Telopea Urban Renewal Project –

Masterplan Flood Assessment

FOR / Frasers Property

CLIENT / Frasers Property Telopea Developer Pty Ltd

DOCUMENT NO / S20156-REP-HYD-0001 REV / C DATE / 10/11/2020

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Revision	Date	Description	Prepared	Reviewed	Approved
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B	24/06/2020	For Development Application	K Heron	L Baxter	L Baxter
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1 INTRODUCTION

This report has been prepared by BG&E Pty Limited (BG&E) on behalf of *Frasers Property Telopea Developer Pty Ltd* (Frasers) and accompanies a State Significant Development application (SSDA) submitted to the NSW Department of Planning, Industry and Environment (DPIE). The SSDA seeks Concept approval, in accordance with Division 4.4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), for the staged redevelopment of the **'Telopea Estate'**, as well as a detailed proposal for the first stage of development, known as **'Stage 1A'**.

The purpose of this report is to provide a flood risk assessment for the redevelopment of the **Telopea Estate**.

The aim of this report is to:

- Describe flood behaviour of The Ponds Creek;
- Understand flood risks to the existing site;
- Identify potential flood risks to the future development; and
- Identify key development constraints in regard to flooding.

This assessment is to focus on mainstream flooding only; that is flooding from watercourses namely The Ponds Creek. As Stage 1A is located away from The Ponds Creek, and therefore not subject to mainstream (creek) flooding from The Ponds Creek, it is not considered further in this assessment. Overland flows and stormwater drainage are not part of this flood assessment, and is being undertaken by others.

This report contains a summary of:

- Development of hydrologic and hydraulic model (XP-RAFTS and TUFLOW) for the assessment of The Ponds Creek;
- Predicted flood extents, depths and levels for 1% AEP and PMF events;
- Mapping of flood levels, depths and hazards; and
- Flood Planning Levels.

1.1 Background

The Telopea Estate forms part of the **Telopea Precinct Master Plan** (February 2017), which was prepared by NSW Land and Housing Corporation (LAHC) and Parramatta City Council (PCC) to facilitate the rezoning of the precinct which occurred in December 2018. The Master Plan seeks to revitalise the Telopea Precinct through the redevelopment of LAHC's social housing assets, as well as sites under private ownership, to deliver an integrated community with upgraded public domain and community facilities – and to capitalise on access to the new Parramatta Light Rail network.

The Telopea Estate is the land identified in **Figure 1** and is currently owned by LAHC. The proposed redevelopment of the Estate is part of the NSW Government *Communities Plus* program, which seeks to deliver new communities where social housing blends with private and affordable housing with good access to transport, employment, improved community facilities and open space. The program seeks to leverage the expertise and capacity of the private and non-government sectors.

In December 2019, the NSW Government announced that the Affinity consortium, comprising Frasers and Hume Community Housing, were awarded the contract to redevelop the Telopea Estate. The SSDA represents

the first step in the delivery of the planned redevelopment of the Telopea Estate and the Stage 1A works will provide the first integrated social and market housing development on the site, as well as a new arrival plaza for the Parramatta Light Rail.

1.2 Site Description

The Telopea Estate is located in the Parramatta Local Government Area (LGA). It is approximately 4km north-east of the Parramatta Central Business District (CBD), 6km south-west of Macquarie Park Strategic Centre, and 17km from Sydney CBD.

The Telopea Estate site is approximately 13.4 (ha) and comprises 99 individual allotments (refer Figure 1). It currently accommodates 486 social housing dwellings, comprising a mix of single dwellings, townhouses, and 3-9 storey residential flat buildings. The area also currently accommodates a range of existing community facilities including the Dundas Community Centre, Dundas Branch Library, Community Health Centre, Hope Connect church, and Telopea Christian Centre.

The immediate surrounds comprise predominantly residential properties within an established landscape setting. The broader Precinct contains the Telopea Public School, a neighbourhood centre known as the Waratah Shops, and two large Council parks known as Sturt Park and Acacia Park.

Figure 1 – Telopea Estate Site Plan

Source: LAHC

1.3 Flooding Terminology

The frequency of a flood event is expressed in terms of its Annual Exceedance Probability (AEP); the probability of an event being equalled or exceeded within a year. Smaller magnitude events are described by Exceedances per Year (EY); the average number of times a year in which the event is likely to be equalled or exceeded. Previously flood probabilities have been described by the Average Recurrence Interval (ARI); that is the average time period between occurrences equalling or exceeding a given value. Some documents, such as Development Control Plans and Guidelines still refer to the ARI terminology.

For example, a 1% AEP event has a 1% chance (i.e. a 1 in 100 chance) of being equalled or exceeded in any one year and is equivalent to a 100 year Average Recurrence Interval (ARI) event. In the same way, a 5% AEP event is the equivalent of a 20 year ARI event.

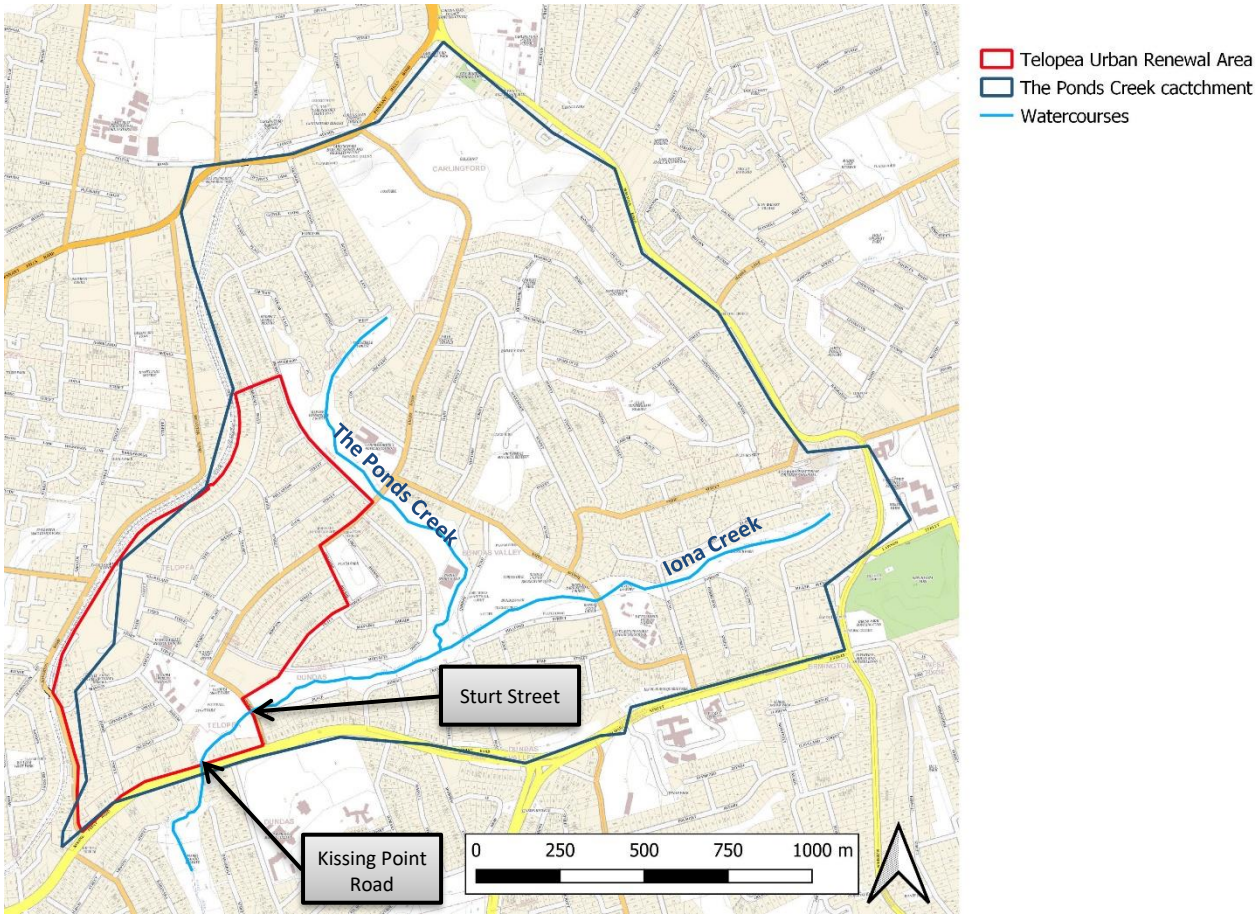
This assessment focusses on the 1% AEP flood and Probable Maximum Flood (PMF) which are used in flood planning within the Parramatta City Council (PCC) LGA.

