodian, Data Set Name/Title, version/Date. Created by ndDalley

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com



Paper Size A3

0 45 90 180 270 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

Tarcoola Quarries
Revised Flooding Assessment

Job Number 23-14626-11
Revision A
Date 18 Aug 2014

Hazard 5 percent AEP Future Wagga Levee
Existing Tarcoola Site

Figure 21

Data source: Data Custodian; Data Set Name/Title; Version/Date. Created by: mbailey

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com

Paper Size A3

0 45 90 180 270 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

GHD

Tarcoola Quarries
Revised Flooding Assessment

Hazard 5 percent AEP Future Wagga Levee
Site Pits 1 and 2

Figure 22

Job Number 23-14626-11
Revision A
Date 18 Aug 2014

N:\AU\Sydney\Projects\23\14626\GIS\Maps\Fig_22_2014_20yr_Hazard_Wagga Wagga.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: initials

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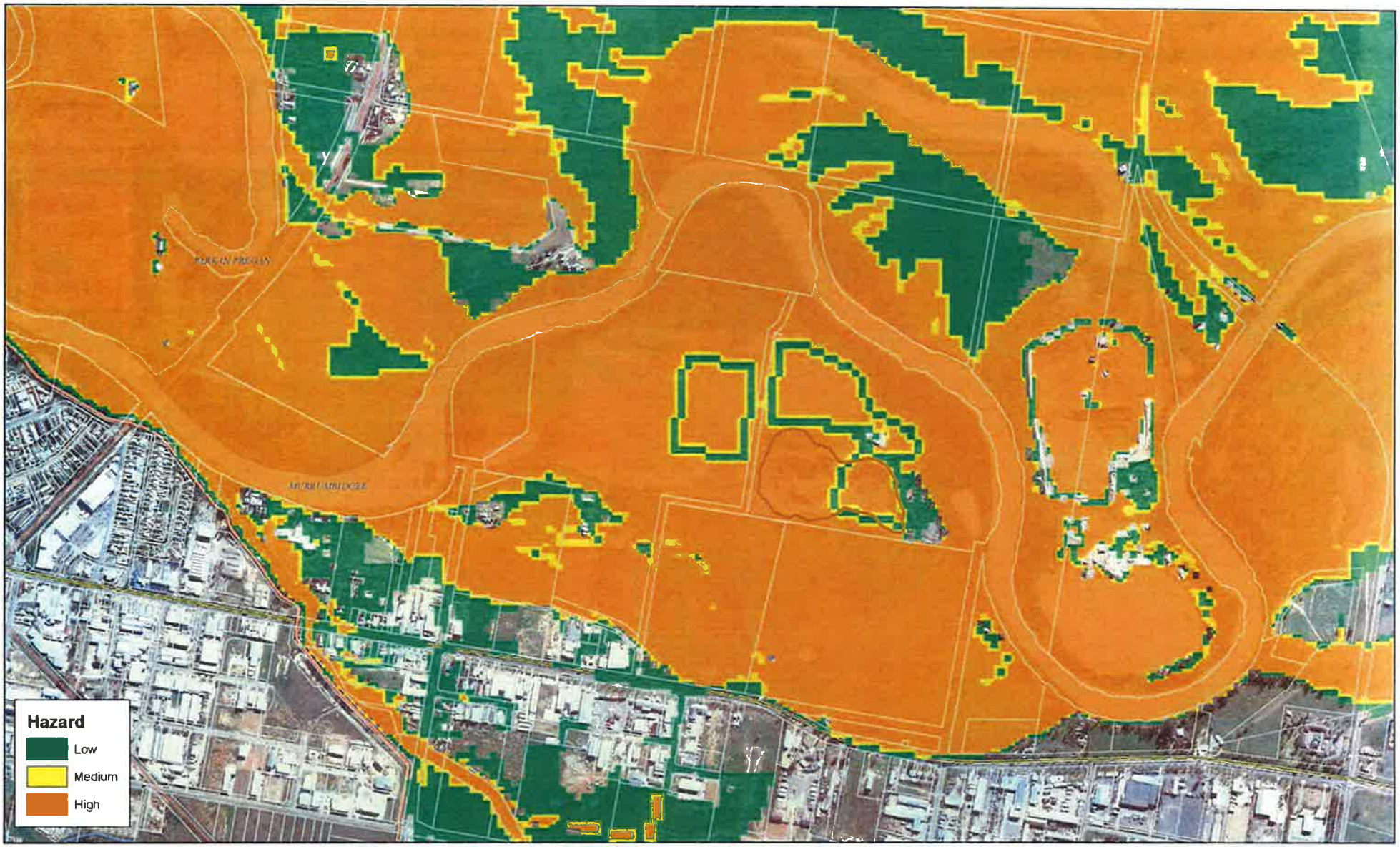

Paper Size A3

0 45 90 180 270 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

GHD

Tarcoola Quarries
Revised Flooding Assessment

Hazard 5 percent AEP Future Wagga Levee
Site Pits 2 and 3

Job Number 23-14626-11
Revision A
Date 18 Aug 2014

Figure 23

N:\AUS\Sydney\Projects\23\14626\GIS\Maps\Fig_23_2014_5Dyr_Hazard_Wagga Wagga.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: ACbailey

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com

Paper Size A3

0 45 90 180 270 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

GHD

Tarcoola Quarries
Revised Flooding Assessment

Job Number 23-14626-11
Revision A
Date 18 Aug 2014

Hazard 5 percent AEP Future Wagga Levee
Site Pits 3 and 4

Figure 24

N:\AU\Sydney\Projects\23\14626\GIS\Maps\MXD_24_2014_50yr_Hazard_Wagga Wagga.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: nbosley

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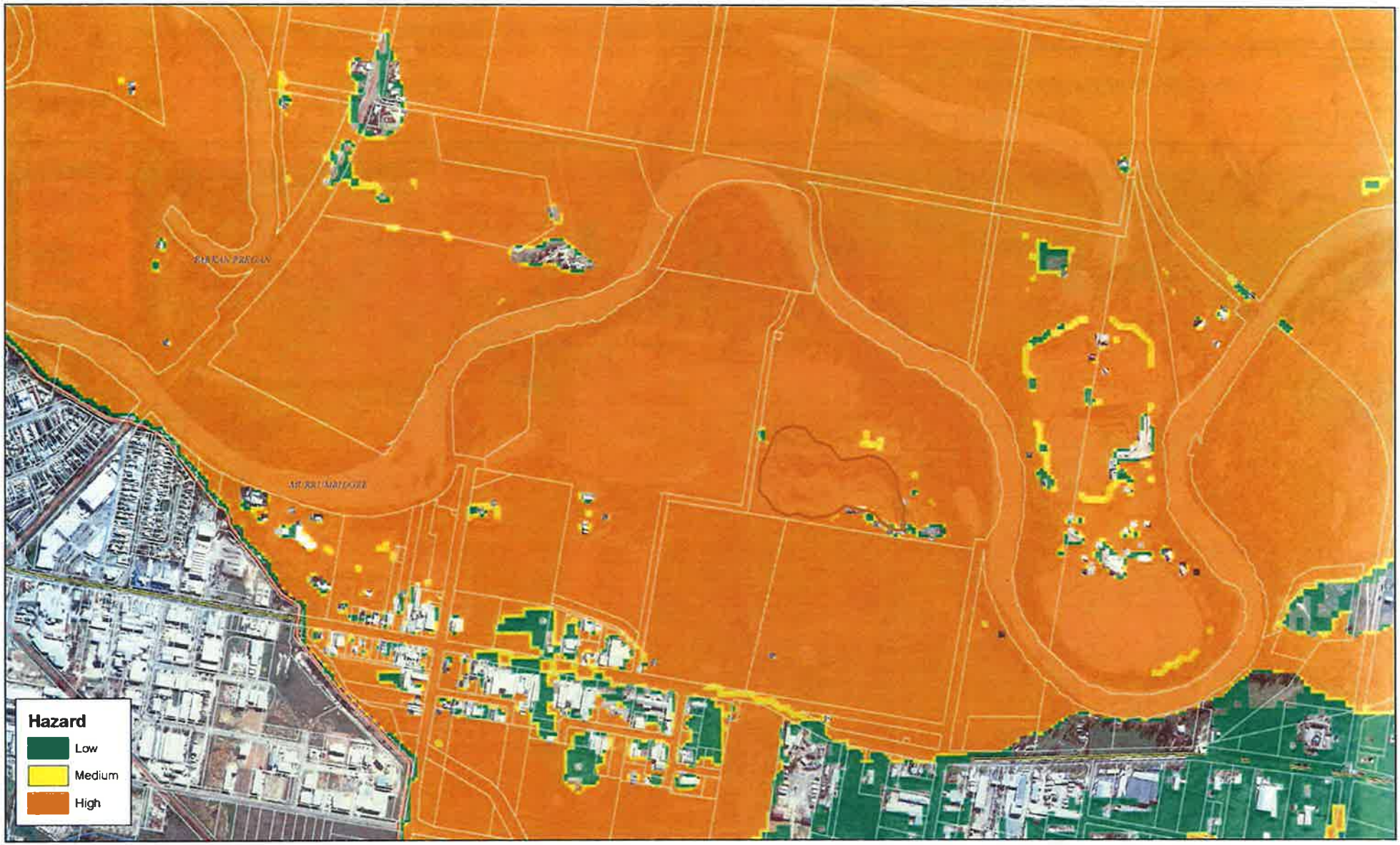

Paper Size A3

0 45 90 180 270 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

Tarcoola Quarries
Revised Flooding Assessment

Job Number 23-14626-11
Revision A
Date 18 Aug 2014

Hazard 1 percent AEP Future Wagga Levee
Existing Tarcoola Site

Figure 25

N:\AU\Sydney\Projects\23\14626\GIS\Maps\Fig_25_2014_100yr_Hazard_Wagga.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created By: rcbaley

