Cardno
Shaping the Future

Central Village Stage 4 and Stage 5

Flood Assessment

Project Number: J11078/R4/v3

Prepared for
Metro Property Development Pty Ltd

27 October 2015

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3	27 October 2015	L. Allan	LA	M. Giles	MG

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1 INTRODUCTION

1.1 Background

Stages 4 and 5 of the Central Village development are located in an area bounded by Water Street to the south, Brunswick Street to the west, the existing Cromwell Terrace Office Park to the north and the existing Central Village Phase 1 site to the east. The real property description of the area is Lot 1 RP10553, Lots 11 and 12 RP10552, Lots 5, 6 and 13 RP81335 and Lot 102 SP143465 in Fortitude Valley, Brisbane.

Located 2km north-north-east of the Brisbane CBD, Stages 4 and 5 of the Central Village development are situated within the Water Street catchment. The catchment covers an area of approximately 87 hectares, spanning from Boundary Street, Spring Hill through Fortitude Valley and Bowen Hills where it drains to Breakfast Creek and ultimately the Brisbane River.

As part of Stages 4 and 5 of the development it is proposed to demolish the existing structures on the site and build two residential towers with underground basement levels combined with several mixed use podium levels including retail areas along the ground floor frontages of Water Street and Brunswick Street. Additionally, the proposed building footprint has been set to allow the existing Water Street road reserve to be widened.

The impact of the development of Stage 4 and 5 was assessed relative to conditions prior to any development occurring on the Stage 4 and 5 site but also considers the adjacent Central Village Phase 1 site in its fully developed condition including the stormwater mitigation elements designed for previous stages of Central Village. The Central Village Phase 1 works and associated flood assessment is detailed in Cardno's *'Central Village – Stage 2 Detailed Design – Flood Report'* dated 8th August 2013.

1.2 Stormwater Infrastructure

Stages 4 and 5 of the development are located immediately upstream of the Central Village Phase 1 development, which is currently nearing completion. Phase 1 of the Central Village development included the construction of an underground detention tank with a volume of 380 m^3 and an outlet to the existing stormwater drainage system. The purpose of the tank was to provide storage to offset the filling associated with development of the Central Village Phase 1 site. A series of vertical inlets were provided along the frontage of the Central Village Phase 1 development to provide for the capture of flow during those events sufficient to exceed the capacity of the existing underground stormwater drainage system and cause overland flow along Water Street.

These inlets capture the stormwater flow that would have previously entered the site prior to the Central Village Phase 1 development, draining to the underground tank allows for the temporary storage of runoff, thereby mimicking the storage afforded within the Central Village Phase 1 site prior to development. The tank drains via gravity to the existing stormwater drainage system in Water Street following the peak flow in the underground pipe system. The tank provided as part of Central Village Phase 1 was sized to provide sufficient storage to offset the development of the entire Central Village Phase 1 site. For this reason, the Central Village Phase 1 works were included in the pre-developed scenario for the flood assessment of Stages 4 and 5.

1.3 Report Purpose

The purpose of the report is to present the results of hydraulic modelling completed to assess flooding impacts associated with the development of Stages 4 and 5 of the Central Village site in order to ensure that the development will not cause any adverse or actionable flood impacts on existing properties external to the site.

For this assessment, two scenarios were considered.

- *Pre-Developed Scenario*

  Considers the Water Street catchment in its current existing situation with the Central Village Phase 1 site and flood mitigation works completed and area occupied by Stages 4 and 5 in its current existing state; and

- *Post-Developed Scenario*

  Modifies the pre-developed scenario to include Stages 4 and 5 of the proposed development.

2 SITE AND DEVELOPMENT DESCRIPTION

2.1 Existing Topography and Drainage

The site is currently used for commercial purposes. An aerial photograph showing the current development of the site and external catchment is shown below, with the site location shown on Figure 1.

Ground levels surrounding the site range from 12.3 mAHD to 20.4 mAHD. The site typically falls from north to south with the highest point along Brunswick Street at the north-west corner of the site and the lowest point along Water Street at the south-east corner of the site.

Water Street Catchment and Site Boundary

The Water Street catchment is fully developed and is an older style of catchment, in that all stormwater discharge is piped, rainfall is rapidly converted to runoff which in turn is transported downstream quickly via the piped drainage system. From the start of heavy rainfall within the Water Street catchment, the peak stormwater discharge arriving at the site can peak in as little as 15 minutes and significant flooding can occur within the Water Street catchment with very little advance warning.

Overland flow that reaches the intersection of Water and Brunswick Streets (adjacent to the Central Village Phase 2 site) initially discharge down Water Street, however, as the discharge within the catchment increases water ponds and backs up within Brunswick Street and the section of Water Street upstream of this intersection. These flood waters back up due to the narrow opening of the Water Street overland flow path on the downstream boundary of the Brunswick Street intersection due to the location of the existing buildings situated on either side of Water Street.

The site is situated within the Water Street overland flow path which is currently choked immediately upstream of the site due to the existing buildings situated on either side of Water Street on the corners of Brunswick Street, as such, the development of the site must allow for the conveyance of existing flow without adverse flood impacts to neighbouring properties. Stages 4 and 5 of the development will effectively increase the overland flood path by approximately 3 metres along the Water Street frontage of the site.

Presently, the flooding within the catchment is exacerbated by the inadequate capacity of the existing pipe and overland drainage network. If designed today, the underground pipe system would be sized to convey the discharge from the 1 in 10 year storm event (i.e. the stormwater runoff that has a 10% probability of occurring in a one year period). The existing underground pipe system within the catchment can convey slightly less than the 1 in 2 year flood flow.

Overland flow will occur in the Water Street catchment any time rainfall within the catchment results in a flow greater than the capacity of the underground drainage system. In the case of the Water Street catchment, the overland flow discharges along Water Street, with subsequent flooding occurring on properties located on either side of Water Street. Since Stages 4 and 5 are situated in one of these areas and specifically situated at the upstream choke point of Water Street, it is imperative that all habitable floor levels, retail areas, basement carpark entries and building emergency exits are designed to the appropriate flood immunity level. To this end, the flood immunity requirements nominated in the *Flood Overlay Code* of Brisbane City Council *City Plan 2014* have been adopted as they reflect current practice and allow the flood immunity adopted for the site to be consistent with that adopted elsewhere in Brisbane for new buildings.

3 HYDROLOGIC ANALYSIS

3.1 Rational Method Calculations

The flows used for the TUFLOW model were derived using a RAFTS rainfall runoff model of the catchment. The model parameters were adjusted until a good agreement was obtained between predicted peak flow rates and those calculated using the Rational Method calculations as outlined in Chapter 7 of the *Infrastructure Design Planning Scheme Policy* of Schedule 6 *Planning Scheme Policies* of *City Plan 2014* (hereafter referred to as the guidelines) and the *Queensland Urban Drainage Manual* (QUDM). This approach was considered to be acceptable due to the uniformity of the catchment and the relatively small sub-catchment areas used for the comparison.

3.1.1 Rainfall Intensities

The rainfall intensities provided in Table 7.2.2.2.A of the guidelines were used to define catchment rainfall for design events.

3.1.2 Catchment Areas

The catchment area was divided into 9 smaller sub-catchments in both the existing and developed cases to allow for a good representation of catchment runoff and to define appropriate inflows to the hydraulic model. The assumed catchment areas are detailed in Table 1 with the hydrologic catchment delineation shown on Figure 2.

Table 1 Catchment Areas

Name	Area (ha)	Name	Area (ha)	Name	Area (ha)
A0	34.83	A3	4.54	A6	1.86
A1	6.18	A4	7.94	A9	1.67
A2	5.55	A5	2.21	A10	1.79

3.1.3 Runoff Coefficient Values

The ultimate level of development for each sub catchment external to the site was determined from the BCC Planning Scheme. The runoff coefficients nominated in Table 7.3.3.1.A of the guidelines were used to define appropriate runoff coefficients for each identified land use. The adopted land use and the corresponding runoff coefficients for the Water Street catchment are listed in Table 2.

Table 2 Runoff Coefficients

Developed Category	C_{10}
High Density Residential	0.87
Low/Medium Density Residential	0.85
Commercial	0.88

3.1.4 Times of Concentration

The time of concentration of each catchment was determined using standard inlet times in accordance with QUDM Section 4 based on the catchment characteristics and assuming a pipe velocity of 2 m/s. A summary of the calculations is provided in Table 3.

Table 3 Time of Concentration Calculations

Catchment	Standard Inlet time (min)	Pipe Flow			Channel Flow			Total Tc (min)
		Length (m)	Velocity (m/s)	Time (min)	Length (m)	Velocity (m/s)	Time (min)	
A0	5	890	2.0	7.42	-	-	-	12.42
A1	5	240	2.0	2.00	-	-	-	7.00
A2	5	-	-	-	300	1.5	3.33	8.33
A3	5	-	-	-	200	1.5	2.22	7.22
A4	5	-	-	-	290	1.5	3.22	8.22
A5	5	135	2.0	1.13	-	-	-	6.13
A6	5	130	2.0	1.08	-	-	-	6.08
A9	5	65	2.0	0.54	-	-	-	5.54
A10	5	-	-	-	-	-	-	5.00

3.1.5 Peak Flows

The peak flow rate for each sub-catchment was calculated for the 50 and 100 year events. The results of the Rational Method analysis are detailed in Table 4.

Table 4 Rational Method Peak Flow – Existing Case

Catchment	Contributing Area (ha)	Coefficients of Runoff C_{10}	Rainfall Intensity (mm/h)		Peak Flow (m^3/s)	
			100 year ARI	50 year ARI	100 year ARI	50 year ARI
A0	34.83	0.86	234	209	22.60	20.00
A1	6.18	0.85	288	258	4.94	4.33
A2	5.55	0.85	271	242	4.17	3.65
A3	4.54	0.85	285	255	3.59	3.14
A4	7.94	0.85	272	243	5.99	5.25
A5	2.21	0.88	302	271	1.85	1.66
A6	1.86	0.88	302	271	1.56	1.40
A9	1.67	0.88	313	277	1.45	1.29
A10	1.79	0.88	325	291	1.62	1.45

3.2 Hydrologic Modelling

A RAFTS hydrologic model of the catchment was setup to determine the discharge hydrographs from each of the sub catchments at their outlet points. RAFTS is an urban and rural rainfall runoff routing program that can be used to determine the peak stormwater flows for a catchment, based on parameters such as area, fraction impervious, slope and catchment storage. A Bx value of 1.0 was adopted for the RAFTS model.

A number of storm durations ranging from 15 minutes to 6 hours were considered to determine the critical storm duration. Rainfall losses of zero initial and continuing loss were adopted for impervious areas and a zero initial loss with a continuing loss of 2.5 mm/h adopted for pervious areas.

The peak flows calculated using the RAFTS model were compared to the results obtained from the Rational Method for the 100 year ARI event. RAFTS model parameters such as Manning's n, slope and Bx were varied within reasonable limits until an acceptable agreement was obtained between the RAFTS and Rational Method flow estimates for the 100 year ARI event. This approach was considered to be acceptable given the relatively small size of the catchments and their uniform nature. The results and comparisons to the Rational Method are presented below in Table 5.