2 FLOOD MODELLING METHODOLOGY

2.1 Existing Site

The Ponds Creek flows past the Telopea Urban Renewal Project area as shown in Figure 2. The Ponds Creek catchment to the bridge at Kissing Point Road has an area of 3.3 km^2. East of Brand Street the creek flows from northwest to southeast through a dedicated reserve and meets Iona Creek downstream of Quarry Road. The Pond Creek continues to flow east to west and crosses below Sturt Street to Sturt Park. At Sturt Park, The Ponds Creek meanders towards the south, below Kissing Point Road and towards Marri Badoo Reserve at the rear of residential properties.

Figure 2: Site Location



2.2 Available Data

Some previous flooding information was available for The Ponds Creek based on the Telopea Master Plan, Flooding and Watercycle Management Report 2017. However, since the time of the previous assessment, changes to best practice including the Australian Rainfall and Runoff (ARR) has been updated.

A flood model prepared for LAHC (Mott MacDonald, 2018) was provided. However the source of much of the input data and hydrology was unknown and no associated report was made available. For this reason, and to

ensure the recent ARR2019 updates were used in the assessment a new XP-RAFTS hydrology model and TUFLOW hydraulic flood model were developed.

2.3 Hydrology Assessment

2.3.1 XP-RAFTS Hydrologic Model

The Ponds Creek catchment upstream of Kissing Point Road was been divided into a number of sub-catchments and modelled in XP-RAFTS. The sub-catchment parameters adopted in the XPRAFTS model are shown in **Appendix A**. Rainfall data and hydrologic parameters were extracted from the Bureau of Meteorology (BOM) and Australian Rainfall and Runoff 2019 (ARR) Data Hub.

The site Intensity-Frequency-Duration (IFD) data was extracted from Bureau of Metrology (BoM) ARR2016 IFDs. The Probable Maximum Precipitation (PMF) rainfalls were developed using the Generalised Short Duration Method (BoM, 2003).

As per the NSW hierarchical approach to loss and pre-burst estimation, the NSW FFA-reconciled losses were adopted for the site using Station F03 (213004 Parramatta Hospital). These were 5.2 mm (initial loss) and 0.004 mm/hr (continuing loss). This was considered appropriate as the Telopea study area is adjacent to the Paramatta Creek study catchment. Both catchments are developed urban catchments.

The ARR2019 ensemble approach was adopted by assessing ten temporal patterns for each of nine storm durations between 10 minutes and two hours.

2.3.2 Adopted Flows

The results from the XP-RAFTS model are shown in **Table 1.** Box plots of the temporal pattern suites for the different event durations are shown in **Appendix A**. The 45 minute storm was found to be critical at Kissing Point Road and the 30 minute storm was found to be critical at Sturt Street. This indicates that the critical storm duration lies between 30 and 45 minutes. The critical storm duration is the duration which produced the highest peak flows for a given probability event.

The representative flow was adopted as the median peak flow of the ensemble of temporal patterns for the critical duration storm. **Table 1** shows the flows at Kissing Point Road and Sturt Street crossings of the creek extracted from the XP-RAFTS model and the temporal pattern ID for this event is shown in brackets afterwards.

Table 1: Design flows

	Peak Flow (m^3/s)							
Duration	**10min**	**15min**	**20min**	**25min**	**30min**	**45min**	**1hr**	**1.5hr**
1% AEP At Kissing Point Road	53.2 (T7)	53.6 (T8)	56.0 (T4)	59.4 (T10)	62.6 (T10)	64.5 (T6)	59.5 (T8)	52.7 (T10)
1% AEP at Sturt Street	52.9 (T7)	52.8 (T8)	55.2 (T3)	55.1 (T10)	61.7 (T7)	60.9 (T1)	55.8 (T4)	49.0 (T10)
PMF at Kissing Point Road		293			350	386	368	
PMF at Sturt Street		291			336	363	345	

2.4 Hydraulic Assessment

2.4.1 TUFLOW Model

A TUFLOW model was developed to define flood levels relevant to the site. Using the hydrographs established in the hydrology assessment, TUFLOW allows for the 2-dimensional assessment of flood flows over a surface (DEM) and outputs flood levels, depths, velocities and other flood behaviour characteristics.

A summary of the key features of the TUFLOW model developed for this assessment is presented in **Table 2**.

Detailed survey was provided of the development site; however, this did not extend into The Ponds Creek channel nor include the road crossings of The Ponds Creek. High Resolution LiDAR was available but due to the density of the vegetation in the creek, no channel inverts could be extracted from the provided RCS file (point cloud survey).

Table 2: Key Features of the Tuflow Model

Feature / Parameter	Value / Comment
Tuflow Version	TUFLOW.2018-03-AE
2d Grid Size	2 m
Inflows / Hydrology input	XP-RAFTS model hydrographs input as 2d boundary conditions
Downstream boundary	Normal depth boundary (HQ) with a slope of 0.9 % estimated from the LiDAR data. The boundary was modelled sufficiently downstream to not impact the area of interest. The nearest confluence with another tributary is more than 850m downstream of Kissing Point Road and backwater affects are not considered likely at this location.
Base Digital Terrain Model	1m resolution LiDAR data (flow 2019, NSW Spatial Services) Terrain was sourced from a publicly available Digital Elevation Model (DEM) flown 2019. The 1 metre DEM is derived from LiDAR (Light Detection and Ranging). The model is not hydrologically enforced. The data used to create this DEM has an accuracy of 0.3m (95% Confidence Interval) vertical and 0.8m (95% Confidence Interval) horizontal.
Representation of The Ponds Creek	A z-shape file was used to hydrographically enforce the digital elevation model (DEM) so that the channel had a minimum width of 1 m. Based on site observations the natural low flow channel is typical larger than 1m in width, so this represents a conservative approach is assessment of channel conveyance. The minimum elevations of the channel were sourced from the low points in LiDAR data which again is a conservative approach as it is unlikely that LiDAR would have sufficiently picked up the channel invert.

Feature / Parameter	Value / Comment
Hydraulic Structures	Bridges at Sturt Street and Kissing Point Road were embedded into the 2-dimensional model as 1-dimensional elements to allow for more accurate hydraulic calculations. Assumptions on structure sizing is discussed below in section 2.4.2.
Hydraulic Roughness	Manning's roughness values were adopted as industry standard from Australian Rainfall and Runoff guidance and based on review of aerial imagery and site visit observations.
Blockage factors	No structure blockage was applied. While typically some allowance for structure blockage is considered in flood modelling, in this scenario a 0% blockage approach was adopted because: • Assuming no blockage allows more flow to pass downstream of Sturt Street thus ensuring peak levels at the Stuart Park area, nearest to the development area, are not underestimated; and • Based on site observations the structure appeared reasonably clear, despite vegetation upstream.
Pits and pipes	Not modelled. Local catchment inflow input into the creek. Stormwater and overland flows to be assessed by others separate to this creek flood assessment.
Design events assessed	1% and PMF Flood events.
Representative Storm 1% AEP	45 minute, Temporal Pattern 6 and 30 minute Temporal Pattern 10
Critical Duration for PMF	45 minute
Simulated run time	1.5 hours (depending on storm duration)

2.4.2 Hydraulic Structures

Two structures have been included in the model at Sturt Street and at Kissing Point Road. No survey was available and therefore the structure details have been assumed from site observations, LiDAR data elevations and the data in the TUFLOW model provided by LAHC (Mott McDonald 2018).

