

Appendix D

UPRCT Upper Parramatta River Model Results

Bewsher Consulting Comments 12th September 2011

BRANCH	CHAINAGE	PMF			100 YEAR			100 YEAR (CLIMATE CHANGE)			20 YEAR			20 YEAR (CLIMATE CHANGE)			5 YEAR			5 YEAR (CLIMATE CHANGE)		
		PEAK WATER SURFACE LEVEL	CRITICAL EVENT	FLOW @ PEAL LEVEL	PEAK WATER SURFACE LEVEL	CRITICAL EVENT	FLOW @ PEAL LEVEL	PEAK WATER SURFACE LEVEL	CRITICAL EVENT	FLOW @ PEAL LEVEL	PEAK WATER SURFACE LEVEL	CRITICAL EVENT	FLOW @ PEAL LEVEL	PEAK WATER SURFACE LEVEL	CRITICAL EVENT	FLOW @ PEAL LEVEL	PEAK WATER SURFACE LEVEL	CRITICAL EVENT	FLOW @ PEAL LEVEL	PEAK WATER SURFACE LEVEL	CRITICAL EVENT	FLOW @ PEAL LEVEL
		mAHD		m ³ /s	mAHD		m ³ /s	mAHD		m ³ /s	mAHD		m ³ /s	mAHD		m ³ /s	mAHD		m ³ /s	mAHD		m ³ /s
CBD-AGC ROW	0.0	11.32	240 min	284.5	6.95	90 min	3.8	6.99	90 min	4.7	6.90	2 hour	2.4	6.93	60 min	4.0	6.88	2 hour	1.9	6.89	2 hour	2.1
CBD-AGC ROW	40.0	11.36	240 min	284.3	6.94	90 min	3.6	6.98	90 min	4.4	6.89	2 hour	2.4	6.93	60 min	3.4	6.87	2 hour	1.9	6.88	2 hour	2.1
CBD-CHURCH3	0.0	12.08	240 min	0.7	8.07	90 min	0.7	8.09	90 min	0.9	8.03	15 min	0.5	8.10	60 min	0.9	8.01	15 min	0.4	8.03	15 min	0.4
CBD-CHURCH3	66.7	12.16	240 min	0.7	7.97	2 hour	0.7	8.06	90 min	0.7	7.84	2 hour	0.6	7.89	60 min	1.4	7.78	30 min	0.5	7.81	30 min	0.6
CBD-CHURCH3	141.0	12.16	240 min	0.0	8.50	15 min	0.0	8.50	15 min	0.0	8.50	15 min	0.0	8.50	15 min	0.0	8.50	15 min	0.0	8.50	15 min	0.0
CBD-PHILIP	108.0	12.08	240 min	759.6	8.07	90 min	0.9	8.09	90 min	1.3	8.03	15 min	0.5	8.10	60 min	1.1	8.01	15 min	0.3	8.03	15 min	0.4
CBD-PHILIP	237.0	11.32	240 min	760.0	6.95	90 min	1.3	6.99	90 min	1.8	6.90	2 hour	0.9	6.93	60 min	2.5	6.88	2 hour	0.6	6.89	2 hour	0.7
CBD-PHILIP	300.0	11.20	240 min	624.5	7.00	90 min	0.1	7.02	90 min	0.1	6.95	2 hour	0.1	6.97	90 min	0.1	6.93	2 hour	0.1	6.94	2 hour	0.1
CBD-PHILIP	389.0	10.84	240 min	624.4	7.58	90 min	0.2	7.59	90 min	0.2	7.55	30 min	0.2	7.56	30 min	0.2	7.51	90 min	0.1	7.54	90 min	0.2
