Flood Impact Assessment

Elizabeth Enterprise Precinct (EEP) – SSDA Masterplan Stage 1

304600112

Prepared for
Mirvac

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Stantec

Contact Information

Stantec Australia Pty Ltd
ABN 17 007 820 322

Level 16, 207 Kent Street, SYDNEY NSW 2000

Telephone: 61 2 9493 9700
International: 61 2 9493 9700

BusinessServices.NSW@stantec.com
www.stantec.com

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Executive Summary

The purpose of this report is to assess the impact of the SSDA Masterplan Stage 1 works which it is proposed to undertake within the Elizabeth Enterprise Precinct.

The flood impact assessment was informed by the assessment of design flood levels under Detailed Survey (2018) conditions as described in Cardno, 2021 which was compared with the flood mapping reported by Advisian, 2020 (refer Section 1.5).

Hydrology

It was found previously that development of the Elizabeth Drive Enterprise Precinct has an adverse impact on peak discharges from the various stages. This adverse impact is greatest in the 2 yr ARI 2 hr storm burst and decreases as the storm burst duration increases. The same trend in adverse impacts on the local runoff in the 100 yr ARI events is also observed.

However, it was also found that increased runoff from the Elizabeth Drive Enterprise Precinct will not adversely impact peak flows in South Creek in 2 yr ARI 2 hr, 9 hr and 36 hr events nor in 100 yr ARI 2 hr, 9 hr and 36 hr events nor in the PMF 6 hr event. This is due to the timing of site runoff in relation to the timing of the peak flows in South Creek.

Notwithstanding the runoff from the Elizabeth Drive Enterprise Precinct will not adversely impact peak flows in South Creek, an assessment of basin sizes to manage 2 yr ARI and 100 yr ARI peak flows in a 2 hr storm burst was undertaken. The assessment estimated the Site Storage Requirement (SSR) and Permissible Site Discharge (PSD) to limit post-development peak runoff from the development in a 2 yr ARI 2 hr storm burst to around the pre-development peak flow in a 2 yr ARI 36 hr storm burst and the SSR and PSD to limit post-development peak runoff from the development in a 100 yr ARI 2 hr storm burst to around the pre-development peak flow in a 100 yr ARI 36 hr storm burst.

The 2yr PSD is around 15 L/s/ha - 24 L/s/ha while the SSR is around 200 m^3/ha - 220 m^3/ha.

The 100yr PSD is around 46 L/s/ha - 70 L/s/ha while the SSR is around 400 m^3/ha - 460 m^3/ha.

Hydrological modelling of the South Creek catchment was undertaken at the catchment and precinct scale using XP-RAFTS as described in Cardno, 2021.

On the basis that the Stage 1 development bulk earthworks include a basin to mitigate the impacts of development (see **Figures 3** and **4**), it is considered that the adopted runoff assessed under Detailed Survey (2018) Conditions (Cardno, 2021) is representative of the Future Conditions with a basin.

Hydraulics

The updated EEP SSDA Masterplan Stage 1A Staging Plan is plotted in **Figure 3** while the updated Stage 1 Layout Plan is plotted in **Figure 4.**

The local floodplain model of proposed Stage 1 bulk earthworks conditions was assembled by updating the DEM adopted for Detailed Survey (2018) Conditions based on DEM provided by AT&L.

Design flood levels and extent, depths, velocities and hazards were assessed under proposed Stage 1 bulk earthworks for the 20 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI floods and the PMF.

Flood Impact Assessment

Flood Level Impacts

The estimated impact of the SSDA Masterplan Stage 1 works on 20 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI flood levels and PMF levels (in comparison to Detailed Survey (2018) Conditions) are plotted in **Figures F5, F11, F17, F23** and **F29** respectively.

These Figures disclose nil impact in the 20 yr ARI and 100 yr ARI events. This was expected because the limit of the bulk earthworks lies just outside the 100 yr ARI flood extent under 2018 Conditions. The impact on flood levels in the 200 yr ARI and 500 yr ARI events are negligible. The impact of PMF levels extends beyond the site boundary it appears that these impacts are exacerbated by the “corner” of the berm which extends east of the limit of Stage 1 earthworks. these impacts are up to around 0.05 m on the eastern extent of the PMF. The PMF impacts extend to Elizabeth Drive. Given the likelihood of the PMF, these flood level impacts are considered to be negligible.

Flood Velocity Impacts

The estimated impact of Proposed Bulk Earthworks on 20 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI flood velocities and PMF velocities (in comparison to Detailed Survey (2018) Conditions) are plotted in **Figures F7, F13, F19, F24** and **F30** respectively.

These Figures disclose nil impact in the 20 yr ARI and 100 yr ARI events. This was expected because the limit of the bulk earthworks lies just outside the 100 yr ARI flood extent under 2018 Conditions. The impact on flood velocities in the 200 yr ARI and 500 yr ARI events are less than 0.05 m/s and are negligible. The impacts on PMF velocities extend across the floodplain just north of Stage 1. It appears that these impacts are initiated by the “corner” of the berm which extends east of the limit of Stage 1 earthworks. These velocities do not exceed 2 m/s expect in a small zone close to the “corner” of the berm. The impact on PMF velocities is minor.

Planning Considerations

The *Western Sydney Aerotropolis Development Control Plan 2022* has been prepared in accordance with Part 3, Division 3.6 of the *Environmental Planning and Assessment Act 1979* (**EP&A Act**) and the Environmental Planning and Assessment Regulation 2021.

As stated in the DCP: *the DCP provides the planning, design and environmental objectives and controls which will inform the preparation and assessment of Development Applications and Masterplans.*

The Elizabeth Enterprise Precinct is located within the land application map given in the DCP (refer **Figure 5)**.

For the purposes of this DCP, the flood planning area is the land identified on the Flood Planning Map of the Western Parkland City SEPP 2021. The flood planning area identified in the Western Parkland City in the vicinity of the subject site is given in **Figure 6.**

The compliance of the updated Stage 1 Masterplan with Section 2.5.1 Flood Management of the Western Sydney Aerotropolis DCP 2022 is assessed in **Attachment A**.

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1 Introduction

1.1 Purpose of this Report

The purpose of this report is to assess the impact of the updated SSDA Masterplan Stage 1 works which it is proposed to undertake within the Elizabeth Enterprise Precinct.

SSDA-19618251 seeks approval for the following scope of development:

- Concept Masterplan for EEP Stage 1 comprising seven (7) industrial buildings, internal road network layout, building locations, GFA, car parking, concept landscaping, building heights, setbacks and built form parameters;
- Stage 1 infrastructure works, including:
  - Demolition and removal of existing rural structures;
  - Heritage salvage works (if applicable);
  - Creation of roads and access infrastructure, including a signalised intersection with Elizabeth Drive;
  - Clearing of existing vegetation on the subject site and associated dam dewatering and decommissioning;
  - On-site bulk earthworks including any required ground dewatering;
  - Construction of boundary retaining walls;
  - Delivery of catchment level stormwater infrastructure, trunk service connections, utility infrastructure;
- Construction and fit out of warehouse and distribution buildings on proposed Lots 2 and 6 (approximately 56,000 m2 GFA), which will operate 24 hours per day, seven days per week;
- Office buildings on proposed Lots 2 and 6 (approximately 3,000 m2 GFA);
- Ancillary works including signage, fencing and landscaping;
- Subdivision of Stage 1;
- Construction of an earth bund within Stage 2 lands to form an interim evaporative storage basin. The basin will capture and store surface water runoff from the Stage 1 development area (via the proposed OSD basin), as well as local catchment runoff from the Stage 2 land to the west. The basin is one of several measures that have been incorporated into the stormwater management strategy to satisfy stormwater quality and flow volume controls for the EEP Stage 1 development; and
- Implementation of construction-phase erosion and sediment controls (refer to Erosion and Sediment Control Plan for details).

The flood impact assessment was informed by the assessment of design flood levels under Detailed Survey (2018) conditions as described in Cardno, 2021 which was compared with the flood mapping reported by Advisian, 2020 (refer Section 1.5).

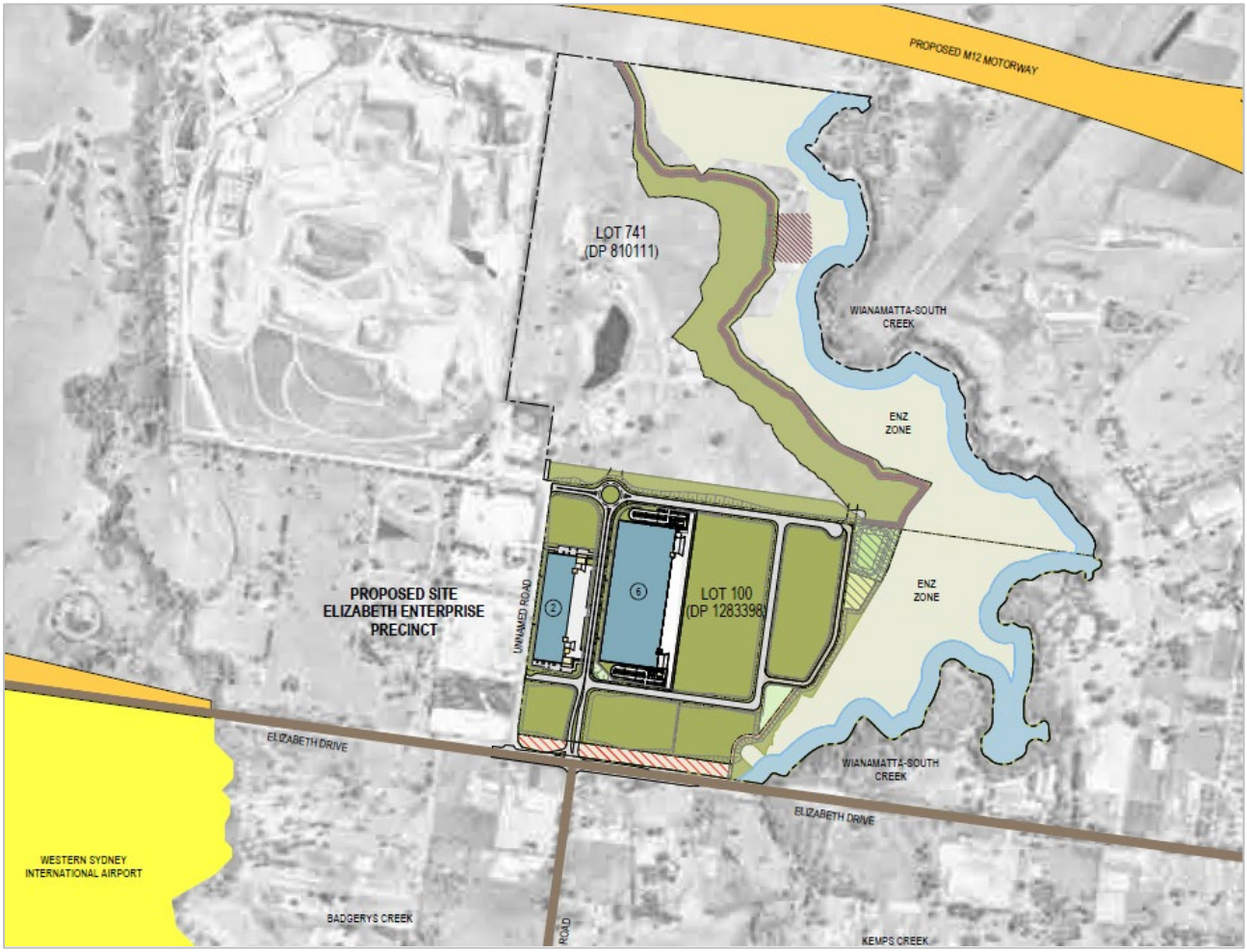


Figure 1 Location of Elizabeth Enterprise Precinct (EEP)
(Source: AT&L Drawing DA000-D dated 12 February 2024)

1.2 Location

The location of the SSDA Masterplan Stage 1 works is indicated in **Figure 1**.

1.3 2015 Updated South Creek Flood Study

The Updated South Creek Flood Study was prepared by WorleyParsons Services on behalf of Penrith City Council, acting in association with Liverpool, Blacktown and Fairfield City Councils.

As described by WorleyParsons, 2015:

> *This flood study covers the South Creek catchment extending from Bringelly Road in the south to the Blacktown/Richmond Road Bridge crossing in the north. The total study area is about 240 km^2 and lies within the Hawkesbury, Penrith, Blacktown, Liverpool and Fairfield LGAs.*
>
> *The hydrologic modelling for this study is based on the previous RAFTS (Runoff Analysis and Flow Training Simulation) hydrologic modelling (Version 2.56, 1991) that was developed by the Department of Water Resources for the 'South Creek Flood Study' (1990). As part of this study, the RAFTS model of the South Creek catchment has been updated to Version 6.52 (2005) XPRAFTS.*

As part of the current study, the sub-catchment delineation and break-up was compared against the latest topographic data available for the study area to determine whether the sub-catchment boundaries required adjustments. Some further refinement of subcatchments was undertaken in order to improve the inter-relationship between the XPRAFTS model and the RMA-2 hydraulic flood model. This improved the interconnectivity between the hydrologic and hydraulic models and made possible the creation of additional localised inflows within the RMA-2 model. ….

The adopted roughness parameters for each sub-catchment were also reviewed against aerial photography in order to determine any changes in vegetation and/or floodplain development that may have occurred since 1990. ….

Intensity-Frequency-Duration (IFD) data was developed for the study catchment according to the standard procedures outlined in Chapter 2 of 'Australian Rainfall & Runoff – A Guide to Flood Estimation' (1987). Due to the significant spatial extent of the study area, across which numerous local catchments and tributaries apply, a total of nine (9) different IFDs were adopted. ….

As no definitive loss rate data is available for the catchment of South Creek and its tributaries, the adopted rainfall loss rates were based on data contained in the 1990 Flood Study. …

The validation of the updated XP-RAFTS model was based on a comparison between the peak discharge and hydrograph shape produced by the RAFTS model developed for the 1990 Flood Study and the results of the latest XP-RAFTS model. ….

In order to undertake validation of the model, the updated XP-RAFTS model was used to simulate the 100 year ARI storm with a critical storm duration of 36 hours. ….

Since completion of the 1990 Flood Study, there have been many changes occur across the South Creek catchment. These changes include the implementation of a number of measures recommended in the South Creek Floodplain Management Study, including works upstream of Elizabeth Drive, at Overett Avenue, and at South St Marys. Major development of the ADI site at St Marys and small areas on the fringe of Erskine Park has also occurred. Changes have also occurred to areas of the floodplain including the construction of levees and earthworks that have the potential to alter flooding patterns. …..

Accordingly, a two-dimensional hydrodynamic model of the South Creek system has been developed using the RMA-2 software package. The model is based on the latest topographic data for the catchment, which was derived from Light Detection and Ranging (LiDAR) data that was gathered for the entire South Creek floodplain between 2002 and 2006. ….

The RMA-2 flood model that has been developed for this study has not been calibrated against historic floods. The Project Brief specified that the model only needed to be validated against predicted peak flood levels generated for the 100 year ARI flood using the MIKE-11 and HEC-2 modelling that was developed for the 1990 Flood Study.

…. The computer models identified in Sections 4 and 5 were used to derive design flood estimates for the 20, 50, 100, 200 and 500 year recurrence floods as well as an Extreme Flood.

1.4 2020 Wianamatta (South) Creek Catchment Flood Study – Existing Conditions

As concluded by Advisian, 2020:

The RMA-2 hydraulic flood model that was developed for the 'Upper South Creek Flood Study' (2015) has been updated to incorporate the latest available topographic data which has been derived from LiDAR, as well as information from recent flood investigations and recent industrial and urban developments that have occurred in parts of the catchment. This has included extensions to the RMA-2 flood model in the upper reaches of the study area, particularly in the vicinity of Bringelly Road.

The XP-RAFTS hydrologic model that was applied as part of the 2015 Flood Study has also been updated. The results of simulations undertaken using the updated XP-RAFTS model indicate that peak flows for the 1% AEP 36 hour critical duration event are similar to those determined as part of the modelling completed for the 2015 Flood Study. Peak flows along South Creek are generally within 2% of the corresponding flows determined in 2015, with a maximum change of up to 8% near the downstream boundary at Richmond Road. Changes along tributaries have greater variability with a maximum change of up to 15% (refer Figure 4.9).

The 36 hour storm duration has been confirmed to be critical for the study area generating the largest peak flows along South Creek and at many of the major bridge crossings. Although shorter storm durations such as the 2 and 9 hour storms generate the largest flows along many of the smaller tributaries such as Thompsons, Bonds, Claremont and Werrington creeks (refer Table 4.3), the 36 hour duration is considered most relevant to the study and the assessment of impacts along the length of South Creek.

The updated XP-RAFTS hydrologic model was also used to simulate the 1% AEP flood based on ARR 2019 inputs and procedures. Peak flows at the Elizabeth Drive crossing were derived based on both ARR 1987 and ARR 2019 inputs and procedures, and the results were compared to peak flows derived at Elizabeth Drive from Flood Frequency Analysis (FFA). The comparison established that the modelling based on ARR 1987 generated a peak flow for the 1% AEP event that matched more closely (9% lower) to the FFA than was the case based on ARR 2019 (29% lower) (refer Table 4.5). Hence, it was determined that the assessment of flood hydrology for the South Creek catchment should continue to be based on ARR 1987 temporal patterns and Intensity-Frequency-Duration (IFD) data. This is consistent with the 'Updated South Creek Flood Study' (Advisian, 2015).

Revised mapping has been prepared for flood levels, depths and hazard for a range of design events. The hydraulic category mapping prepared previously for Penrith City Council as part of the 'South Creek Floodplain Risk Management Study & Plan' (2020) has also been updated according to the revised modelling results.

Some differences have been observed between the 2015 and 2020 flood model results for the 1% AEP flood. This is not unexpected given the catchment and floodplain changes associated with recent development and also the incorporation of more detailed topographic data that has led to a significant increase in the number of RMA-2 model nodes; i.e., greater network detail.

Detailed inspection of the modelling results has established that the areas where the changes occur, and their magnitude are consistent with the expected impact due to the local changes to the floodplain and catchment that have been observed over the last 5 years.

Accordingly, the updated flood models are considered to suitably represent the contemporary conditions across the South Creek catchment and floodplain. The models are therefore considered to be fit for purpose and appropriate tools for assessing the potential impact of future development scenarios on flood characteristics, including the potential impact of the blue-green grid infrastructure that is proposed as part of the Western Sydney Aerotropolis.

1.5 2021 Flood Risk Assessment

The purpose of this report was to provide a high-level understanding of the opportunities and constraints of the Elizabeth Enterprise Precinct (EEP) due to flooding and to inform the development of a precinct wide stormwater strategy/management plan for the EEP based on an assessment of flooding under 2015 and 2018 conditions using two-dimensional hydrodynamic flood models of the South Creek floodplain prepared using the following topographic data.

- LiDAR (2015) – Light Detection and Ranging (LiDAR) survey that was gathered for the entire South Creek floodplain between 2002 and 2006 and input into a hydraulic model by Worley Parsons in 2015;
- Detailed Survey (2018) – Detailed survey for the EEP site completed by Lockley Title Solutions in October 2016 and incorporated into a hydraulic model by Cardno in 2018. This detailed survey included for the earthworks completed over Lot 5 DP860456 and Lot 741 DP810111 as approved by Penrith City Council (Ref: DA08/0681) and completed in accordance with the consent as certified by Blackett Maguire + Goldsmith in Certificate No. CC09-104 on 13 May 2009.

In 2015 an Updated South Creek Flood Study was prepared by Worley Parsons Services on behalf of Penrith City Council, acting in association with Liverpool, Blacktown and Fairfield City Councils. This flood study was based on the LiDAR topographic survey data gathered for the entire South Creek floodplain between 2002 and 2006.

In November 2020, a final report titled the “Wianamatta (South) Creek Catchment Flood Study – Existing Conditions” was released by Infrastructure NSW (Advisian, 2020). This study updated the 2015 hydrological and hydraulic assessments.

1.5.1 Hydrology

Hydrological modelling of the South Creek catchment was undertaken at the catchment and development scale using XP-RAFTS. The hydrological model assembled by Worley Parsons in 2015 was used for consistency with the 2015 study. This model is based on ARR1987 IFD.

While the precinct overlaps adjoining subcatchments the great majority of the precinct lies within Subcatchments 1.14 and 1.15 (refer **Figure 5** in Cardno, 2021). Consequently, the precinct was partitioned into local subcatchments which would be drained into Subcatchment 1.14 (Subcatchment BE13) and into Subcatchment 1.15 (Subcatchment BE12) to separate any future development from the remainder of the subcatchment.

The estimated peak flows (in m^3/s) in South Creek in the precinct in a 2 yr ARI and 100 yr ARI 2 hr, 9hr and 36 hr storm bursts and a PMP 6 hr storm are summarised as follows.