Table 5 RAFTS Model Validation – 100 Year ARI Event

Catchment	Rational Method (m^3/s)	RAFTS (m^3/s)	Difference (%)	Catchment	Rational Method (m^3/s)	RAFTS (m^3/s)	Difference (%)
A0	22.61	22.62	0.0	A5	1.85	1.84	-0.5
A1	4.94	4.87	-1.4	A6	1.56	1.57	0.6
A2	4.17	4.21	1.0	A9	1.45	1.43	-1.4
A3	3.59	3.56	-0.8	A10	1.62	1.55	-4.5
A4	5.99	5.98	-0.2				

The results indicate that the RAFTS model is adequate to calculate the discharge hydrographs for the catchment. This validated model was used to derive runoff hydrographs for the 50 and 100 year ARI events. The hydrographs were input to the hydraulic model to enable peak flows and flood levels within the study area to be calculated.

4 HYDRAULIC ANALYSIS

4.1 Data Sources

The sources of the data used as part of the flood assessment of the subject site are listed below:

- Survey – external to the site, aerial laser survey data (collected in 2002) ; and within the site, detailed survey completed by Jensen Bowers
- Aerial Photography – Aerial photography of the site was obtained from Nearmap.

4.2 Stormwater Infrastructure

At present the current flooding situation within the Water Street catchment is exacerbated by the inadequate existing pipe and overland drainage network. If designed today, the underground system would be sized to convey the 10 year ARI event flow event (i.e. the stormwater runoff that has a 10% probability of occurring in a one year period). The current system can convey slightly less than the 2 year ARI event flow. Therefore flooding currently occurs more frequently and to a greater extent than would now be considered acceptable.

Any rainfall causing a flow greater than the capacity of the underground drainage system, the remaining flow is conveyed overland. In the case of the Water Street catchment, the overland flow occurs along Water Street, with consequent flooding of properties located on either side of the street.

Pipe details such as size, length and invert levels for the existing drainage network in the catchment were taken from the BCC's eBimap and stormwater drainage drawings obtained from the BCC Plan Custodian. This data was verified against information listed in a previous study completed for Council (Tod Group, circa 1997). As sections of the existing drainage network are quite old, some of the required information was not available. In these instances the best estimates were taken, i.e. by assuming slope of the pipes matched the surface slope. Appropriate manhole losses were adopted based on the recommendations of the QUDM.

A key consideration in modelling is the interaction of the surface and underground drainage networks. Allowing water to freely transfer between the two networks (a common modelling assumption) can lead to erroneous results as the quantum of water transferred (for instance in an area where the capacity of the piped drainage system is reduced) can be unrealistic.

To overcome this issue, particular care was taken to model the gully pits and small pipes that connect the pits to the trunk drainage system. All gully inlets for the entire catchment area were surveyed during the site visit.

Stages 4 and 5 of the Central Village development are located immediately upstream of the Central Village Phase 1 development, which is currently nearing completion. Phase 1 of the Central Village development included the construction of an underground detention tank with a volume of 380 m^3 and an outlet to the existing stormwater drainage system. The purpose of the tank was to provide storage to offset the filling associated with development of the Central Village Phase 1 site. A series of vertical inlets were provided along the frontage of the Central Village Phase 1 development to provide for the capture of flow during those events sufficient to exceed the capacity of the existing underground stormwater drainage system and cause overland flow along Water Street. For this reason, the Phase 1 works were included in the 'pre-developed' scenario for the Stage 4 and 5 flood assessment.

4.3 Existing Pre-Developed TUFLOW Scenario Model Setup

4.3.1 Model Data

To determine the impact of Stages 4 and 5 of the development, the site was modelled using TUFLOW and the resultant flood levels compared to those calculated for the pre-development scenario.

The pre-developed scenario also considers the adjacent Central Village Phase 1 site in its fully developed condition including the stormwater mitigation elements designed for the Central Village Phase 1 site. The Central Village Phase 1 works and associated flood assessment is detailed in Cardno's *'Central Village – Stage 2 Detailed Design – Flood Report'* dated 8th August 2013.

The stormwater drainage through the subject site was modelled using the linked one-dimensional / two-dimensional hydraulic model TUFLOW (Build 2012-05-AA). TUFLOW was considered to be suitable for use in this case due to its ability to model the underground drainage network one-dimensionally while allowing a detailed representation of the overland flow via a two-dimensional grid.

A digital terrain model (DTM) of the study site was setup based on ground level survey obtained from the BCC. The pre-developed TUFLOW model of the Stage 4 and 5 area is shown on Figure 3. Due to the urban nature of the study area, a 3 metre grid was adopted.

Stormwater pipes and gully inlets were modelled as one dimensional links, connected to the two dimensional domain.

4.3.2 Roughness Values

The Manning's n roughness values for the study area were derived from aerial photographs and site inspections. The typical values adopted for the model are listed below in Table 6. Based on site inspections certain man made features like brick buildings and wall within the modelled area site that were deemed to block the catchment overland flow paths were modelled as blockages to provide an accurate representation of the flow patterns.

Table 6 Roughness Values

Land Use	Manning's n
Residential / Commercial Areas	0.20
Roads and Carparks	0.02
Open Space and Parks	0.04
Fences and Gates	0.08

4.3.3 Inflows

The discharge hydrographs calculated for the catchments using the RAFTS hydrologic model were used in the TUFLOW hydraulic model as detailed in Section 3.

4.3.4 Tail water Conditions

A normal depth corresponding to a slope of one percent was assumed as the tail water condition occurring at the northern boundary of the model (corresponding to the slope of the tributary along Water Street downstream of Anderson Street). A water level of 8.04 mAHD, equal to obvert of the pipe at the downstream end of the model along the eastern boundary, was adopted for the one dimensional drainage network.

4.3.5 Time Step

The adopted time step used for the one dimensional / two dimensional model was one second. This relatively short time step was required to increase the model stability and reduce the continuity error within the nested grid model.

4.4 Post-Developed TUFLOW Scenario Model Setup

The post-developed model used the same data and setup as for the existing pre-developed model, with the existing structures within the Stage 4 and 5 area replaced by the proposed residential towers footprint.

4.5 Results

The pre- and post-development hydraulic models were run for the 1 in 50 and 1 in 100 year ARI storm events to determine the impact the Central Village Phase 2 development has on existing flood levels in the vicinity of the site.

Peak flood level, depth, speed and hydraulic afflux maps are provided in Appendix A and B for the pre- and post-development scenarios respectively.

The resultant peak water levels at a number of key points surrounding the Central Village Phase 2 site are detailed in Table 7 with a the locations of each point identified on Figures 3 and 4.

Table 7 Peak Water Surface Levels (mAHD)

Location	Pre-Development		Post-Development		Impact	
	Q100	Q50	Q100	Q50	Q100	Q50
His_01	15.989	15.989	15.985	15.857	-0.005	-0.133
His_02	15.887	15.887	15.878	15.824	-0.009	-0.063
His_03	15.853	15.853	15.820	15.751	-0.034	-0.103
His_04	15.871	15.871	15.837	15.763	-0.034	-0.108
His_05	15.872	15.872	15.837	15.763	-0.035	-0.109
His_06	15.831	15.831	15.764	15.679	-0.067	-0.151
His_07	15.757	15.757	15.632	15.530	-0.125	-0.228
His_08	15.845	15.845	15.742	15.620	-0.103	-0.225
His_09	14.528	14.528	14.164	14.112	-0.364	-0.416
His_10	13.313	13.313	13.249	13.251	-0.064	-0.062
His_11	13.135	13.135	12.830	12.778	-0.305	-0.358
His_12	12.673	12.673	12.687	12.614	0.014	-0.059
His_13	12.024	12.024	12.002	11.967	-0.022	-0.057

Location	Pre-Development		Post-Development		Impact	
	Q100	Q50	Q100	Q50	Q100	Q50
His_14	11.930	11.930	11.919	11.842	-0.011	-0.088
His_15	11.394	11.394	11.392	11.347	-0.002	-0.048
His_16	11.162	11.162	11.160	11.116	-0.002	-0.046
His_17	10.607	10.607	10.605	10.574	-0.002	-0.033
His_18	15.845	15.845	15.805	15.729	-0.040	-0.116
His_19	15.845	15.845	15.805	15.729	-0.040	-0.116
His_20	13.254	13.254	13.159	13.090	-0.095	-0.164
His_21	13.096	13.096	13.030	12.981	-0.067	-0.115
His_22	12.378	12.378	12.344	12.270	-0.033	-0.108
His_23	12.115	12.115	12.110	12.040	-0.005	-0.075

4.6 Discussion

The results presented in Table 7 and shown graphically in Appendix A and Appendix B indicate that the proposed development of Stages 4 and 5 of the Central Village development typically yields a reduction in peak water levels in the area surrounding the site and does not adversely impact on properties within the vicinity of the subject site. Some localised increases in flood levels are predicted within the road reserve in Water Street. However, any increase in flood levels is limited to the road reserve only.

Following a detailed review of the cause of the impact, it was confirmed that the increase in level is due to the improved flow conveyance in Water Street that results from widening the road reserve associated with the Stages 4 to 5 of the development. In this context, the impact can be attributed to the widening of the road rather than the construction of the proposed Central Village buildings. Calculations indicate there would be no increase in flood levels within the catchment if the building were to be constructed to the match the footprint of the existing building.

Furthermore, the impact is localised and limited to short spans of road reserve and not on any private properties. Flood depths upstream and downstream of the area (which no increase in level is obtained) are already well in excess of the depth necessary to cause road closure. Given this, it is considered that the increase in level will not materially affect the trafficability of the road or the flood risk in the Water Street area.

4.7 Minimum Development Levels

Subsequent to the January 2011 flood event, Brisbane City Council invoked a Temporary Local Planning Instrument (TLPI) in relation to flooding. The requirements of the planning instrument were subsequently incorporated into the version of City Plan current at the time of this report. The minimum flood immunity levels adopted by Council are nominated in Table 8.2.11.3.D and 8.2.11.3.L of the *Flood Overlay Code* of *City Plan 2014.*

Although the area is administered through EDQ, EDQ typically sets minimum development levels with reference to the requirements of the relevant local authority. It is therefore considered reasonable to adopt flood immunity levels that match those nominated by Brisbane City Council.

Consequently, the minimum development levels applicable to the site are:

- Floors for Commercial (including retail) Purposes *50 Year Event (no additional freeboard);*
- Habitable Floors for Residential Purposes *50 Year Event plus 500mm freeboard;*
- Points of entry to basement car park (ramps, doors etc.) *100 Year Event plus 300mm freeboard; and*
- Substation (If not Community Infrastructure) *100 Year Event plus 500mm freeboard.*

The relevant minimum flood levels for the derivation of development levels are listed in Table 7. Due to the varying level along the frontage of the Central Village Phase 2 site 100mm contours of the water surface profile for the post-developed scenario of the 50 and 100 year events are included on Figures B.1.3 and B.1.4 in Appendix B.

4.8 Adopted Floor Levels

It is worth noting that the flood level changes significantly along the Water Street frontage of site as stormwater ponds at the intersection of Water Street and Brunswick Street, and then funnels down Water Street, next to the Phase 2 site.

Lobby Entry

The lobby entry level off Water Street, which ultimately provides access to the basement area via lifts, has been set at 13.3 mAHD. This level is adequate.

Basement Access

As the MSB for Stage 4 and Stage 5 will be located in the basement, the level of the basement ramp has been set to provide 500 mm of freeboard (providing a level of 13.4 mAHD) rather than the 300 mm required for basement entry. The level of other points of entry to the basement (lift and stairs) have been set at 300 mm above the requisite flood level as it is considered that additional freeboard at these locations is not warranted due to the small volume of water that could enter the basement at these points and the fact that there are three levels of basement beneath the MSB level.

Essential Services – Substation and Communications

The substation is the most critical piece of infrastructure and the new City Plan immunity requirements reflect this. As a consequence, the substation has been located well above flood level at 16.2 mAHD at the rear of the site.