LENNOX_BR OR	2358.4	12.16	240 min	655.2	8.50	15 min	0.0	8.50	15 min	0.0	8.50	15 min	0.0	8.50	15 min	0.0	8.50	15 min	0.0	8.50	15 min	0.0
PARRAMATTA_R	2287.9	12.36	240 min	1351.7	7.36	9 hour	733.7	8.03	9 hour	814.5	5.90	9 hour	536.4	6.63	9 hour	640.1	5.13	9 hour	419.3	5.45	9 hour	469.5
PARRAMATTA_R	2323.7	12.24	240 min	1227.4	7.29	9 hour	733.8	7.93	9 hour	814.5	5.85	9 hour	536.4	6.58	9 hour	640.1	5.07	9 hour	419.3	5.40	9 hour	469.5
PARRAMATTA_R	2341.9	12.23	240 min	1225.8	7.26	9 hour	733.8	7.91	9 hour	814.6	5.81	9 hour	536.4	6.55	9 hour	640.1	5.03	9 hour	419.3	5.36	9 hour	469.5
PARRAMATTA_R	2373.3	9.67	240 min	1643.2	5.76	9 hour	734.1	6.01	9 hour	814.9	5.08	9 hour	536.7	5.44	9 hour	640.4	4.64	9 hour	419.5	4.83	9 hour	469.7
PARRAMATTA_R	2387.8	9.64	240 min	1643.4	5.72	9 hour	734.2	5.97	9 hour	814.9	5.05	9 hour	536.7	5.41	9 hour	640.4	4.61	9 hour	419.5	4.80	9 hour	469.7
PARRAMATTA_R	2420.0	9.66	240 min	1643.9	5.74	9 hour	734.2	5.99	9 hour	815.0	5.07	9 hour	536.7	5.43	9 hour	640.5	4.63	9 hour	419.5	4.82	9 hour	469.7
PARRAMATTA_R	2467.0	9.94	240 min	1928.0	5.82	9 hour	735.0	6.09	9 hour	815.8	5.11	9 hour	537.1	5.49	9 hour	641.1	4.65	9 hour	419.7	4.85	9 hour	469.9
PARRAMATTA_R	2537.0	9.98	240 min	1926.9	5.84	9 hour	735.1	6.11	9 hour	815.9	5.12	9 hour	537.2	5.51	9 hour	641.2	4.64	9 hour	419.7	4.85	9 hour	469.9
PARRAMATTA_R	2609.0	9.85	240 min	1927.3	5.79	9 hour	735.2	6.05	9 hour	816.0	5.08	9 hour	537.2	5.47	9 hour	641.2	4.62	9 hour	419.7	4.82	9 hour	469.9
PARRAMATTA_R	2629.0	9.86	240 min	1927.6	5.80	9 hour	735.3	6.07	9 hour	816.1	5.09	9 hour	537.3	5.47	9 hour	641.3	4.62	9 hour	419.7	4.83	9 hour	470.0
PARRAMATTA_R	2652.0	9.27	240 min	1927.8	5.73	9 hour	735.4	5.99	9 hour	816.1	5.02	9 hour	537.3	5.40	9 hour	641.3	4.56	9 hour	419.7	4.76	9 hour	470.0
PARRAMATTA_R	2701.0	9.32	240 min	2094.6	5.74	9 hour	750.0	6.00	9 hour	831.8	5.03	9 hour	545.8	5.41	9 hour	652.8	4.56	9 hour	425.2	4.76	9 hour	476.4