ARI (yrs)	2	2	2	100	100	100	PMF
Storm Burst (mins)	120	540	2160	120	540	2160	360
Node ID							
BE13	0.02	1.0	1.46	2.7	4.8	4.0	14.6
1.14	13.0	90.6	167.4	215.0	439.3	498.9	1,812
BE12	0.01	0.6	1.61	1.5	4.1	5.4	19.2
1.15	13.3	112.1	211.0	256.7	555.3	648.3	2,300

Advisian, 2020 advised:

> *The XP-RAFTS hydrologic model that was applied as part of the 2015 Flood Study has also been updated. The results of simulations undertaken using the updated XP-RAFTS model indicate that peak flows for the 1% AEP 36 hour critical duration event are similar to those determined as part of the modelling completed for the 2015 Flood Study. Peak flows along South Creek are generally within 2% of the corresponding flows determined in 2015, with a maximum change of up to 8% near the downstream boundary at Richmond Road. Changes along tributaries have greater variability with a maximum change of up to 15% (refer Figure 4.9).*

1.5.2 Hydraulics

Cardno assembled a local TUFLOW model of the reaches of South Creek and Kemps Creek which extended 1 km upstream and downstream of the subject site. The upstream inflow boundary conditions and the downstream stage boundary conditions were obtained from the WorleyParsons (LiDAR survey based) 2015 flood study results. The roughness zones for the floodplain were based on the roughness values and their spatial distribution adopted in the WorleyParsons 2015 flood study.

The local floodplain model of LiDAR survey (2015) Conditions was based on the Digital Elevation Model (DEM) adopted for the WorleyParsons 2015 flood study. It was noted from Figure 3.1 in WorleyParsons, 2015 that the Elizabeth Enterprise Precinct is located within the zone identified as *ALS data collected within the Penrith LGA in 2003.*

The TUFLOW floodplain model was run for the 100 yr ARI 36 hour storm burst duration and the 6 hour PMP event to estimate flooding under LiDAR survey (2015) Conditions.

The local floodplain model of detailed survey (2018) conditions was assembled by updating the DEM adopted for LiDAR survey (2015) Conditions based on site survey provided by Mirvac. It was noted that the site survey disclosed that earthworks were undertaken on the site subsequent to the collection of ALS in 2003. In 2008 Penrith City Council approved DA08/0691 for “Earthworks – Pasture improvement to improve Drainage”. The consent become operational on 31 October 2008. The earthworks were completed in accordance with the consent as certified by Blackett Maguire + Goldsmith in Certificate No. CC09-104 on 13 May 2009.

The updated TUFLOW floodplain model was run for the 20 yr ARI, 100 yr ARI, 200 yr ARI and 500 yr ARI 36 hour storm burst duration events and the 6 hour PMP event to estimate flooding under Detailed Survey (2018) Conditions.

Figure 3-2 from the 2020 Advisian study attached in Appendix B of Cardno, 2021 indicated that the terrain in the 2020 Advisian model was updated, and this is expected to align closely with the detailed survey (2018) conditions in the local study area.

The differences between the 100 yr ARI flood levels estimated by the local TUFLOW model under Detailed Survey (2018) conditions and the 2015 RMA-2 model disclosed that the earthworks locally decreased or locally increased 100 yr ARI flood levels through the site. This is also observed in Figure 4-11 from the 2020 Advisian study attached in Appendix B of Cardno, 2021 which indicates that the updated terrain in the Advisian model has slightly lowered 1% AEP flood levels in comparison to 2015 flood levels. It is concluded that impact of the 2018 terrain on 2015 flood levels reported in this study aligns with the Advisian, 2020 results.

It was therefore concluded that under Detailed Survey (2018) Conditions are comparable to the updated 2020 Advisian floodplain modelling.

The estimated 20 year ARI, 200 yr ARI and 500 yr ARI flood levels and extent, depths, velocities, velocity x depth and hazards under Detailed survey (2018) Conditions have been plotted.

The estimated 100 year ARI hydraulic categories under Detailed Survey (2018) Conditions are also plotted as are also the estimated extents of the flood planning level under Detailed Survey (2018) Conditions

1.6 Flood Hazards

The 2023 Flood Risk Management Guideline FB03 released on 30 June 2023 by NSW DPE includes a plot of flood hazard vulnerability curves based on six hazard categories H1 – H6 (see **Figure 2**).

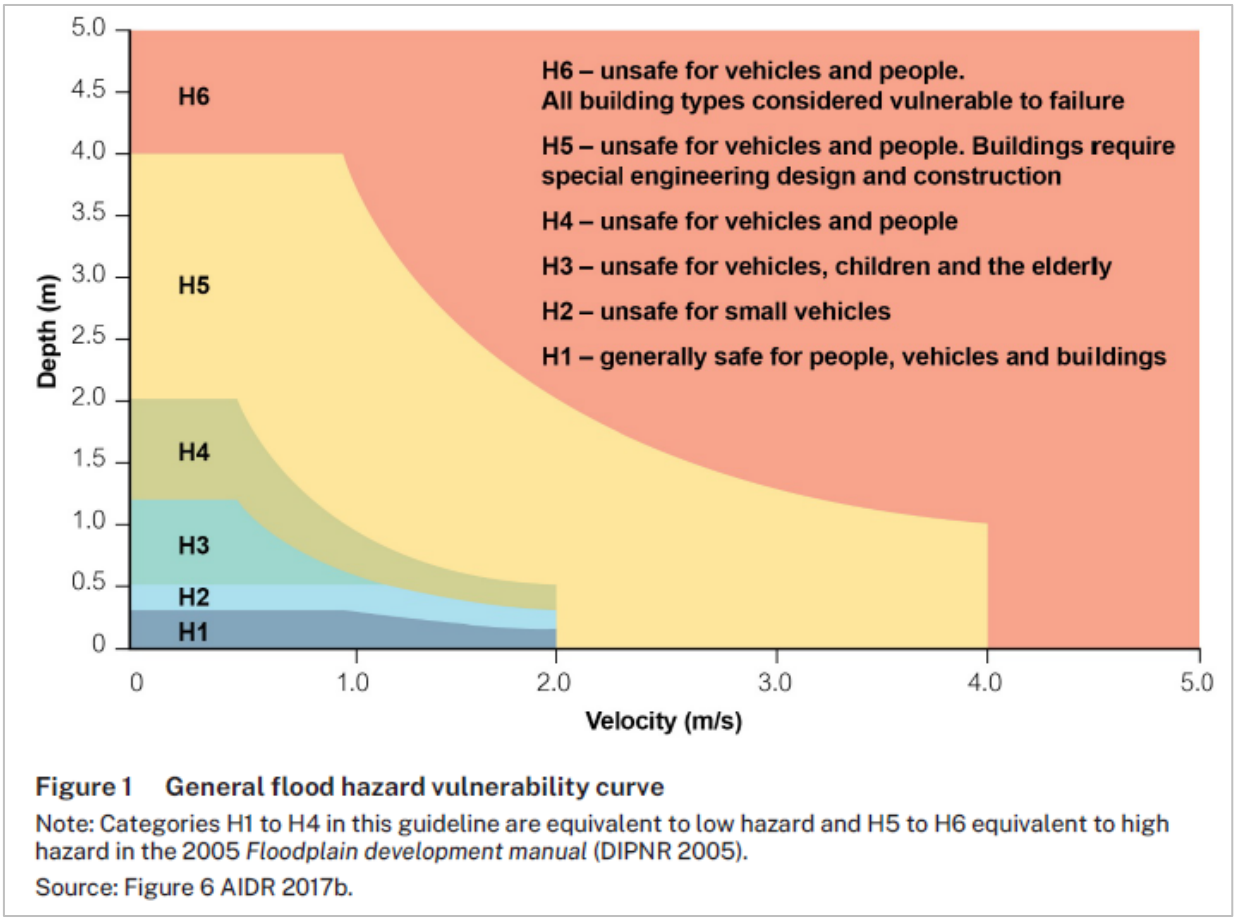


Figure 1 General flood hazard vulnerability curve

Note: Categories H1 to H4 in this guideline are equivalent to low hazard and H5 to H6 equivalent to high hazard in the 2005 *Floodplain development manual* (DIPNR 2005).

Source: Figure 6 AIDR 2017b.

Figure 2 Flood Hazard Categories (Source: 2023 FRM Guideline FB03)

1.7 Terminology

The terminology adopted herein depends on the edition of Australian Rainfall and Runoff provide the IFD data. In the case of assessments based on ARR1987 the ARI terminology was adopted design floods. In the case of assessments based on ARR2019 the AEP terminology was adopted design floods.

The terminology adopted herein is the same as adopted for the 2015 Updated South Creek Flood Study and the 2019 Flood Risk Assessment, namely, ARI for design floods.

2 Hydrology

It was found previously that development of the Elizabeth Drive Enterprise Precinct has an adverse impact on peak discharges from the various stages. This adverse impact is greatest in the 2 yr ARI 2 hr storm burst and decreases as the storm burst duration increases. The same trend in adverse impacts on the local runoff in the 100 yr ARI events is also observed.

However, it was also found that increased runoff from the Elizabeth Drive Enterprise Precinct will not adversely impact peak flows in South Creek in 2 yr ARI 2 hr, 9 hr and 36 hr events nor in 100 yr ARI 2 hr, 9 hr and 36 hr events nor in the PMF 6 hr event. This is due to the timing of site runoff in relation to the timing of the peak flows in South Creek.

Notwithstanding the runoff from the Elizabeth Drive Enterprise Precinct will not adversely impact peak flows in South Creek, an assessment of basin sizes to manage 2 yr ARI and 100 yr ARI peak flows in a 2 hr storm burst was undertaken. The assessment estimated the Site Storage Requirement (SSR) and Permissible Site Discharge (PSD) to limit post-development peak runoff from the development in a 2 yr ARI 2 hr storm burst to around the pre-development peak flow in a 2 yr ARI 36 hr storm burst and the SSR and PSD to limit post-development peak runoff from the development in a 100 yr ARI 2 hr storm burst to around the pre-development peak flow in a 100 yr ARI 36 hr storm burst.

The 2yr PSD is around 15 - 24 L/s/ha while the SSR is around 200 - 220 m^3/ha.

The 100yr PSD is around 46 - 70 L/s/ha while the SSR is around 400 - 460 m^3/ha.

Hydrological modelling of the South Creek catchment was undertaken at the catchment and precinct scale using XP-RAFTS as described in Cardno, 2021.

On the basis that the Stage 1 development bulk earthworks include a basin to mitigate the impacts of development (see **Figures 3, 4** and **5**), it is considered that the adopted runoff assessed under Detailed Survey (2018) Conditions (Cardno, 2021) is representative of the Future Conditions with a basin.

3 Flooding Assessment

The updated EEP SSDA Masterplan Stage 1A Staging Plan is plotted in **Figure 3.**

The layout of the proposed EEP SSDA Stage 1 works is plotted in **Figure 4.**

The assessment of flooding under the proposed Masterplan Stage 1 bulk earthworks was undertaken by modifying the local TUFLOW model of the reaches of South Creek and Kemps Creek described in Cardno, 2021 to represent the planned earthworks as follows.

3.1 Proposed Masterplan Stage 1 Conditions

The local floodplain model of proposed Stage 1 bulk earthworks conditions was assembled by updating the DEM adopted for Detailed Survey (2018) Conditions based on DEM provided by AT&L.

The TUFLOW floodplain model was run for the critical storm burst duration for the 20 yr ARI, 100 yr ARI and 200 yr ARI, 500 yr ARI and PMF events.

3.1.1 20 yr ARI

The estimated 20 year ARI flood levels and extent, depths, velocities and hazards under SSDA Masterplan Stage 1 Conditions are plotted in **Figures F1, F2 F3** and **F4** respectively.

3.1.2 100 yr ARI

The estimated 100 year ARI flood levels and extent, depths, velocities and hazards under SSDA Masterplan Stage 1 Conditions are plotted in **Figures F7, F8, F9** and **F10** respectively.

3.1.3 200 yr ARI

The estimated 200 year ARI flood levels and extent, depths, velocities and hazards under SSDA Masterplan Stage 1 Conditions are plotted in **Figures F13 F14 F15** and **F16** respectively.

3.1.4 500 yr ARI

The estimated 500 year ARI flood levels and extent, depths, velocities and hazards under SSDA Masterplan Stage 1 Conditions are plotted in **Figures F19, F20, F21** and **F22** respectively.

3.1.5 PMF

The estimated PMF levels and extent, depths, velocities and hazards under SSDA Masterplan Stage 1 Conditions are plotted in **Figures F25, F26, F27** and **F28** respectively.

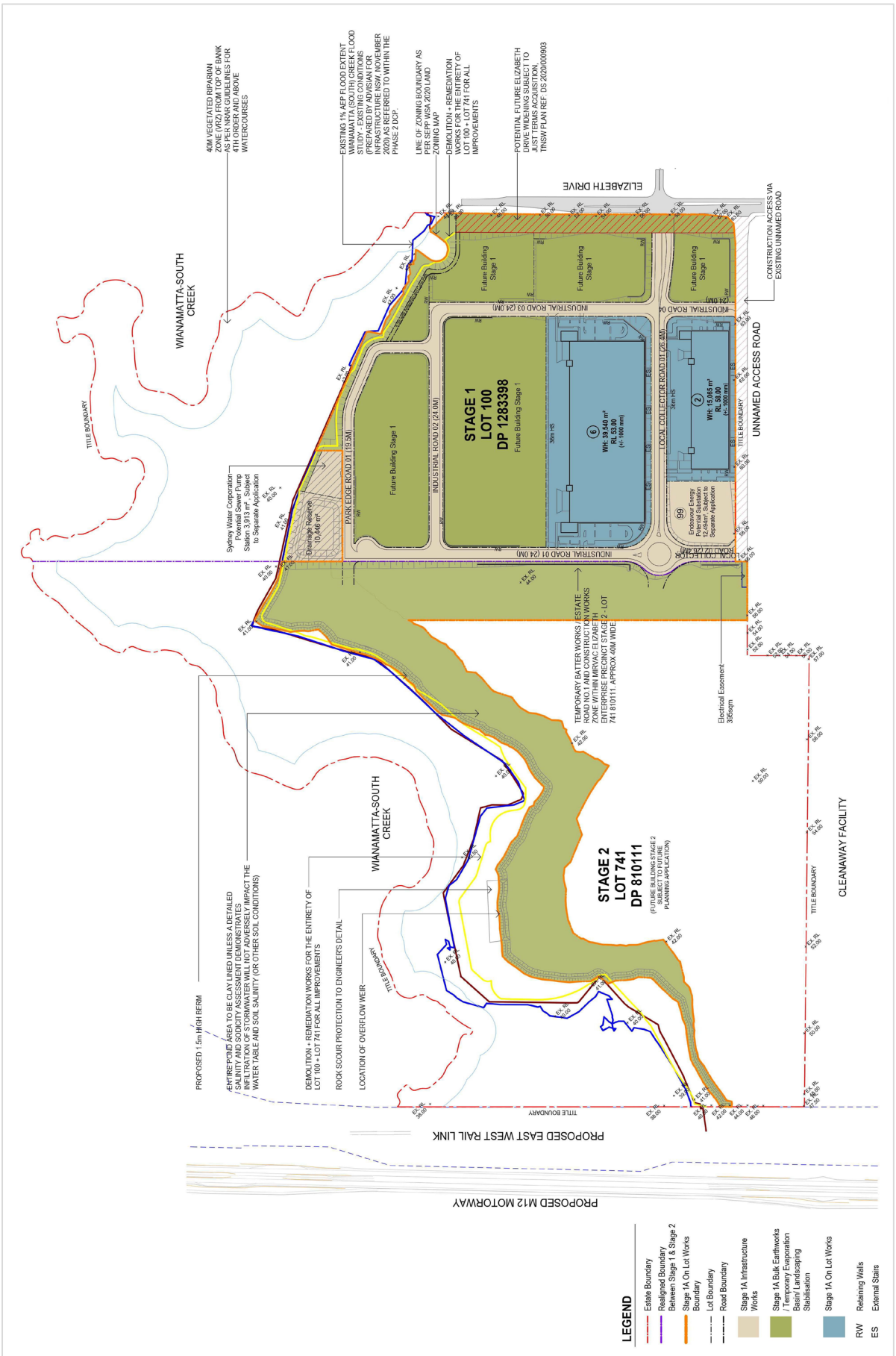


Figure 3 EEP Updated SSDA Stage 1A Staging Plan
(Source: SBA Architects Drawing MP03-H dated 19 February 2025)

Figure 4 EEP Updated SSDA Stage 1 Layout

(Source: SBA Architects Drawing MP02-M dated 19 February 2025)

4 Flood Impact Assessment

The impacts of the proposed Stage 1 bulk earthworks are described as follows.

4.1 Flood Level Impacts

The estimated impact of the SSDA Masterplan Stage 1 works on 20 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI flood levels and PMF levels (in comparison to Detailed Survey (2018) Conditions) are plotted in **Figures F5, F11, F17, F23** and **F29** respectively.

These Figures disclose nil impact in the 20 yr ARI and 100 yr ARI events. This was expected because the limit of the bulk earthworks lies just outside the 100 yr ARI flood extent under 2018 Conditions. The impact on flood levels in the 200 yr ARI and 500 yr ARI events are negligible. The impact of PMF levels extends beyond the site boundary it appears that these impacts are exacerbated by the “corner” of the berm which extends east of the limit of Stage 1 earthworks. these impacts are up to around 0.05 m on the eastern extent of the PMF. The PMF impacts extend to Elizabeth Drive. Given the likelihood of the PMF, these flood level impacts are considered to be negligible.

4.2 Flood Velocity Impacts

The estimated impact of Proposed Bulk Earthworks on 20 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI flood velocities and PMF velocities (in comparison to Detailed Survey (2018) Conditions) are plotted in **Figures F7, F13, F19, F24** and **F30** respectively.

These Figures disclose nil impact in the 20 yr ARI and 100 yr ARI events. This was expected because the limit of the bulk earthworks lies just outside the 100 yr ARI flood extent under 2018 Conditions. The impact on flood velocities in the 200 yr ARI and 500 yr ARI events are less than 0.05 m/s and are negligible. The impacts on PMF velocities extend across the floodplain just north of Stage 1. It appears that these impacts are initiated by the “corner” of the berm which extends east of the limit of Stage 1 earthworks. These velocities do not exceed 2 m/s expect in a small zone close to the “corner” of the berm. The impact on PMF velocities is minor.

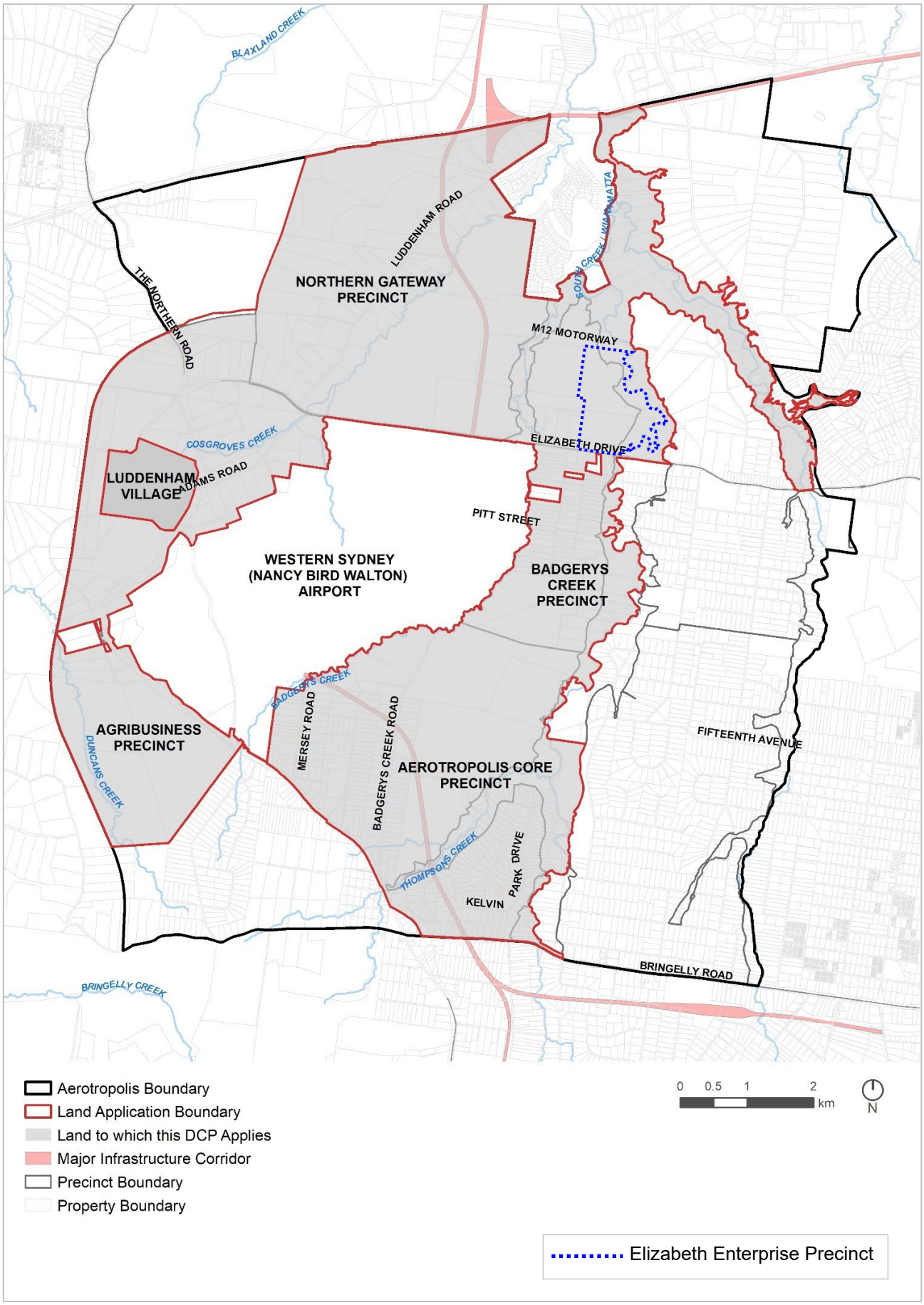


Figure 5 Land to which the Western Sydney Aerotropolis DCP 2022 Applies

5 Planning Considerations

The *Western Sydney Aerotropolis Development Control Plan 2022* has been prepared in accordance with Part 3, Division 3.6 of the *Environmental Planning and Assessment Act 1979* (**EP&A Act**) and the Environmental Planning and Assessment Regulation 2021.