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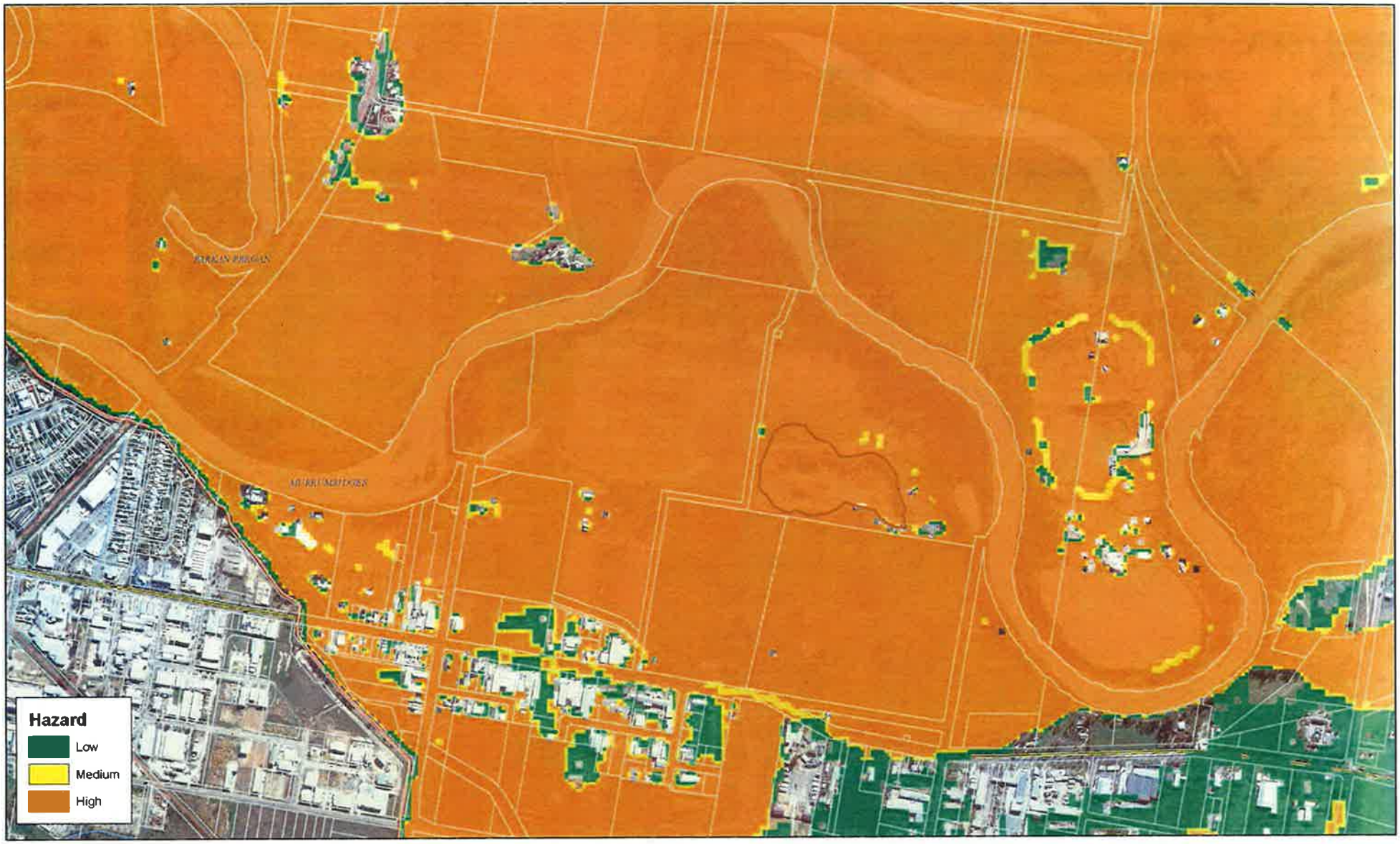


Paper Size A3

0 45 90 180 270 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

Tarcoola Quarries
Revised Flooding Assessment

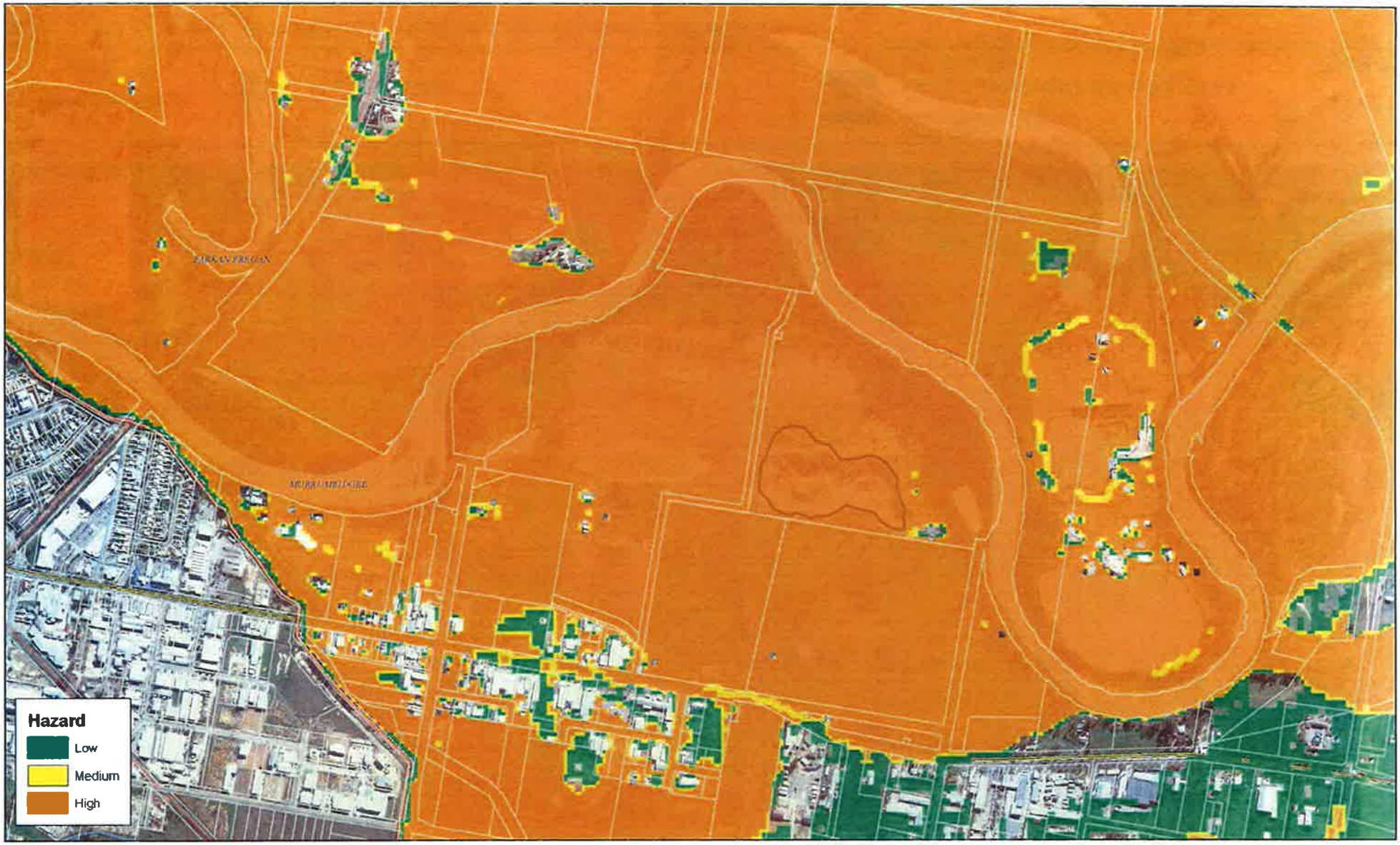
Hazard 1 percent AEP Future Wagga Levee
Site Pits 1 and 2

Job Number 23-14626-11
Revision A
Date 18 Aug 2014

Figure 26

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: mdaley

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com



Paper Size A3

0 45 90 180 270 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

GHD

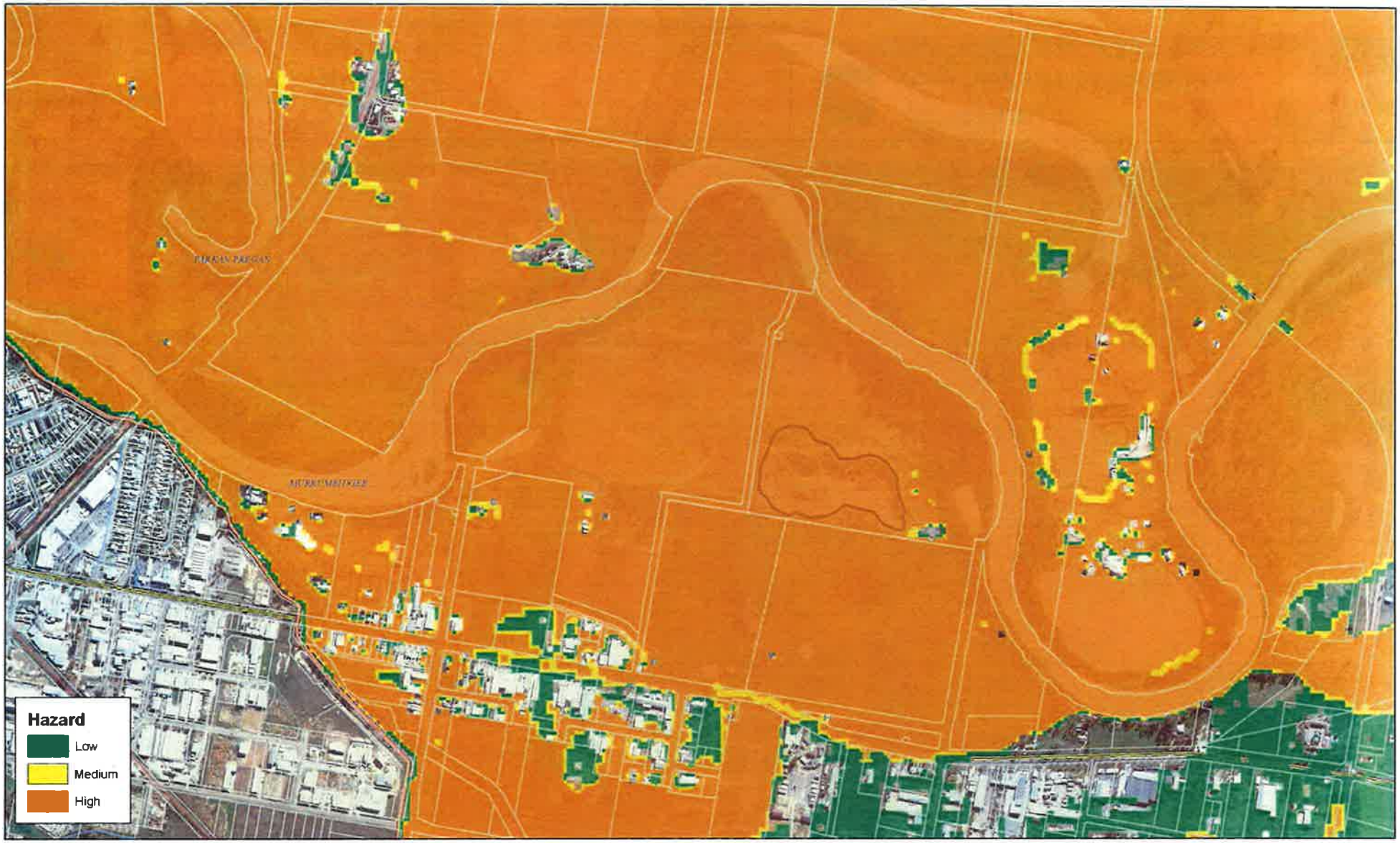
Tarcoola Quarries
Revised Flooding Assessment