Figure 3: Sturt Street Culvert – downstream face

Figure 4: Kissing Point Road culvert - upstream face

Both structures were modelled as box culverts. The adopted assumptions for each of the structures are summarised in **Table 3**.

Table 3: Sturt Street and Kissing Point Road Assumed Crossing Dimensions

Location	Sturt Street	Kissing Point Road
Invert of channel upstream	23.56 mAHD	21.2 mAHD
Invert of channel downstream of structure	22.48 mAHD	21.1 mAHD
Road Elevation	25.7 mAHD	24.4 mAHD
Minimum cover / deck depth	0.6 m	0.6 m
Structure soffit above channel invert	3 m	3 m
Width of structure (waterway opening)	8 m	6 m
Assumed structure dimensions	Single Span	2x 3mx3m

2.4.3 Modelling Limitations

No detailed survey was available at the time of preparing the flood modelling. Therefore, the reported flood behaviour may differ should the model be updated with detailed survey. The LiDAR data adopted for vertical accuracy of 0.3m (95% Confidence Interval) vertical and 0.8m (95% Confidence Interval) horizontal which is typical of this type of data, and it often used for flood modelling of watercourse floodplains. However, there is likely to be a higher degree of uncertainty of the invert level of the creeks along The Ponds Creek due to the vegetation density. Typically, levels along the creek line could be overestimated. As the TUFLOW model prepared for this assessment utilised the LiDAR data to inform the channel inverts, the modelled DEM may produce conservative results as the channel represented in the LiDAR data is not well defined. While this is unlikely to significantly affect the 1% AEP and PMF events assessed, the TUFLOW model would need to be updated with survey if looking at smaller flood events such as the 5% AEP event, where channel conveyance is more important. Likewise, additional survey of the existing structures and creek inverts may be required to improve the accuracy of the model results and is more important when considering smaller flood events.

There is likely to be some differences in the model prepared as part of this assessment and the TUFLOW model provided by LAHC (Mott MacDonald, 2018). This is not unexpected and would due to modelling assumptions such as TUFLOW version used, roughness values adopted, and terrain or survey data used.

3 FLOOD BEHAVIOUR

3.1 Flood Behavior

Flood maps for the 1% AEP and PMF events are presented in Appendix B.

In the 1% AEP event, flooding is generally confined to the drainage reserve and public open space areas except for:

- Flooding of properties along Rumsey Crescent south of The Ponds Creek. This is not part of the Telopea Estate area.
- Flooding of properties on Holland Place south of The Ponds Creek. Again, this is not part of the Telopea Estate.
- A lot located between Sturt Street and Moffats Drive north of the creek. This lot is not considered part of the Telopea Estate but is within the Telopea Urban Renewal area.
- Flooding of properties on Kissing Point Road south of the creek and Sturt Park. These lots are not considered part of the Telopea Estate but are within the Telopea Urban Renewal area.

In the PMF event, the flood extent encroaches onto additional properties on Rumsey Street, Holland Place and the adjoining streets. To the north of the creek towards the Telopea Urban Renewal Area the difference in the 1% AEP and PMF flood extent is not so pronounced due to the steeper sloping terrain. Additional properties on Kissing Point Road which are part of the Telopea Urban Renewal area are affected by the PMF however these properties are not part of the Telopea Estate (refer Figure B 1).

At both Sturt Street and Kissing Point Road crossings of The Ponds Creek, the limited capacity of the culverts to convey the 1% AEP flow causes afflux on the upstream side of the culvert before overtopping the roads.

3.2 Flood Levels Depths

Flood levels for the 1% AEP and PMF event are presented in Figure B 2 and Figure B 3. The flood extents do not encroach onto lots identifies as part of the Telopea Estate, however, as noted above do affect lots within the Urban Renewal area.

Flood depths on affected lots on Kissing Point Road are up to about 2.3 m in the 1% AEP flood event. Depth in the channel exceed 3m. In the PMF event depths in the channel can be expected to exceed 4.5 m.

Flood levels upstream of Kissing Point Road are 25.4m AHD in the 1% AEP flood event and 26.6m AHD in the PMF flood event. Just downstream of Sturt Street the flood levels in the creek are 25.6 mAHD in the 1% AEP event and 27.3 mAHD in the PMF event. At the upstream of Kissing Point Road flood levels are 25.3 mAHD in the 1% AEP event and 26.5 mAHD in the PMF event.

For the lots on Chestnut Avenue identified as within the Telopea Estate, the applicable flood levels are:

- 1% AEP = 25.3 mAHD
- PMF = 26.7 mAHD

For the affected lots on Kissing Point Road, the applicable flood level varies with proximity to the creek:

- 1% AEP = 25.3 to 25.5 mAHD
- PMF = 26.7 to 27.0 MAHD

3.3 Flood Hazards

Flood hazard for the 1% AEP and PMF is mapped in Figure B 6 and Figure B 7 based on the ARR2019 and Australia Institute for Disaster Resilience Guidelines.

At Stuart Street the hazard on the road exceeds H3 and is therefore considered as unsafe for vehicles and people. At Kissing Point Road, hazard on the road up to H3; considered unsafe for vehicles and people.

Alternative access to the Urban Renewal area is available via alternative routes should the Sturt Street crossing of The Ponds Creek be closed.

4 FLOOD RISK MANAGEMENT

Controls on development within and near flood hazard areas are provided in the Parramatta Local Environment Plan (LEP) Parramatta City Council Floodplain Risk Management Policy and Parramatta Development Control Plan 2011 (DCP).

4.1 Flood Impact Assessment

PCCs DCP stipulates that *filling of land up to 1:100 Average Recurrence Interval (ARI) (or flood storage area if determined) is not permitted. Filling of and above 1:100 ARI up to the Probable Maximum Flood (PMF) (or in flood fringe) must not adversely impact upon flood behaviour.*

The proposed Telopea Estate and Stage 1 A is located outside of the modelled flood levels and there will be no impact on the existing flood behaviour of The Ponds Creek.

Should there be any changes to surface levels within the flood extent as a result of future proposed work (not part of this SSDA) further flooding assessment would be required to ensure there are no adverse increase in flood behaviour as a result.

4.2 Floodway Zone

PCC's DCP (2011) aims to prevent any intensification of development in high flood risk precincts or floodways.

A floodway is defined in the Floodplain Development Manual and associated Floodplain Risk Management Guideline as areas of high velocity and depth where the flood hazard is high.

As the proposed lots which comprise the Telopea Estate are located out of the 1% AEP flood extent they are not affected by floodway areas.

4.3 Flood Planning Levels

While the lots of the proposed Telopea Estate redevelopment are located away from the 1% AEP and PMF flood extents, a 500 mm freeboard is required when determining the Flood Planning Level.

The applicable flood planning levels for properties on Chestnut Avenue are:

- 1% AEP = 25.8 mAHD
- PMF = 27.2 mAHD

The lowest elevation on the Telopea Estate lots on Chestnut Drive near to the creek is about 28.5 mAHD. This level is some 3 m above the Flood Planning Level and is also above the PMF level.

Therefore no further flood controls in relation to flooding from The Ponds Creek are anticipated as part of the Telopea Estate Master Plan.

For future redevelopment of flood affected lots on Kissing Point Road (not part of this SSDA), flood planning controls will need to be considered.

5 CONCLUSIONS AND RECOMMENDATIONS

- The Ponds Creek flows past the Telopea Estate from north-east to south-west crossing Sturt Street and Kissing Point Road.
- Flood modelling has shown that a number of lots on Kissing Point Road would be affected by flooding from the Creek. These are not part of the Telopea Estate.
- No lots identified as being within the Telopea Estate redevelopment are subject to flooding from The Ponds Creek.
- Therefore the Telopea Estate will have no adverse impact on flood behaviour of the creek.
- The nearest Telopea Estate lots to the creek (on Chestnut Drive) are above the Flood Planning Levels and the PMF level and no further flood controls should apply.