As stated in the DCP: *the DCP provides the planning, design and environmental objectives and controls which will inform the preparation and assessment of Development Applications and Masterplans.*

The Elizabeth Enterprise Precinct is located within the land application map given in the DCP (refer **Figure 5)**.

For the purposes of this DCP, the flood planning area is the land identified on the Flood Planning Map of the Western Parkland City SEPP 2021. The flood planning area identified in the Western Parkland City in the vicinity of the subject site is given in **Figure 6.**

The compliance of the updated Stage 1 Masterplan with Section 2.5.1 Flood Management of the Western Sydney Aerotropolis DCP 2022 is assessed in **Attachment A**.

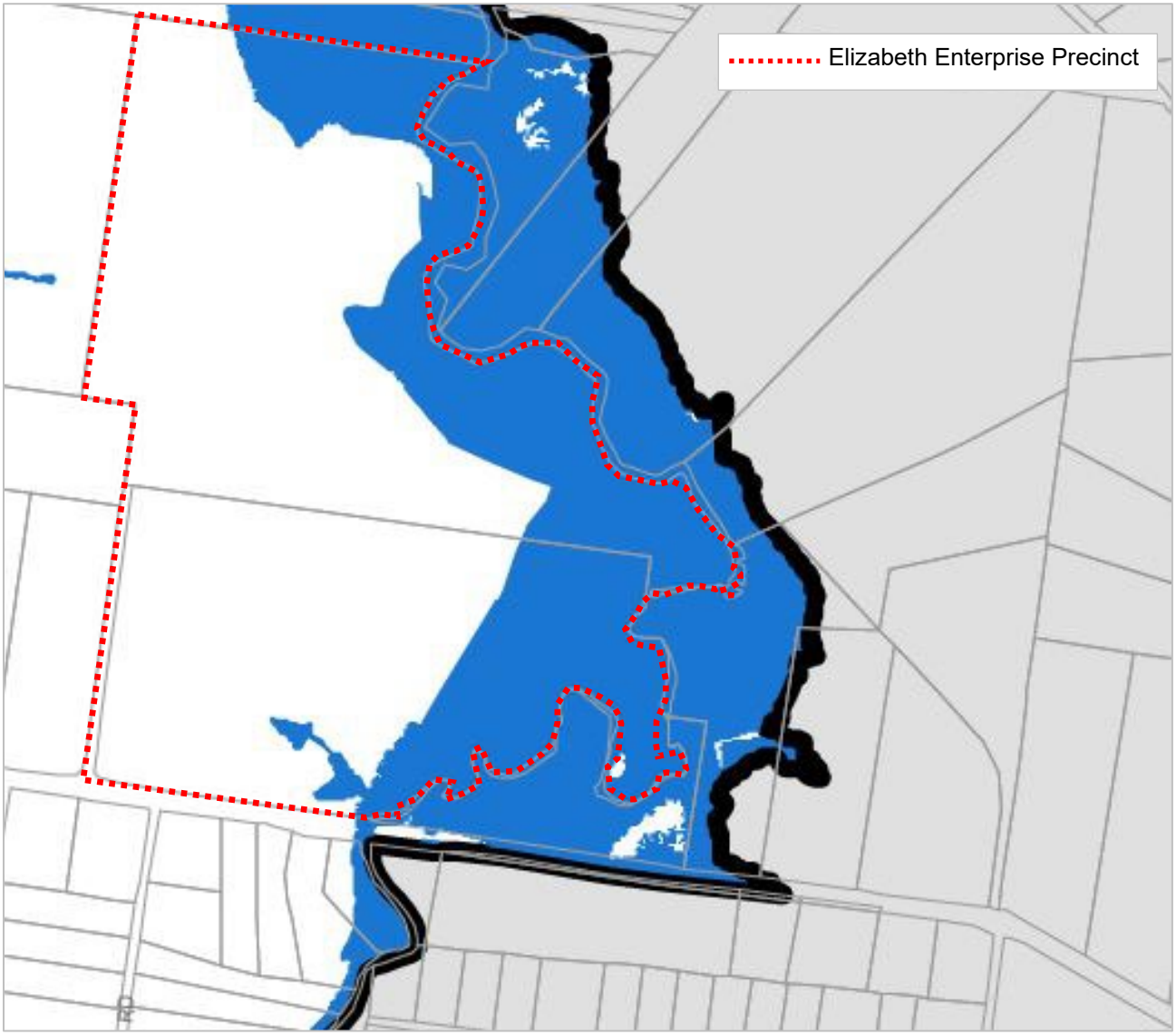


Figure 6 Western Parkland City Flood Planning Area in vicinity of the EEP

6 References

Advisian (2020) “Wianamatta (South) Creek Catchment Flood Study – Existing Conditions”, *Final Report*, Rev H, prepared for Infrastructure NSW, November, 27 pp + Maps + Apps

Cardno (2021) “Flood Risk Assessment, Elizabeth Drive Precinct”, *Final Report*, prepared for Mirvac, 6 September, 18 pp + App.

WorleyParsons (2015) “Updated South Creek Flood Study”, *Final Report*, 2 Vols, prepared for Penrith City Council, acting in association with Liverpool, Blacktown and Fairfield City Councils, 74 pp + Apps.

Elizabeth Enterprise Precinct

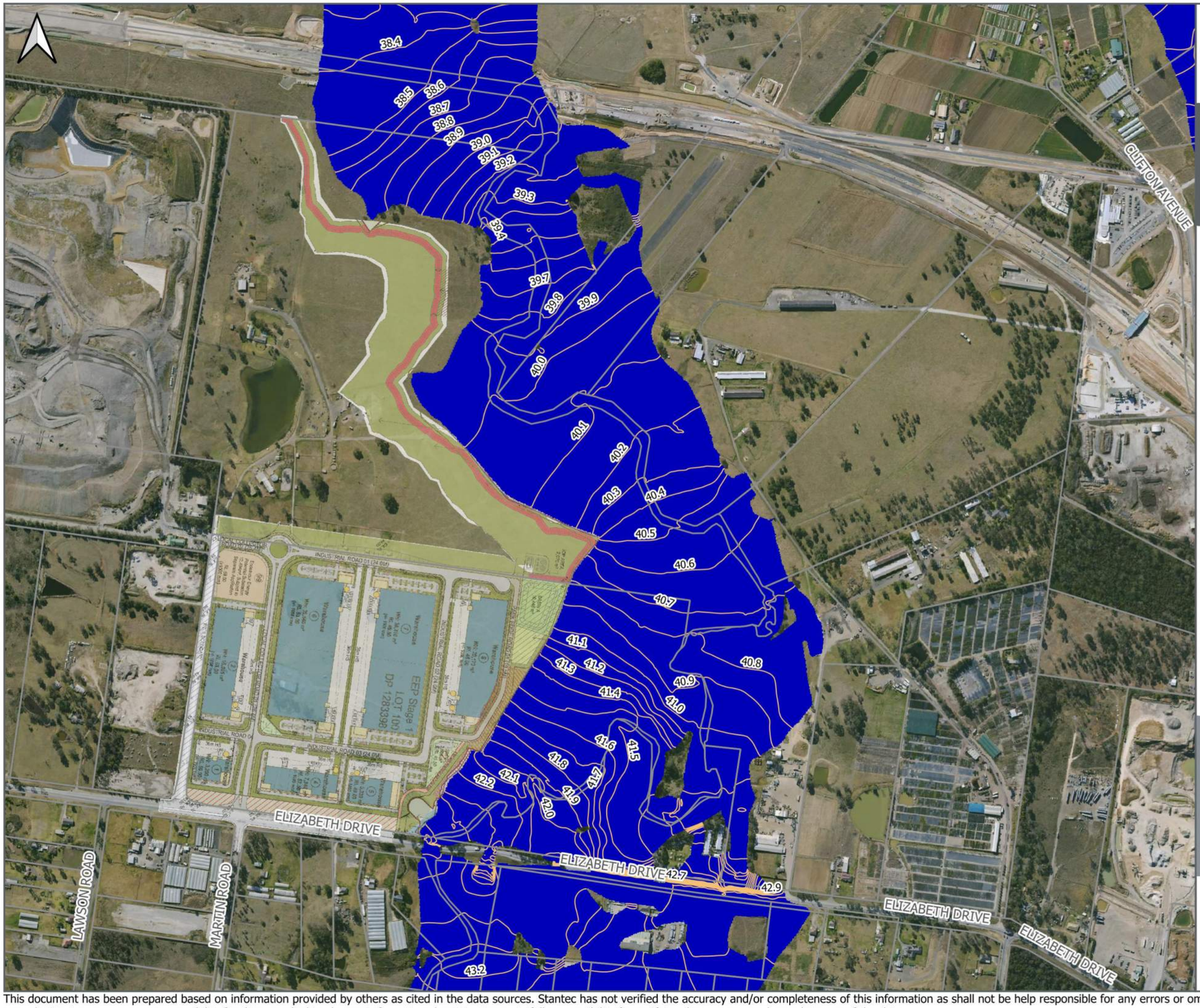
APPENDIX A
FIGURES

Stantec

Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

20yr ARI
Flood Extents and Flood Levels

SSDA Masterplan Stage 1



Legend

- Cadastre
- 0.1m Water Level Contour (mAHD)
- Flood Extent

FIGURE F1

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

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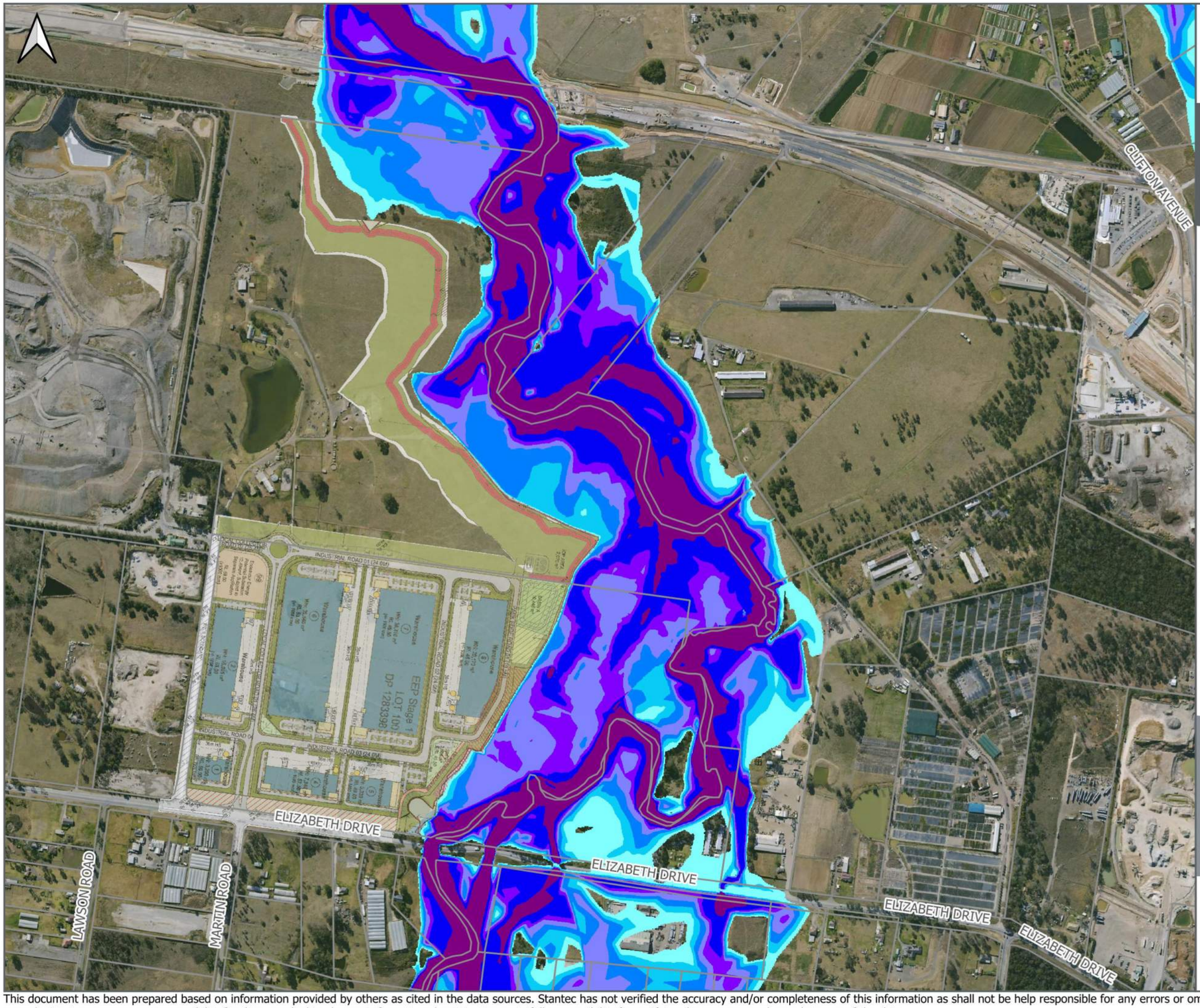

Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

20yr ARI
Flood Depths

SSDA Masterplan Stage 1

Legend

- Cadastre

Flood Depth (m)

- <= 0.20
- 0.20 - 0.40
- 0.40 - 0.60
- 0.60 - 0.80
- 0.80 - 1.00
- 1.00 - 1.50
- > 1.50

FIGURE F2

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

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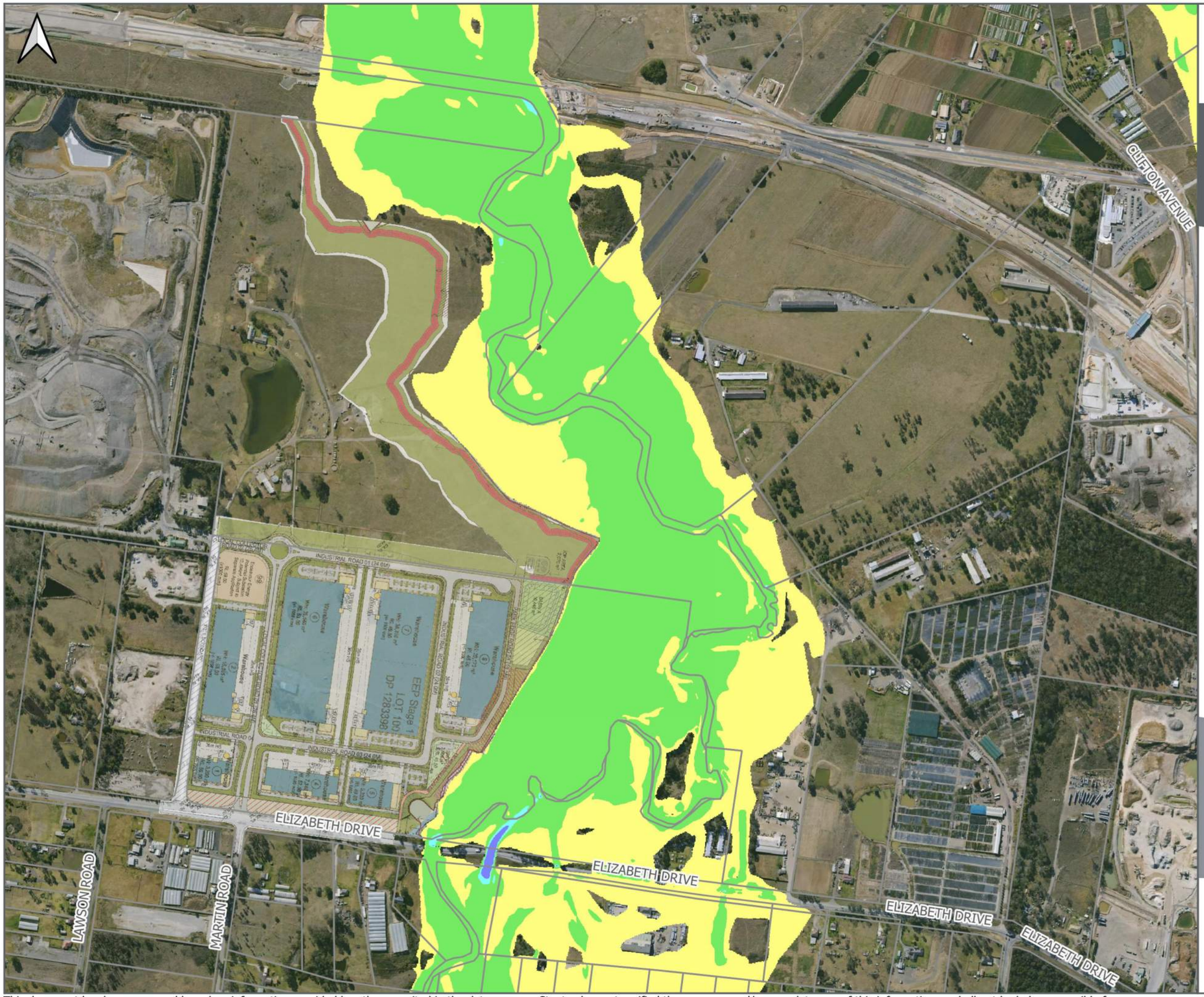

Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

20yr ARI
Flood Velocities

SSDA Masterplan Stage 1

Legend

- Cadastre

Flood Velocity (m/s)

- <= 0.50
- 0.50 - 1.50
- 1.50 - 2.00
- 2.00 - 3.00
- > 3.00

FIGURE F3

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

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File Ref:
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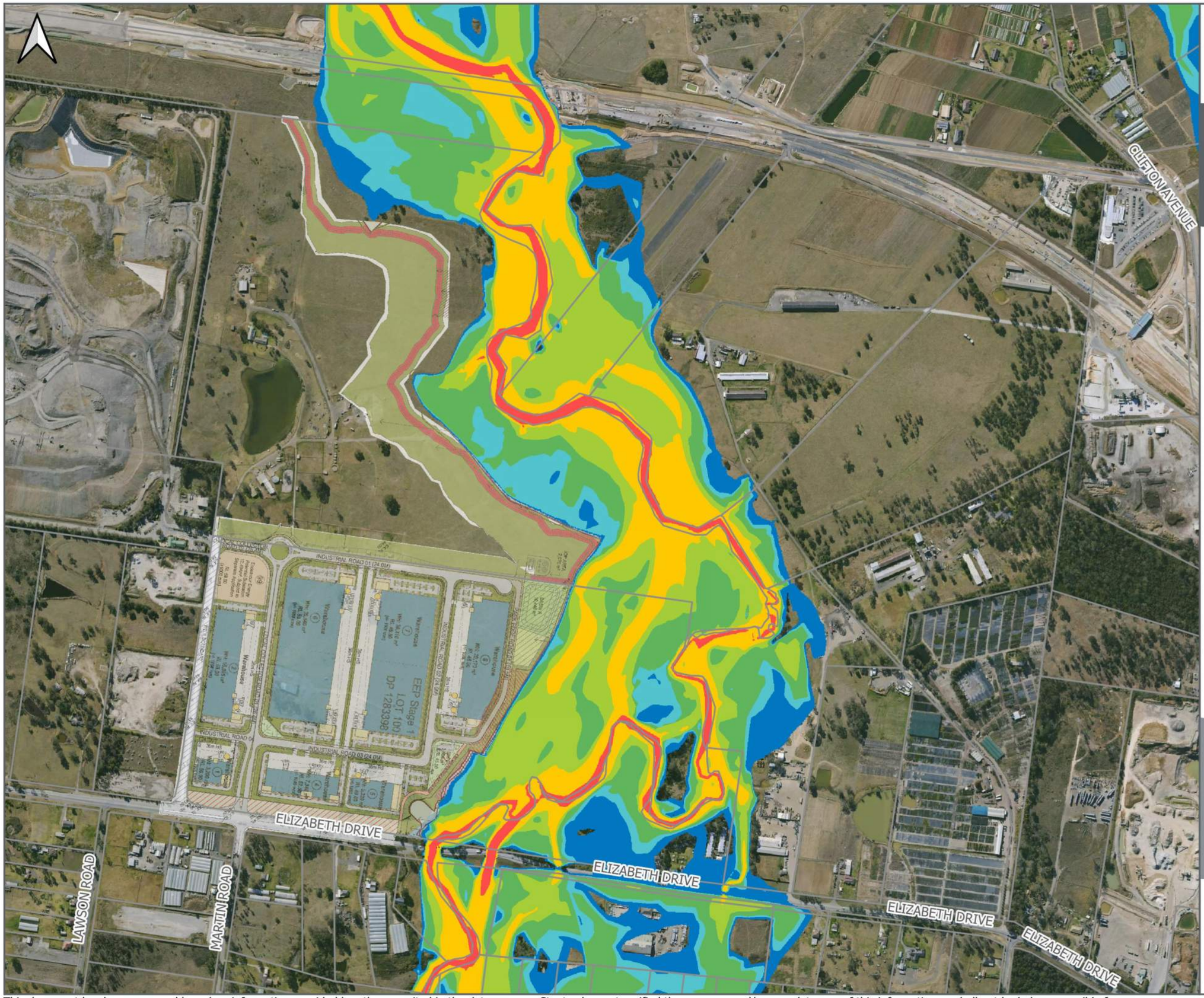

Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

20yr ARI
Flood Hazards

SSDA Masterplan Stage 1

Legend

- Cadastre

Flood Hazard Categories

- H1 - Generally safe for vehicles, people and buildings.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for vehicles, children and the elderly.
- H4 - Unsafe for vehicles and people.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.