Job Number 23-14626-11
Revision A
Date 18 Aug 2014

Hazard 1 percent AEP Future Wagga Levee Site Pits 2 and 3

Figure 27

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com



Paper Size A3

0 45 90 180 270 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

Tarcoola Quarries
Revised Flooding Assessment

Hazard 1 percent AEP Future Wagga Levee
Site Pits 3 and 4

Figure 28

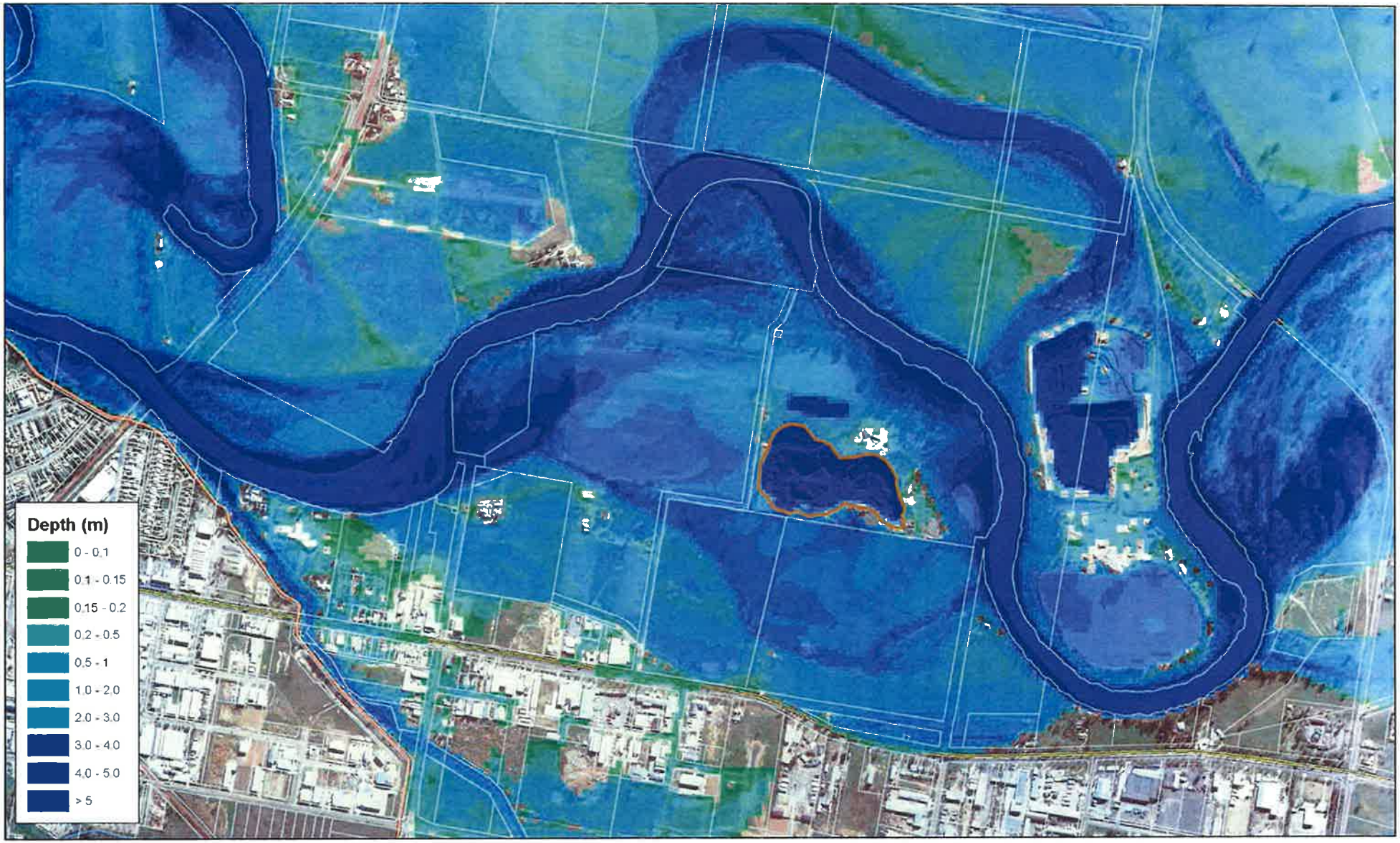
Job Number	23-14626-11
Revision	A
Date	18 Aug 2014

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: xxxxxxx

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com

Appendix C – Flood Depth Maps

Figure 29 Depth 5% Event, Existing Wagga Levees, Existing Site
Figure 30 Depth 5% Event, Existing Wagga Levees, Site Pits 1 and 2
Figure 31 Depth 5% Event, Existing Wagga Levees, Site Pits 3 and 4
Figure 32 Depth 5% Event, Existing Wagga Levees, Site Pits 3 and 4
Figure 33 Depth 1% Event, Existing Wagga Levees, Existing Site
Figure 34 Depth 1% Event, Existing Wagga Levees, Site Pits 1 and 2
Figure 35 Depth 1% Event, Existing Wagga Levees, Site Pits 3 and 4
Figure 36 Depth 1% Event, Existing Wagga Levees, Site Pits 3 and 4
Figure 37 Depth 5% Event, Future Wagga Levees, Future Site
Figure 38 Depth 5% Event, Future Wagga Levees, Site Pits 1 and 2
Figure 39 Depth 5% Event, Future Wagga Levees, Site Pits 3 and 4
Figure 40 Depth 5% Event, Future Wagga Levees, Site Pits 3 and 4
Figure 41 Depth 1% Event, Future Wagga Levees, Future Site
Figure 42 Depth 1% Event, Future Wagga Levees, Site Pits 1 and 2
Figure 43 Depth 1% Event, Future Wagga Levees, Site Pits 3 and 4
Figure 44 Depth 1% Event, Future Wagga Levees, Site Pits 3 and 4



Paper Size A3

0 45 90 180 270 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
GRID: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

Tarcoola Quarries
Revised Flooding Assessment

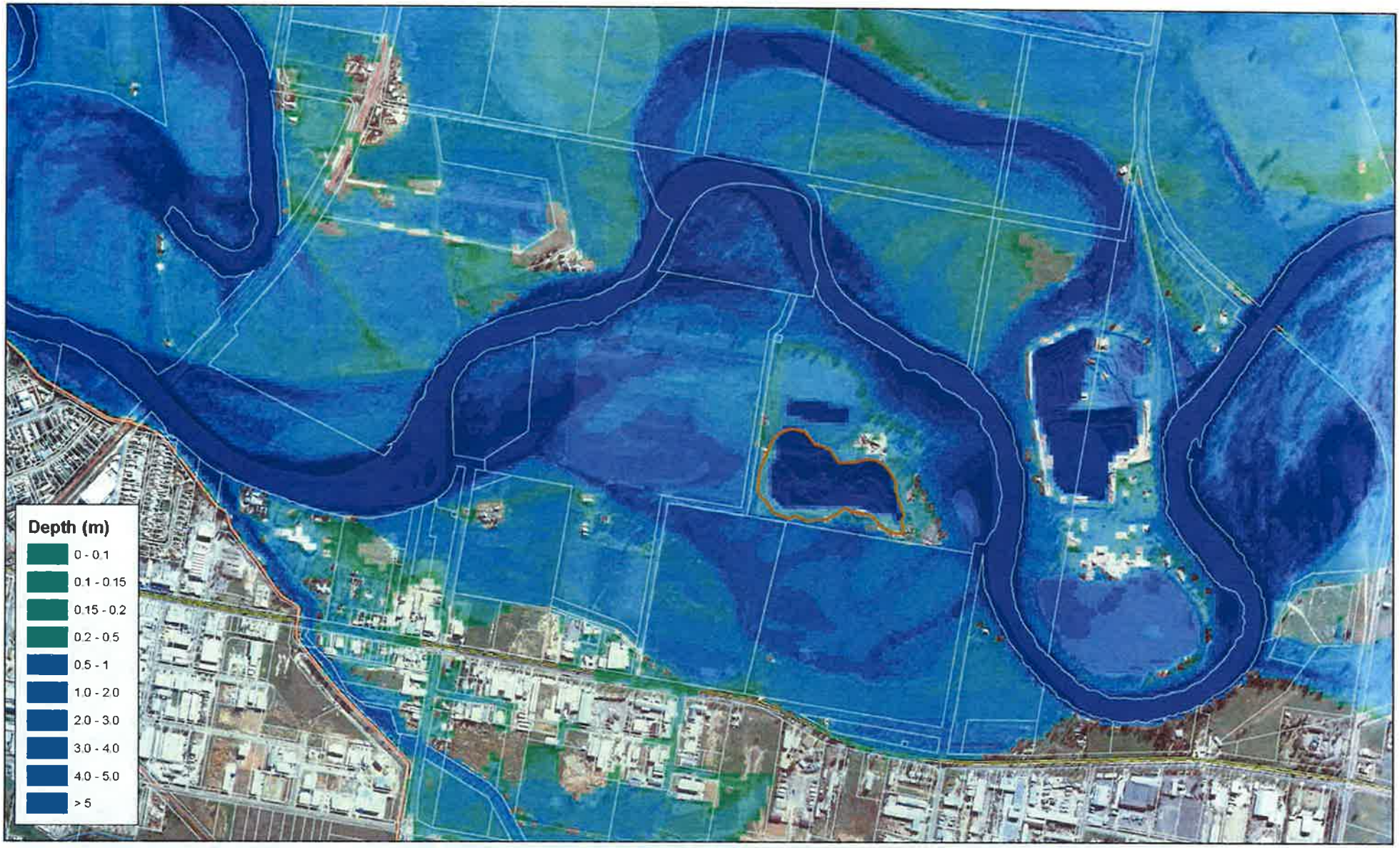
Depth 5 percent AEP Existing Wagga Levee
Existing Tarcoola Site