Appendix A

XP-RAFTS model parameters and outputs

Table 4: Catchment Parameters

BASINID	AREA (Ha)	SLOPE (%)	% IMPERVIOUS	Catchment Centroid X	Catchment Centroid Y	Catchment Manning's n	Losses
1_pond	41.6812	3.98	35	319583.9	6259994	0.05	F03
10_Iona	15.4748	3.42	46	319933.7	6258894	0.05	F03
12_pond	19.9337	3.89	70	319839.5	6258581	0.05	F03
13_pond	12.4709	4.08	52	319354.3	6258615	0.05	F03
14_pond	34.1618	4.54	65	319076.9	6258943	0.05	F03
15_pond	19.2236	4.81	57	318821.7	6258494	0.05	F03
16_pond	34.5871	3.16	48	318985.2	6258163	0.05	F03
17_pond	18.471	3	63	318938.9	6257781	0.05	F03
18_pond	42.3843	5.16	66	319882.5	6258098	0.05	F03
19_pond	31.4708	3.55	46	319451.8	6257827	0.05	F03
2_pond	30.23	4.84	63	319154.6	6259790	0.05	F03
3_pond	25.2026	3.06	49	319550.9	6259138	0.05	F03
4_pond	24.1792	6.57	46	319953.7	6259895	0.05	F03
5_pond	33.4793	5.34	61	320326.3	6259541	0.05	F03
6_pond	10.9024	2.48	47	319774.2	6259396	0.05	F03
7_pond	11.0333	6.03	70	320161.8	6259255	0.05	F03
8_Iona	26.4437	6.55	61	320726.5	6259012	0.05	F03
9_Iona	21.1619	3.82	63	320303	6258875	0.05	F03
10_Iona	15.4748	3.42	46	319933.7	6258894	0.05	F03
12_pond	19.9337	3.89	70	319839.5	6258581	0.05	F03
13_pond	12.4709	4.08	52	319354.3	6258615	0.05	F03
14_pond	34.1618	4.54	65	319076.9	6258943	0.05	F03
15_pond	19.2236	4.81	57	318821.7	6258494	0.05	F03
16_pond	34.5871	3.16	48	318985.2	6258163	0.05	F03
17_pond	18.471	3	63	318938.9	6257781	0.05	F03
18_pond	42.3843	5.16	66	319882.5	6258098	0.05	F03
19_pond	31.4708	3.55	46	319451.8	6257827	0.05	F03

Table 5: Link Parameters

Reach ID	Length (m)	Slope	Travel Vel (m/s)	Catchment Lag (Minutes)	US Node	DS Node
1	687.12	3.877	0.7	8.016	1_pond	J1
2	445.79	4.286	2	14.86	2_pond	J1
3	326.08	2.18	0.7	3.804	J1	3_pond
4	370.48	4.65	2	12.349	4_pond	J2
5	427.81	4.49	2	14.26	5_pond	J2
6	340.79	3.126	0.7	3.976	6_pond	3_pond
7	412.55	2.39	0.7	4.813	7_pond	6_pond
8	445.09	5.42	2	14.836	8_Iona	9_Iona
9	369.83	3.38	0.7	4.315	9_Iona	10_Iona

Reach ID	Length (m)	Slope	Travel Vel (m/s)	Catchment Lag (Minutes)	US Node	DS Node
10	286.77	3.16	0.7	3.346	10_Iona	J3
11	185.4	1.65	0.7	2.163	J4	13_pond
12	320.39	2.74	0.7	3.738	12_pond	J4
13	245.25	0.74	0.3	1.226	13_pond	J5
14	416.85	3.15	0.7	4.863	14_pond	J5
15	201.36	6.26	2	6.712	15_pond	J6
16	384.82	1	0.3	1.924	16_pond	17_pond
18	508.67	4.12	2	16.956	18_pond	19_pond
19	396.76	2.24	0.7	4.629	19_pond	OUT
35	397.79	2.87	0.7	4.641	3_pond	J3
55	170.89	2.166	0.7	1.994	J2	6_pond
105	174.47	1.09	0.3	0.872	J3	J4
135	214.03	1.32	0.3	1.07	J5	J6
155	193.52	2.12	0.7	2.258	J6	16_pond
175	287.79	5.37	2	9.593	17_pond	OUT

Table 6: IFD Table for the site – 1% AEP event

Duration	Intensity (mm/hr)
5 min	224
10 min	182
15 min	152
20 min	130
25 min	113
30 min	101
45 min	77.4
1 hour	63.7
1.5 hour	48.6
2 hour	40.4
3 hour	31.7
4.5 hour	25.4

Rare Design Rainfall Intensity (mm/h).
Nearest grid cell: Latitude 33.7875 (S), Longitude 151.0375 (E)

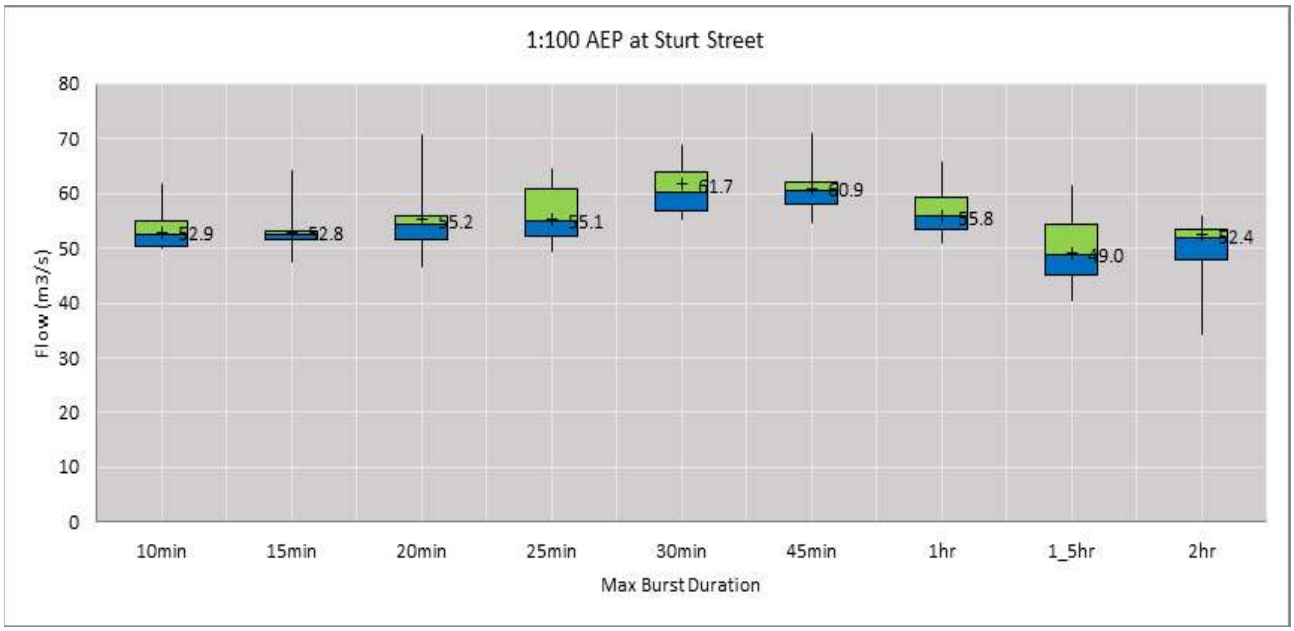


Figure A1: Box Plots ARR2019 ensemble flows at Kissing Point Road for 1% AEP event