FIGURE F4

1:8,000 Scale at A3

0 100 200 300 400 m

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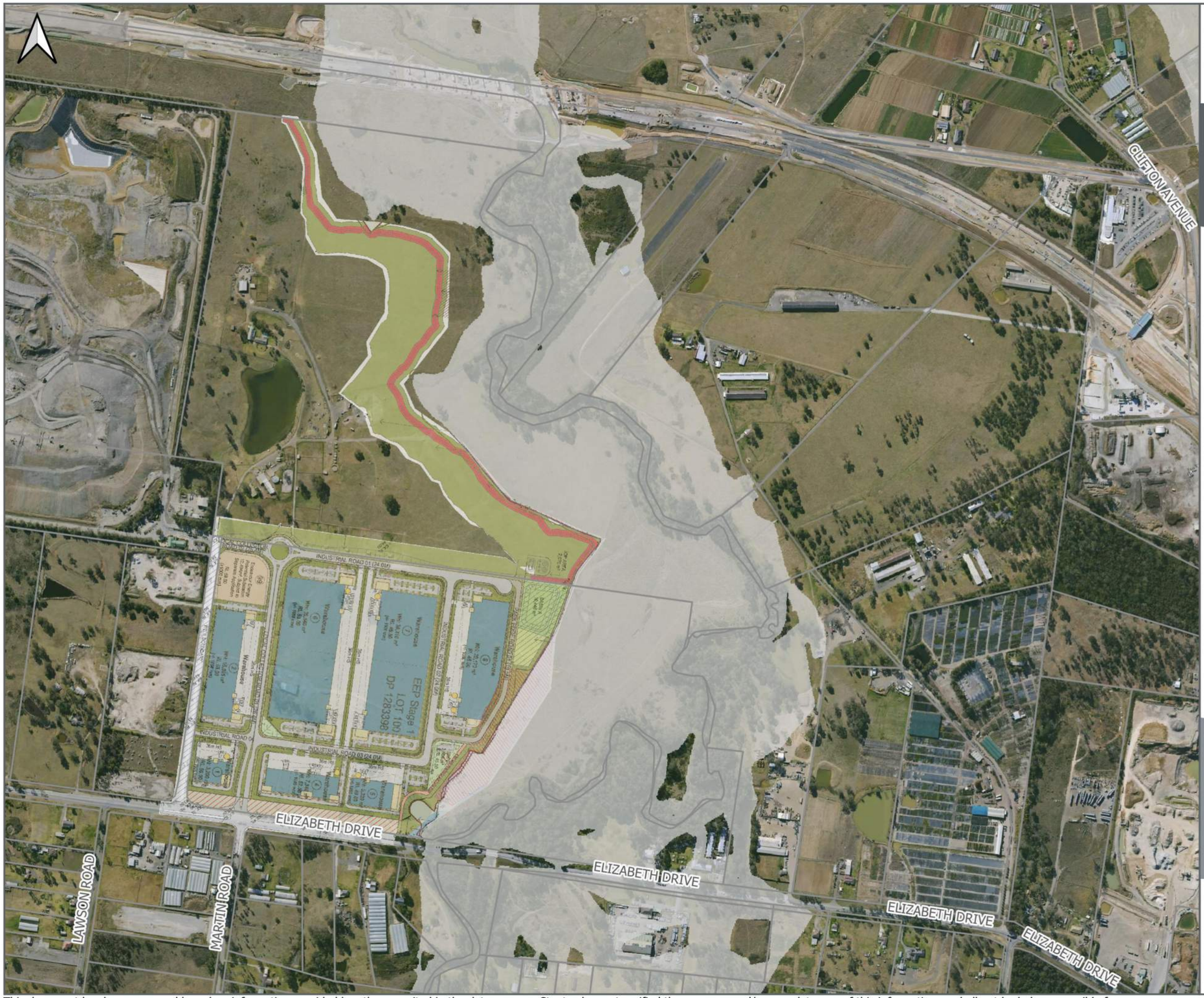
Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

20yr ARI
Level Differences

(SSDA Masterplan Stage 1 – Benchmark (2018) Conditions)



Legend

- Cadastre

Water Level Difference (m)

- <= -0.15
- -0.15 - -0.10
- -0.10 - -0.05
- -0.05 - -0.02
- -0.02 - -0.01
- -0.01 - 0.01
- 0.01 - 0.02
- 0.02 - 0.05
- 0.05 - 0.10
- 0.10 - 0.15
- > 0.15

FIGURE F5

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

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Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

20yr ARI
Velocity Differences

(SSDA Masterplan Stage 1 – Benchmark (2018) Conditions)

Legend

- Cadastre

Velocity Difference (m/s)

- <= 0.05
- 0.05 - 0.10
- 0.10 - 0.20
- 0.20 - 0.40
- 0.40 - 0.60
- 0.60 - 0.80
- 0.80 - 1.00
- > 1

FIGURE F6

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

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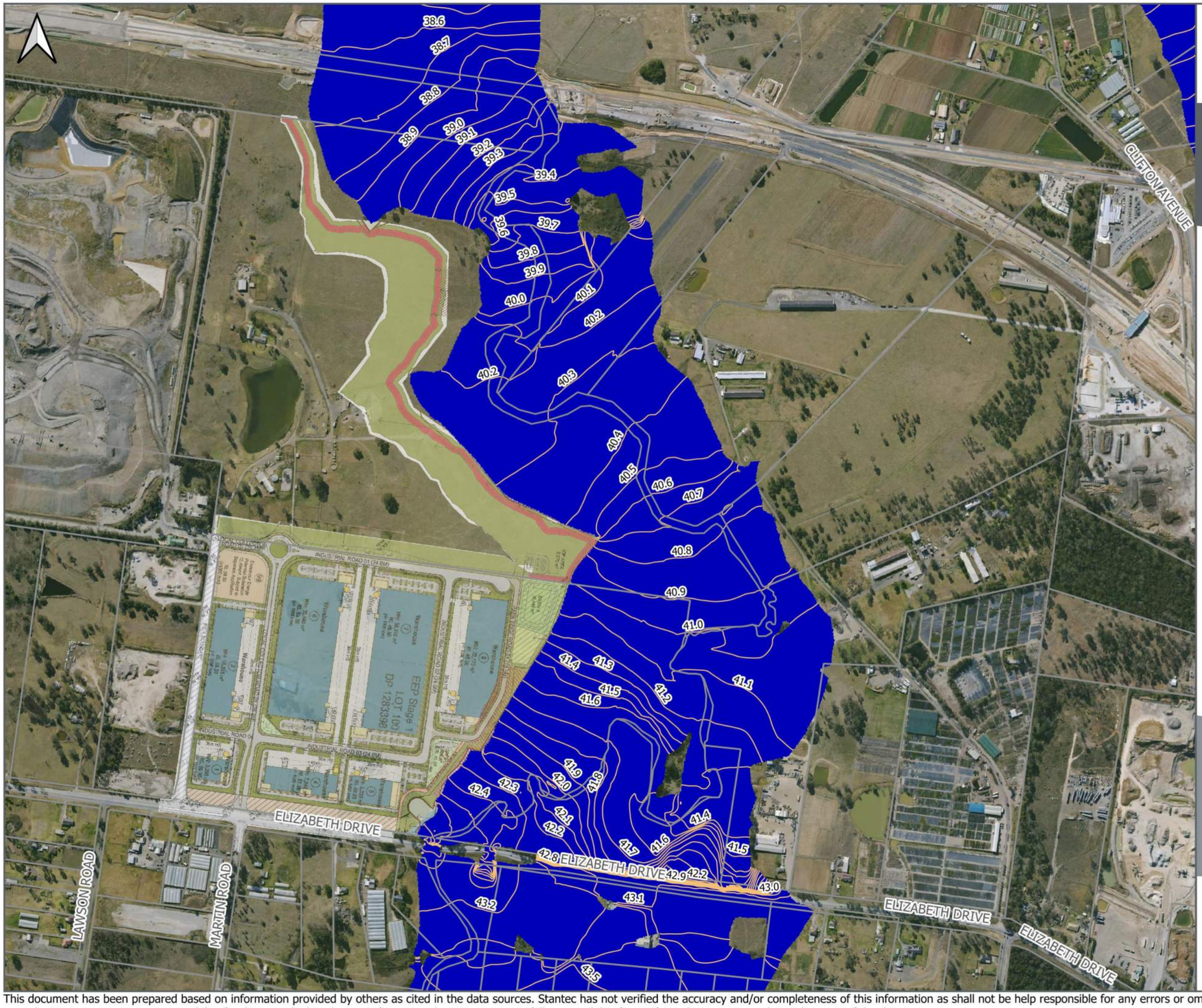
Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

100 yr ARI
Flood Extents and Flood Levels

SSDA Masterplan Stage 1



Legend

- Cadastre
- 0.1m Water Level Contour (mAHD)
- Flood Extent

FIGURE F7

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

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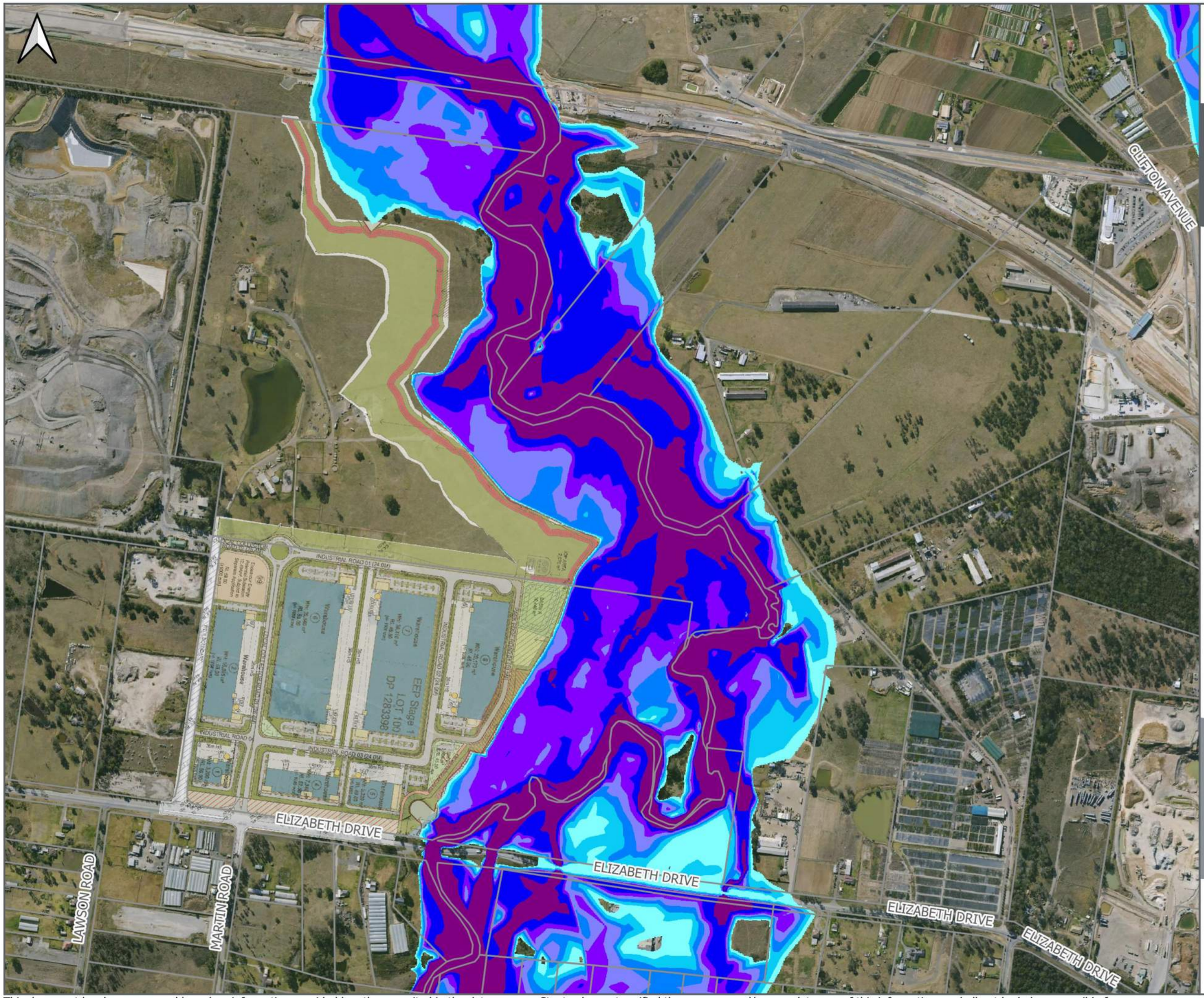

Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

100 yr ARI
Flood Depths

SSDA Masterplan Stage 1

Legend

- Cadastre

Flood Depth (m)

- <= 0.20
- 0.20 - 0.40
- 0.40 - 0.60
- 0.60 - 0.80
- 0.80 - 1.00
- 1.00 - 1.50
- > 1.50

FIGURE F8

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

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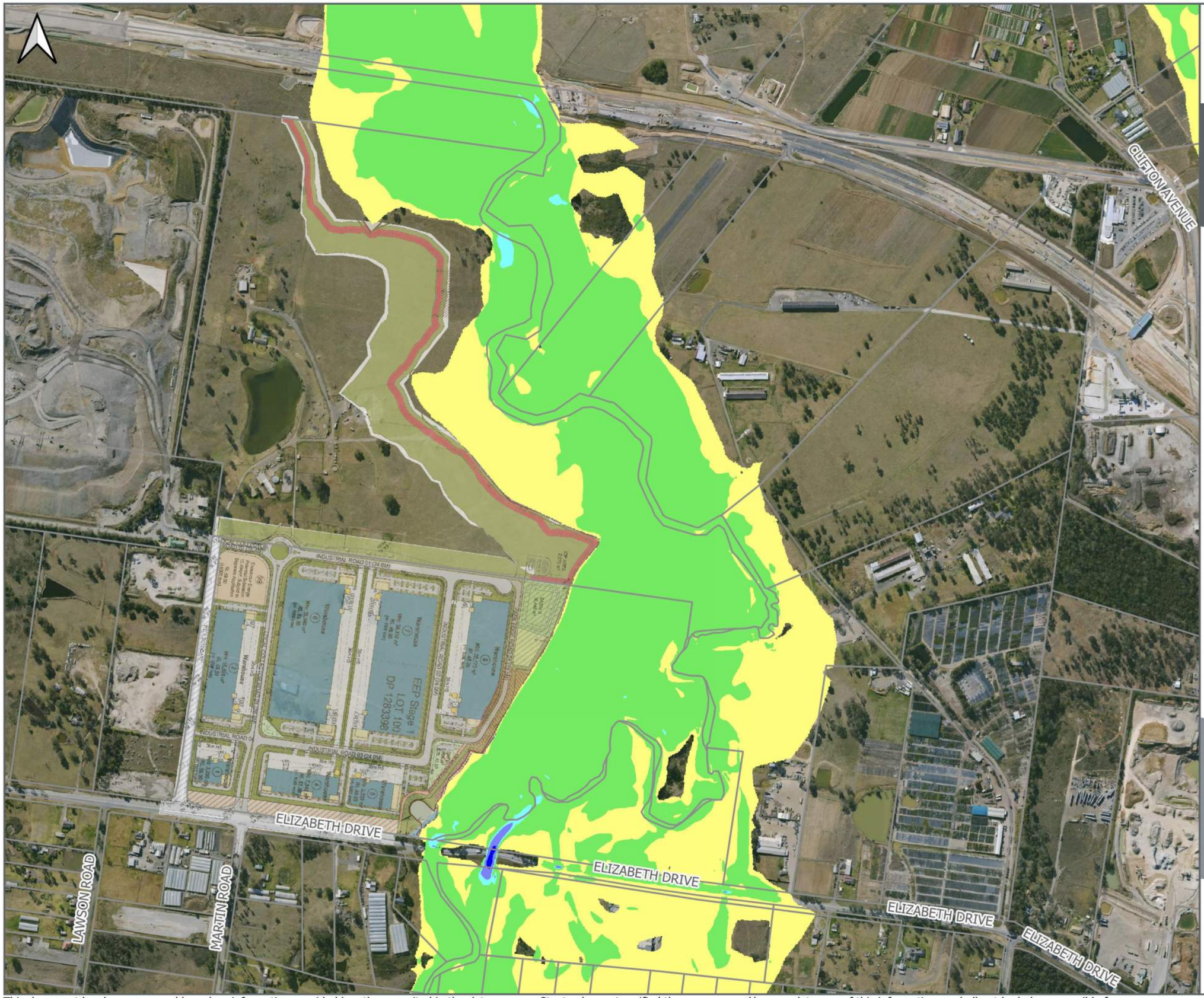

Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

100 yr ARI
Flood Velocities

SSDA Masterplan Stage 1

Legend

- Cadastre

Flood Velocity (m/s)

- <= 0.50
- 0.50 - 1.50
- 1.50 - 2.00
- 2.00 - 3.00
- > 3.00

FIGURE F9

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

Map Produced by St Leonards Water (AWE)
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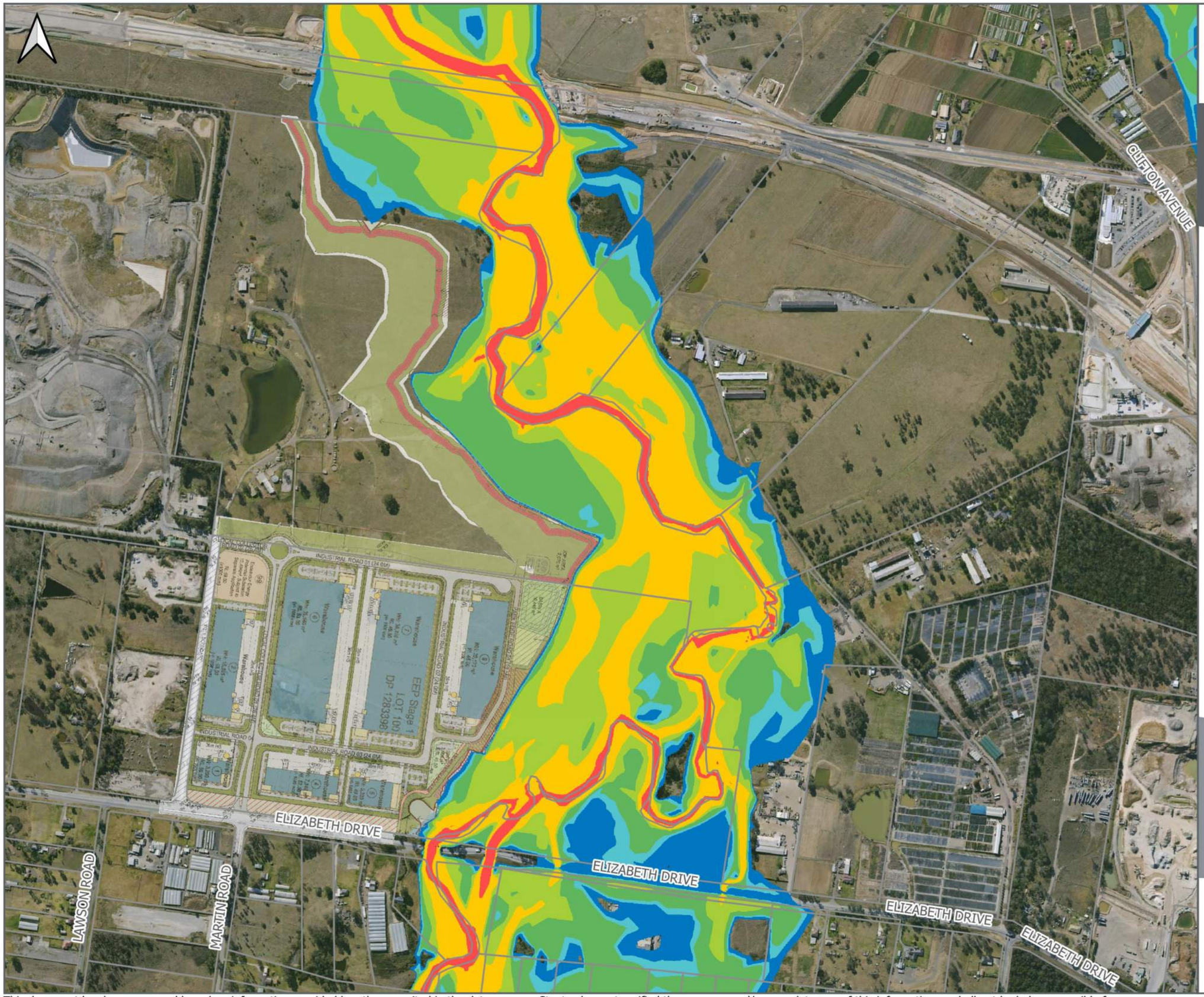

Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

100 yr ARI
Flood Hazards

SSDA Masterplan Stage 1

Legend

- Cadastre

Flood Hazard Categories

- H1 - Generally safe for vehicles, people and buildings.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for vehicles, children and the elderly.
- H4 - Unsafe for vehicles and people.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.