Figure 29

Job Number	23-14626-11
Revision	A
Date	18 Aug 2014

N:\AU\Sydney\Projects\23\14626\GIS\Maps\Fig_29_2014_05yr_Depth_5m_Wagga Wagga.mxd

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com



Paper Size A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

GHD

Tarcoola Quarries
Revised Flooding Assessment

Depth 5 percent AEP Existing Wagga Levee
Site Pits 1 and 2

Figure 30

Job Number	23-14626-11
Revision	A
Date	16 Aug 2014

N:\AUS\Sydney\Projects\23\14626\GIS\Maps\Fig_30_2014_05yr_Depth (m)_Wagga Wagga.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created By: nbowery

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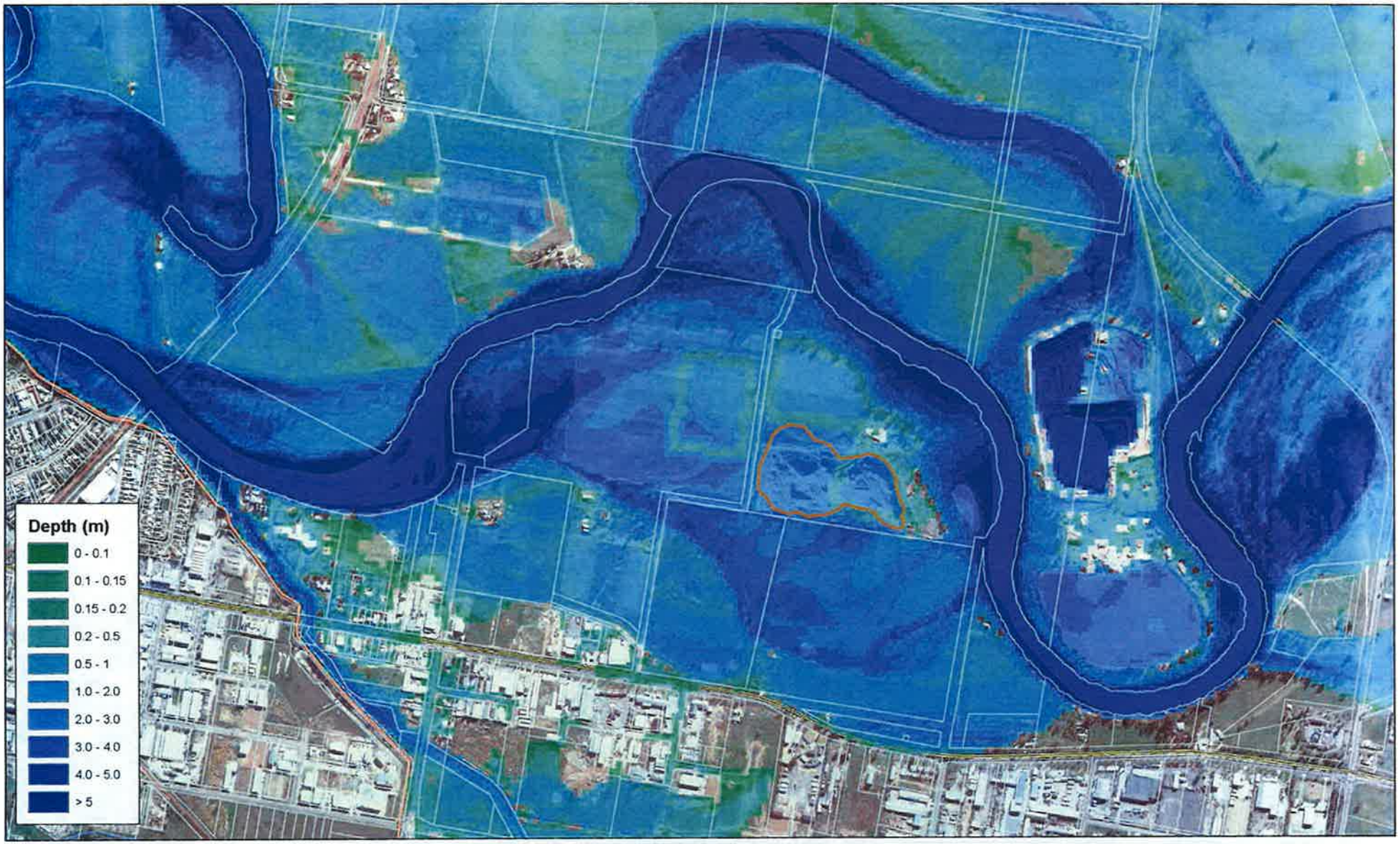

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

Tarcoola Quarries
Revised Flooding Assessment

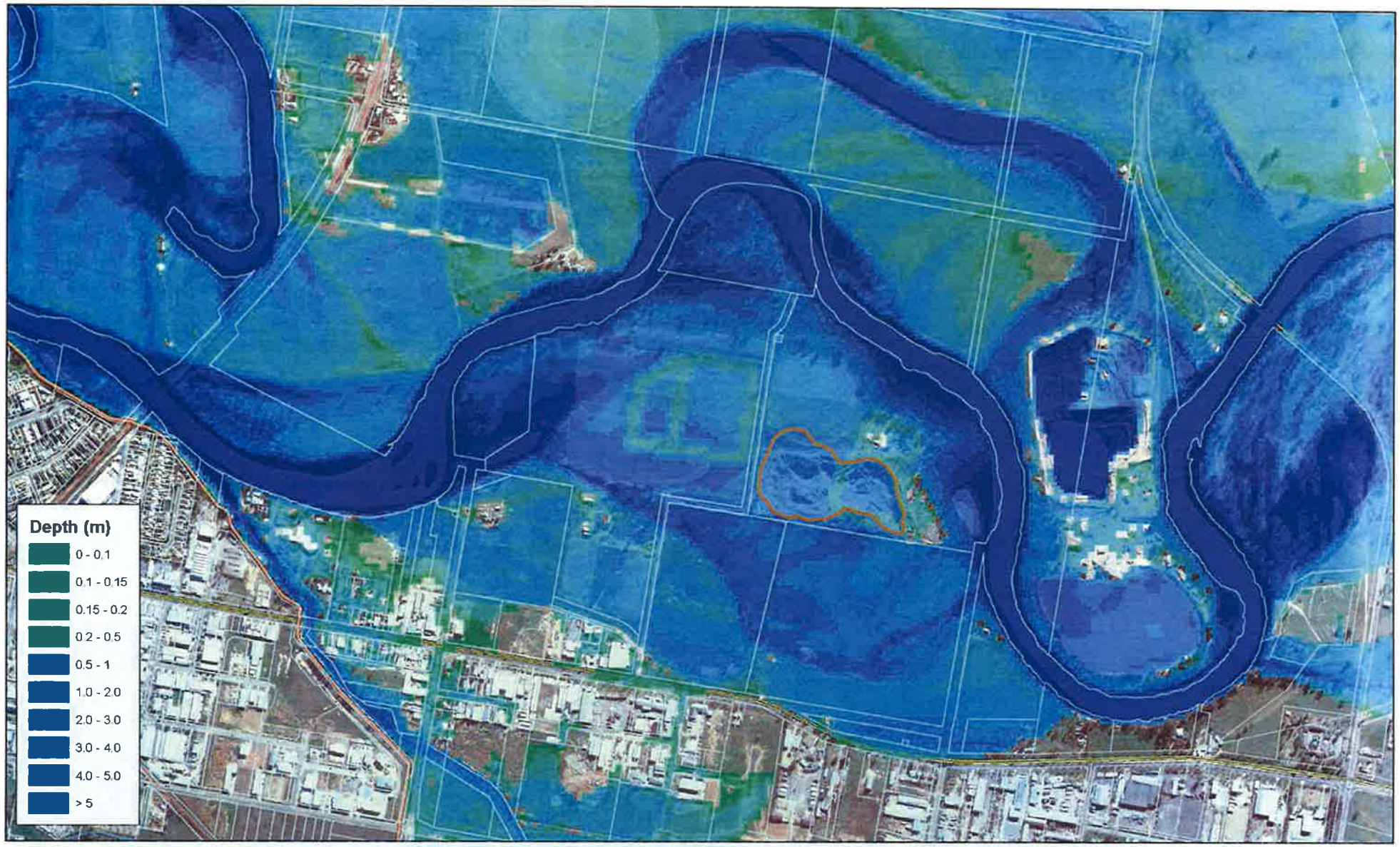
Depth 5 percent AEP Existing Wagga Levee
Site Pits 2 and 3