The communications room, which is located near the entry ramp, will be set at a level of at 13.4 mAHD, this level provides an acceptable level of freeboard.

Retail Areas

The retail area adjacent to Brunswick Street is sufficiently high enough to be unaffected by flood levels along Brunswick Street.

5 CONCLUSION

A mixed use development is proposed for Stages 4 and 5 of the Central Village development situated on Lot 1 RP10553, Lots 11 and 12 RP10552, Lots 5, 6 and 13 RP81335 and Lot 102 SP143465 in Fortitude Valley, Brisbane. A flood study of the catchment draining to the site was conducted to determine the existing flood levels within and surrounding the site and the subsequent impact of development on flood levels.

The results of the TUFLOW model are presented in Appendix B and indicate that the proposed development does not adversely impact on properties within the vicinity of the subject site. The development generally results in a reduction in flood levels, with a localised increase in flood level predicted in the road reserve in Water Street. However, any increase in flood levels is limited to the road reserve and does not affect private property.

Furthermore, it was determined that the reason for the increase in flood levels is the widening of Water Street rather than the construction of Stages 4 and 5. If the buildings were to be constructed to the match the footprint of the existing building; calculations indicate there would be no increase in flood levels within the catchment. As the increase occurs in an area where the water depths both upstream and downstream are higher, it was concluded that the trafficability of the road and the flood hazard in Water Street would not be materially affected by the change in level.

It is therefore considered that Stages 4 and 5 of the Central Village development will not result in unacceptable adverse impacts on flooding in the catchment and can proceed.

Figures

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LEGEND:

Site Boundary

Aerial imagery courtesy of Nearmap, 2014

150 0 150 300 450 600 750m
1:15,000

Scale 1:15,000 (A3)

FIGURE 1
SITE LOCATION

October 2014

Project No.: J11078

Metro Property Development Pty Ltd

CAD FILE: O:\J11078\Tuflow\Truncated\results\Respro\DE02d\Figures - J11078-R4 RAFTS.dwg
XREF's: Tuflow_Results; xr-DCDB 3503-78 2013 MGA94 zone56

PRINT DATE: 02 October, 2014 - 3:17pm

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LEGEND:

Site Boundary

A1 Catchment Boundary and Label

Aerial imagery courtesy of Nearmap, 2014

75 0 75 150 225 300 375m 1:7500

Scale 1:7,500 (A3)

FIGURE 2

RAFTS WATER STREET CATCHMENT DELINEATION

October 2014

Project No.: J11078

Metro Property Development Pty Ltd

CAD FILE: O:\J11078\Tuflow\Truncated\results\Respro\DE02d\Figures - J11078-R4 RAFTS.dwg
XREF's: Tuflow_Results; xr-DCDB 3503-78 2013 MGA94 zone56

PRINT DATE: 02 October, 2014 - 3:17pm

LEGEND:

Phase 1 Boundary

Phase 2 Boundary

His13 Reporting Nodes

RESULTS LEGEND:
Topography (mAHD)

- Above 27.00
- 25.00 to 27.00
- 23.00 to 25.00
- 21.00 to 23.00
- 19.00 to 21.00
- 17.00 to 19.00
- 15.00 to 17.00
- 14.00 to 15.00
- 13.50 to 14.00
- 13.00 to 13.50
- 12.50 to 13.00
- 12.00 to 12.50
- 11.50 to 12.00
- 11.00 to 11.50
- 10.50 to 11.00
- 10.00 to 10.50
- 9.00 to 10.00
- Below 9.00

12.5 0 12.5 25.0 37.5 50.0 62.5m

1:1250

Scale 1:1,250 (A3)

FIGURE 3

PRE-DEVELOPED MODEL TOPOGRAPHY MAP (BA02)

October 2014

Project No.: J11078

Metro Property Development Pty Ltd

CAD FILE: O:\J11078\Tuflow\Truncated\results\Respro\BA02\Figures - J11078 - Tuflow Results.dwg
XREF's: Tuflow_Results; xr-DCDB 3503-78 2013 MGA94 zone56; xr - J11078 2014 DCDB MGA94 z56

PRINT DATE: 02 October, 2014 - 4:55pm

LEGEND:

Phase 1 Boundary

Phase 2 Boundary

His13 Reporting Nodes

RESULTS LEGEND:
Topography (mAHD)

- Above 27.00
- 25.00 to 27.00
- 23.00 to 25.00
- 21.00 to 23.00
- 19.00 to 21.00
- 17.00 to 19.00
- 15.00 to 17.00
- 14.00 to 15.00
- 13.50 to 14.00
- 13.00 to 13.50
- 12.50 to 13.00
- 12.00 to 12.50
- 11.50 to 12.00
- 11.00 to 11.50
- 10.50 to 11.00
- 10.00 to 10.50
- 9.00 to 10.00
- Below 9.00

Aerial imagery courtesy of Nearmap, 2014

12.5 0 12.5 25.0 37.5 50.0 62.5m
1:1250

Scale 1:1,250 (A3)

FIGURE 4

POST-DEVELOPED MODEL TOPOGRAPHY MAP (DE02d)

October 2014

Project No.: J11078

Metro Property Development Pty Ltd

CAD FILE: C:\Users\laurence.allan\appdata\local\temp\AcPublish_9400\Figures - J11078 - Tuflow Results.dwg
XREF's: Tuflow_Results; xr-DCDB 3503-78 2013 MGA94 zone56; xr - J11078 2014 DCDB MGA94 z56

PRINT DATE: 02 October, 2014 - 4:28pm

Reference Drawings

PODIUM 1

bureau proberts

REV	DESCRIPTION	DATE
25	PRELIMINARY DA ISSUE	23.10.15
21	PRELIMINARY DA ISSUE	20.10.15
20	CIVIL COORDINATION	20.10.15
16	EDQ PACKAGE	12.10.15
15	Co-ordination Issue	12.10.15
11	Client Issue	02.10.15
10	QS issue	02.10.15

CLIENT: METRO PROPERTY DEVELOPMENT
PROJECT: CENTRAL VILLAGE STAGE 4 AND 5
ADDRESS: CORNER OF WATER AND BRUNSWICK STREET

SCALE: 1 : 250 [A1]
DATE: 23.10.15
DRAWN: AE
NORTH:
PROJECT NO: 14037
PHASE: DA
DRAWING NUMBER: 20.03
REVISION: 25

23/10/2015 5:46:37 PM

PODIUM 2

REV	DESCRIPTION	DATE
25	PRELIMINARY DA ISSUE	23.10.15
21	PRELIMINARY DA ISSUE	20.10.15
20	CIVIL COORDINATION	20.10.15
16	EDQ PACKAGE	12.10.15
15	Co-ordination Issue	12.10.15
11	Client Issue	02.10.15
10	QS issue	02.10.15

bureau proberts

CLIENT: METRO PROPERTY DEVELOPMENT
PROJECT: CENTRAL VILLAGE STAGE 4 AND 5
ADDRESS: CORNER OF WATER AND BRUNSWICK STREET

SCALE: 1 : 250 [A1]
DATE: 23.10.15
DRAWN: AE
NORTH:
PROJECT NO: 14037
PHASE: DA
DRAWING NUMBER: 20.04
REVISION: 25
23/10/2015 5:46:39 PM

PODIUM 3

bureau proberts

REV	DESCRIPTION	DATE
25	PRELIMINARY DA ISSUE	23.10.15
21	PRELIMINARY DA ISSUE	20.10.15
16	EDQ PACKAGE	12.10.15
15	Co-ordination Issue	12.10.15
11	Client Issue	02.10.15
10	QS issue	02.10.15
9	Preliminary Co-ordination	24.09.15

CLIENT: METRO PROPERTY DEVELOPMENT
PROJECT: CENTRAL VILLAGE STAGE 4 AND 5
ADDRESS: CORNER OF WATER AND BRUNSWICK STREET

SCALE: 1 : 250 [A1]
DATE: 23.10.15
DRAWN: JC
NORTH:
PROJECT NO: 14037
PHASE: DA
DRAWING NUMBER: 20.05
REVISION: 25

23/10/2015 5:46:41 PM

bureau^proberts

REV	DESCRIPTION	DATE
25	PRELIMINARY DA ISSUE	23.10.15
21	PRELIMINARY DA ISSUE	20.10.15
16	EDQ PACKAGE	12.10.15
15	Co-ordination Issue	12.10.15
11	Client Issue	02.10.15
10	QS issue	02.10.15
9	Preliminary Co-ordination	24.09.15

LEVEL 1

CLIENT:
METRO PROPERTY DEVELOPMENT
PROJECT:
CENTRAL VILLAGE STAGE 4 AND 5
ADDRESS:
CORNER OF WATER AND BRUNSWICK STREET

SCALE: 1 : 250 [A1]
DATE: 23.10.15
DRAWN: JC
NORTH:

PROJECT NO: 14037
PHASE: DA
DRAWING NUMBER: 20.06
REVISION: 25

23/10/2015 5:46:45 PM

Appendix A

Pre-Developed TUFLOW Results

LEGEND:

- Phase 1 Boundary
- Phase 2 Boundary
- His13 Reporting Nodes

RESULTS LEGEND:
Water Surface Level (mAHD)

- Above 16.40
- 16.00 to 16.40
- 15.60 to 16.00
- 15.20 to 15.60
- 14.80 to 15.20
- 14.40 to 14.80
- 14.00 to 14.40
- 13.60 to 14.00
- 13.20 to 13.60
- 12.80 to 13.20
- 12.40 to 12.80
- 12.00 to 12.40
- 11.60 to 12.00
- 11.20 to 11.60
- 10.80 to 11.20
- 10.40 to 10.80
- 10.00 to 10.40
- 9.60 to 10.00
- 9.20 to 9.60
- Below 9.20

Aerial imagery courtesy of Nearmap, 2014

12.5 0 12.5 25.0 37.5 50.0 62.5m
1:1250

Scale 1:1,250 (A3)

FIGURE A.1.1
PRE-DEVELOPED Q100 WATER SURFACE LEVELS (BA02)

October 2014

Project No.: J11078

Metro Property Development Pty Ltd

CAD FILE: O:\J11078\Tuflow\Truncated\results\Respro\BA02\Figures - J11078 - Tuflow Results.dwg
XREF's: Tuflow_Results; xr-DCDB 3503-78 2013 MGA94 zone56; xr - J11078 2014 DCDB MGA94 z56

PRINT DATE: 02 October, 2014 - 4:56pm

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N

LEGEND:

Phase 1 Boundary

Phase 2 Boundary

His13 Reporting Nodes

RESULTS LEGEND:
Water Surface Level (mAHD)

- Above 16.40
- 16.00 to 16.40
- 15.60 to 16.00
- 15.20 to 15.60
- 14.80 to 15.20
- 14.40 to 14.80
- 14.00 to 14.40
- 13.60 to 14.00
- 13.20 to 13.60
- 12.80 to 13.20
- 12.40 to 12.80
- 12.00 to 12.40
- 11.60 to 12.00
- 11.20 to 11.60
- 10.80 to 11.20
- 10.40 to 10.80
- 10.00 to 10.40
- 9.60 to 10.00
- 9.20 to 9.60
- Below 9.20

Aerial imagery courtesy of Nearmap, 2014

12.5 0 12.5 25.0 37.5 50.0 62.5m
1:1250

Scale 1:1,250 (A3)

FIGURE A.1.2

PRE-DEVELOPED Q50 WATER SURFACE LEVELS (BA02)