FIGURE F10

1:8,000 Scale at A3

0 100 200 300 400 m

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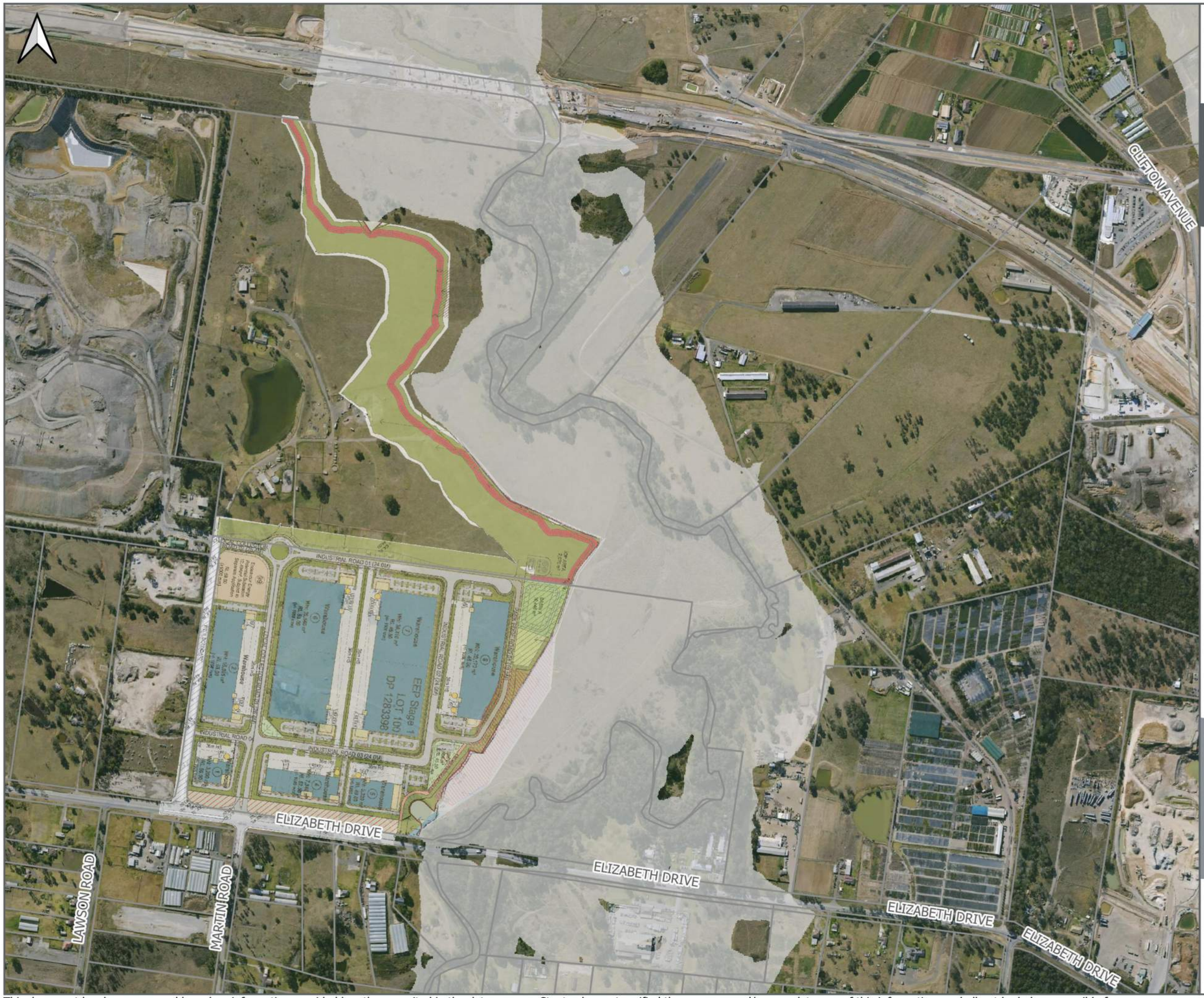
Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

100 yr ARI
Level Differences

(SSDA Masterplan Stage 1 – Benchmark (2018) Conditions)



Legend

- Cadastre

Water Level Difference (m)

- <= -0.15
- -0.15 - -0.10
- -0.10 - -0.05
- -0.05 - -0.02
- -0.02 - -0.01
- -0.01 - 0.01
- 0.01 - 0.02
- 0.02 - 0.05
- 0.05 - 0.10
- 0.10 - 0.15
- > 0.15

FIGURE F11

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

Map Produced by St Leonards Water (AWE)
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File Ref:
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Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

100 yr ARI
Velocity Differences

(SSDA Masterplan Stage 1 – Benchmark (2018) Conditions)

Legend

- Cadastre

Velocity Difference (m/s)

- <= 0.05
- 0.05 - 0.10
- 0.10 - 0.20
- 0.20 - 0.40
- 0.40 - 0.60
- 0.60 - 0.80
- 0.80 - 1.00
- > 1

FIGURE F12

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

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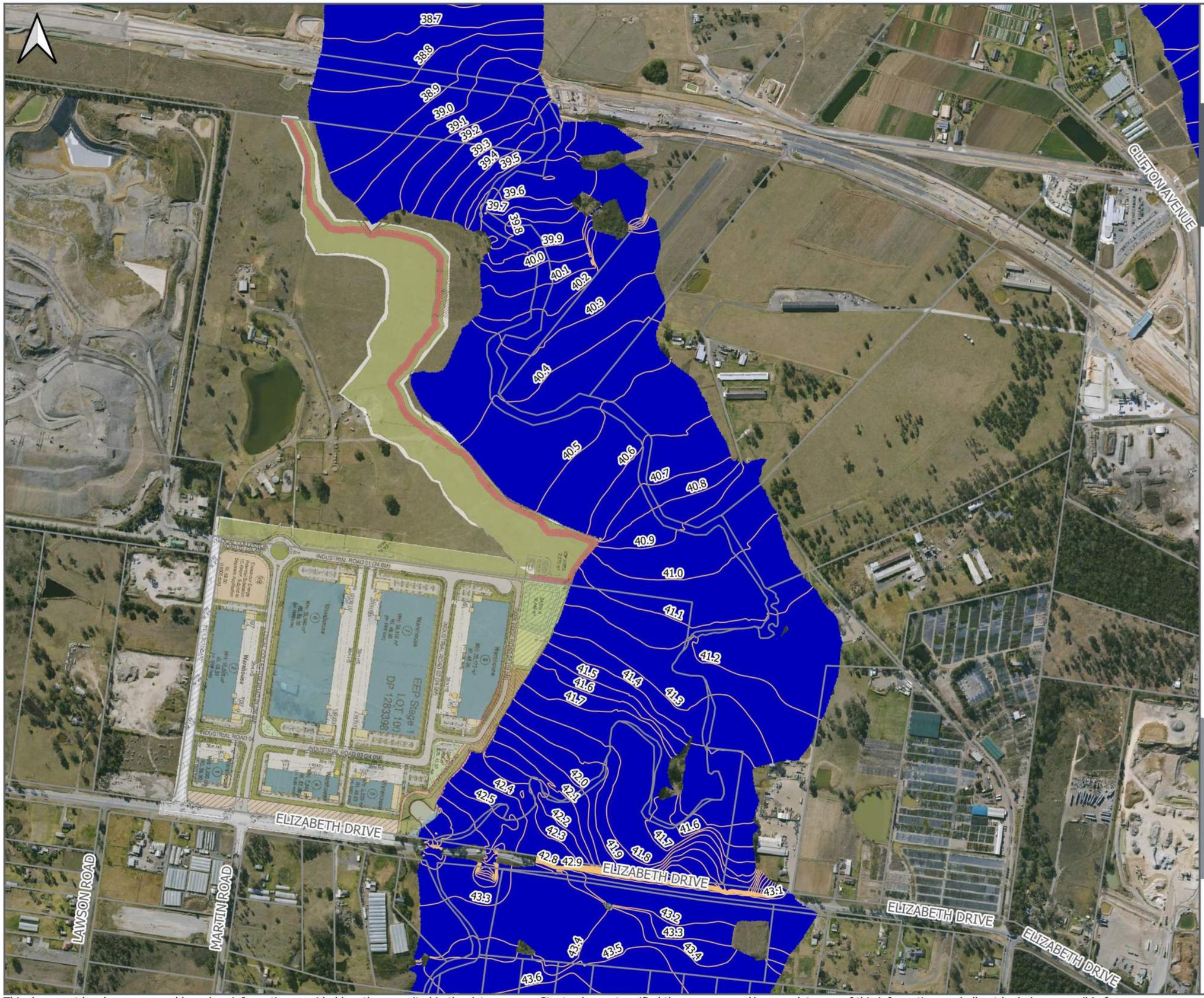
Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

200 yr ARI
Flood Extents and Flood Levels

SSDA Masterplan Stage 1



Legend

- Cadastre
- 0.1m Water Level Contour (mAHD)
- Flood Extent

FIGURE F13

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

Map Produced by St Leonards Water (AWE)
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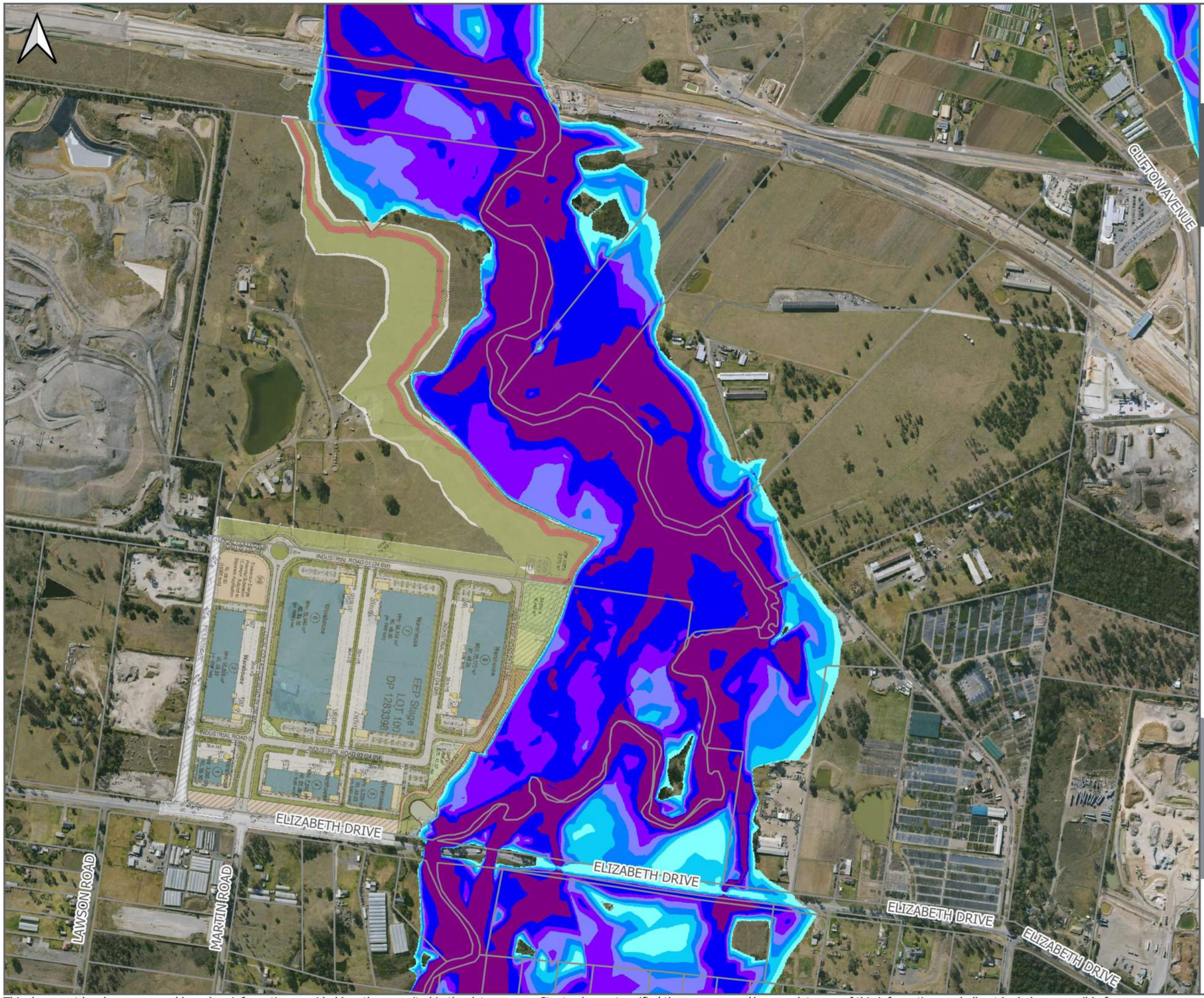

Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

200 yr ARI
Flood Depths

SSDA Masterplan Stage 1

Legend

- Cadastre

Flood Depth (m)

- <= 0.20
- 0.20 - 0.40
- 0.40 - 0.60
- 0.60 - 0.80
- 0.80 - 1.00
- 1.00 - 1.50
- > 1.50

FIGURE F14

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

Map Produced by St Leonards Water (AWE)
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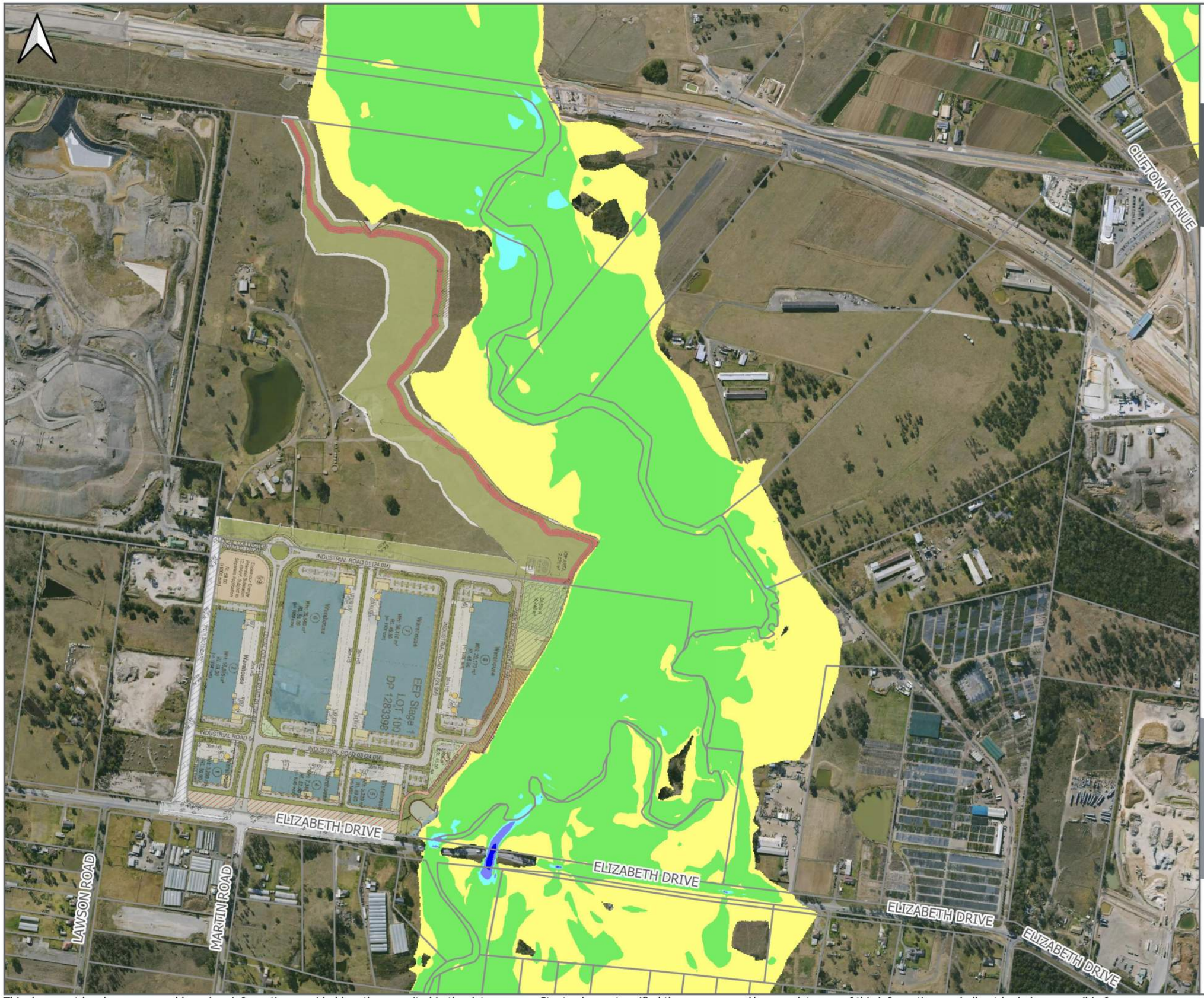
Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

200 yr ARI
Flood Velocities

SSDA Masterplan Stage 1



Legend

- Cadastre

Flood Velocity (m/s)

- <= 0.50
- 0.50 - 1.50
- 1.50 - 2.00
- 2.00 - 3.00
- > 3.00

FIGURE F15

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

Map Produced by St Leonards Water (AWE)
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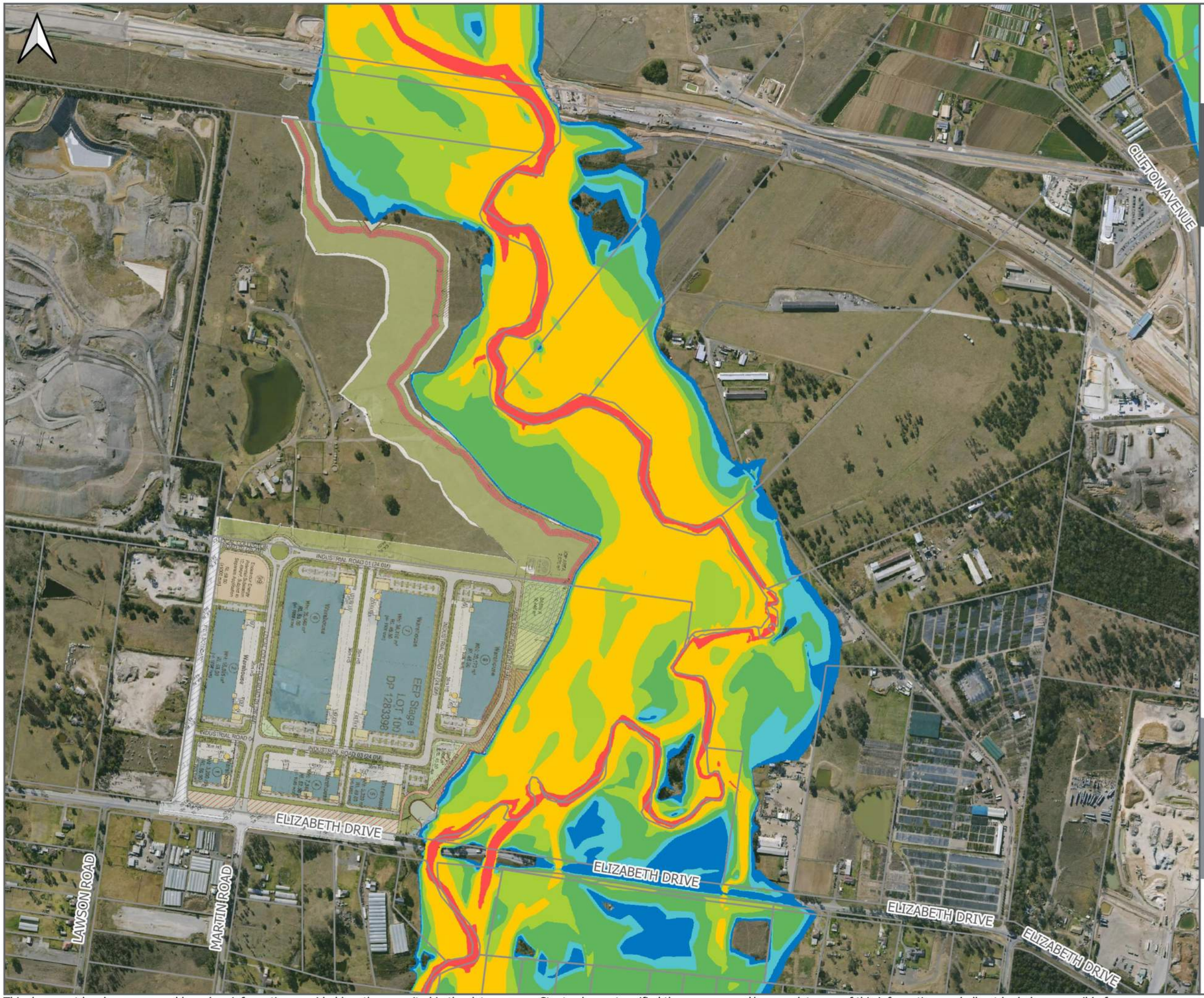

Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

200 yr ARI
Flood Hazards

SSDA Masterplan Stage 1

Legend

- Cadastre

Flood Hazard Categories

- H1 - Generally safe for vehicles, people and buildings.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for vehicles, children and the elderly.
- H4 - Unsafe for vehicles and people.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.