Figure 31

Job Number	23-14626-11
Revision	A
Date	18 Aug 2014

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: ndewey

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

Tarcoola Quarries
Revised Flooding Assessment

Depth 5 percent AEP Existing Wagga Levee
Site Pits 3 and 4

Figure 32

Job Number	23-14626-11
Revision	A
Date	18 Aug 2014

N:\AU\Sydney\Projects\23\14626\GIS\Maps\Fig_32_2014_20yr_Depth (m)_Wagga Wagga.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: mcbailey

160 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com

Paper Size A3

0 45 90 180 270 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

Tarcoola Quarries
Revised Flooding Assessment

Depth 1 percent AEP Existing Wagga Levee
Existing Tarcoola Site

Figure 33

Job Number	23-14626-11
Revision	A
Date	18 Aug 2014

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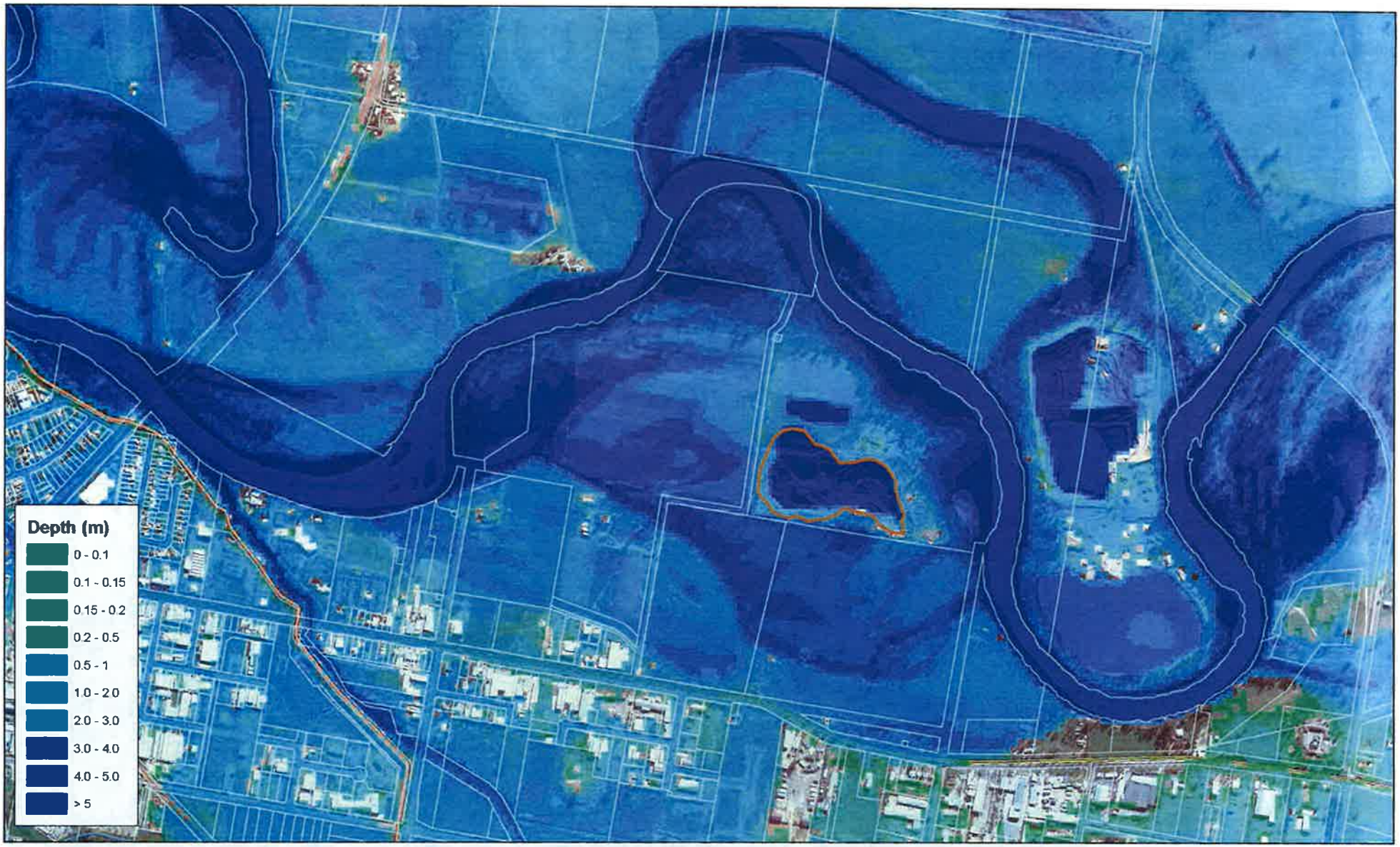
Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: nbailey



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

Tarcoola Quarries
Revised Flooding Assessment

Job Number 23-14626-11
Revision A
Date 18 Aug 2014

Depth 1 percent AEP Existing Wagga Levee
Site Pits 1 and 2

Figure 34

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: ncoatley

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com

Paper Size A3

0 45 90 180 270 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

GHD

Tarcoola Quarries
Revised Flooding Assessment

Depth 1 percent AEP Existing Wagga Levee
Site Pits 2 and 3

Job Number	23-14626-11
Revision	A
Date	18 Aug 2014

Figure 35

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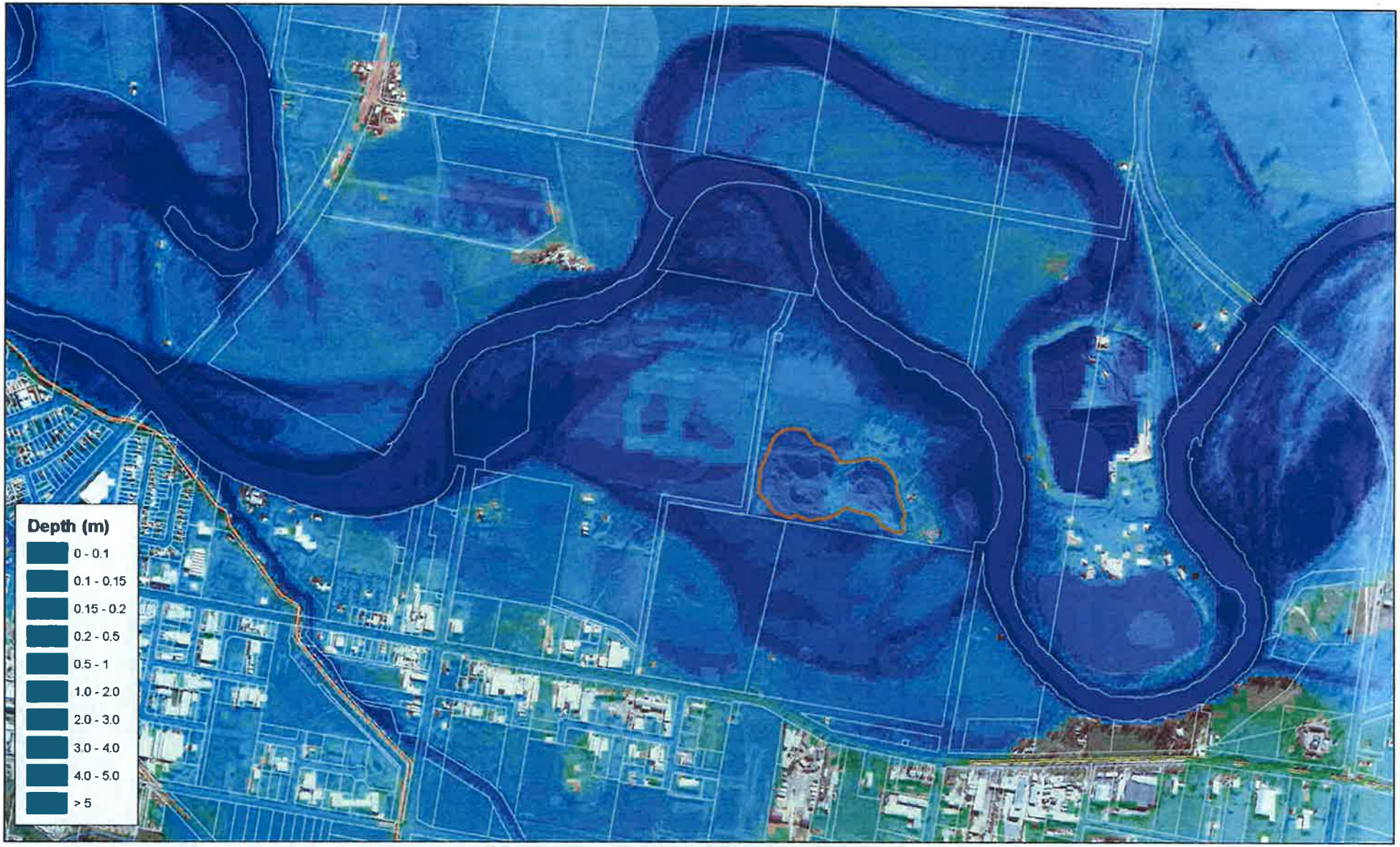
Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: nobaley