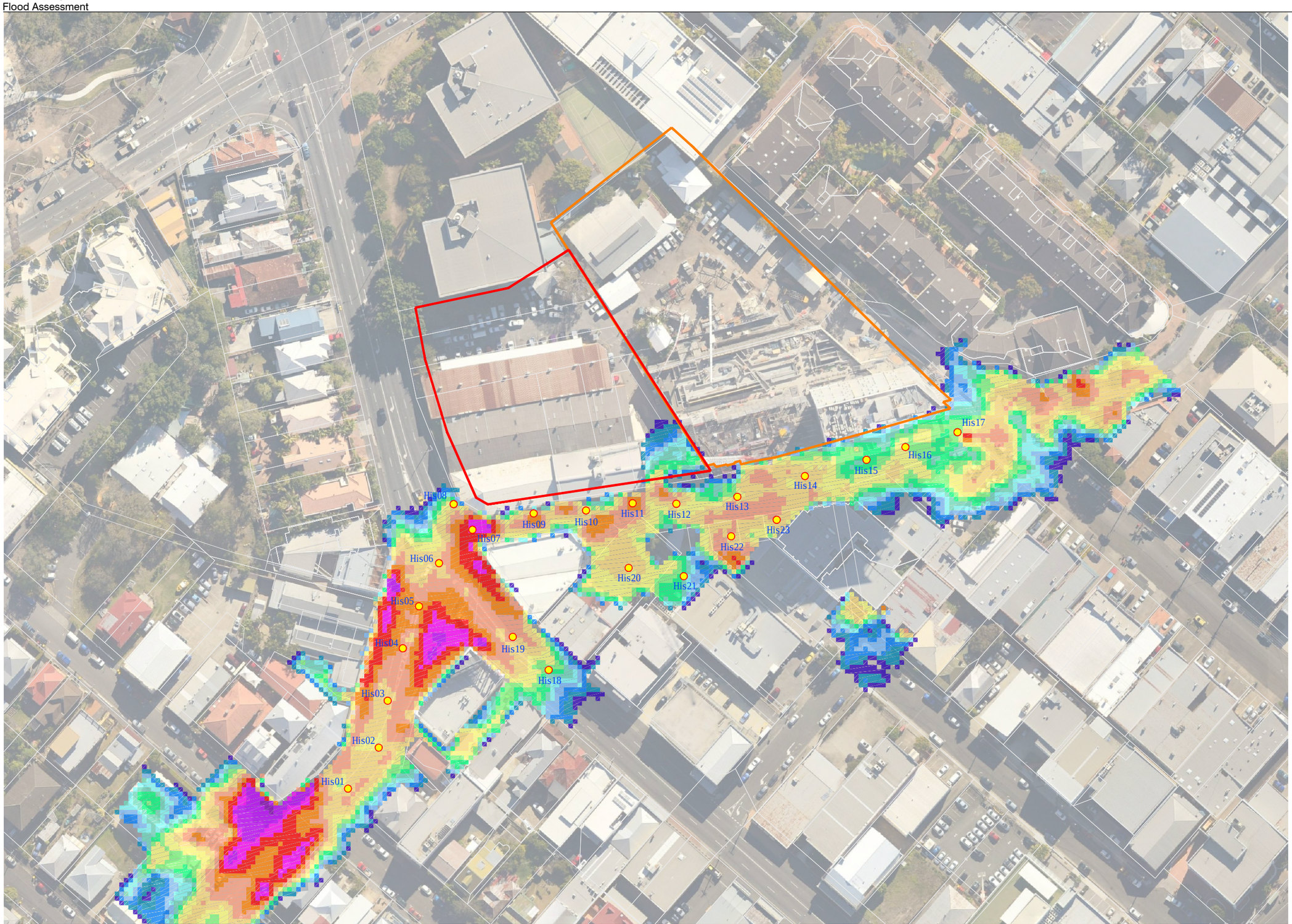
October 2014

Project No.: J11078

Metro Property Development Pty Ltd

CAD FILE: O:\J11078\Tuflow\Truncated\results\Respro\BA02\Figures - J11078 - Tuflow Results.dwg
XREF's: Tuflow_Results; xr-DCDB 3503-78 2013 MGA94 zone56; xr - J11078 2014 DCDB MGA94 z56

PRINT DATE: 02 October, 2014 - 4:56pm



LEGEND:

Phase 1 Boundary

Phase 2 Boundary

His13 Reporting Nodes

RESULTS LEGEND:
Depth (m)

- Above 1.25
- 1.00 to 1.25
- 0.90 to 1.00
- 0.80 to 0.90
- 0.70 to 0.80
- 0.60 to 0.70
- 0.50 to 0.60
- 0.40 to 0.50
- 0.35 to 0.40
- 0.30 to 0.35
- 0.25 to 0.30
- 0.20 to 0.25
- 0.15 to 0.20
- 0.10 to 0.15
- 0.05 to 0.10
- 0.01 to 0.05

Aerial imagery courtesy of Nearmap, 2014

12.5 0 12.5 25.0 37.5 50.0 62.5m

1:1250

Scale 1:1,250 (A3)

FIGURE A.2.1
PRE-DEVELOPED Q100 WATER DEPTH (BA02)

October 2014

Project No.: J11078

Metro Property Development Pty Ltd

PRINT DATE: 02 October, 2014 - 4:56pm

CAD FILE: O:\J11078\Tuflow\Truncated\results\Respro\BA02\Figures - J11078 - Tuflow Results.dwg
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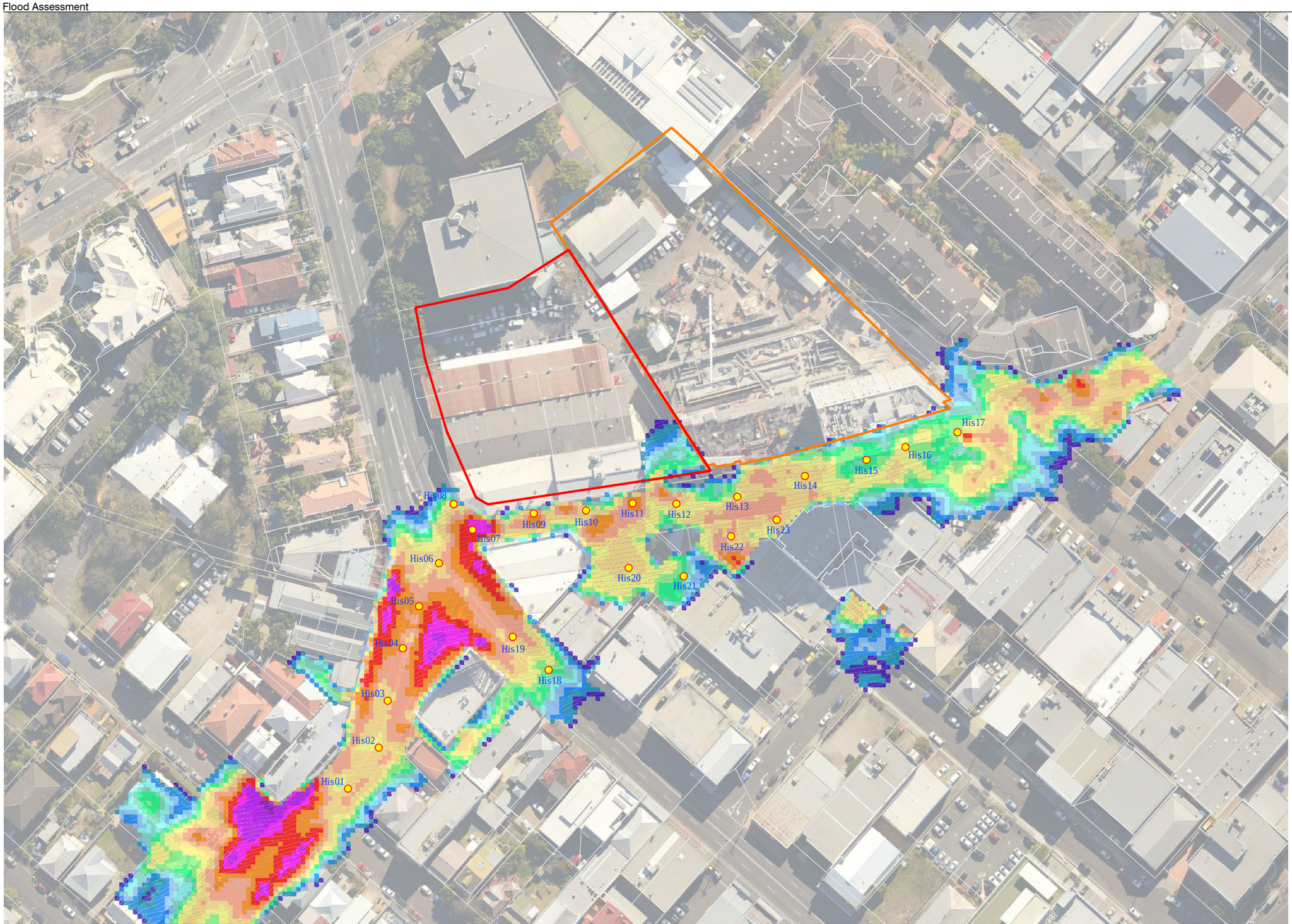

LEGEND:

Phase 1 Boundary

Phase 2 Boundary

His13 Reporting Nodes

RESULTS LEGEND:
Depth (m)

- Above 1.25
- 1.00 to 1.25
- 0.90 to 1.00
- 0.80 to 0.90
- 0.70 to 0.80
- 0.60 to 0.70
- 0.50 to 0.60
- 0.40 to 0.50
- 0.35 to 0.40
- 0.30 to 0.35
- 0.25 to 0.30
- 0.20 to 0.25
- 0.15 to 0.20
- 0.10 to 0.15
- 0.05 to 0.10
- 0.01 to 0.05

Aerial imagery courtesy of Nearmap, 2014

12.5 0 12.5 25.0 37.5 50.0 62.5m 1:1250

Scale 1:1,250 (A3)

FIGURE A.2.2
PRE-DEVELOPED Q50 WATER DEPTH (BA02)

