25 October 2012

Department of Planning & Infrastructure
Metropolitan and Regional Projects North
23-33 Bridge Street
Sydney NSW 2000

Attention: Ben Lusher

Dear Ben,

Advice on Flooding and Stormwater for the Proposed Shepherds Bay Concept Plan

Introduction

At your request, and following our meeting held on 15 October 2012, Evans & Peck has reviewed the flooding and hydrological issues associated with the proposed Shepherds Bay Concept Master Plan (The Development).

At our meeting, two key questions were put to Evans & Peck by the Department of Planning and Infrastructure (DP&I):

1. Is the lowering of Constitution Road and the installation of trunk drainage essential for the Development?
2. If these, or other works, are essential to the Development, at what stage do they need to be undertaken?

Methodology

In formulating our response Evans & Peck has relied on the information provided by DP&I, discussions with the Proponents Hydraulic Consultant, Cardno, and discussions with Ryde City Council. We have not undertaken any independent analysis to substantiate the information provided by those parties. Specifically Evans & Peck has relied on the following documentation:

- *Flooding Assessment of the Shepherds Bay Urban Renewal Masterplan*, 6 July 2012, Cardno,
- *Addendum to the Flooding Assessment of the Shepherds Bay Urban Renewal Masterplan*, 26 July 2012, Cardno,
- *Shepherds Bay, Meadowbank Trunk Drainage Design, Concept Civil Engineering Design*, 16 December 2011, Cardno,
- *City of Ryde Comments by Letter to Department of Planning*, Dated 12 March 2012 and 4 September 2012,

- *Draft Voluntary Planning Agreement between City of Ryde Council and Holdmark Property Group* dated the 12 October 2012-10-16,
- *Shepherds Bay Renewal Concept Plan Draft Statement of Commitments* dated 5 October 2012,
- *Integrated Water Management Report, Shepherds Bay Urban Renewal Stage 1*, May 2010, Cardno,
- *Section 94 Development Contribution Plan*, December 2007, City of Ryde - Section 3.9 Stormwater Management Facilities Strategy Plan, and
- *Meeting Minutes, Committee of the Whole Agenda*, 13/07 City of Ryde
- *Development Control Plan 2010 – Stormwater Management Technical Material*, City of Ryde, 2010

Previous Studies

Investigations and studies relating to the Ann Thorn Catchment, where the proposed Development is to be undertaken, date back to 2002.

In 2002 the Rose Consulting group prepared a Catchment Drainage Materplan for the Ann Thorn Catchment.

In June 2004 Cardno Willing prepared a flood study report for the proposed development of 146 Bowden Street. This report assessed overland flows from Nancarrow Avenue discharging into 146 Bowden Street.

In 2007 Cardno Willing undertook a study to estimate the 100 year ARI runoff from the Ann Thorn Catchment. The analysis took into account the mitigating effect of Constitution Road detaining water at Ann Thorn Park and the drainage provided by a proposed Box Culvert and overland flow path on the downstream side of Constitution Road. This study found that in the 100 year ARI event velocity x depths of overland flooding across the development site would be less than $0.4m^2/s$ (the depth velocity referenced by Council in Section 5.4 of their Stormwater Management Technical Material, 2010), apart from within the culvert and swales.

In 2007 Ryde City Council commissioned Golder Associates to undertake a study of the Constitution Road Embankment. The findings of this study were summarised in the meeting minutes of Ryde City Council in 2007 (*The Manager – Catchments & Assets reports 31 July 2007*) and state:

> *"the majority of the study catchment now drains to a trapped depression formed by Constitution Road at Ann Thorn Park…..This major alteration to the natural creek alley has acted to exacerbate flooding in the catchment. In particular, the construction of the Constitution Road embankment and building structures across the old creek valley have generated circumstances where the potential collapse of the embankment under flood conditions may have a catastrophic impact on people and property immediately downstream. "*

The minutes go on to state that

"investigations indicate the risk level posed by the existing embankment in Constitution Road and drainage configurations under flood conditions are high"

Golder Associates suggested a number of possible mitigations measures:

- Control Development of properties downstream of the embankment,
- Re-engineer the embankment in accordance with ANCOLD Guidelines for small dams,
- Introduce further hydraulic works such that the embankment no longer functioned as a dry detention basin, and
- Remove the embankment.