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

Tarcoola Quarries
Revised Flooding Assessment

Job Number 23-14626-11
Revision A
Date 18 Aug 2014

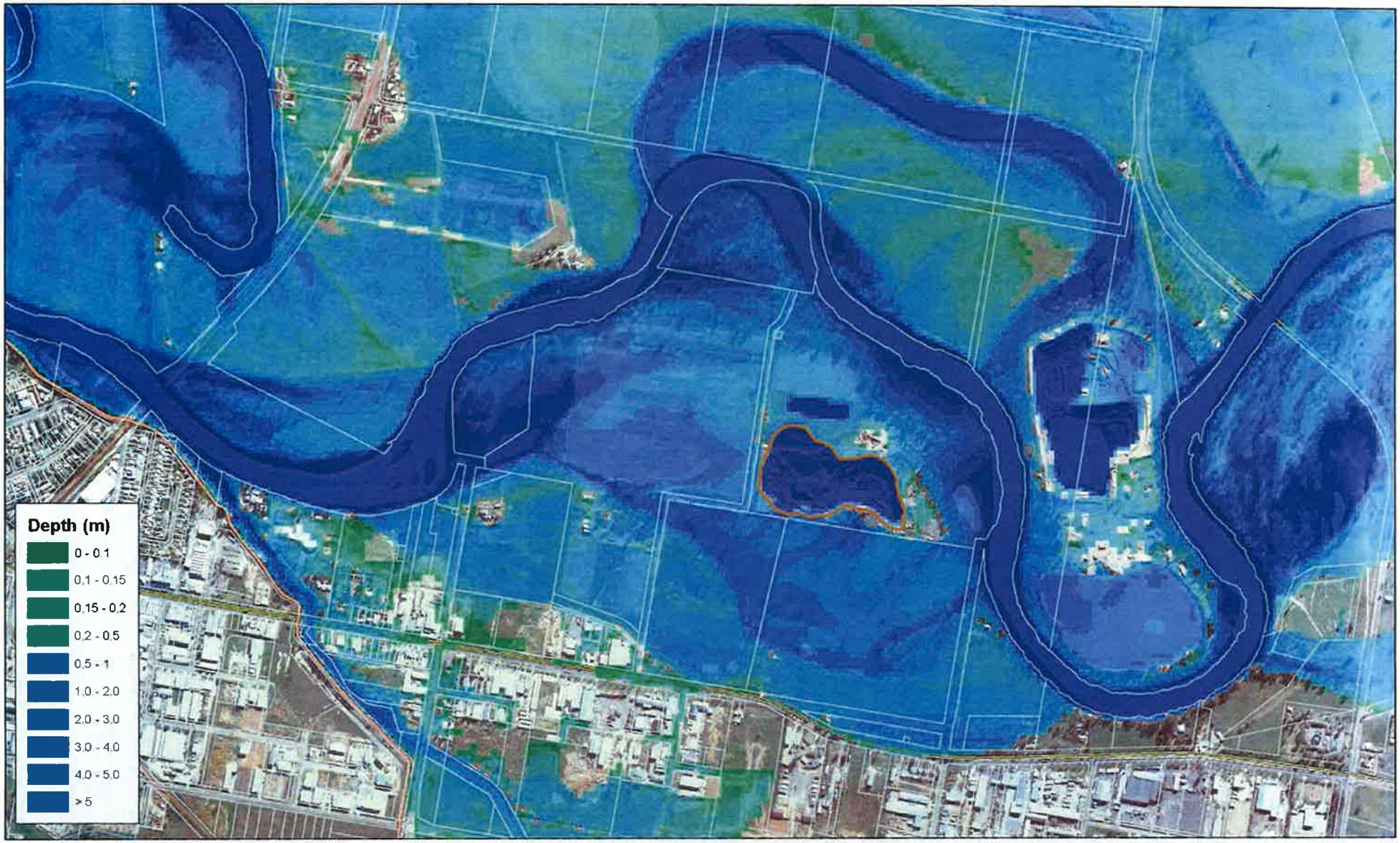
Depth 1 percent AEP Existing Wagga Levee Site Pits 3 and 4

Figure 36

N:\AU\Sydney\Projects\23\14626\GIS\Maps\Fig_36_2014_100yr_Depth (m)_Wagga Wagga.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: mdavery

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com



Paper Size A3

0 45 90 180 270 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

Tarcoola Quarries
Revised Flooding Assessment

Depth 5 percent AEP Future Wagga Levee
Existing Tarcoola Site

Figure 37

Job Number	23-14626-11
Revision	A
Date	18 Aug 2014

N:\AU\Sydney\Projects\23\14626\GIS\Maps\Fig_37_2014_05yr_Depth (m)_Wagga Wagga.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: mbailey

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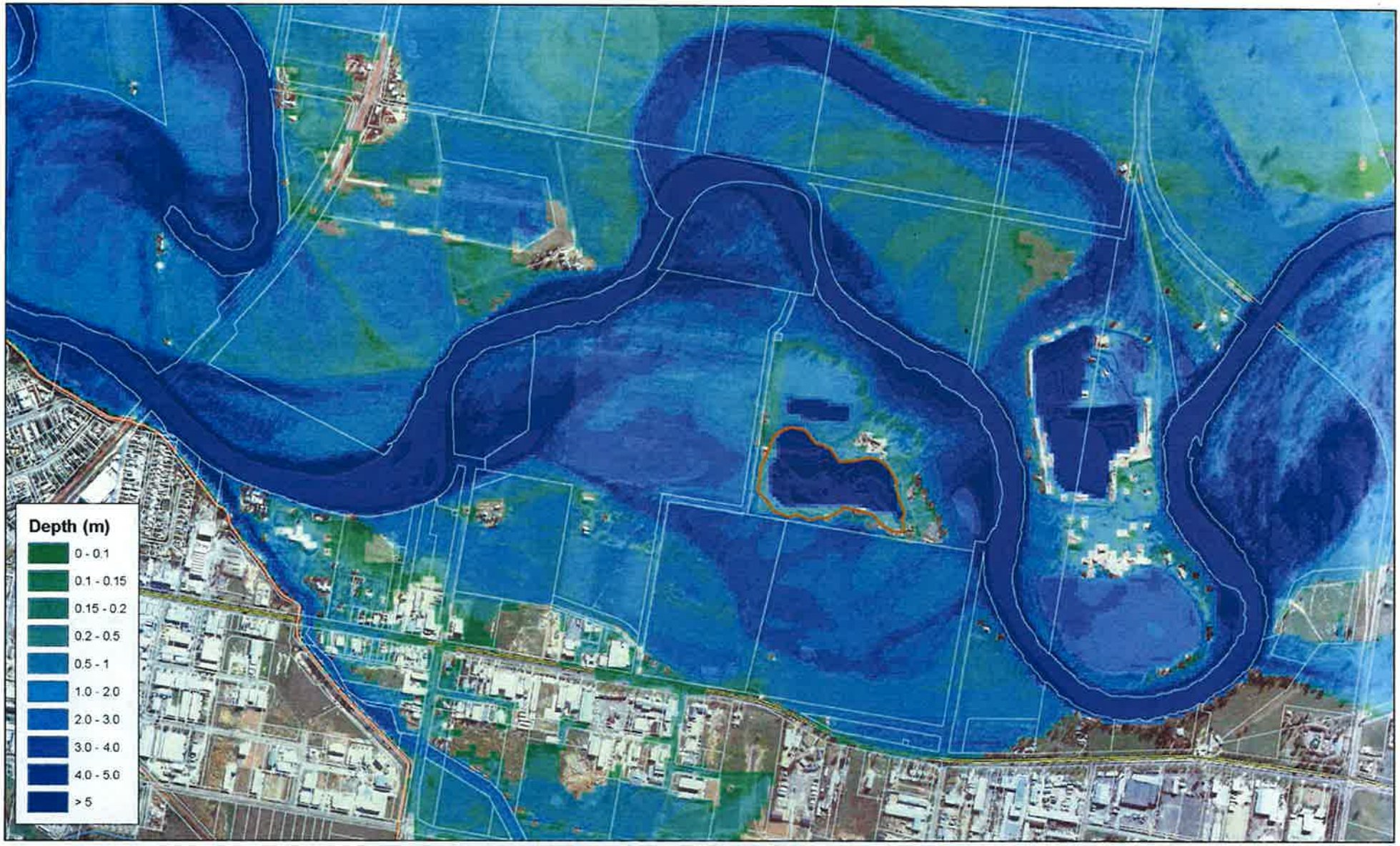