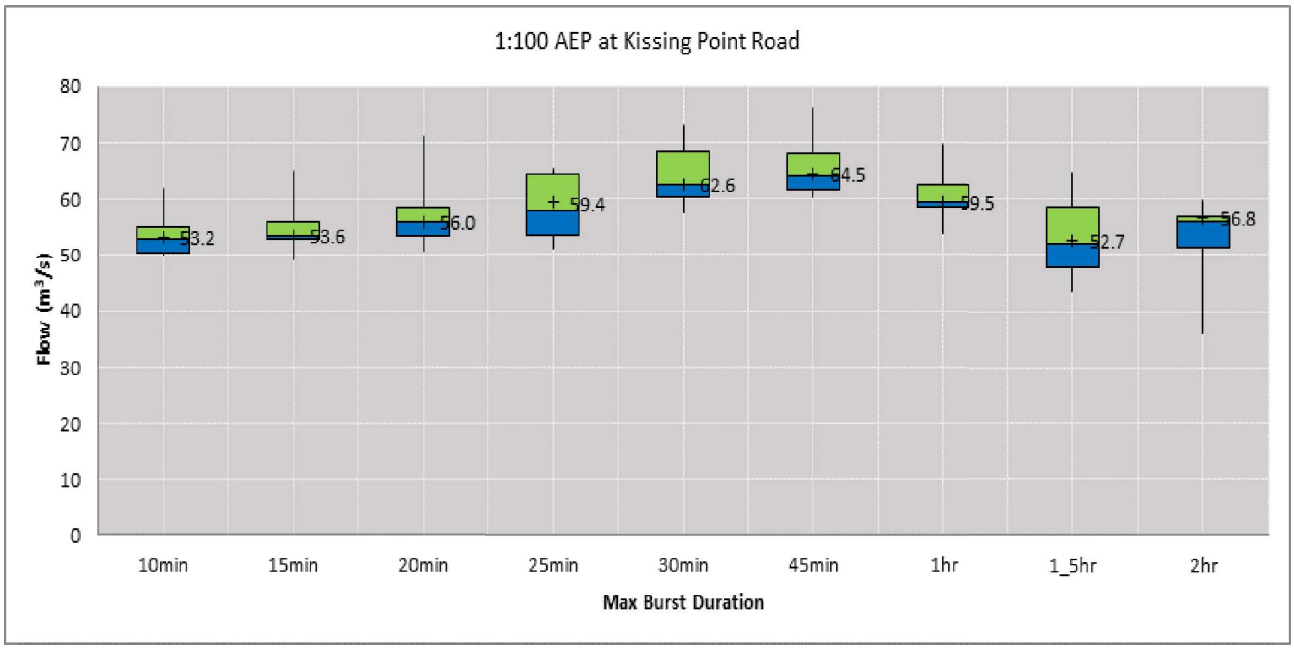


Figure A2: Box Plots ARR2019 ensemble flows at Sturt Street for 1% AEP event

Appendix B

Flood Mapping

Legend

- 1% AEP Flood Extent
- PMF extent
- Flood model Extent

NOTE: Only mainstream flooding from The Ponds Creek has been assessed. Overland flow flooding is subject to a seprate assessment by others.

0 50 100 150 200 250 m

DRAWN: KH
REVIEWED: LB
APPROVED: LB

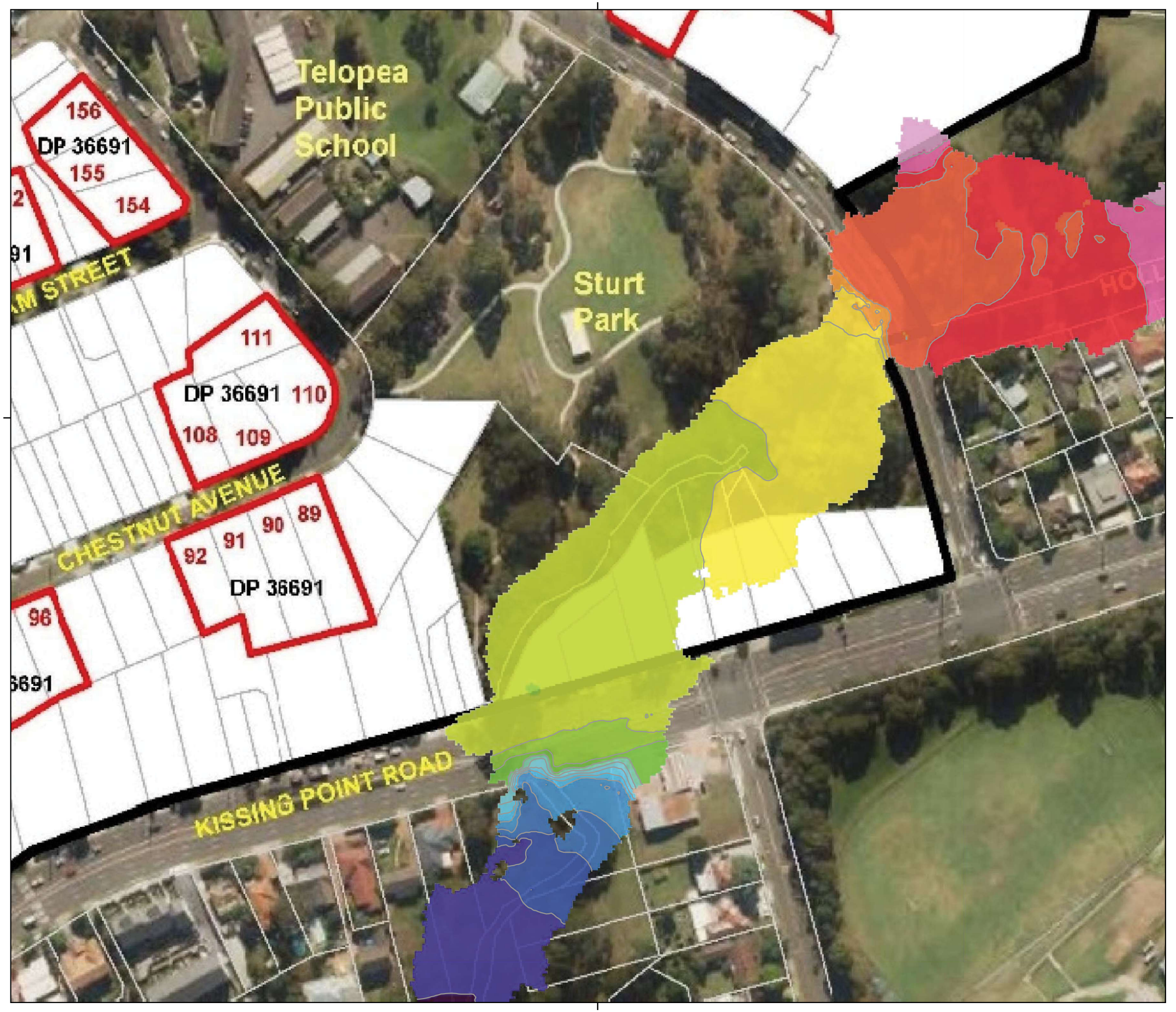
DATE: 19/6/2020
PROJECT: Telopea Estate Master Plan Flood Assessment
CLIENT: Frasers Property Telopea Developer Pty Ltd

FIGURE B 1 –
The Ponds Creek Flood Extent
1% AEP Event and Probable Maximum Flood Event

DATUM GDA 1994 MGA Zone 56

P:\BGE\SYD\S20156\100 Draw\QGIS\REPORT_FIGURES.qgz | Flood_Extents

Aerial Imagery Source: SixMaps



Legend

Flood Level contour (250 mm)

Flood Level (mAHD)

- <= 22.75
- 22.75 - 23
- 23 - 23.25
- 23.25 - 23.5
- 23.5 - 23.75
- 23.75 - 24
- 24 - 24.25
- 24.25 - 24.5
- 24.5 - 24.75
- 24.75 - 25
- 25 - 25.25
- 25.25 - 25.5
- 25.5 - 25.75
- 25.75 - 26
- 26 - 26.25
- 26.25 - 26.5
- 26.5 - 26.75
- 26.75 - 27
- 27 - 27.25
- > 27.25

NOTE: Only mainstream flooding from The Ponds Creek has been assessed. Overland flow flooding is subject to a seprate assessment by others.