October 2014

Project No.: J11078

Metro Property Development Pty Ltd

PRINT DATE: 02 October, 2014 - 4:56pm

CAD FILE: O:\J11078\Tuflow\Truncated\results\Respro\BA02\Figures - J11078 - Tuflow Results.dwg
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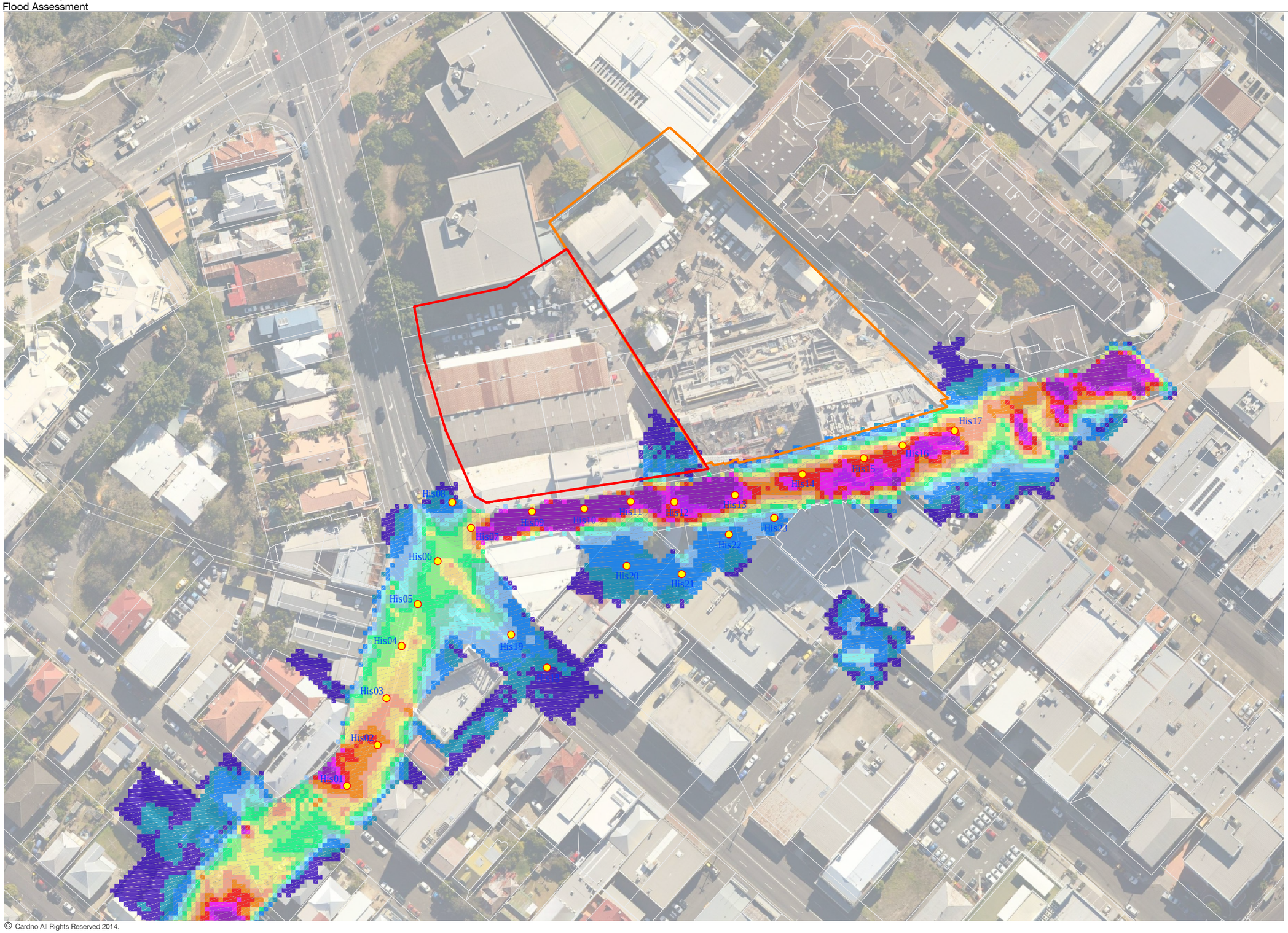
Cardno



N

LEGEND:

- Phase 1 Boundary
- Phase 2 Boundary
- His13 Reporting Nodes

RESULTS LEGEND:
Speed (m/s)

- Above 3.50
- 3.25 to 3.50
- 3.00 to 3.25
- 2.75 to 3.00
- 2.50 to 2.75
- 2.25 to 2.50
- 2.00 to 2.25
- 1.75 to 2.00
- 1.50 to 1.75
- 1.25 to 1.50
- 1.00 to 1.25
- 0.75 to 1.00
- 0.50 to 0.75
- 0.20 to 0.50
- 0.10 to 0.20
- Below 0.10

12.5 0 12.5 25.0 37.5 50.0 62.5m
1:1250

Scale 1:1,250 (A3)

FIGURE A.3.1

PRE-DEVELOPED Q100 WATER SPEED (BA02)

October 2014

Project No.: J11078

Metro Property Development Pty Ltd

PRINT DATE: 02 October, 2014 - 4:56pm
CAD FILE: O:\J11078\Tuflow\Truncated\results\Respro\BA02\Figures - J11078 - Tuflow Results.dwg
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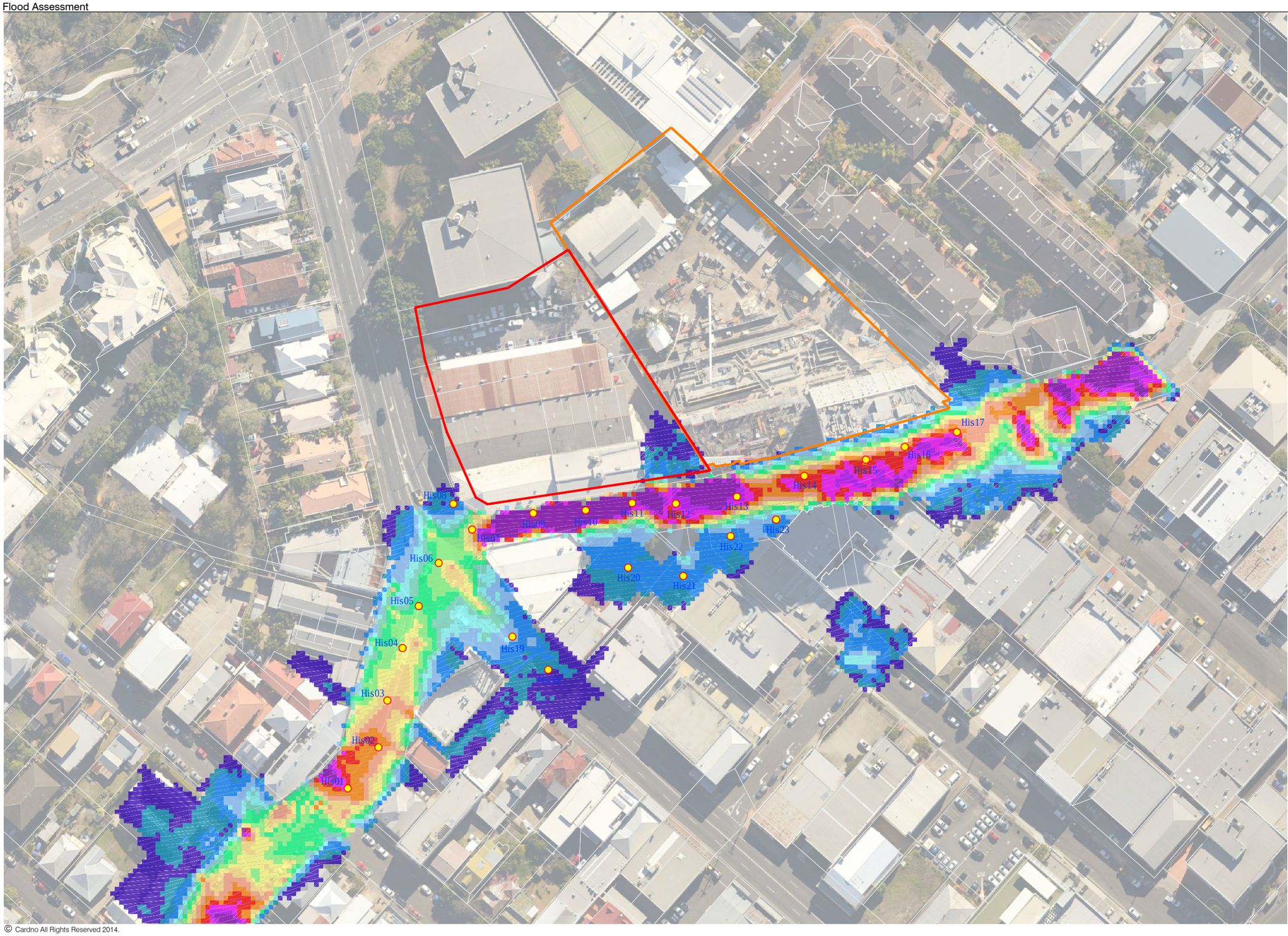


N

LEGEND:

- Phase 1 Boundary
- Phase 2 Boundary
- His13 Reporting Nodes

RESULTS LEGEND:
Speed (m/s)

- Above 3.50
- 3.25 to 3.50
- 3.00 to 3.25
- 2.75 to 3.00
- 2.50 to 2.75
- 2.25 to 2.50
- 2.00 to 2.25
- 1.75 to 2.00
- 1.50 to 1.75
- 1.25 to 1.50
- 1.00 to 1.25
- 0.75 to 1.00
- 0.50 to 0.75
- 0.20 to 0.50
- 0.10 to 0.20
- Below 0.10

12.5 0 12.5 25.0 37.5 50.0 62.5m
1:1250

Scale 1:1,250 (A3)

FIGURE A.3.2
PRE-DEVELOPED Q50 WATER SPEED (BA02)

October 2014

Project No.: J11078

Metro Property Development Pty Ltd

CAD FILE: O:\J11078\Tuflow\Truncated\results\Respro\BA02\Figures - J11078 - Tuflow Results.dwg
XREF's: Tuflow_Results; xr-DCDB 3503-78 2013 MGA94 zone56; xr - J11078 2014 DCDB MGA94 z56

PRINT DATE: 02 October, 2014 - 4:56pm

Appendix B

Post-Developed TUFLOW Results

LEGEND:

- Phase 1 Boundary
- Phase 2 Boundary
- His13 Reporting Nodes

RESULTS LEGEND:
Water Surface Level (mAHD)

- Above 16.40
- 16.00 to 16.40
- 15.60 to 16.00
- 15.20 to 15.60
- 14.80 to 15.20
- 14.40 to 14.80
- 14.00 to 14.40
- 13.60 to 14.00
- 13.20 to 13.60
- 12.80 to 13.20
- 12.40 to 12.80
- 12.00 to 12.40
- 11.60 to 12.00
- 11.20 to 11.60
- 10.80 to 11.20
- 10.40 to 10.80
- 10.00 to 10.40
- 9.60 to 10.00
- 9.20 to 9.60
- Below 9.20

Aerial imagery courtesy of Nearmap, 2014

12.5 0 12.5 25.0 37.5 50.0 62.5m
1:1250

Scale 1:1,250 (A3)

FIGURE B.1.1
POST-DEVELOPED Q100 WATER SURFACE LEVELS (DE02d)

October 2014

Project No.: J11078

Metro Property Development Pty Ltd

CAD FILE: O:\J11078\Tuflow\Truncated\results\Respro\DE02d\Figures - J11078 - Tuflow Results.dwg
XREF's: Tuflow_Results; xr-DCDB 3503-78 2013 MGA94 zone56; xr - J11078 2014 DCDB MGA94 z56

PRINT DATE: 02 October, 2014 - 4:49pm

LEGEND:

- Phase 1 Boundary
- Phase 2 Boundary
- His13 Reporting Nodes

RESULTS LEGEND:
Water Surface Level (mAHD)

- Above 16.40
- 16.00 to 16.40
- 15.60 to 16.00
- 15.20 to 15.60
- 14.80 to 15.20
- 14.40 to 14.80
- 14.00 to 14.40
- 13.60 to 14.00
- 13.20 to 13.60
- 12.80 to 13.20
- 12.40 to 12.80
- 12.00 to 12.40
- 11.60 to 12.00
- 11.20 to 11.60
- 10.80 to 11.20
- 10.40 to 10.80
- 10.00 to 10.40
- 9.60 to 10.00
- 9.20 to 9.60
- Below 9.20

Aerial imagery courtesy of Nearmap, 2014

12.5 0 12.5 25.0 37.5 50.0 62.5m
1:1250

Scale 1:1,250 (A3)

FIGURE B.1.2
POST-DEVELOPED Q50 WATER SURFACE LEVELS (DE02d)