Paper Size A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

Tarcoola Quarries
Revised Flooding Assessment

Depth 5 percent AEP Future Wagga Levee
Site Pits 1 and 2

Figure 38

Job Number	23-14626-11
Revision	A
Date	18 Aug 2014

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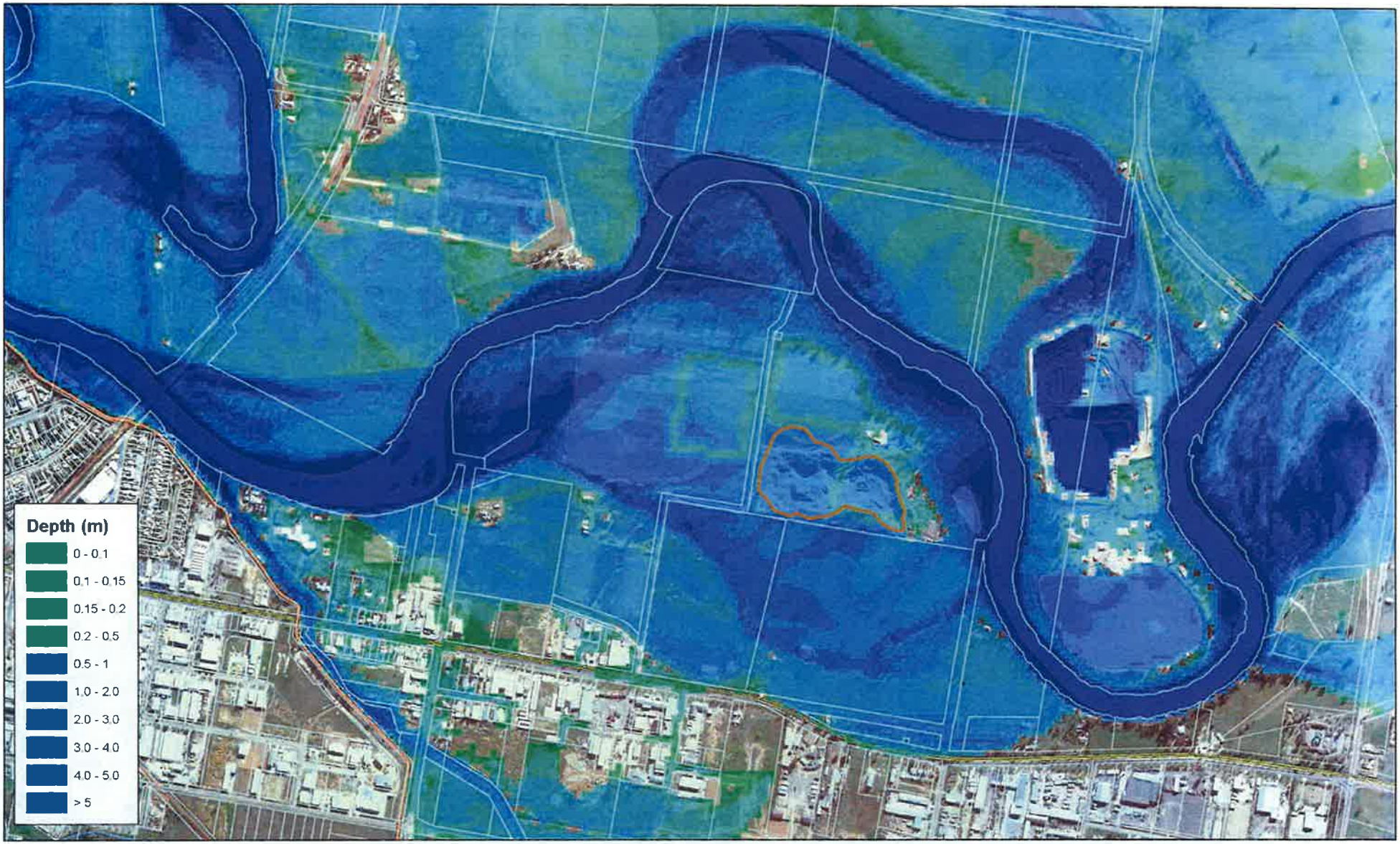

Paper Size A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

Tarcoola Quarries
Revised Flooding Assessment

Job Number 23-14626-11
Revision A
Date 18 Aug 2014

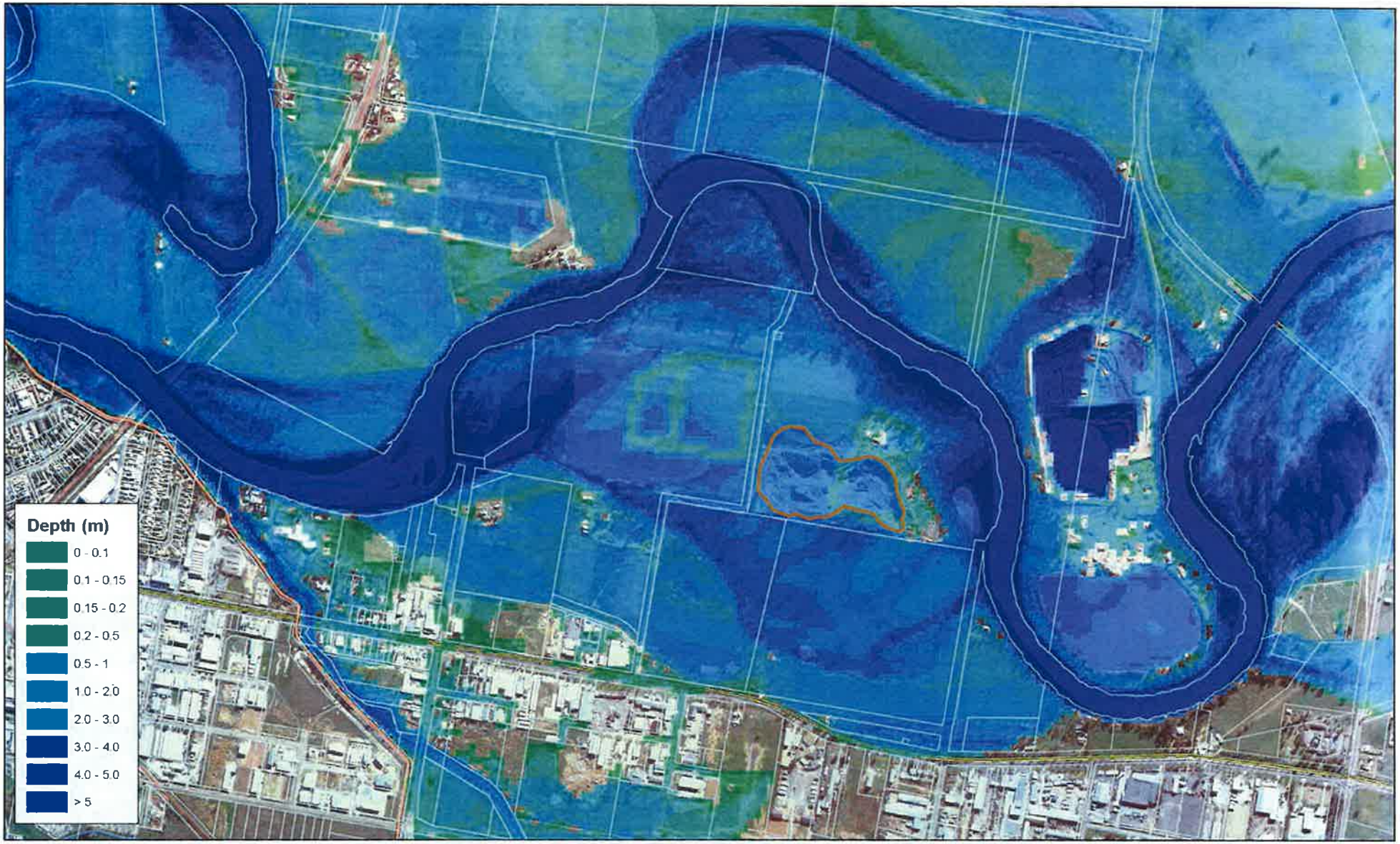
Depth 5 percent AEP Future Wagga Levee
Site Pits 2 and 3

Figure 39

N:\AAS\Sydney\Projects\23\14626\GIS\Maps\Fig_39_2014_05yr_Depth (m)_Wagga Wagga.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: nbailey

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com



Paper Size A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

Tarcoola Quarries
Revised Flooding Assessment

Depth 5 percent AEP Future Wagga Levee
Site Pits 3 and 4

Figure 40

Job Number	23-14626-11
Revision	A
Date	18 Aug 2014

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Paper Size A3

0 45 90 180 270 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

Tarcoola Quarries
Revised Flooding Assessment

Depth 1 percent AEP Future Wagga Levee
Existing Tarcoola Site

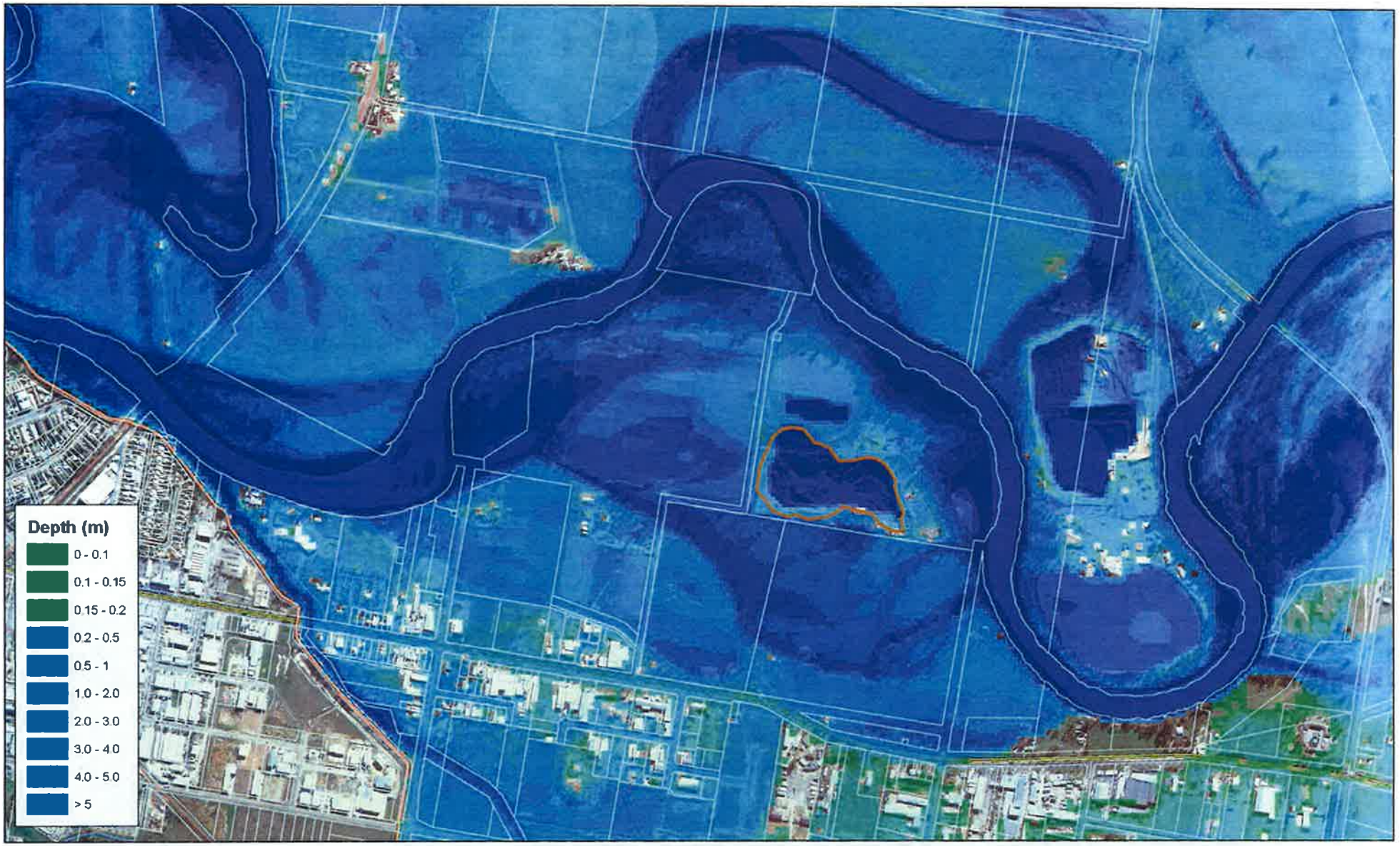
Figure 41

Job Number	23-14626-11
Revision	A
Date	18 Aug 2014

N:\AU\Sydney\Projects\23\14626\GIS\Maps\Fig_41_2014_100yr_Depth (m)_Wagga Wagga.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: hcoakley