Note : Climate Change runs include a 15% increase in design rainfall. Currently they do not take into account sea level rise.

TO: JIM TSOM, PARRAMATTA CITY COUNCIL

FROM: DON STILL, BEWSHER CONSULTING

DATE: 12 SEPTEMBER 2011

SUBJECT: PART 3A EPA ACT PROJECT, 330 CHURCH STREET PARRAMATTA
ASSESSMENT OF JUNE 2011 SITE FLOOD REPORT

The project proposes the re-development of a current commercial/retail property which has the Parramatta River adjacent to its northern boundary. The current building covers all or almost all the entire site.

In its current conceptual stage, the project would consist of a mixed use residential commercial and retail development accommodated in two towers with multiple level basement car parking. Vehicular access to the basement levels is to be provided at the rear of the development from Phillip Street.

All levels in this report are in metres relative to the Australian Height Datum.

1. Flood Levels and Flood Hazard

1.1 Flood Levels

The Parramatta River flood levels adopted by Council are as provided by the UPRCT from its MIKE-11 model.

Council's flood mapping shows that:

- (a) There are floodplain cross sections located along the site's frontage to the river which is downstream of Church Street (Lennox Bridge). The model results show a significant drop in river flood levels at Church Street in the 20 year, 100 year and PMF events and this is primarily a function of the relatively small waterway area of Lennox Bridge. Despite the constriction at Lennox Bridge, there is no overtopping of the bridge (or elsewhere along Church Street) in the 100 year flood event. **Table 1** lists the 100 year flood levels for the site's frontage to the river which have been gathered from various sources. While all have been sourced from the UPRCT's flood model, the values at the various cross sections downstream of Lennox Bridge vary slightly (within a range of about 0.1 metres) and that this is the case reflects slight changes and enhancements that have recently been made to the model. It is noted that the levels quoted by Mott MacDonald (as part of their site-specific flood reporting) happen to be the lowest levels in the table;
- (b) There would be 20 year and 100 year flooding at a minor sag point in Church Street (including adjacent to No. 330) just south of Lennox Bridge. We have not sighted any Council definition of the flood levels at that sag point but have sighted a 100 year level from the UPRCT's MIKE-11 model. That level, provided by email

to Bewsher Consulting on 22/12/10 is RL 8.00m (and it is noted that the email referred to changes made to the flood model to better reflect the performance of the Council 900mm diameter stormwater pipe which carries the Church Street flows to the river immediately downstream of Lennox Bridge).

- (c) There would be 20 year and 100 year flooding in Phillip Street (which is the public roadway by which vehicular access is currently available to and from the site). As for (b), we have not sighted any Council definition of the flood levels at that location but have sighted a 100 year level from the UPRCT's MIKE-11 model email of 22/12/10. At Phillip Street the flood level is RL 6.95m whilst about 40 metres closer to the river (i.e. along the access roadway to the site and adjoining properties) the flood level is RL 6.94m.

The Council map also identifies that the property itself is not inundated in the 20 year and 100 year events however this presentation is reflecting the current building's elevated floor level rather than 'natural' ground levels.

TABLE 1: SUMMARY OF 100 year FLOOD LEVELS AT SITE FRONTAGE TO PARRAMATTA RIVER

MIKE-11 Cross Section Chainage (m)	Cross Section Location	Differing Series of 100 year Flood Levels at Site's Frontage to Parramatta River (m AHD)			
		'Draft 8' Flood Levels Provided by PCC (email dated 29/10/10)	Flood Levels Provided by UPRCT (email to Bewsher Consulting dated 22/12/10)	UPRCT-sourced levels presented in Mott MacDonald site report (dated June 2011)	'Lennox Bridge With Portal Works Option' Flood Levels Provided by UPRCT (email to Bewsher Consulting dated 8/9/11)
2341.9	Just U/S of Lennox Bridge	7.53	7.39	N/A	6.68
2373.3	Just D/S of Lennox Bridge	5.86	5.82	5.75	5.78
2384.8		N/A	N/A	5.72	N/A
2387.8		5.83	5.79	N/A	5.75
2420.0		5.84	5.81	5.74	5.77
2467.0	D/S Limit of Site	5.93	5.89	5.82	5.85
2537.0		5.95	5.91	N/A	5.87

1.2 Flood Hazard

Council has a flood hazard map for the area (which was produced by the UPRCT).

It is understood that the mapping has been prepared on the following basis:

- the High Hazard precinct corresponds to the area where the velocity depth product is within the high hazard region defined in Figure L2 of the 2005 *Floodplain Development Manual*;

- the Medium Hazard precinct corresponds to the area where the velocity depth product is within the low hazard region defined in Figure L2 of the 2005 *Floodplain Development Manual*; and
- the Low Hazard precinct corresponds to the area inundated between the 100 year and PMF events.

The floodprone area immediately adjoining the current building's northern wall is defined as High Hydraulic Hazard. While the current building itself is shown to be in a Low Hydraulic Hazard area, this presumably reflects the position of the building.

Based on the above hydraulic hazard mapping criteria, it is considered that the Low, Medium and High Hydraulic Hazard areas effectively correspond to draft Low, Medium and High Flood Risk Precincts.

2. Relevant Project Documentation used for This Review

2.1 Reports, etc

- Letter dated 22 November 210 from the NSW Department of Planning to Meriton Apartments which includes a copy of the Director-General's Requirements (DGRs) for the preparation of the project's Environmental Assessment;
- A *Flood and Stormwater Management Report* dated June 2011 and prepared by Mott MacDonald.