0 10 20 30 40 50 m

N

BG&E

DRAWN: KH
REVIEWED: LB
APPROVED: LB

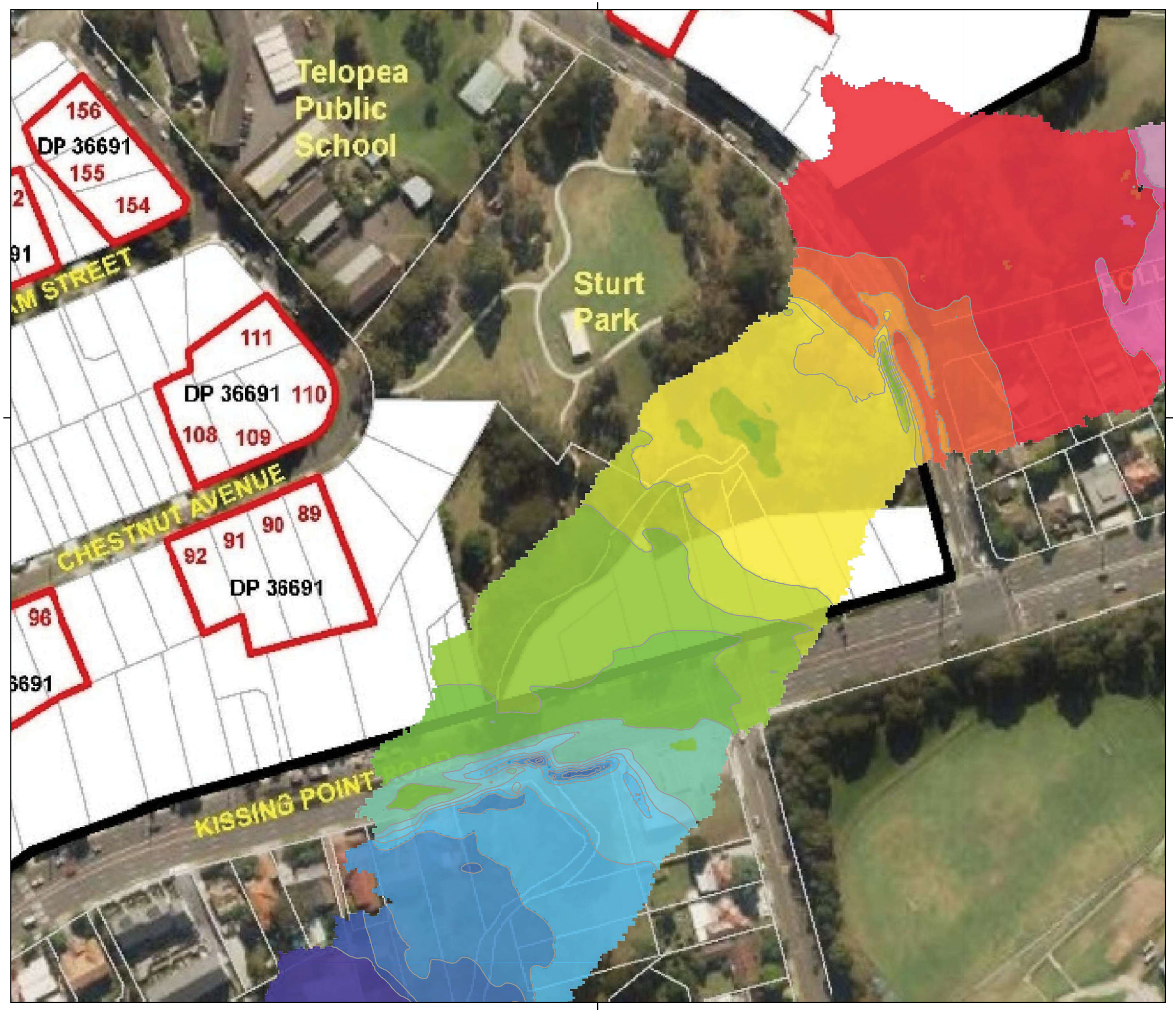
DATE: 19/6/2020
PROJECT: Telopea Estate Master Plan Flood Assessment
CLIENT: Frasers Property Telopea Developer Pty Ltd

FIGURE B 2 –
The Ponds Creek
1% AEP Flood Level

DATUM GDA 1994 MGA Zone 56

P:\BGE\SYD\S20156\100 Draw\QGIS\REPORT_FIGURES.qgz | 100y_H

Aerial Imagery Source: Client Supplied



Legend

Flood Level contour (250 mm)

Flood Level (mAHD)

- <= 24.25
- 24.25 - 24.5
- 24.5 - 24.75
- 24.75 - 25
- 25 - 25.25
- 25.25 - 25.5
- 25.5 - 25.75
- 25.75 - 26
- 26 - 26.25
- 26.25 - 26.5
- 26.5 - 26.75
- 26.75 - 27
- 27 - 27.25
- 27.25 - 27.5
- 27.5 - 27.75
- 27.75 - 28
- 28 - 28.25
- 28.25 - 28.5
- 28.5 - 28.75
- > 28.75

NOTE: Only mainstream flooding from The Ponds Creek has been assessed. Overland flow flooding is subject to a seprate assessment by others.

0 10 20 30 40 50 m

N

DRAWN: KH
REVIEWED: LB
APPROVED: LB

DATE: 19/6/2020
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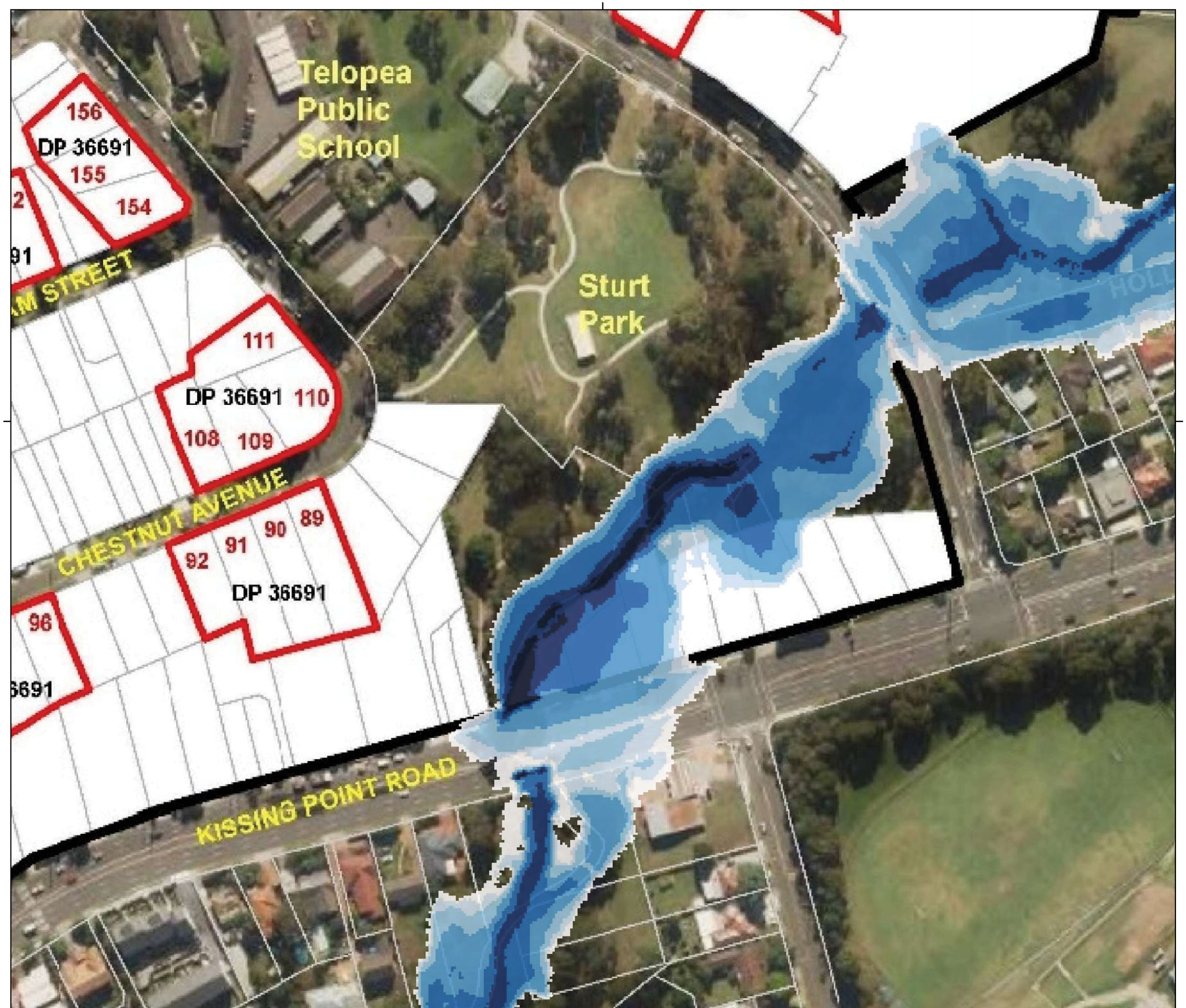
CLIENT: Frasers Property Telopea Developer Pty Ltd