FIGURE F16

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

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Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

200 yr ARI
Level Differences

(SSDA Masterplan Stage 1 – Benchmark (2018) Conditions)

Legend

- Cadastre

Water Level Difference (m)

- <= -0.15
- -0.15 - -0.10
- -0.10 - -0.05
- -0.05 - -0.02
- -0.02 - -0.01
- -0.01 - 0.01
- 0.01 - 0.02
- 0.02 - 0.05
- 0.05 - 0.10
- 0.10 - 0.15
- > 0.15

FIGURE F17

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

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File Ref:
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Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

200 yr ARI
Velocity Differences

(SSDA Masterplan Stage 1 – Benchmark (2018) Conditions)

Legend

- Cadastre

Velocity Difference (m/s)

- <= 0.05
- 0.05 - 0.10
- 0.10 - 0.20
- 0.20 - 0.40
- 0.40 - 0.60
- 0.60 - 0.80
- 0.80 - 1.00
- > 1

FIGURE F18

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

Map Produced by St Leonards Water (AWE)
Date: 2024-3-4| Project:59918138/304600112
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File Ref:
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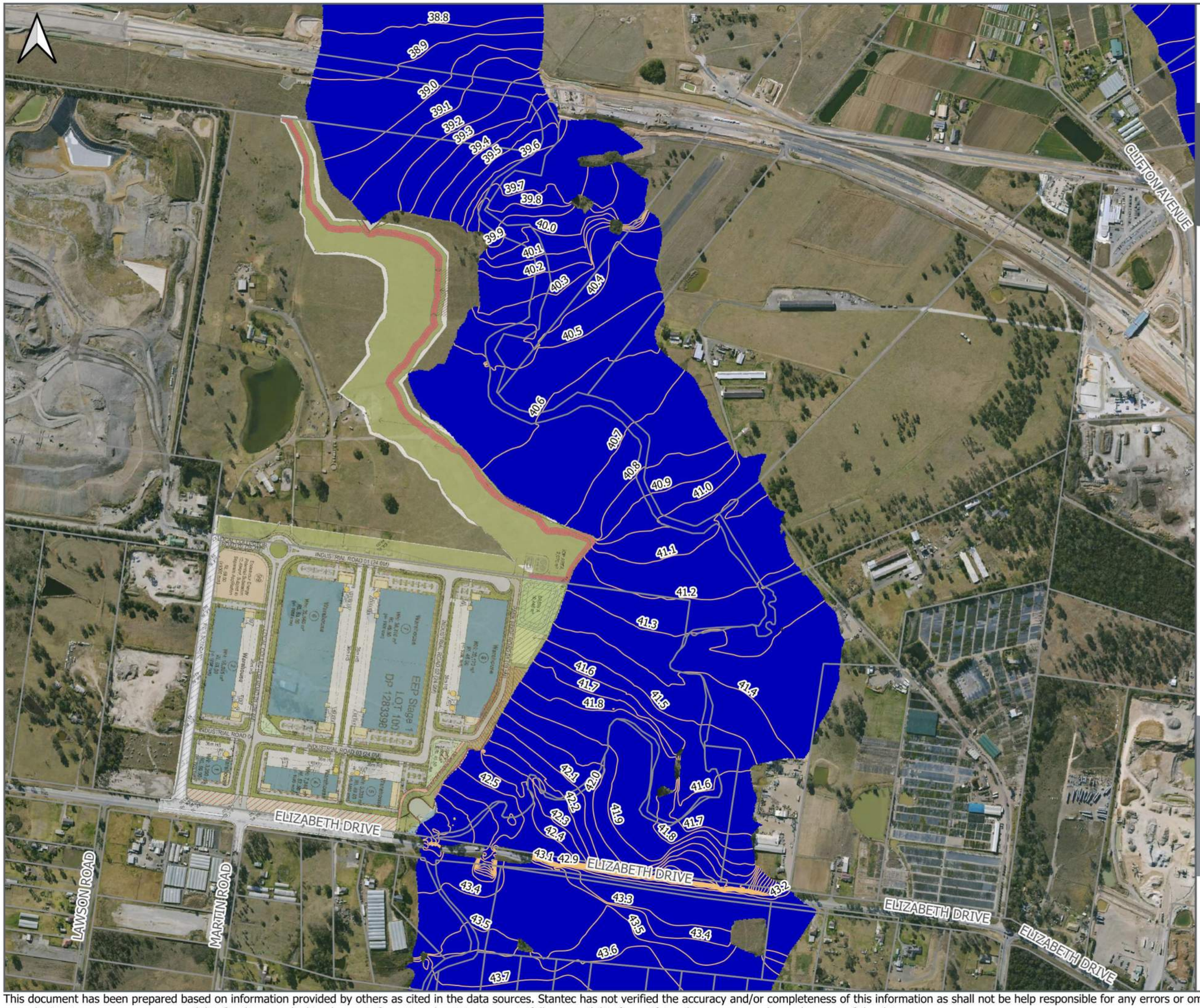
Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

500 yr
Flood Extents and Flood Levels

SSDA Masterplan Stage 1



Legend

- Cadastre
- 0.1m Water Level Contour (mAHD)
- Flood Extent

FIGURE F19

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

Map Produced by St Leonards Water (AWE)
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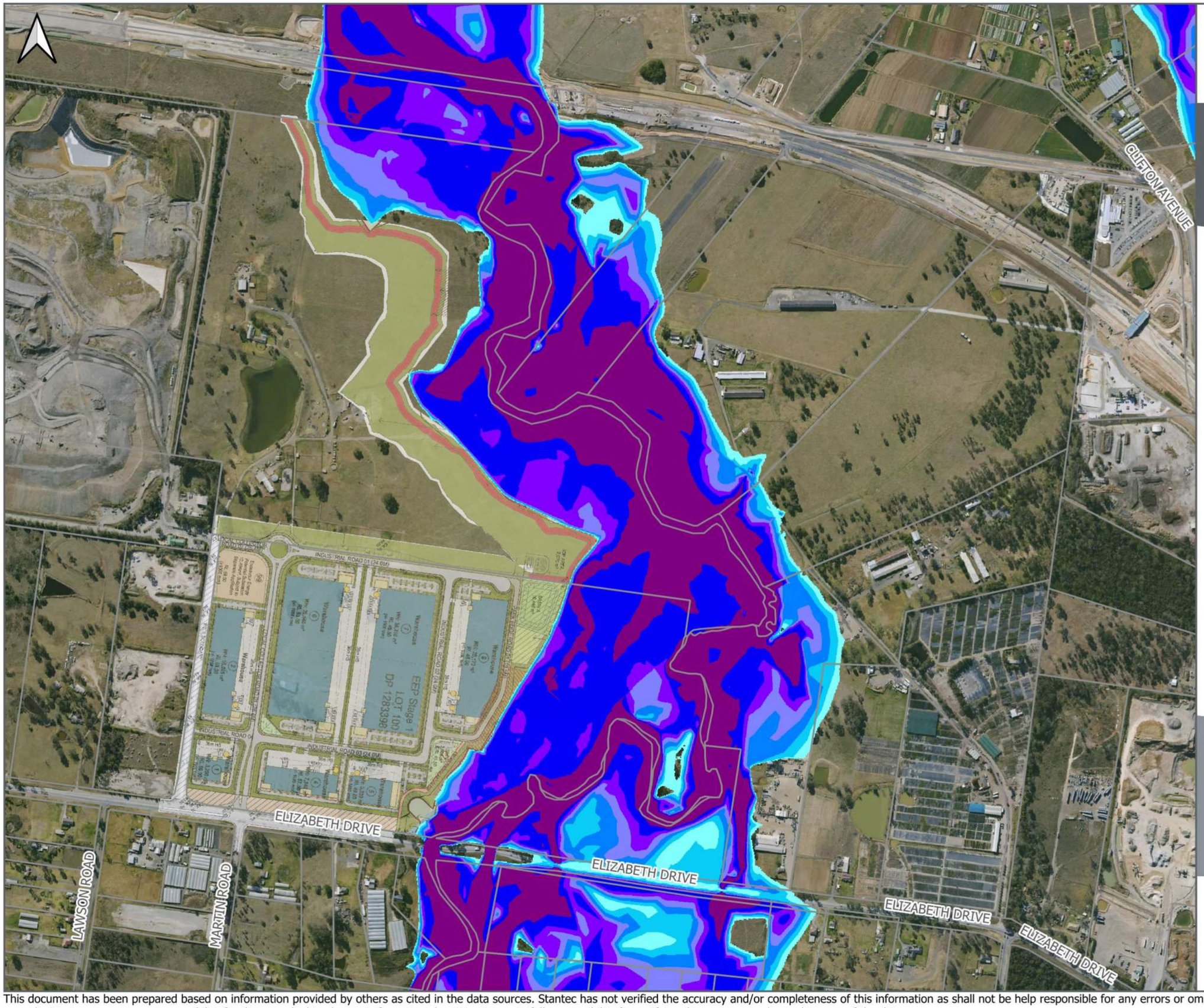

Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

500 yr
Flood Depths

SSDA Masterplan Stage 1

Legend

- Cadastre

Flood Depth (m)

- <= 0.20
- 0.20 - 0.40
- 0.40 - 0.60
- 0.60 - 0.80
- 0.80 - 1.00
- 1.00 - 1.50
- > 1.50

FIGURE F20

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

Map Produced by St Leonards Water (AWE)
Date: 2024-3-4| Project:59918138/304600112
Coordinate System: MGA Zone 56
File Ref:
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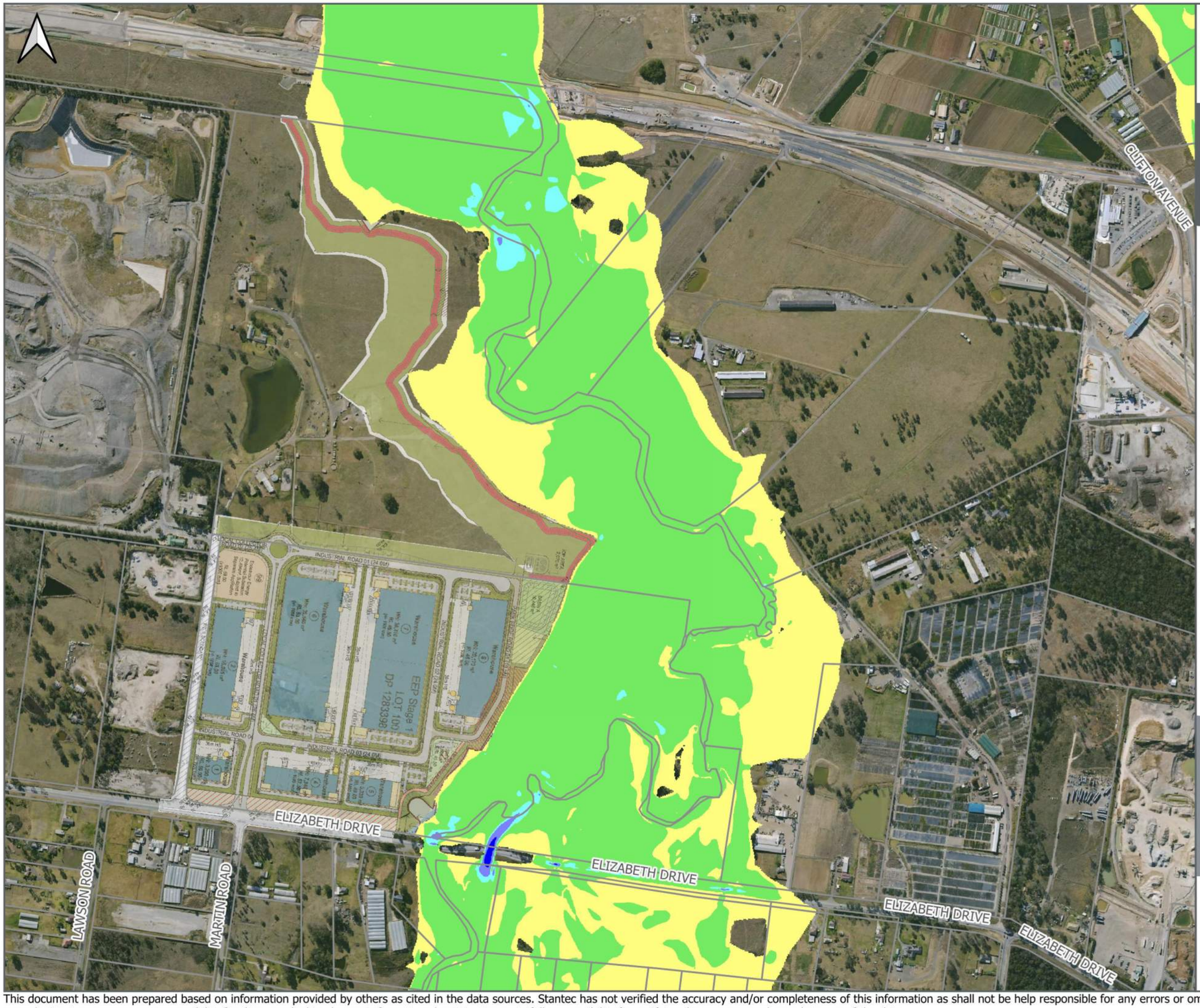

Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

500 yr
Flood Velocities

SSDA Masterplan Stage 1

Legend

- Cadastre

Flood Velocity (m/s)

- <= 0.50
- 0.50 - 1.50
- 1.50 - 2.00
- 2.00 - 3.00
- > 3.00

FIGURE F21

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

Map Produced by St Leonards Water (AWE)
Date: 2024-3-4| Project:59918138/304600112
Coordinate System: MGA Zone 56
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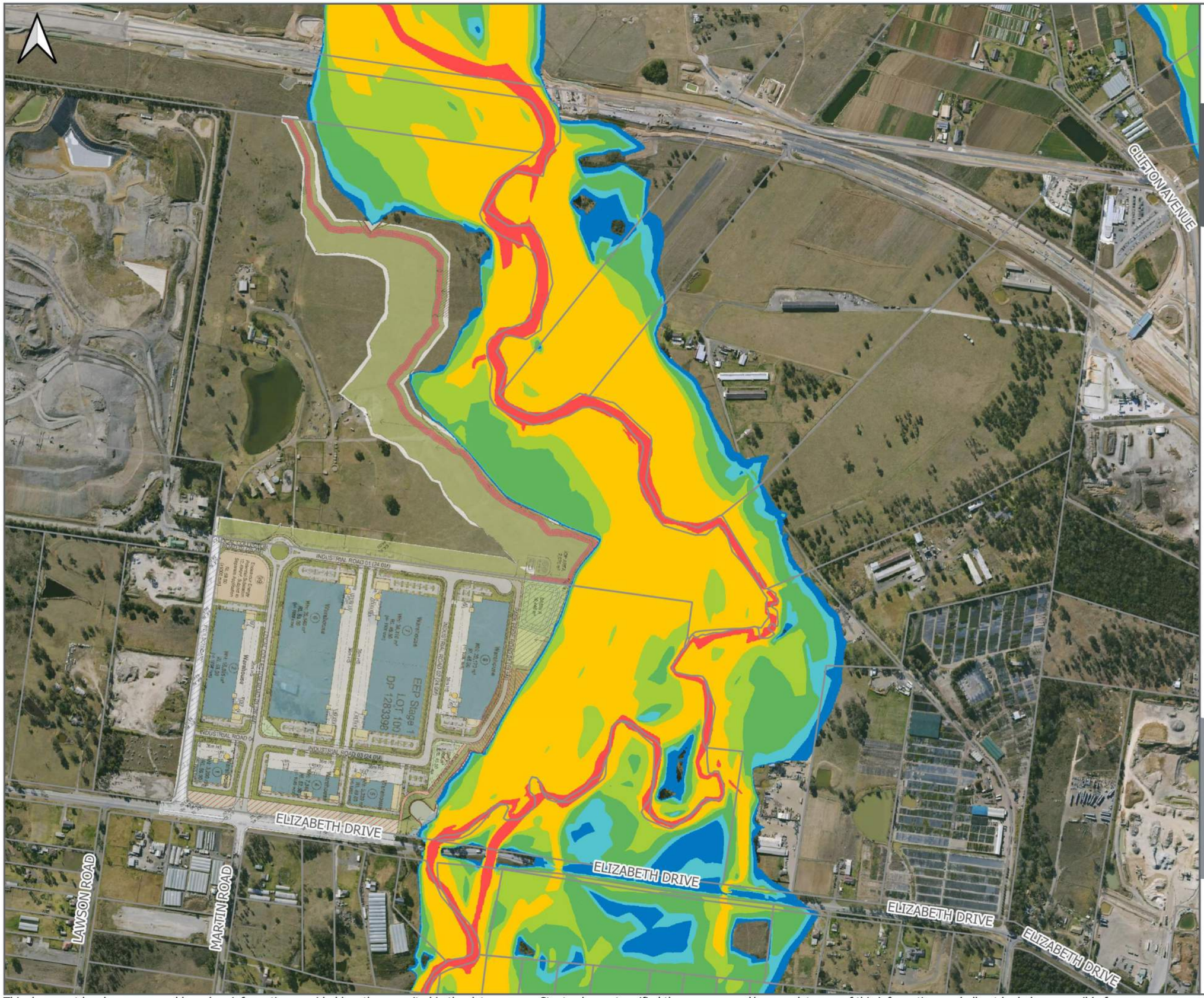

Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

500 yr
Flood Hazards

SSDA Masterplan Stage 1

Legend

- Cadastre

Flood Hazard Categories

- H1 - Generally safe for vehicles, people and buildings.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for vehicles, children and the elderly.
- H4 - Unsafe for vehicles and people.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.