2.2 Drawings

- A series of Meriton architectural plans of which the most relevant are A099 (5) *Plan_Parking Level 01*, A100 (5) *Plan_Level 00 Retail*, A200 (3) *Sections* & A300 (4) *Elevations Compiled*.

3. Review of Mott MacDonald Report

In its Introduction chapter the report explicitly describes how its objectives were to address the Director General's requirements (DGRs) re Issues 15 (Flooding/Climate Change) and 16 (Drainage).

One of the report's opening sentences states that "*it does not constitute a flood study rather it draws on conclusions from an existing modelling exercise and an assessment of local topographic conditions to address the impact of flooding at the site*". And one of its concluding sentences states that "*this assessment does not preclude the need for post-development flood study (using the UPRCT model) and a formal flood risk management plan to manage flood risk at the site*".

It is noted that the report's almost exclusive flood-related focus is on the 100 year flood event. In so doing it looks at – and utilises - the results of flood modelling undertaken by the UPRCT (and which are reproduced in this memo's **Table 1**). As shown in **Table 1**, we note that the flood levels they have quoted in their report are slightly different – and marginally lower – than the flood levels provided to Bewsher Consulting by Council.

3.1 Building Floor Level Controls

As detailed below, the report looks at two flood regimes in order to determine what floor level controls should be adopted for the development.

3.1.1 Limit of Development & Flood Levels along Northern Boundary

The report draws attention to the fact that the proposed development will not extend to the site's northern – that is, riverside - boundary unlike the current building. As acknowledged in the report, this scenario has not yet been tested in a flood model.

It is agreed that this situation will mean that the project will have no adverse impact on the Parramatta River 100 year level. Given the very flat flood gradient downstream of the site there will be no accompanying reduction in the flood level.

Relative to the quoted 100 year river level of RL 5.82m, the report shows how the lowest river-frontage building floor level (i.e. RL 7.80m) has easily exceeded the 500mm freeboard requirement.

3.1.2 Church Street Sag Point Flooding

Council's flood map shows that local inundation of Church Street occurs south of Lennox Bridge in the 100 year event and this is centred on a sag point in Church Street adjacent to the southern boundary of No. 330. As stated in *Section 1.1* in this memo, the UPRCT-sourced 100 year flood level at this location is RL 8.00m.

The Mott MacDonald report does not quote any flood level for that location but utilises an approach based on the relieving flood mechanism for the sag point flooding, as follows. The report states that the road gutter level at that sag point is RL 7.33m. They adopt a maximum flood level of RL 8.4m in Church Street based on their assessment of RL 8.3m being the ground level for the 'relieving weir' located in the car park west of Church Street. This analysis has therefore calculated a maximum flood depth at the sag point of about 1.1 metres. While they acknowledge that these key levels will need to be confirmed, for the purposes of their report they adopt a site floor level control of RL 8.9 based on the 500m freeboard requirement.

In either case (i.e. adopting a Church Street flood level of 8.0 or 8.4m), the sag point inundation shows that the wall-to-wall Church Street western frontage buildings (which include No. 330) are serving to obstruct the relief of that ponding. Given that the current No. 330 building is immediately adjacent to the sag point, it would seem to be important that the re-development provide some sort of relieving flowpath – by provision of either (i) a surface overland flow path, or (ii) a series of new drainage inlets at the property frontage to Church Street together with receiving conduits, etc which carry the flows under or through the new building footprint.

3.2 Basement Ramp Level

The report identifies that the proposed basement crest level (of RL 6.95m) is 1.13m higher than the Mott MacDonald-referenced 100 year river level of RL 5.82m.

However related to this ramp level is the nearby Phillip Street flood regime. While the report acknowledges this flood issue, it considers that since local ground levels continue

to fall to the east they "will not impact on the basement access ramp and floor levels along this frontage".

However it is noted that the basement crest level is proposed to be RL 6.95m and that this is the same as the UPRCT's Phillip Street 100 year flood levels. Hence the Phillip Street-sourced flood regime immediately adjacent to the site needs to be formally modelled if the currently proposed crest level is intended to be retained.