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com



Paper Size A3

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Metres

Map Projection Transverse Mercator
Horizontal Datum GDA 1994
Grid GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

Tarcoola Quarries
Revised Flooding Assessment

Depth 1 percent AEP Future Wagga Levee
Site Pits 1 and 2

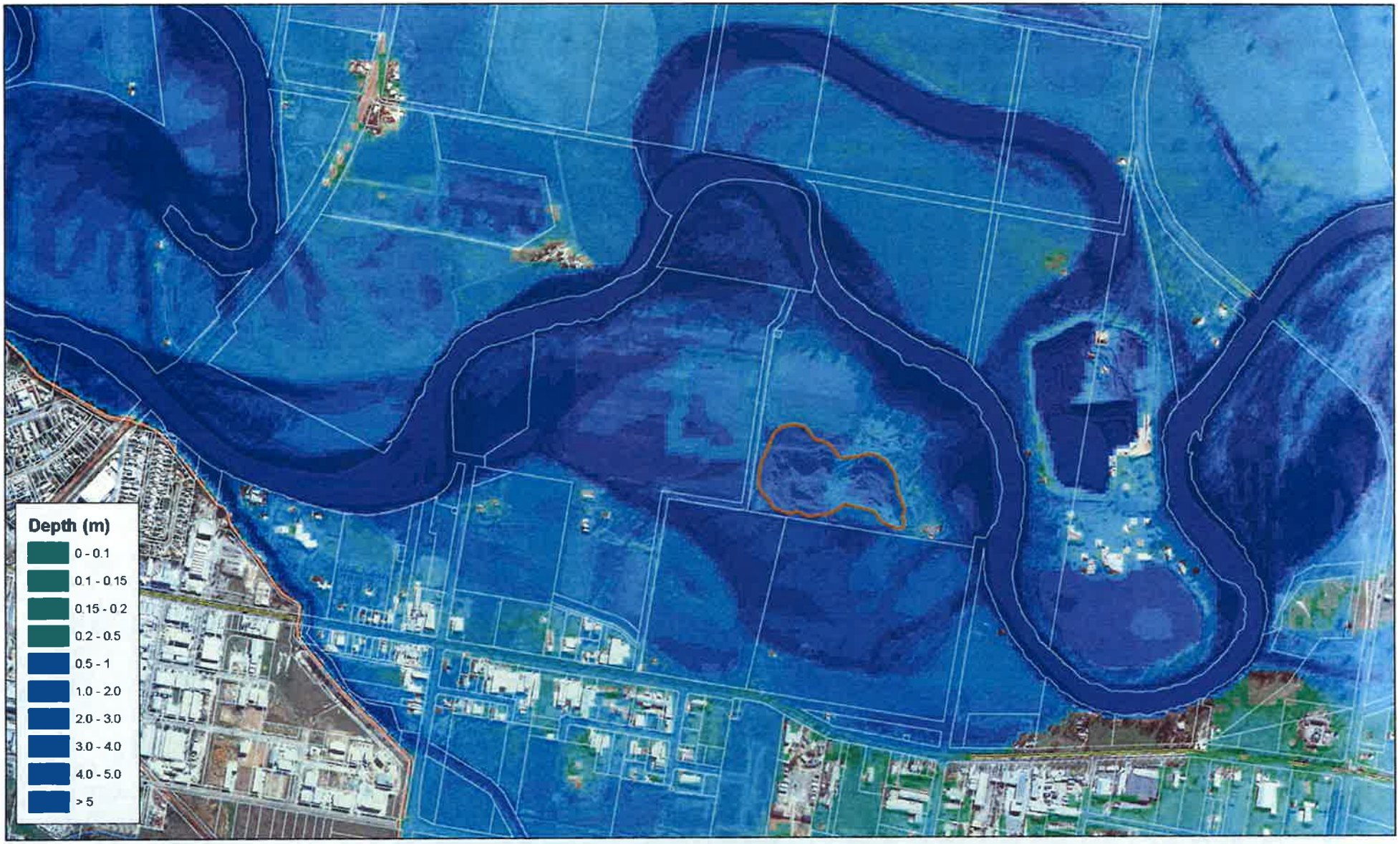
Figure 42

Job Number	23-14626-11
Revision	A
Date	18 Aug 2014

N:\AUSydney\Projects\23\14626\GIS\Maps\Wg_42_2014_100yr_Depth (m)_Wagga Wagga.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: initials

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com



Paper Size A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

Tarcoola Quarries
Revised Flooding Assessment

Depth 1 percent AEP Future Wagga Levee
Site Pits 2 and 3

Figure 43

Job Number	23-14626-11
Revision	A
Date	18 Aug 2014

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: ndoherty

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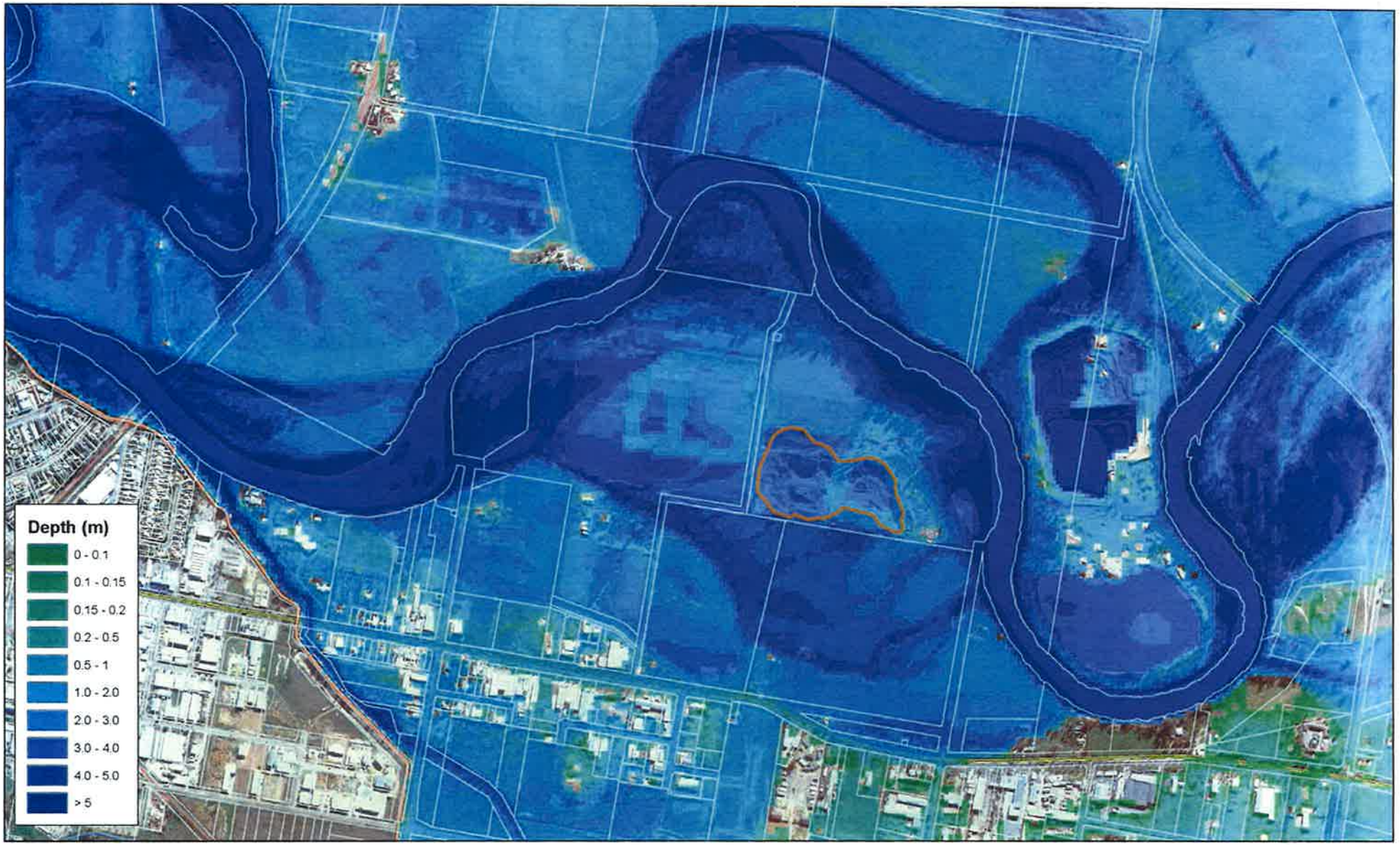

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

City levee

Existing Quarry Levee

Tarcoola Quarries
Revised Flooding Assessment

Depth 1 percent AEP Future Wagga Levee
Site Pits 3 and 4

Figure 44

Job Number	23-14626-11
Revision	A
Date	18 Aug 2014

Data source: Data Custodian, Data Set Name/Title, version/Date. Created by: nclavery

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Appendix D – Residence Floor Levels

Figure D-A Residence 1

Figure D-B Residence 2

Figure D-C Residence 3

Figure D-D Residence 4

Figure D-E Residence 5, ground floor

Figure D-F Residence 5, first floor

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Document Status

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		Name	Signature	Name	Signature	Date
A	N Bailey	R. Kwan / K. Rosen		K. Rosen		21.08.14

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