FIGURE B 3 –
The Ponds Creek
Probable Maximum Flood Level

DATUM GDA 1994 MGA Zone 56

P:\BGE\SYD\S20156\100 Draw\QGIS\REPORT_FIGURES.qgz | PMF_H

Aerial Imagery Source: Client Supplied



Legend

Peak Flood Depth (m)

- <= 0.1
- 0.1 - 0.25
- 0.25 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3
- > 3

NOTE: Only mainstream flooding from The Ponds Creek has been assessed. Overland flow flooding is subject to a seprate assessment by others.

0 10 20 30 40 50 m

N

BG&E

DRAWN: KH
REVIEWED: LB
APPROVED: LB

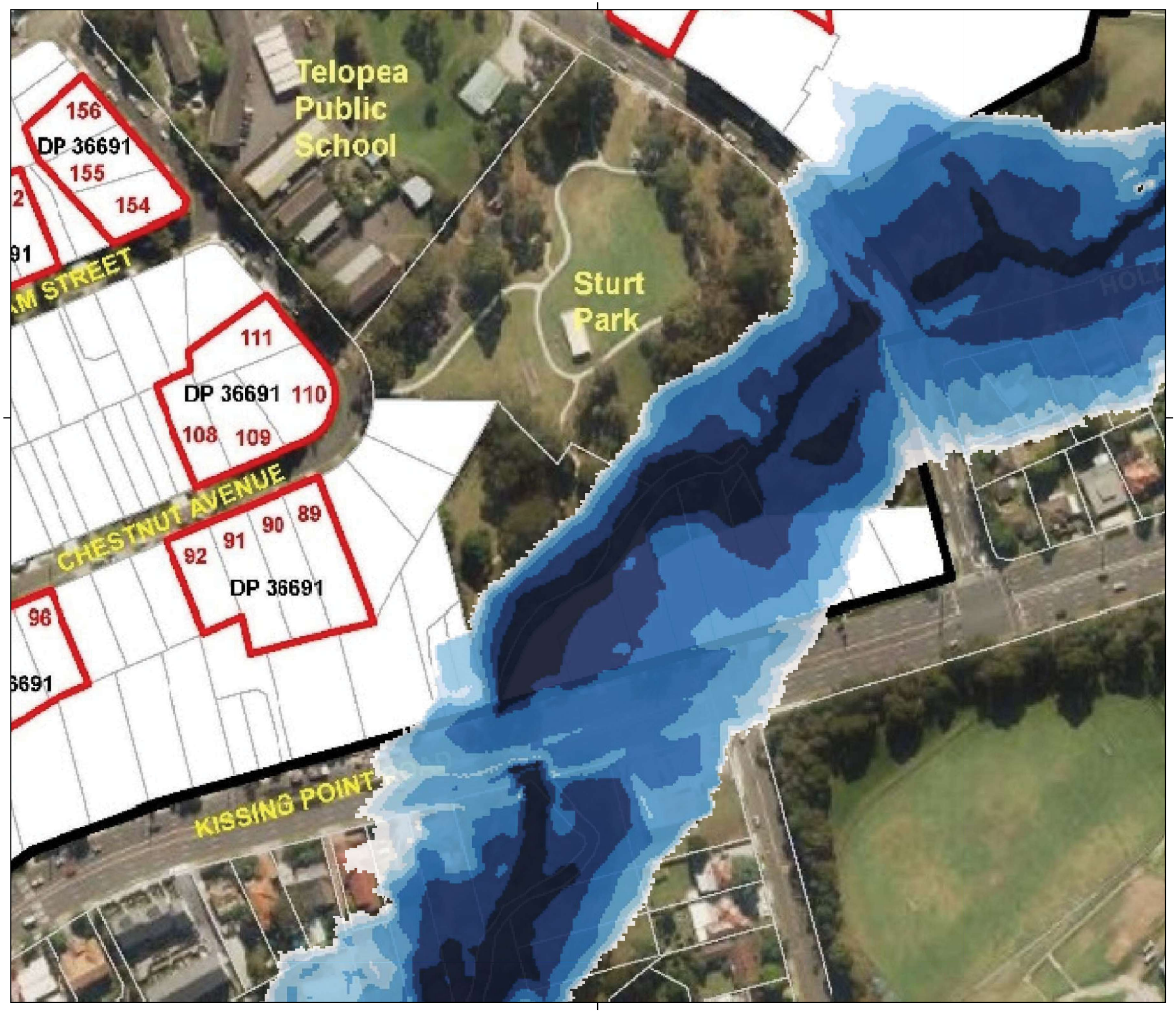
DATE: 19/6/2020
PROJECT: Telopea Estate Master Plan Flood Assessment
CLIENT: Frasers Property Telopea Developer Pty Ltd

FIGURE B 4 –
The Ponds Creek
1% AEP Flood Event Depth

DATUM GDA 1994 MGA Zone 56

Aerial Imagery Source: Client Supplied

P:\BGE\SYD\S20156\100 Draw\QGIS\REPORT_FIGURES.qgz | 100y_D



Legend

Peak Flood Depth (m)

- <= 0.1
- 0.1 - 0.25
- 0.25 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3
- > 3

NOTE: Only mainstream flooding from The Ponds Creek has been assessed. Overland flow flooding is subject to a seprate assessment by others.