3.3 Phillip Street Evacuation Issues

As mentioned earlier Council's flood map shows 20 year and 100 year flood waters in both Phillip Street and the small roadway which currently takes traffic towards No. 330 and adjoining properties. It therefore follows that the current site development has potential flood evacuation difficulties.

It is noted that the potential for post-development traffic to be impacted by the Phillip Street flooding is not discussed in the Mott MacDonald report.

4. Assessment Against Relevant Provisions of the 2005 Floodplain Development Manual

4.1 Introduction

The report does not attempt to identify/discuss "the relevant provisions" of the 2005 Manual. Its principal focus is on the following:

- Building floor level controls (based on 100 year flood level plus 500mm); and
- Climate change matters,

With a third aspect being flood risk management (with an emphasis on pedestrian flood-time evacuation).

4.2 Building Floor Level Controls

This has already been reviewed in *Section 3.1* of this memo where it is shown that (a) the project has a 500mm freeboard relative to Church Street (local) flooding, and (b) the project has a freeboard well in excess of 500mm relative to river flooding.

4.3 Climate Change Matters

The report states that changes in design flood levels resulting from climate change have not yet been formally modelled. Nonetheless given that the river-related floor level controls provide considerably more freeboard than the statutory 500mm, they conclude that the proposed floor levels will probably not require adjustment following completion of the modelling.

While we concur with that conclusion, the report fails to comment on the potential climate change-related impacts on design river flood levels upstream of Lennox Bridge (where the levels are much higher than downstream). The current PCC 100 year flood level immediately upstream of Lennox Bridge is RL 7.5m (reference **Table 1** in this memo) and the modelling of climate change impacts will see this level increase. The 'worst' scenario would be if the increase is large enough, there is river-related inundation of Church Street adjacent to the site rather than just the local catchment flood regime. If this was to be the case, the approach used by Mott MacDonald to assess the worst flood regime scenario in

Church Street and hence the project's minimum floor level would need to be revisited. Furthermore, it may impact on the building footprint and/or treatment facing Church Street since an overland flowpath through the site may be required.

With regard to this overall matter, we understand that at least some climate change-related flood modelling has already been undertaken by the Sydney Catchment Management Authority (CMA).

4.4 Flood Risk and Flood Time Evacuation

The Mott MacDonald report states that "*a full flood risk management plan that identifies access and egress, emergency evacuation and disabled access in accordance with the NSW Floodplain Development Manual should be considered in terms of the 100 year ARI and PMF events*". It does not attempt to prepare such a plan but rather provides an outline of how the flood risks could be managed.

Most of the outline is a reiteration of the floor level controls. Without specifically making reference to very rare flood events up to and including the PMF flood regime and the accompanying flood levels, the report alludes to the use of 'vertical evacuation' by stating that suitable access and egress is available "providing access to the upper floors is enabled".

The report fails to make any mention of the risks associated with such flood waters entering the basement car park levels.

It is noted that the 2005 Manual discusses the development issues related to floods bigger than the 'Flood Planning Level' (FPL) in a number of locations. In particular, the "risk to life" issues are addressed in Section K4 of Appendix K where issues of water entering buildings, changes in hazard or flow conditions and changes in flood time access conditions may occur. The Manual goes on to state "these issues need consideration in the development of specific areas of land, the type and scale of such developments and in selecting FPLs for... development control". It also adds "these considerations need to address the cumulative impacts of future development, particularly for emergency planning and response".

It is considered that the Mott MacDonald report is deficient in not identifying the issues related to floods bigger than the 100 year event and the associated risks for the proposed development (including the basement levels).

5. Assessment Against Council's "Local Floodplain Risk Management Policy" (dated June 2006)

Despite including Council's 2006 *Local Floodplain Risk Management Policy* in its list of relevant documents/information, the Mott MacDonald report does not attempt to define the site's flood risk precinct nor address the associated floodplain matrix controls which form such an essential part of Council's policy.

As discussed earlier, on the basis of Council's flood hazard map, the site appears to be in a Low Flood Risk Precinct. However it is considered an important factor that the proposed project involves the introduction of a large number of dwelling units into a floodprone site which currently does not include any residential development and which is completely isolated in an event not much bigger than the 100 year event (with attendant risks associated with flood damages, risk to life and problems with evacuation, etc).