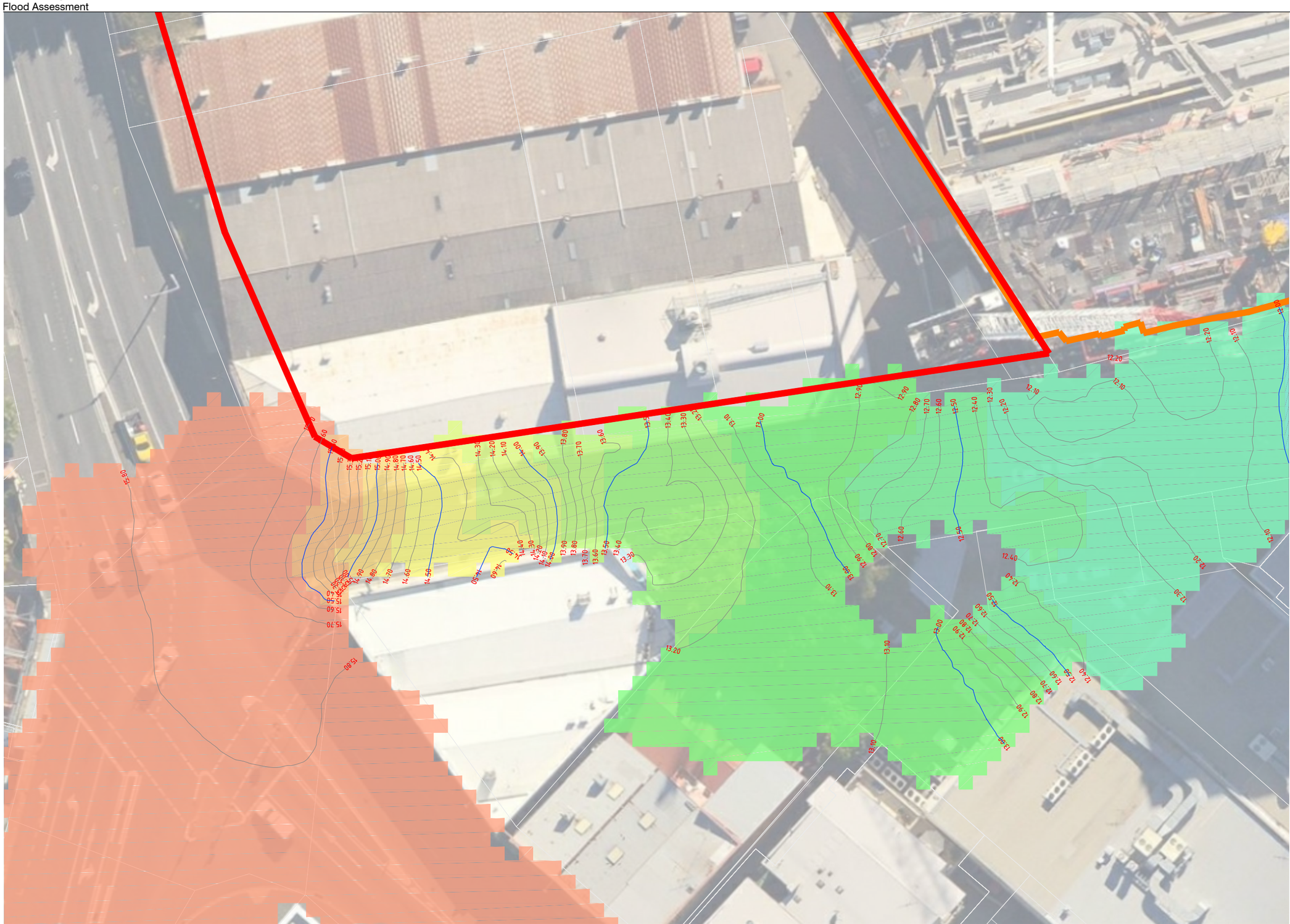
October 2014

Project No.: J11078

Metro Property Development Pty Ltd

CAD FILE: O:\J11078\Tuflow\Truncated\results\Respro\DE02d\Figures - J11078 - Tuflow Results.dwg
XREF's: Tuflow_Results; xr-DCDB 3503-78 2013 MGA94 zone56; xr - J11078 2014 DCDB MGA94 z56

PRINT DATE: 02 October, 2014 - 4:49pm



Aerial imagery courtesy of Nearmap, 2014

4 0 4 8 12 16 20m
1:400

Scale 1:400 (A3)

FIGURE B.1.3
POST-DEVELOPED Q100 WATER SURFACE LEVELS WITH 100mm CONTOURS (DE02d)

October 2014

Project No.: J11078

Metro Property Development Pty Ltd

CAD FILE: O:\J11078\Tuflow\Truncated\results\Respro\DE02d\Figures - J11078 - Tuflow Results.dwg
XREF's: Tuflow_Results; xr-DCDB 3503-78 2013 MGA94 zone56; xr - J11078 2014 DCDB MGA94 z56

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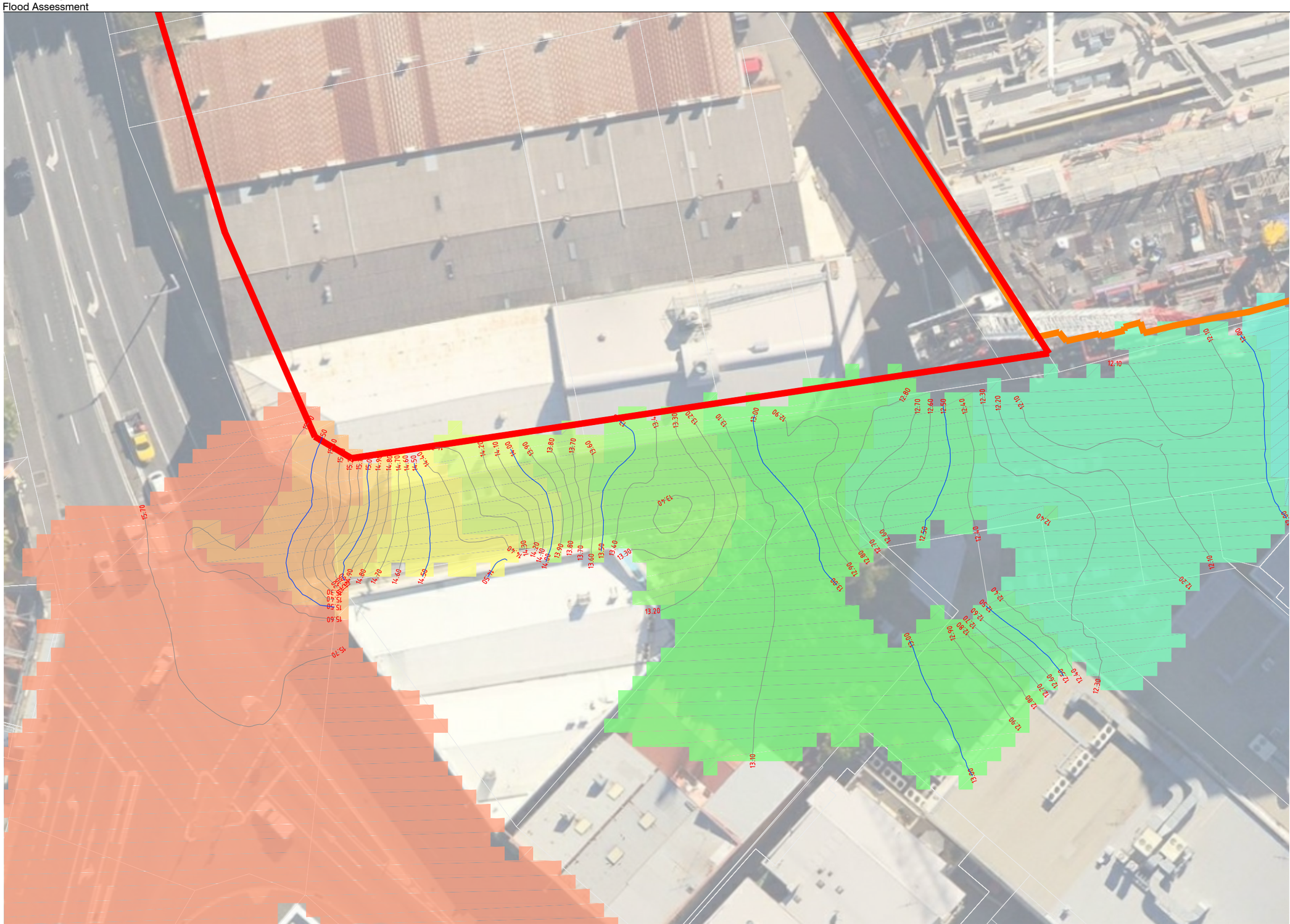


4 0 4 8 12 16 20m
1:400

Scale 1:400 (A3)

FIGURE B.1.4

POST-DEVELOPED Q50 WATER SURFACE LEVELS WITH 100mm CONTOURS (DE02d)

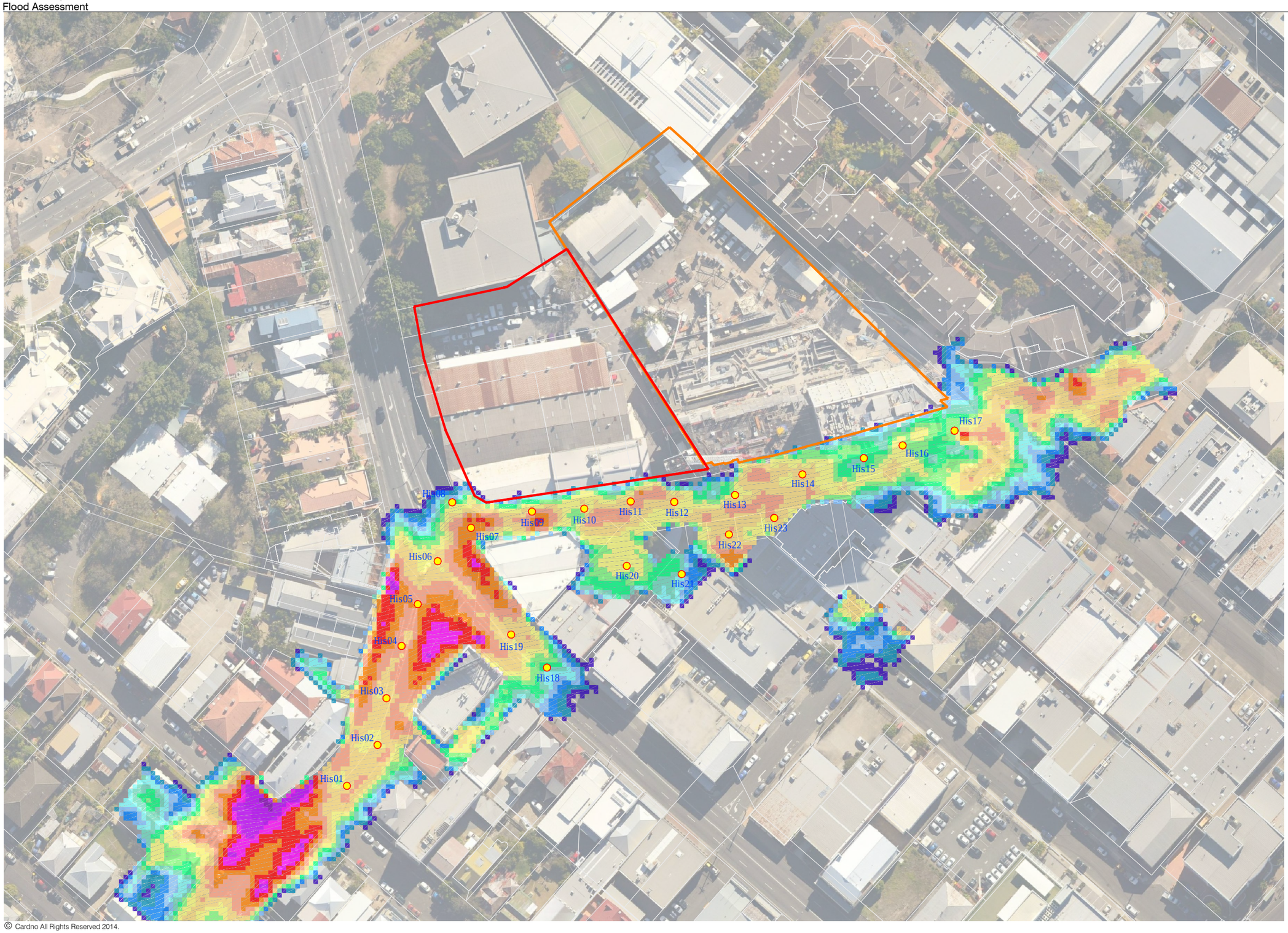
October 2014

Project No.: J11078

Metro Property Development Pty Ltd

CAD FILE: O:\J11078\Tuflow\Truncated\results\Respro\DE02d\Figures - J11078 - Tuflow Results.dwg
XREF's: Tuflow_Results; xr-DCDB 3503-78 2013 MGA94 zone56; xr - J11078 2014 DCDB MGA94 z56