FIGURE F22

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

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Date: 2024-3-4| Project:59918138/304600112
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Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

500 yr
Level Differences

(SSDA Masterplan Stage 1 – Benchmark (2018) Conditions)

Legend

- Cadastre

Water Level Difference (m)

- <= -0.15
- -0.15 - -0.10
- -0.10 - -0.05
- -0.05 - -0.02
- -0.02 - -0.01
- -0.01 - 0.01
- 0.01 - 0.02
- 0.02 - 0.05
- 0.05 - 0.10
- 0.10 - 0.15
- > 0.15

FIGURE F23

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

Map Produced by St Leonards Water (AWE)
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Coordinate System: MGA Zone 56
File Ref:
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Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

500 yr
Velocity Differences

(SSDA Masterplan Stage 1 – Benchmark (2018) Conditions)

Legend

- Cadastre

Velocity Difference (m/s)

- <= 0.05
- 0.05 - 0.10
- 0.10 - 0.20
- 0.20 - 0.40
- 0.40 - 0.60
- 0.60 - 0.80
- 0.80 - 1.00
- > 1

FIGURE F24

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

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Date: 2024-3-4| Project:59918138/304600112
Coordinate System: MGA Zone 56
File Ref:
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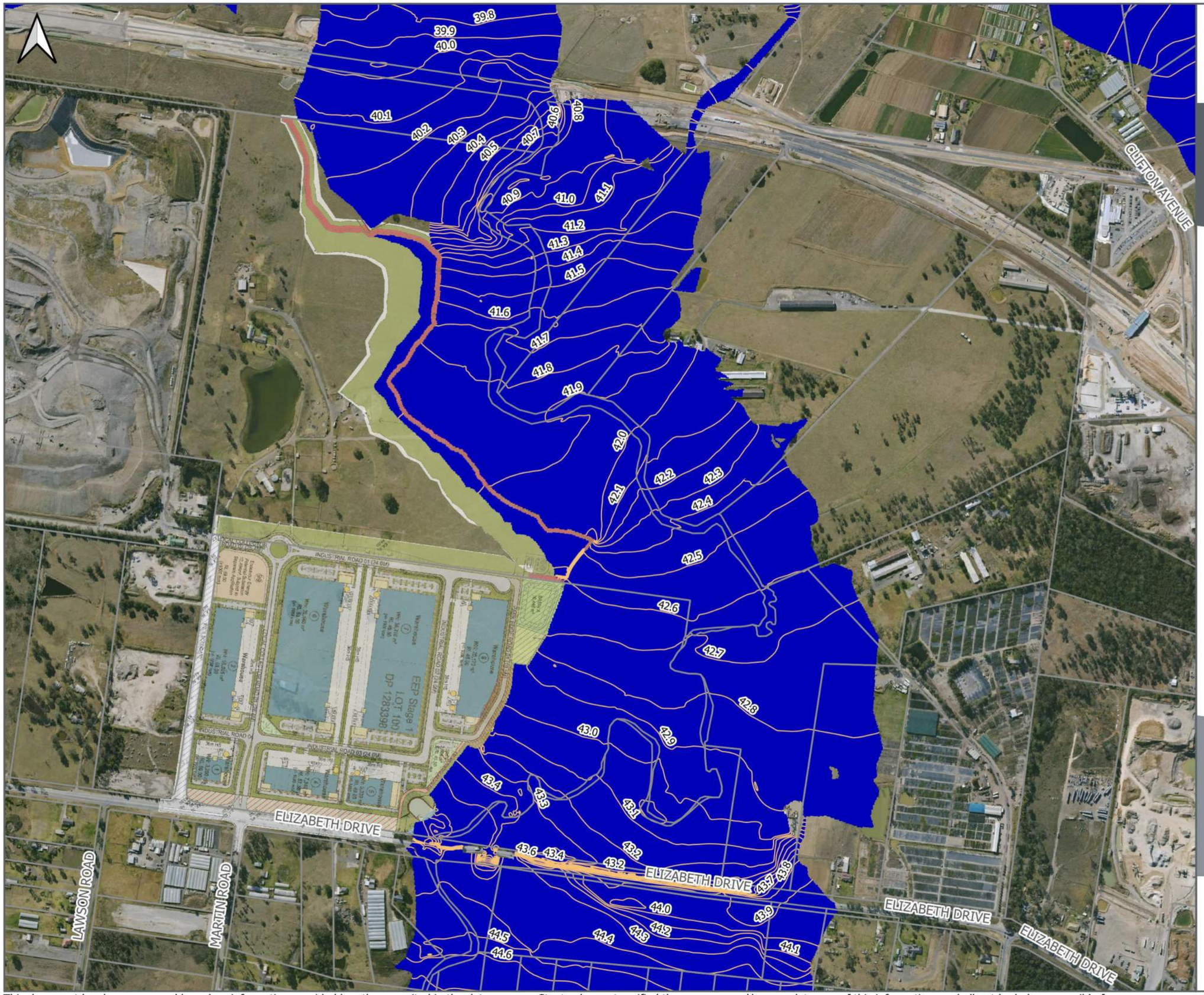

Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

PMF
Flood Extents and Flood Levels

SSDA Masterplan Stage 1

Legend

- Cadastre
- 0.1m Water Level Contour (mAHD)
- Flood Extent

FIGURE F25

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

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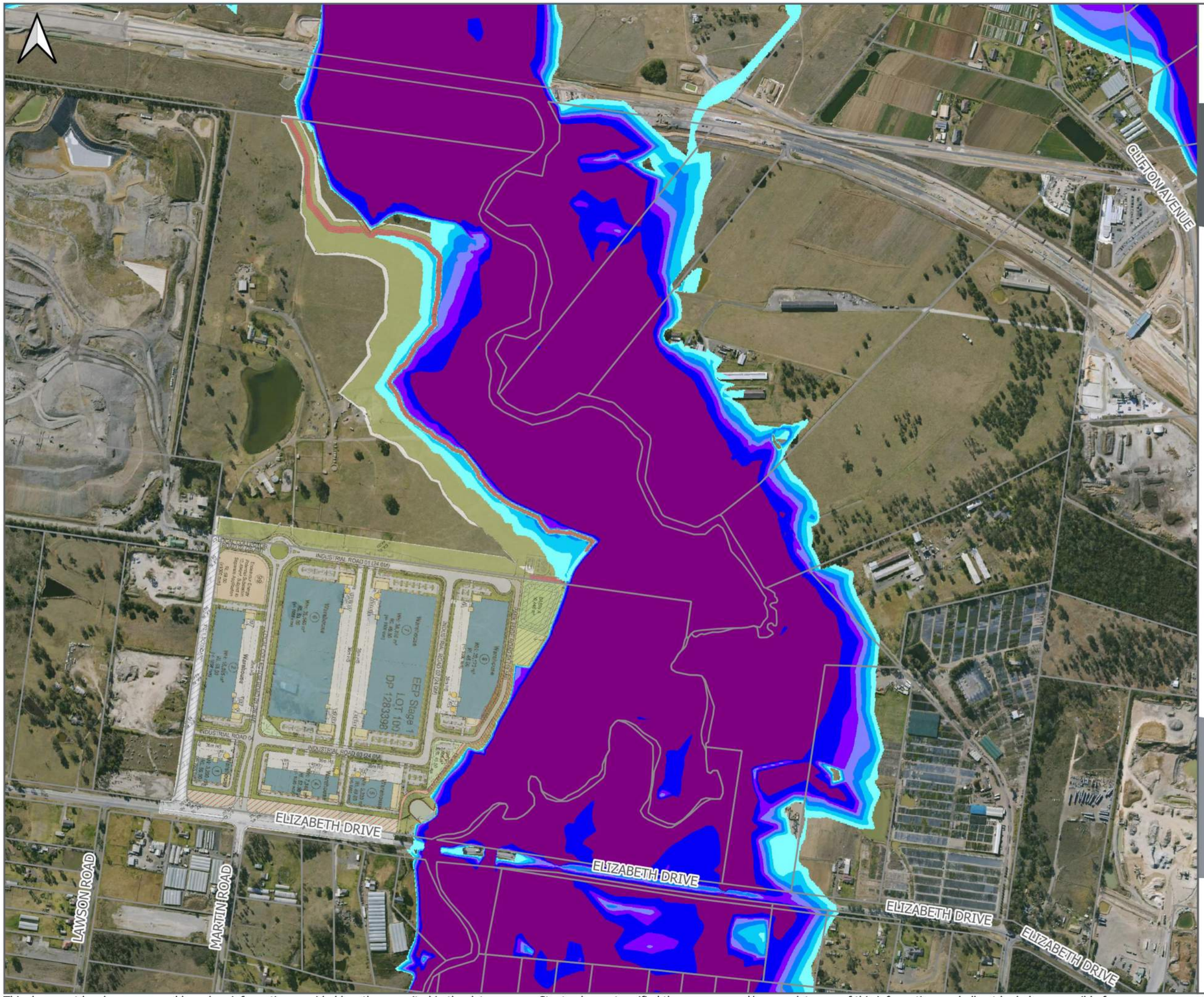
Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

PMF
Flood Depths

SSDA Masterplan Stage 1



Legend

- Cadastre

Flood Depth (m)

- <= 0.20
- 0.20 - 0.40
- 0.40 - 0.60
- 0.60 - 0.80
- 0.80 - 1.00
- 1.00 - 1.50
- > 1.50

FIGURE F26

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

Map Produced by St Leonards Water (AWE)
Date: 2024-3-4| Project:59918138/304600112
Coordinate System: MGA Zone 56
File Ref:
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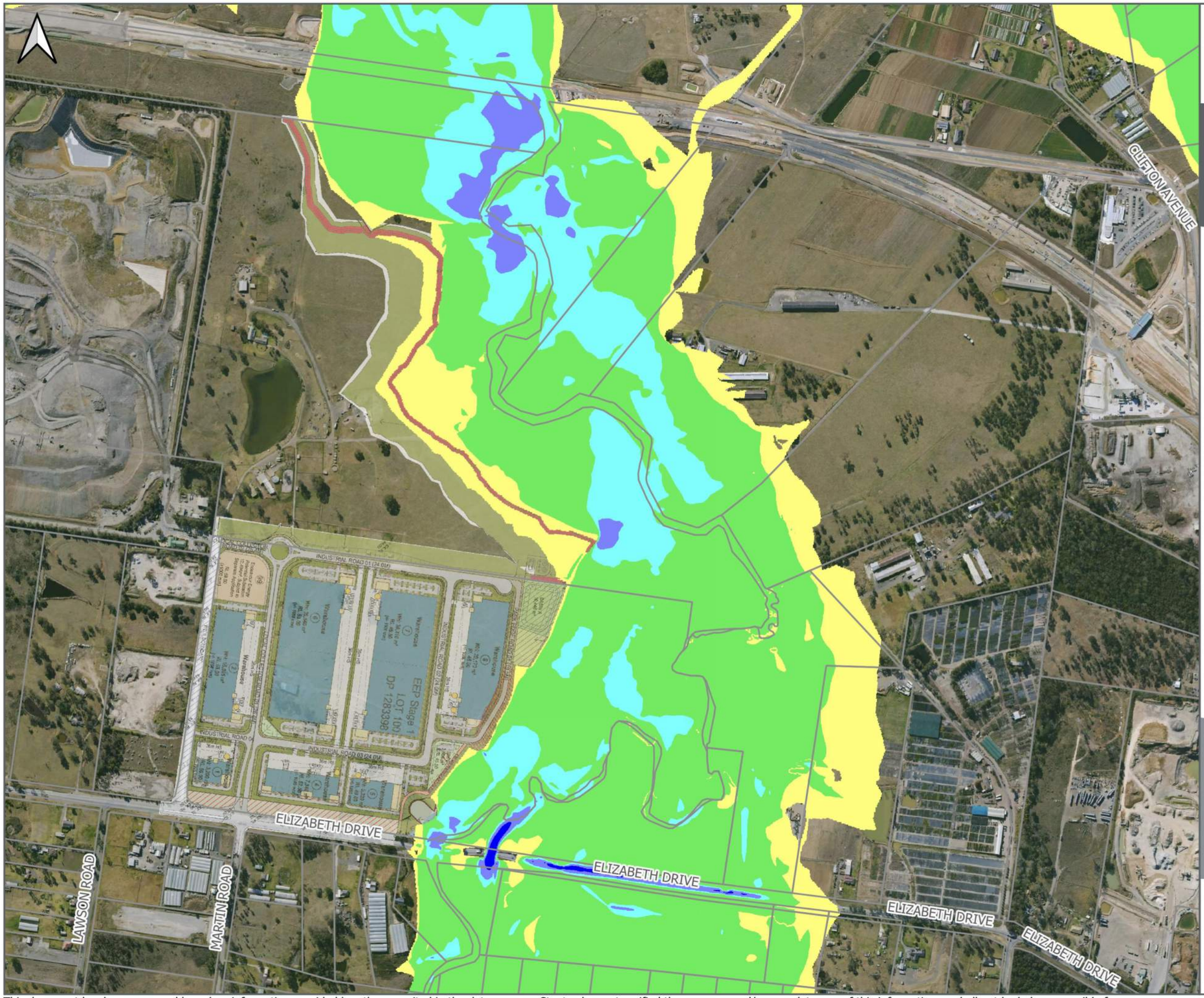


Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

PMF
Flood Velocities

SSDA Masterplan Stage 1

Legend

- Cadastre

Flood Velocity (m/s)

- <= 0.50
- 0.50 - 1.50
- 1.50 - 2.00
- 2.00 - 3.00
- > 3.00

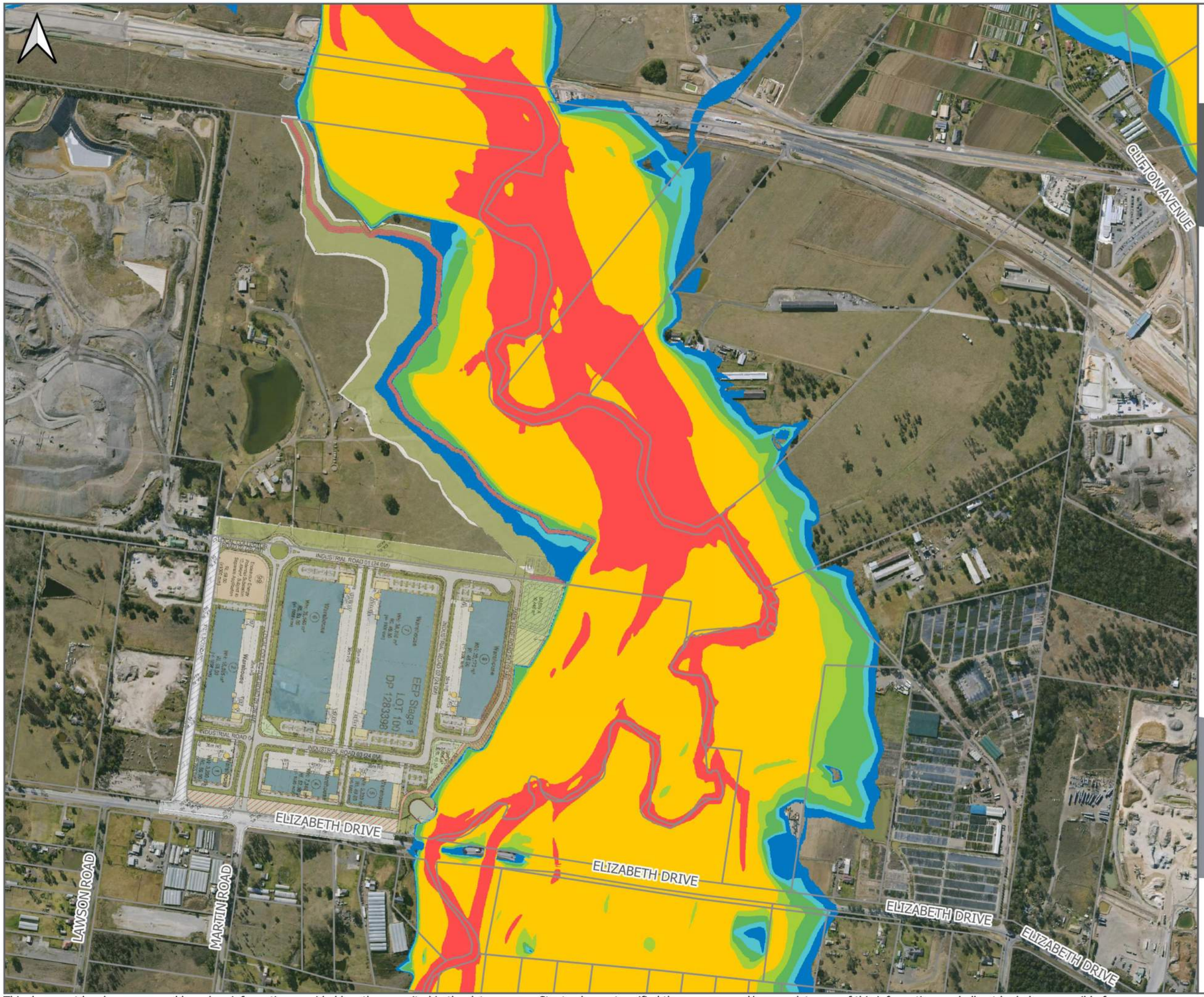
FIGURE F27

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

Map Produced by St Leonards Water (AWE)
Date: 2024-3-4| Project:59918138/304600112
Coordinate System: MGA Zone 56
File Ref:
U:\304600112\Drawings\GIS\Figure_generation\Workspace\20240223 Update\FIA.qgz



Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

PMF
Flood Hazards

SSDA Masterplan Stage 1

Legend

- Cadastre

Flood Hazard Categories

- H1 - Generally safe for vehicles, people and buildings.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for vehicles, children and the elderly.
- H4 - Unsafe for vehicles and people.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.

FIGURE F28

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

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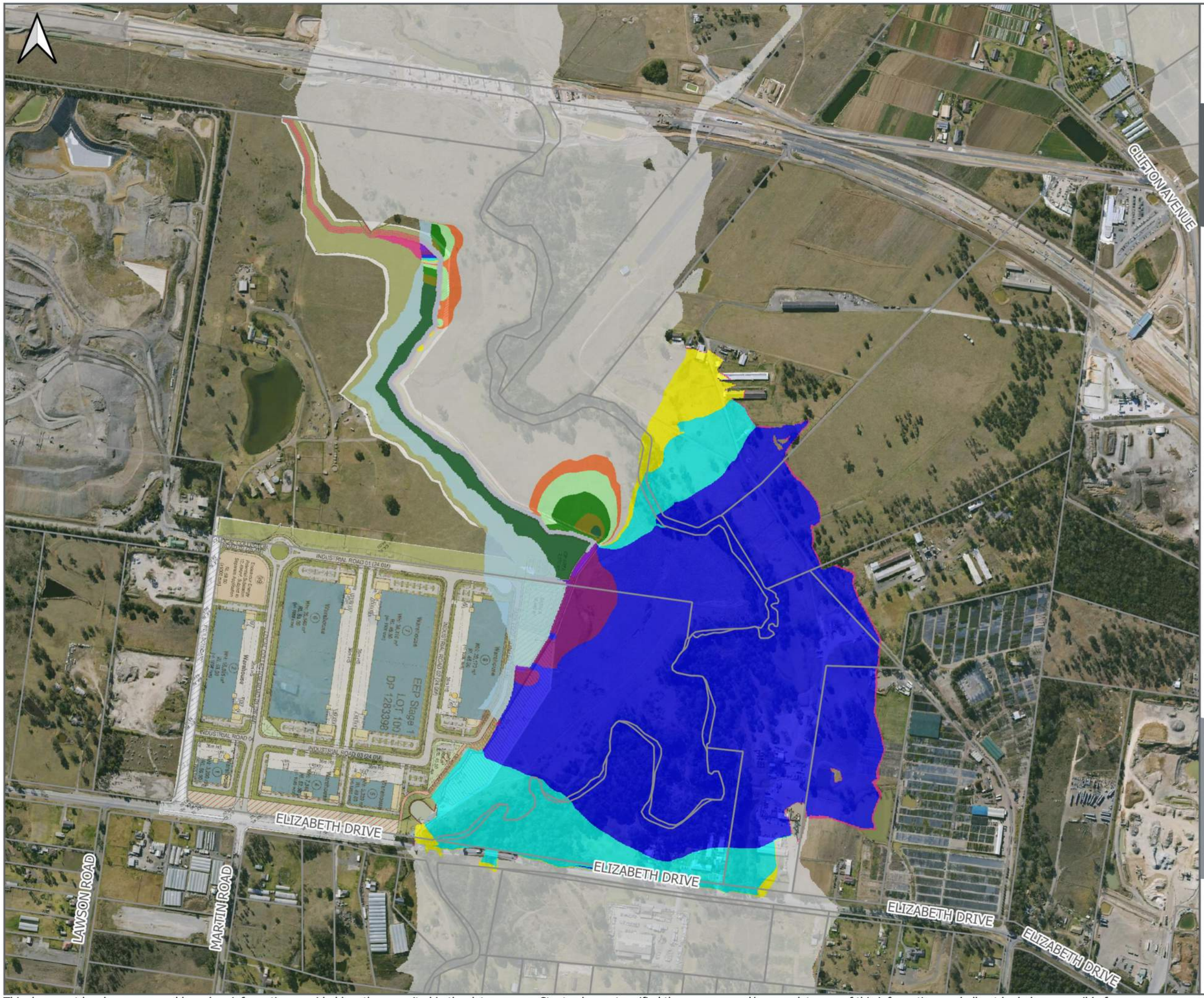
Coordinate System: MGA Zone 56
File Ref:
U:\304600112\Drawings\GIS\Figure_generation\Workspace\20240223 Update\FIA.qgz



Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

PMF
Level Differences

(SSDA Masterplan Stage 1 – Benchmark (2018) Conditions)

Legend

- Cadastre

Change in Flood Extents (Wet/Dry)

- Was Wet, Now Dry
- Was Dry, Now Wet

Water Level Difference (m)

- <= -0.15
- -0.15 - -0.10
- -0.10 - -0.05
- -0.05 - -0.02
- -0.02 - -0.01
- -0.01 - 0.01
- 0.01 - 0.02
- 0.02 - 0.05
- 0.05 - 0.10
- 0.10 - 0.15
- > 0.15

FIGURE F29

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

Map Produced by St Leonards Water (AWE)
Date: 2024-3-4| Project:59918138/304600112
Coordinate System: MGA Zone 56
File Ref:
U:\304600112\Drawings\GIS\Figure_generation\Workspace\20240223 Update\FIA.qgz

Flood Impact Assessment
Elizabeth Enterprise Precinct
SSDA Masterplan Stage 1

PMF
Velocity Differences

(SSDA Masterplan Stage 1 – Benchmark (2018) Conditions)

Legend

- Cadastre

Velocity Difference (m/s)

- <= 0.05
- 0.05 - 0.10
- 0.10 - 0.20
- 0.20 - 0.40
- 0.40 - 0.60
- 0.60 - 0.80
- 0.80 - 1.00
- > 1

FIGURE F30

1:8,000 Scale at A3

0 100 200 300 400 m

Stantec

Map Produced by St Leonards Water (AWE)
Date: 2024-3-4| Project:59918138/304600112
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File Ref:
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Elizabeth Enterprise Precinct

APPENDIX B

ASSESSING THE IMPACT OF DEVELOPMENT CONTROLS ON DESIGN FLOWS

Stantec

2.0 –General Controls

2.5 Flooding and Environmental Resilience Management

2.5.1 Flood Management

Objectives	Assessment
O1. Ensure development in the floodplain is consistent with the *NSW Flood Prone Land Policy* and the principles of the *NSW Floodplain Development Manual*.	The proposed works achieve this objective by limiting the bulk earthworks to the area just outside the 100 year ARI flood extent. A full range of floods have been assessed in this Flood Impact Assessment with design flood levels and extent, depths, velocities and hazards assessed under proposed Stage 1 bulk earthworks for the 20 year ARI, 100 year ARI, 200 year ARI, 500 year ARI floods and the PMF. As described in this Flood Impact Assessment**:** Figures F5, F11, F17, F23 and F29 *disclose nil impact in the 20 yr ARI and 100 yr ARI events. This was expected because the limit of the bulk earthworks lies just outside the 100 yr ARI flood extent under 2018 Conditions. The impact on flood levels in the 200 yr ARI and 500 yr ARI events are negligible. The impact of PMF levels extends beyond the site boundary it appears that these impacts are exacerbated by the "corner" of the berm which extends east of the limit of Stage 1 earthworks. these impacts are up to around 0.05 m on the eastern extent of the PMF. The PMF impacts extend to Elizabeth Drive. Given the likelihood of the PMF, these flood level impacts are considered to be negligible.* Figures F7, F13, F19, F24 and F30 *disclose nil impact in the 20 yr ARI and 100 yr ARI events. This was expected because the limit of the bulk earthworks lies just outside the 100 yr ARI flood extent under 2018 Conditions. The impact on flood velocities in the 200 yr ARI and 500 yr ARI events are less than 0.05 m/s and are negligible. The impacts on PMF velocities extend across the floodplain just north of Stage 1. It appears that these impacts are initiated by the "corner" of the berm which extends east of the limit of Stage 1 earthworks. These velocities do not exceed 2 m/s expect in a small zone close to the "corner" of the berm. The impact on PMF velocities is minor.*
O2. Embed Aboriginal cultural knowledge and caring for Country practices to minimise the impact of development on flood behaviour and function of the floodplain and avoid adverse impacts to the existing flora, fauna and community.	The proposed works achieve this objective by limiting the bulk earthworks to the area just outside the 100 year ARI flood extent which does not impact on the blue-green infrastructure. As also discussed in Section 2 of this FIA report: *Notwithstanding the runoff from the Elizabeth Drive Enterprise Precinct will not adversely impact peak flows in South Creek, an assessment of basin sizes to manage 2 year ARI and 100 year ARI peak flows in a 2 hr storm burst was undertaken*. A preceding assessment of the Steam Erosion Index in South Creek just downstream of the proposed development reported on 2 February 2019 concluded that the daily rainfall model gave an SEI of 1.0 while the model which analysed

	six minute rainfall gave an SEI of 1.13. This outcome was expected given the results of the hydrological assessments of flood flows and the relative size of the proposed development in comparison to the catchment area to Node 1.15, namely, around 1.3% of the catchment area. The incorporation of a basin sized to limit the peak discharges from the development to no greater than Existing Conditions across the range of floods from 2 year ARI to 100 year ARI also avoids adverse impacts to the existing flora, fauna and community.
O3. To minimise the flood risk to life and property associated with the use of land considering the full range of flooding.	A full range of floods have been assessed in this Flood Impact Assessment with design flood levels and extent, depths, velocities, velocity x depth and hazards assessed under proposed Stage 1 Bulk Earthworks for the 20 year ARI, 100 year ARI, 200 year ARI, 500 year ARI floods and the PMF. As described in this Flood Impact Assessment: Figures F5, F11, F17, F23 and F29 *disclose nil impact in the 20 yr ARI and 100 yr ARI events. This was expected because the limit of the bulk earthworks lies just outside the 100 yr ARI flood extent under 2018 Conditions. The impact on flood levels in the 200 yr ARI and 500 yr ARI events are negligible. The impact of PMF levels extends beyond the site boundary it appears that these impacts are exacerbated by the "corner" of the berm which extends east of the limit of Stage 1 earthworks. these impacts are up to around 0.05 m on the eastern extent of the PMF. The PMF impacts extend to Elizabeth Drive. Given the likelihood of the PMF, these flood level impacts are considered to be negligible.* Figures F7, F13, F19, F24 and F30 *disclose nil impact in the 20 yr ARI and 100 yr ARI events. This was expected because the limit of the bulk earthworks lies just outside the 100 yr ARI flood extent under 2018 Conditions. The impact on flood velocities in the 200 yr ARI and 500 yr ARI events are less than 0.05 m/s and are negligible. The impacts on PMF velocities extend across the floodplain just north of Stage 1. It appears that these impacts are initiated by the "corner" of the berm which extends east of the limit of Stage 1 earthworks. These velocities do not exceed 2 m/s expect in a small zone close to the "corner" of the berm. The impact on PMF velocities is minor*
O4. Enable key community services and infrastructure that respond to flood threats to function during flooding.	This objective is achieved by the adopted platform level of the Stage 1 development which is higher than the PMF level.
O5. Allow development on land that is compatible with the flood function and behaviour on the land, taking into account projected changes as a result of climate change.	The proposed works achieve this objective by limiting the Stage 1 bulk earthworks to the area just outside the 100 yr ARI flood extent. A full range of floods have been assessed in this Flood Impact Assessment with design flood levels and extent, depths, velocities, velocity x depth and hazards assessed under proposed Stage 1 bulk earthworks for the 20 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI floods and the PMF. The 200 yr ARI and 500 yr ARI are viewed as surrogates for the impact of climate change on 100 yr ARI flooding by around the year 2100 under climate scenarios RCP4.5 and RCP8.5. As described in this Flood Impact Assessment: *… The impact on flood levels in the 200 yr ARI and 500 yr ARI events are negligible. ….. The impact on flood velocities in the 200 yr ARI and 500 yr ARI events are less than 0.05 m/s and are negligible.*

O6. Consider areas within the floodplain for amenity and recreation use where compatible with flood function and flood risk.	Compatibility of areas on the South Creek floodplain for amenity and recreation use within the 100 yr ARI flood extent will be guided by the assessments of flood levels, depths velocities and hazards under the 20 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI floods and the PMF reported in the 2021 Flood Risk Assessment.
O7. Development is not intensified in a floodway or flood storage area.	There is no development in Stage 1 in the floodway or in any flood storage area in a 100 yr ARI flood.
O8. Avoid adverse or cumulative impacts on flood behaviour and the environment.	As described in Section 4.1 of this FIA report: *The estimated impact of the SSDA Masterplan Stage 1 works on 20 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI flood levels and PMF levels (in comparison to Detailed Survey (2018) Conditions) are plotted in Figures F5, F11, F17, F23 and F29 respectively.* *These Figures disclose nil impact in the 20 yr ARI and 100 yr ARI events. This was expected because the limit of the bulk earthworks lies just outside the 100 yr ARI flood extent under 2018 Conditions. The impact on flood levels in the 200 yr ARI and 500 yr ARI events are negligible. The impact of PMF levels extends beyond the site boundary it appears that these impacts are exacerbated by the "corner" of the berm which extends east of the limit of Stage 1 earthworks. these impacts are up to around 0.05 m on the eastern extent of the PMF. The PMF impacts extend to Elizabeth Drive. Given the likelihood of the PMF, these flood level impacts are considered to be negligible.* As described in Section 4.2 of this FIA report: *The estimated impact of Proposed Bulk Earthworks on 20 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI flood velocities and PMF velocities (in comparison to Detailed Survey (2018) Conditions) are plotted in Figures F7, F13, F19, F24 and F30 respectively.* *These Figures disclose nil impact in the 20 yr ARI and 100 yr ARI events. This was expected because the limit of the bulk earthworks lies just outside the 100 yr ARI flood extent under 2018 Conditions. The impact on flood velocities in the 200 yr ARI and 500 yr ARI events are less than 0.05 m/s and are negligible. The impacts on PMF velocities extend across the floodplain just north of Stage 1. It appears that these impacts are initiated by the "corner" of the berm which extends east of the limit of Stage 1 earthworks. These velocities do not exceed 2 m/s expect in a small zone close to the "corner" of the berm. The impact on PMF velocities is minor.* The proposed works achieve this objective.
O9. Enable the safe occupation and efficient evacuation of people in the event of a flood.	This objective is achieved by the adopted Stage 1 platform levels of the development which is higher than the PMF level. People can safely remain on the site and do not need to evacuate.

Performance Outcome	Benchmark Solution	Assessment
PO1 Conveyance and storage of floodwaters through the floodplain is managed. The siting and layout of development considers flood constraints, including risks to personal safety during the full range of floods. The site layout and built form of the development is compatible with flood constraints and potential risk.	Outside Flood Planning Area to Probable Maximum Flood (defined in Appendix A) Unsuitable for Critical Land Uses	The proposed land use is not a Critical Land Use. The proposed earthworks in Stage 1 also mean the development will occur only on land higher than and beyond the PMF extent.
	1. Applicant to demonstrate that development as a consequence of a subdivision or development proposal, can be undertaken in accordance with a FIRA.	This performance outcome is achieved.
	2. The FIRA is undertaken by a suitably qualified professional engineer and considers the impacts of: a. Flooding on the development;	The FIRA comprises the 2021 Flood Risk Assessment and this Flood Impact Assessment of Stage 1 which were prepared by Stantec staff who are suitably qualified professional engineers. The proposed earthworks also mean the development will occur only on land higher than and beyond the PMF extent.
	b. The development on flooding; c. Flooding and the development on property and the existing and future community; and	As described in Section 4.1 of this FIA report: Figures F5, F11, F17, F23 and F29 *disclose nil impact in the 20 yr ARI and 100 yr ARI events. This was expected because the limit of the bulk earthworks lies just outside the 100 yr ARI flood extent under 2018 Conditions. The impact on flood levels in the 200 yr ARI and 500 yr ARI events are negligible. The impact of PMF levels extends beyond the site boundary it appears that these impacts are exacerbated by the "corner" of the berm which extends east of the limit of Stage 1 earthworks. these impacts are up to around 0.05 m on the eastern extent of the PMF. The PMF impacts extend to Elizabeth Drive. Given the likelihood of the PMF, these flood level impacts are considered to be negligible.* Figures F7, F13, F19, F24 and F30 *disclose nil impact in the 20 yr ARI and 100 yr ARI events. This was expected because the limit of the bulk earthworks lies just outside the 100 yr ARI flood extent under 2018 Conditions. The impact on flood velocities in the 200 yr ARI and 500 yr ARI events are less than 0.05 m/s and are negligible. The impacts on PMF velocities extend across the floodplain just north of Stage 1. It appears that these impacts are initiated by the "corner" of the berm which extends east of the limit of Stage 1 earthworks. These velocities do not exceed 2 m/s expect in a small zone close to the "corner" of the berm. The impact on PMF velocities is minor.*

	d. Climate change consistent with the objectives of this DCP.	The 200 yr ARI and 500 yr ARI are viewed as surrogates for the impact of climate change on 100 yr ARI flooding by around the year 2100 under climate scenarios RCP4.5 and RCP8.5. As described in this Flood Impact Assessment: *… The impact on flood levels in the 200 yr ARI and 500 yr ARI events are negligible. ….. The impact on flood velocities in the 200 yr ARI and 500 yr ARI events are less than 0.05 m/s and are negligible.*
	3. The FIRA assesses flood constraints for both pre and post development cases with and without climate change to ensure there are no detrimental impacts on flood behaviour or to the community upstream, downstream, or adjacent to the site.	A full range of floods have been assessed in the 2021 Flood Risk Assessment and in this Flood Impact Assessment with design flood levels and extent, depths, velocities and hazards assessed under Benchmark Conditions and under proposed Stage 1 bulk earthworks for the 20 year ARI, 100 year ARI, 200 year ARI, 500 year ARI floods and the PMF. A preceding assessment of the Steam Erosion Index in South Creek just downstream of the proposed development reported on 2 February 2019 concluded that the daily rainfall model gave an SEI of 1.0 while the model which analysed six minute rainfall gave an SEI of 1.13. This outcome was expected given the results of the hydrological assessments of flood flows and the relative size of the proposed development in comparison to the catchment area to Node 1.15, namely, around 1.3% of the catchment area. The incorporation of a basin sized to limit the peak discharges from the development to no greater than Existing Conditions across the range of floods from 2 yr ARI to 100 yr ARI also avoids adverse impacts to the existing flora, fauna and community.
	4. Critical and sensitive land uses are to have floor levels equal to or greater than the PMF level where intended to be utilised during flooding.	There are no critical or sensitive land uses proposed in the Stage 1 development.
PO2 Development has minimal impact on flood behaviour.	1. The FIRA demonstrates that development will not increase flood affectation to existing and proposed development within and outside the development site.	This performance outcome is achieved. As described in Section 4.1 of this FIA report: Figures F5, F11, F17, F23 and F29 *disclose nil impact in the 20 yr ARI and 100 yr ARI events. This was expected because the limit of the bulk earthworks lies just outside the 100 yr ARI flood extent under 2018 Conditions. The impact on flood levels in the 200 yr ARI and 500 yr ARI*

		events are negligible. The impact of PMF levels extends beyond the site boundary it appears that these impacts are exacerbated by the "corner" of the berm which extends east of the limit of Stage 1 earthworks. these impacts are up to around 0.05 m on the eastern extent of the PMF. The PMF impacts extend to Elizabeth Drive. Given the likelihood of the PMF, these flood level impacts are considered to be negligible. Figures F7, F13, F19, F24 and F30 *disclose nil impact in the 20 yr ARI and 100 yr ARI events. This was expected because the limit of the bulk earthworks lies just outside the 100 yr ARI flood extent under 2018 Conditions. The impact on flood velocities in the 200 yr ARI and 500 yr ARI events are less than 0.05 m/s and are negligible. The impacts on PMF velocities extend across the floodplain just north of Stage 1. It appears that these impacts are initiated by the "corner" of the berm which extends east of the limit of Stage 1 earthworks. These velocities do not exceed 2 m/s expect in a small zone close to the "corner" of the berm. The impact on PMF velocities is minor.*
	2. Except for single detached dwellings and alterations and additions to existing dwellings, an engineer's report is required to certify that the development will not increase flood affectation to existing and proposed development.	This Flood Impact Assessment satisfies this performance outcome.
PO3 Structures are designed and constructed so they remain structurally sound for the life of the development considering flood and debris forces.	1. Critical and sensitive land uses are of flood-compatible building components below or at the PMF level where intended to be utilised during flooding.	The proposed earthworks are such that development in Stage 1 will occur only on land higher than and beyond the PMF extent, so flood and debris forces are not applicable.
	2. An engineer's report is submitted to certify the structure can withstand the forces of floodwater including debris and buoyancy up to and including the PMF level for sensitive development or essential community facilities intended to be utilised during flooding.	Not a relevant consideration.

PO4 All fill ensures the long-term stability of the development site and is not affected by erosion.	1. The FIRA demonstrates that any fill as a result of the development will not be impacted by erosion and will have long term stability.	This has been considered in the design of the development. Refer to the Civil Engineering Plans.
PO5 The safety of users of developed areas located on the floodplain for the full range of flooding is ensured.	1. Vehicular access to precincts are designed to ensure rising road access/egress is provided to above the predicted peak level of the PMF.	This performance outcome is achieved. Vehicular access to the precinct is from Elizabeth Drive is higher than the PMF noting that there are sections of Elizabeth Drive which are overtopped by floodwaters at major creek crossings (South Creek, Cosgroves Creek). In the future the M12 will provide an opportunity for vehicles to safely egress along Elizabeth Drive and on to the M12 motorway except in extreme floods where unsafe conditions may develop at the Badgerys Creek crossing. It will be safer to remain on site than to evacuate along Elizabeth Drive to another location which is equally higher than the PMF level.
	2. FIRA for sensitive and critical development demonstrates evacuation can be undertaken consistent with the Local Flood Plan or SES flood emergency strategy for the area.	The proposed development is neither Sensitive development nor Critical development.
PO6 Public safety and the environment are not adversely affected by the detrimental impacts of floodwater on hazardous materials manufactured or stored in bulk.	1. No external storage of materials which may cause pollution or be potentially hazardous during any flood.	This performance outcome is achieved because the proposed earthworks are such that development will occur only on land higher than and beyond the PMF extent in Stage 1.
PO7 Fencing is designed and constructed so it does not impede and/or direct the flow of floodwaters, add debris to floodwaters or increase flood affectation on surrounding land.	N/A	This performance outcome is achieved because the proposed earthworks are such that development will occur only on land higher than and beyond the PMF extent in Stage 1.
PO8 Earthworks including cut and fill do not impact flood storage areas.	1. The FIRA demonstrates earthworks will not affect flood storage capacity or flood behaviour for the full range of flood events.	This performance outcome is achieved. The proposed earthworks also mean the development will occur only on land higher than and beyond the PMF extent in Stage 1.. The FIRA is described in the 2021 Flood Risk Assessment and this Flood Impact Assessment of Stage 1.

	As described in Section 4.1 of this FIA report: Figures F5, F11, F17, F23 and F29 *disclose nil impact in the 20 yr ARI and 100 yr ARI events. This was expected because the limit of the bulk earthworks lies just outside the 100 yr ARI flood extent under 2018 Conditions. The impact on flood levels in the 200 yr ARI and 500 yr ARI events are negligible. The impact of PMF levels extends beyond the site boundary it appears that these impacts are exacerbated by the "corner" of the berm which extends east of the limit of Stage 1 earthworks. these impacts are up to around 0.05 m on the eastern extent of the PMF. The PMF impacts extend to Elizabeth Drive. Given the likelihood of the PMF, these flood level impacts are considered to be negligible.* Figures F7, F13, F19, F24 and F30 *disclose nil impact in the 20 yr ARI and 100 yr ARI events. This was expected because the limit of the bulk earthworks lies just outside the 100 yr ARI flood extent under 2018 Conditions. The impact on flood velocities in the 200 yr ARI and 500 yr ARI events are less than 0.05 m/s and are negligible. The impacts on PMF velocities extend across the floodplain just north of Stage 1. It appears that these impacts are initiated by the "corner" of the berm which extends east of the limit of Stage 1 earthworks. These velocities do not exceed 2 m/s expect in a small zone close to the "corner" of the berm. The impact on PMF velocities is minor.*
2. Any fill platform associated with development does not create a local site-specific flood island isolating the user from safety during flooding	Vehicular access to the precinct is from Elizabeth Drive which is higher than the PMF. However, there are sections of Elizabeth Drive which are overtopped by floodwaters at major creek crossings (South Creek, Cosgroves Creek, …). This is a pre-existing condition which is not altered by the proposed development. It will be safer for everyone to remain on site than to evacuate along Elizabeth Drive to another location which is equally higher than the PMF level.

* Areas identified in Wianamatta (South) Creek Flood Study – Existing Conditions prepared by Advisian for Infrastructure NSW in November 2020 or subsequent versions of this report by Advisian for Infrastructure NSW and the Western Sydney Planning Partnership.

Note: Refer to Appendix A of the WSA DCP for a definition of terms referred to in this section, including definitions for critical and sensitive land uses, as well as concessional development.