0 10 20 30 40 50 m

N

DRAWN: KH
REVIEWED: LB
APPROVED: LB

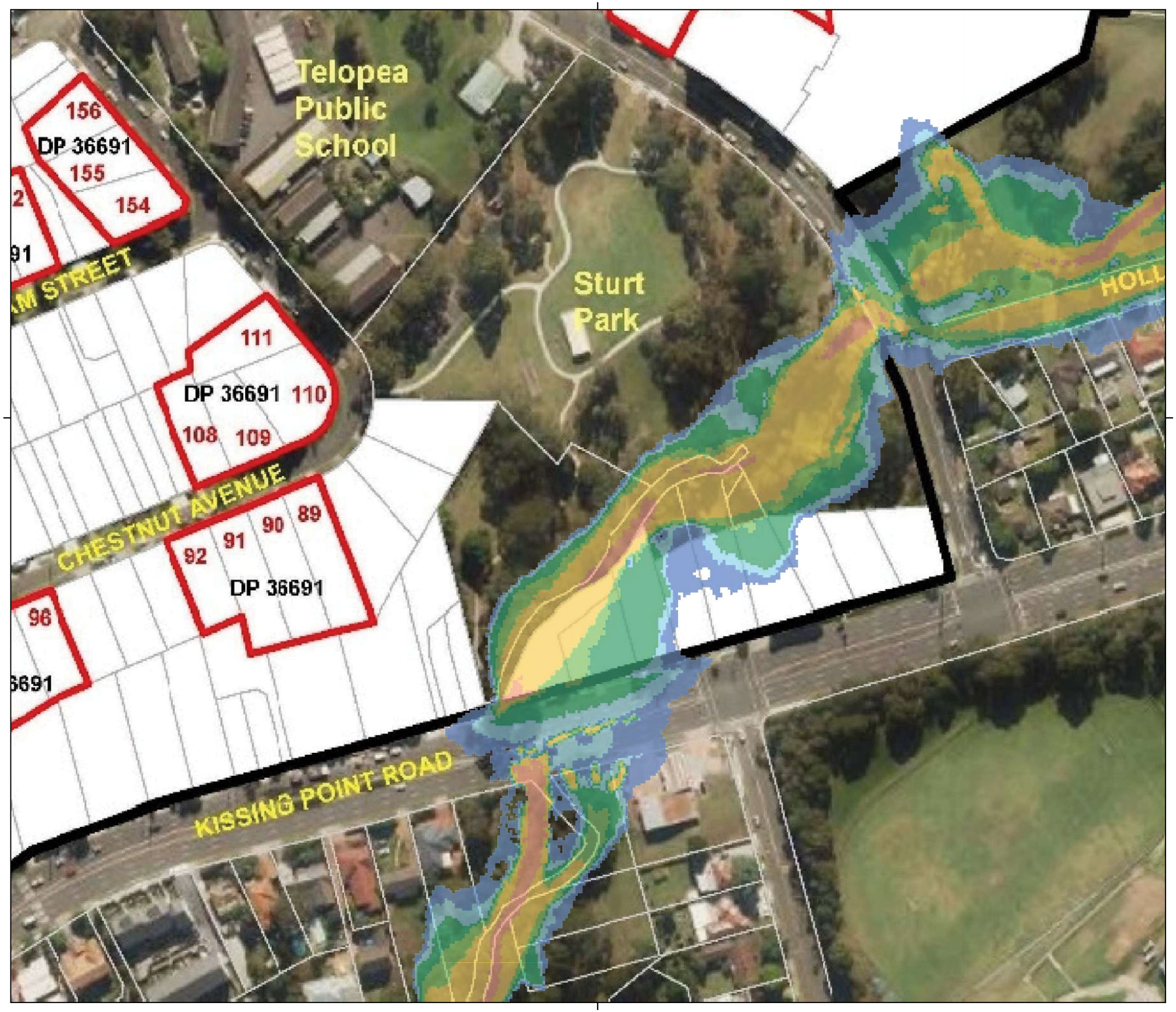
DATE: 19/6/2020
PROJECT: Telopea Estate Master Plan Flood Assessment
CLIENT: Frasers Property Telopea Developer Pty Ltd

FIGURE B 5 –
The Ponds Creek
Probable Maximum Flood Depth

DATUM GDA 1994 MGA Zone 56

P:\BGE\SYD\S20156\100 Draw\QGIS\REPORT_FIGURES.qgz | PMF_D

Aerial Imagery Source: Client Supplied



Legend

Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

NOTE: Only mainstream flooding from The Ponds Creek has been assessed. Overland flow flooding is subject to a seprate assessment by others.

0 10 20 30 40 50 m

N

BG&E

DRAWN: KH
REVIEWED: LB
APPROVED: LB

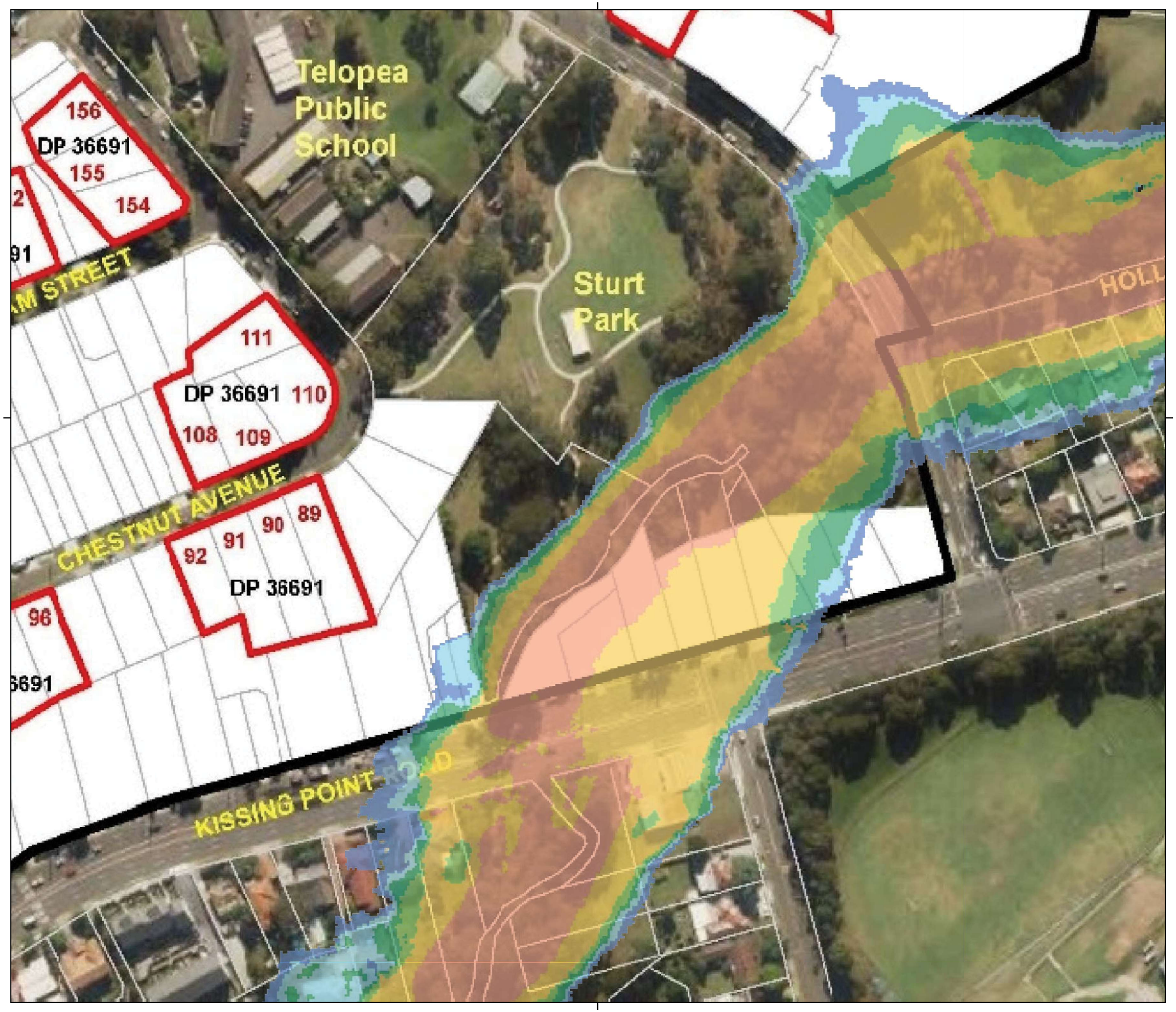
DATE: 19/6/2020
PROJECT: Telopea Estate Master Plan Flood Assessment
CLIENT: Frasers Property Telopea Developer Pty Ltd

FIGURE B 6 –
The Ponds Creek
1% AEP Flood Hazard

DATUM GDA 1994 MGA Zone 56

P:\BGE\SYD\S20156\100 Draw\QGIS\REPORT_FIGURES.qgz | 100y_Zaem1

Aerial Imagery Source: Client Supplied



Legend

Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

NOTE: Only mainstream flooding from The Ponds Creek has been assessed. Overland flow flooding is subject to a seprate assessment by others.

0 10 20 30 40 50 m

N

BG&E

DRAWN:	KH
REVIEWED:	LB
APPROVED:	LB
DATE:	19/6/2020
PROJECT:	Telopea Estate Master Plan Flood Assessment
CLIENT:	Frasers Property Telopea Developer Pty Ltd

FIGURE B 7 –
The Ponds Creek
Probable Maximum Flood Hazard

DATUM GDA 1994 MGA Zone 56

Aerial Imagery Source: Client Supplied