PRINT DATE: 02 October, 2014 - 4:49pm



LEGEND:

- Phase 1 Boundary
- Phase 2 Boundary
- His13 Reporting Nodes

RESULTS LEGEND:
Depth (m)

- Above 1.25
- 1.00 to 1.25
- 0.90 to 1.00
- 0.80 to 0.90
- 0.70 to 0.80
- 0.60 to 0.70
- 0.50 to 0.60
- 0.40 to 0.50
- 0.35 to 0.40
- 0.30 to 0.35
- 0.25 to 0.30
- 0.20 to 0.25
- 0.15 to 0.20
- 0.10 to 0.15
- 0.05 to 0.10
- 0.01 to 0.05

Aerial imagery courtesy of Nearmap, 2014

12.5 0 12.5 25.0 37.5 50.0 62.5m
1:1250

Scale 1:1,250 (A3)

FIGURE B.2.1
POST-DEVELOPED Q100 WATER DEPTH (DE02d)

October 2014

Project No.: J11078

PRINT DATE: 02 October, 2014 - 4:49pm

Metro Property Development Pty Ltd

CAD FILE: O:\J11078\Tuflow\Truncated\results\Respro\DE02d\Figures - J11078 - Tuflow Results.dwg
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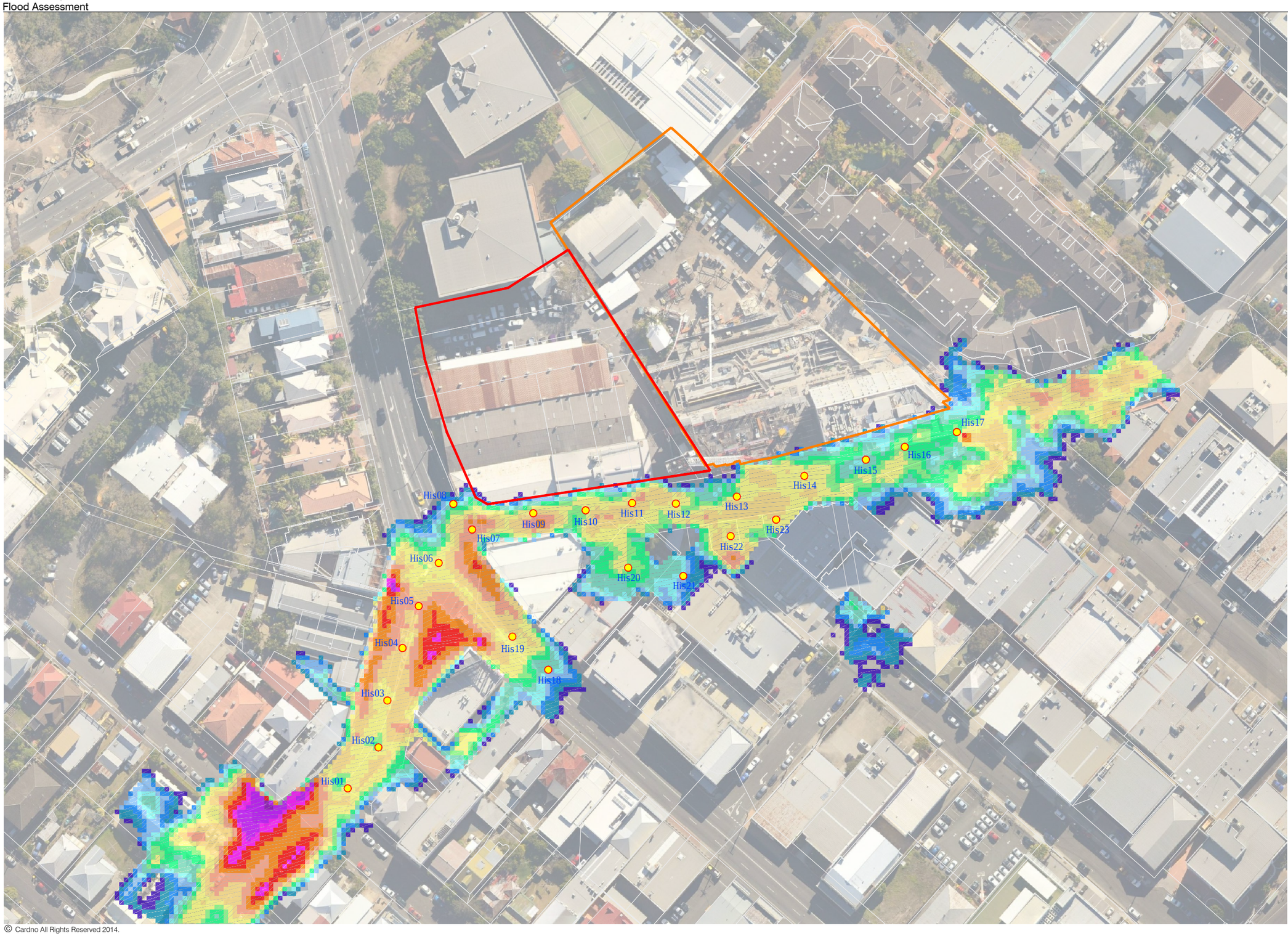

LEGEND:

- Phase 1 Boundary
- Phase 2 Boundary
- His13 Reporting Nodes

RESULTS LEGEND:
Depth (m)

- Above 1.25
- 1.00 to 1.25
- 0.90 to 1.00
- 0.80 to 0.90
- 0.70 to 0.80
- 0.60 to 0.70
- 0.50 to 0.60
- 0.40 to 0.50
- 0.35 to 0.40
- 0.30 to 0.35
- 0.25 to 0.30
- 0.20 to 0.25
- 0.15 to 0.20
- 0.10 to 0.15
- 0.05 to 0.10
- 0.01 to 0.05

Aerial imagery courtesy of Nearmap, 2014

12.5 0 12.5 25.0 37.5 50.0 62.5m
1:1250

Scale 1:1,250 (A3)

FIGURE B.2.2
POST-DEVELOPED Q50 WATER DEPTH (DE02d)

October 2014

Project No.: J11078

Metro Property Development Pty Ltd

CAD FILE: O:\J11078\Tuflow\Truncated\results\Respro\DE02d\Figures - J11078 - Tuflow Results.dwg
XREF's: Tuflow_Results; xr-DCDB 3503-78 2013 MGA94 zone56; xr - J11078 2014 DCDB MGA94 z56

PRINT DATE: 02 October, 2014 - 4:50pm

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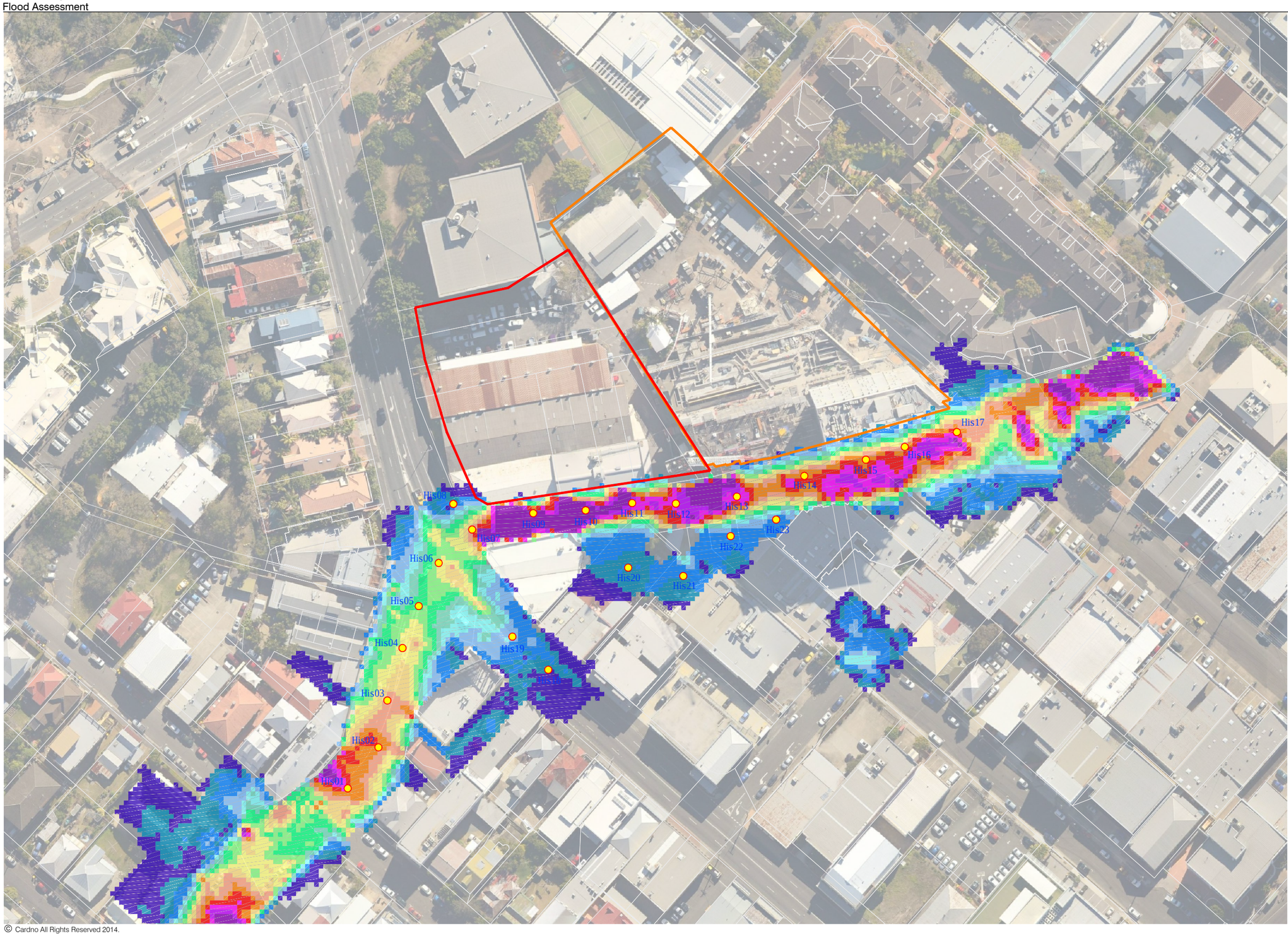


N

LEGEND:

- Phase 1 Boundary
- Phase 2 Boundary
- His13 Reporting Nodes

RESULTS LEGEND:
Speed (m/s)