In the 2005 *Floodplain Development Manual* it states that "land use planning cannot be effectively undertaken without an understanding of flood risks and the associated consequences. In turn, land use planning controls are an essential element in effectively managing flood risk in new and redevelopment areas" (Section G6). Given that the proposal involves locating new populations into a significantly floodprone site and the associated risks have not been fully assessed, it is considered that the site might provisionally be treated as lying within a High Flood Risk Precinct.

Such a definition would result in the re-development proposal needing to be considered in the light of the "unsuitable land use" tag under Council's flood policy. It is therefore considered that the project documentation should demonstrate that the rezoning/re-development of the site is compatible with both the objectives and design principles listed in Council's flood policy and in the 2005 *Floodplain Development Manual*. It is noted that within the latter document it is stated that re-zoning applications need to be assessed on a number of bases which include (i) it being "designed and constructed in such a manner as to ensure that potential loss of life in an extreme flood event is minimal", (ii) it "does not significantly adversely impact upon emergency response management of other sites or areas" and (iii) "it has to be undertaken, designed and constructed in such a manner as to hold potential financial losses from flooding at an acceptably low level" (Section I6.3.7).

Also as noted earlier, the report has failed to address any risks associated with rare event flood waters entering the basement car park levels. Therefore the current proposal for basement parking requires a detailed examination of the personnel risks and associated property damages when flood waters do enter the basement.

6. Further Matters Related to Council Officers Meeting of 17 May 2011

Our discussions with PCC staff indicate that the Mott MacDonald report's treatment of issues discussed with Council staff in May does not cover "all the bases".

That is, we have been informed that the following items also formed part of the meeting discussions:

- Any detailed survey that may be required for flood modelling work would need to be undertaken by the applicant at their cost;
- The applicant is to demonstrate if the proposed development is increasing Flood Risk and how this risk will be adequately managed;
- The water surface levels for the PMF will need to be confirmed by the Sydney CMA;
- The CMA is responsible for managing and upgrading the Upper Parramatta River Flood model to include impact of Climate Change and Sea Level Rise. The applicant would need to contact the CMA for further information; and
- The applicant will need to contact Council's Development Services Engineer Elie Azzi with regards to details regarding Council's On-Site Detention and WSUD requirements.

7. Conclusions

The project would see the introduction of over four hundred dwelling units into a floodprone site. Furthermore given the range of flood events which would impact on the site (and its potential evacuation routes) it is considered that it should be provisionally treated as a High Flood Risk location.

In order to address the whole range of the site's significant flood issues, it is recommended that the project flood submission should also address the following:

- The potential climate change impacts on design flood levels, especially flood levels upstream of Lennox Bridge (and their associated impact on flooding in Church Street);
- Site development options to alleviate the sag point inundation in Church Street (and it is noted that at some stage the Church Street inundation regime needs to be modelled at an appropriate level of detail – that is, possibly beyond the level of detail in the current broad scale flood model);
- The flood risk issues associated with the overall project for the range of floods between the 100 year and PMF event in accordance with the objectives and design principles listed in both Council's flood policy and in the 2005 Floodplain Development Manual. This should include (a) the inundation issues related to the proposed basement car parks together with details of how those risks will be addressed, and (b) the impact of Phillip Street-sourced floodwaters on the site's evacuation issues. It is expected that this risk assessment will necessitate the development of a detailed Flood Response Plan for the site (and it is noted that this should reflect the results of formal discussions with the SES).

With regard to the above first dot point it is understood that climate change flood regimes (based on an increase in design rainfall intensities) has been completed by the Sydney CMA/UPRCT. Hence it is likely that there is sufficient available information to enable the first dot point issue to be readily addressed.

With regard to the third dot point it is noted that the final paragraph in the Mott MacDonald states *"this assessment does not preclude the need for post development flood study and a formal flood risk management plan to manage current flood risk at the site"*. We concur with this statement and consider that the issues are of such critical importance that they should be addressed at this stage of the project.

Any of the issues that have not yet been addressed from the meeting held at Council's office on 17 May 2011 (reference Section 6 of this memo) also need to be dealt with.



Don Still
Director