- Above 3.50
- 3.25 to 3.50
- 3.00 to 3.25
- 2.75 to 3.00
- 2.50 to 2.75
- 2.25 to 2.50
- 2.00 to 2.25
- 1.75 to 2.00
- 1.50 to 1.75
- 1.25 to 1.50
- 1.00 to 1.25
- 0.75 to 1.00
- 0.50 to 0.75
- 0.20 to 0.50
- 0.10 to 0.20
- Below 0.10

Aerial imagery courtesy of Nearmap, 2014

12.5 0 12.5 25.0 37.5 50.0 62.5m
1:1250

Scale 1:1,250 (A3)

FIGURE B.3.1
POST-DEVELOPED Q100 WATER SPEED (DE02d)

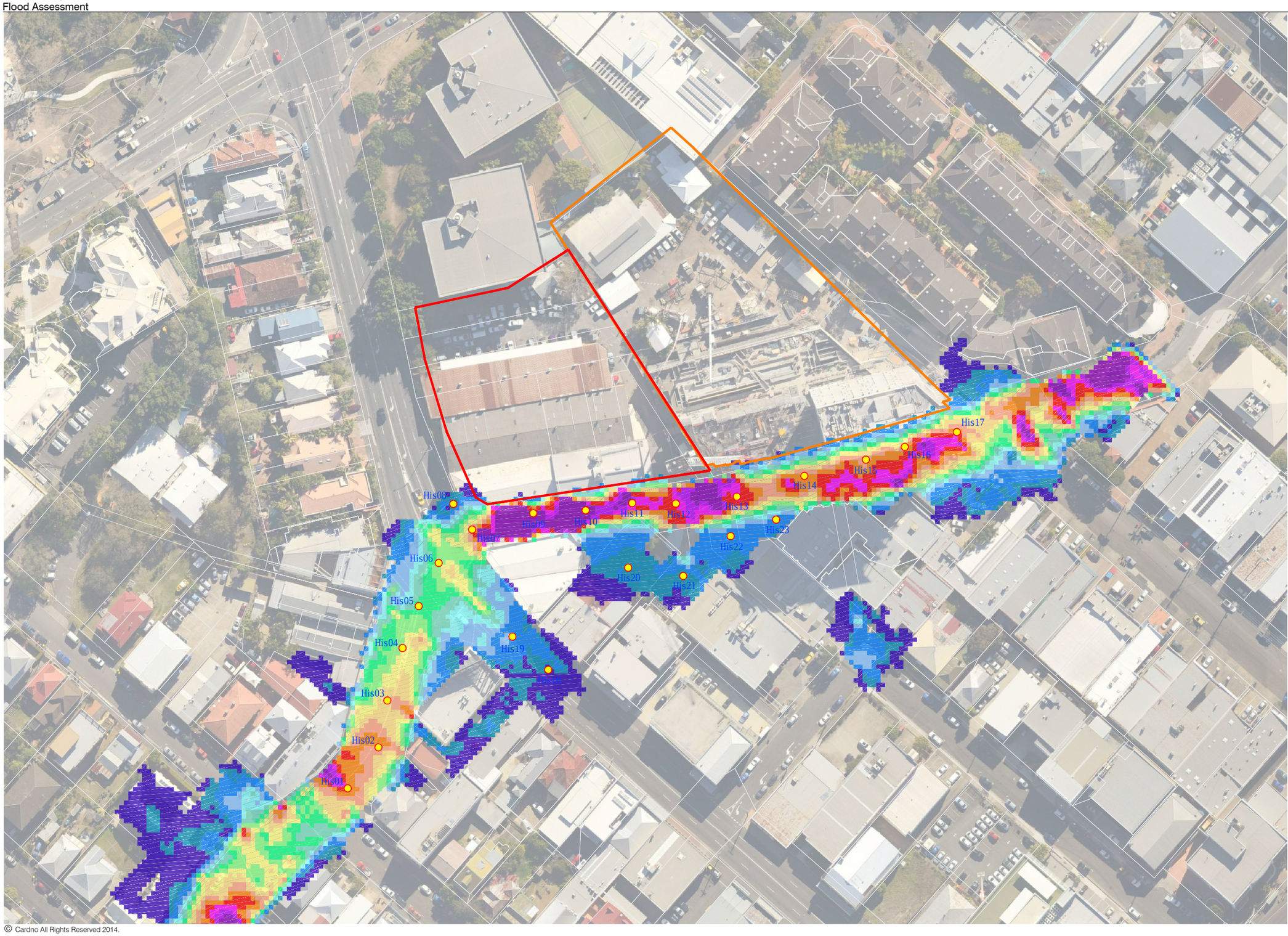
October 2014

Project No.: J11078

PRINT DATE: 02 October, 2014 - 4:50pm

Metro Property Development Pty Ltd

CAD FILE: O:\J11078\Tuflow\Truncated\results\Respro\DE02d\Figures - J11078 - Tuflow Results.dwg
XREF's: Tuflow_Results; xr-DCDB 3503-78 2013 MGA94 zone56; xr - J11078 2014 DCDB MGA94 z56



LEGEND:

- Phase 1 Boundary
- Phase 2 Boundary
- His13 Reporting Nodes

RESULTS LEGEND:
Speed (m/s)

- Above 3.50
- 3.25 to 3.50
- 3.00 to 3.25
- 2.75 to 3.00
- 2.50 to 2.75
- 2.25 to 2.50
- 2.00 to 2.25
- 1.75 to 2.00
- 1.50 to 1.75
- 1.25 to 1.50
- 1.00 to 1.25
- 0.75 to 1.00
- 0.50 to 0.75
- 0.20 to 0.50
- 0.10 to 0.20
- Below 0.10

Aerial imagery courtesy of Nearmap, 2014

12.5 0 12.5 25.0 37.5 50.0 62.5m
1:1250

Scale 1:1,250 (A3)

FIGURE B.3.2
POST-DEVELOPED Q50 WATER SPEED (DE02d)

October 2014

Project No.: J11078

Metro Property Development Pty Ltd

CAD FILE: O:\J11078\Tuflow\Truncated\results\Respro\DE02d\Figures - J11078 - Tuflow Results.dwg
XREF's: Tuflow_Results; xr-DCDB 3503-78 2013 MGA94 zone56; xr - J11078 2014 DCDB MGA94 z56

PRINT DATE: 02 October, 2014 - 4:50pm

Cardno

N

LEGEND:

Phase 1 Boundary

Phase 2 Boundary

His13 Reporting Nodes

RESULTS LEGEND:
Impact (mm)

- Above 150
- 100 to 150
- 50 to 100
- 25 to 50
- 10 to 25
- -25 to -10
- -50 to -25
- -100 to -50
- -150 to -100
- Below -150

Aerial imagery courtesy of Nearmap, 2014

12.5 0 12.5 25.0 37.5 50.0 62.5m 1:1250

Scale 1:1,250 (A3)

FIGURE B.4.1
POST-DEVELOPED Q100 IMPACT (DE02d)

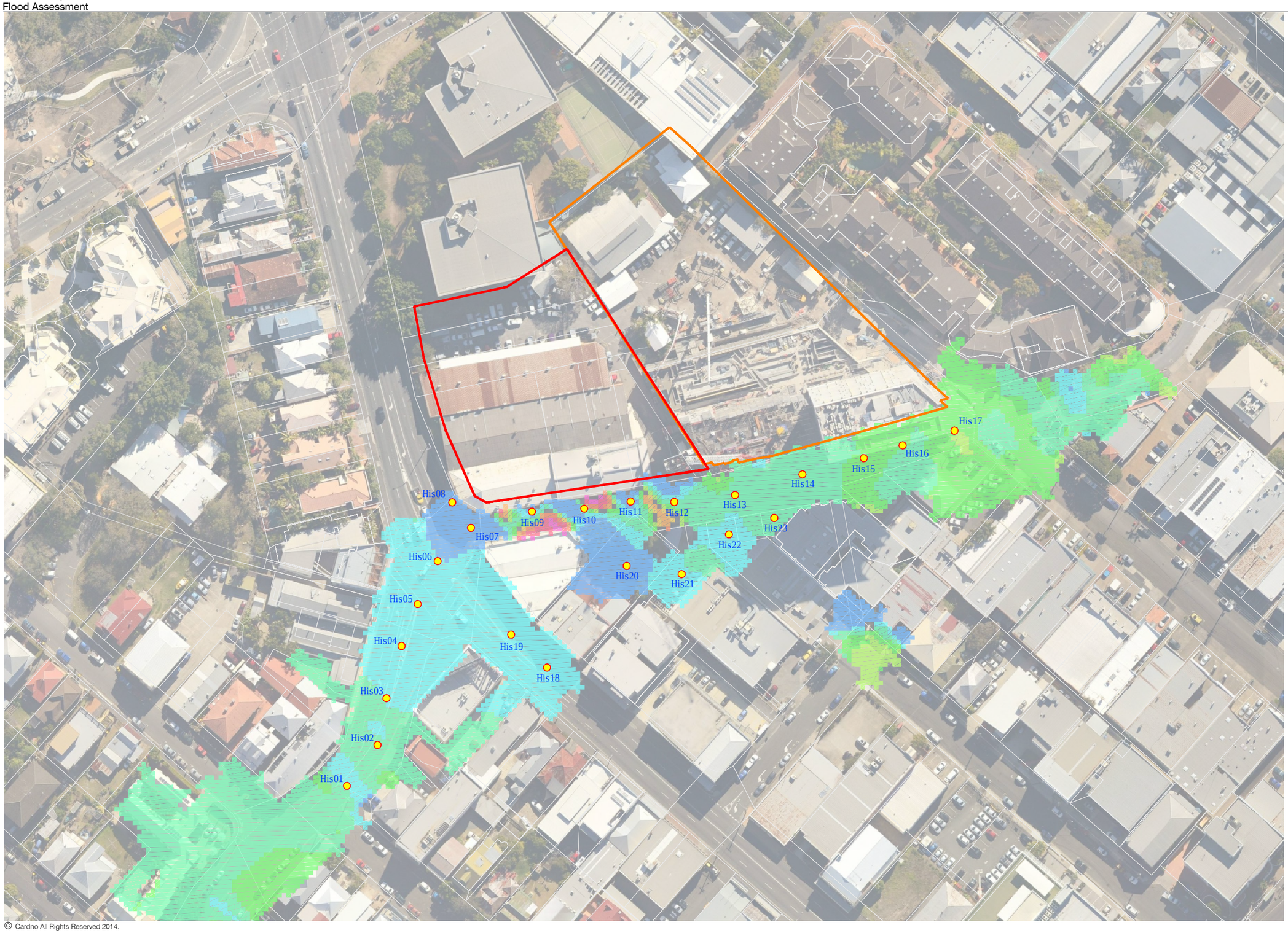
October 2014

Project No.: J11078

Metro Property Development Pty Ltd

CAD FILE: O:\J11078\Tuflow\Truncated\results\Respro\DE02d\Figures - J11078 - Tuflow Results.dwg
XREF's: Tuflow_Results; xr-DCDB 3503-78 2013 MGA94 zone56; xr - J11078 2014 DCDB MGA94 z56

PRINT DATE: 02 October, 2014 - 4:50pm



LEGEND:

Phase 1 Boundary

Phase 2 Boundary

His13 Reporting Nodes

RESULTS LEGEND:
Impact (mm)

- Above 150
- 100 to 150
- 50 to 100
- 25 to 50
- 10 to 25
- -25 to -10
- -50 to -25
- -100 to -50
- -150 to -100
- Below -150

12.5 0 12.5 25.0 37.5 50.0 62.5m
1:1250

Scale 1:1,250 (A3)

FIGURE B.4.2
POST-DEVELOPED Q50 IMPACT (DE02d)

October 2014

Project No.: J11078

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