Ryde City Council (Committee of the Whole 20 November 2007) chose to adopt a flood management strategy that involved:

- Lowering of Constitution Road by a maximum of about 2.5 m at the lowest point to be approximately the same as the levels in Ann Thorn Park;
- Construction of upgraded trunk drainage pipeline generally along the alignment of the existing Council drainage pipeline (starting point not defined);
- Construction of an engineered culvert or spillway through Constitution road to facilitate overland flow, and
- Provision of a 16 m overland flow pathway from Ann Thorn Park to the Parramatta River.

It was agreed by the Council that all of these works would be funded by landowners downstream of Ann Thorn Park as these would be "*the primary beneficiaries of these safety measures*". To date no physical works to mitigate this risk appear to have been undertaken.

In 2012 Cardno prepared a flooding assessment of the Proposed Development on behalf of the Proponent. This assessment was based on the assumption that the lowering of Constitution Road and the construction of upgraded trunk drainage and culverts would be undertaken.

The results of the 2012 study indicate that under the new drainage conditions all but minor local overland flows down the proposed overland flow path would be achieved.

The Study did not publish any modelling results for the culvert and trunk drainage being installed and Constitution Road remaining unchanged. Further modelling should be undertaken to confirm the need for the lowering of Constitution Road as the proposed Trunk Drainage system has been sized for a 100yr storm event with a 50% blockage at the inlets.

The City of Ryde Council provided a written submission to DPI on the 12 March 2012 regarding the proposed Development. In this letter CRC stated:

"*Generally the proposed flood management methods are in accordance with Council's requirements and is supported in principle……With respect to the proposed trunk drainage line, it should be noted that Council is still negotiating with the proponent regarding the funding of this infrastructure…"*

The Council provided a further submission dated 14 September 2012. The submission discussed agreement being reached in principle with the proponent regarding the design of the drainage system, but negotiations being ongoing regarding the funding and ownership of the system.

Key Facts and Assumptions

Our findings and recommendations are based on the following key facts and assumptions:

- Constitution Road is upstream of the proposed Development.
- Constitution Road is a Council owned road on Council Land.
- Constitution Road acts as a dry detention basin. However it is not clear as to whether it was designed to perform this function.
- In the event of a 100 year storm event a substantial volume of water (15,300m^3) would be retained by Constitution Road.
- This retained water would flood up to 10 upstream properties.
- The water retained behind Constitution Road in a 100 year ARI flood poses a high risk of causing a failure of Constitution Road through "*overflow and scour*", releasing the retained water along a route traversing the pre-existing creek line.
- Ryde City Council has been aware of this risk since 2007.
- In the event of a catastrophic failure it is likely that those properties within the vicinity of the pre-existing creek line would be impacted. This would include those properties in the proposed Stages 7, 8, 9 and 10 of the proposed development.
- There has been no cited documentation indicating Council has undertaken physical works to minimise the existing risk.
- The land downstream of Constitution Road is currently zoned industrial.
- Under the proposed development the land downstream of Constitution Road would be zoned residential.
- In the absence of any action to mitigate the risk of failure of the Constitution Road embankment, the placement of high density residential development downstream of Constitution Road would increase the overall population at risk.
- Lowering Constitution Road would remove the upstream and downstream risk to Ryde City Council.
- The lowering of Constitution Road would, essentially, return overland flows to pre-existing conditions, resulting in the land occupied by the proposed Development being subject to increased overland flow.
- The Proponent would, under the above circumstances, be obliged to manage all stormwater on site, both generated on their development and received from upstream sources.
- In order to comply with Council's *Stormwater Management Technical Material* and Council's submission dated 14 September 2012, the Proponent would need to construct a stormwater system between Constitution Road and the Parramatta River to convey the peak runoff from a 20 year ARI storm in a piped drainage system with an overland flow path to convey any excess flow up to the 100 year ARI storm.
- The current proposal by the developer would involve construction of a piped stormwater drainage system to convey the 100 year ARI flow with an overland flow path capable of conveying the probable maximum flood in a manner that poses minimal risk to human life (currently defined by depth x velocity less than 0.4 m^2/s)

Findings

1. Is the lowering of Constitution Road and the installation of trunk drainage essential for the Development?

There currently exists a flooding risk associated with the development of Stages 7-10 of the Proposal. This risk should be mitigated prior to these stages of the development occurring. This can be undertaken through the installation of trunk drainage and mitigation of the risk of 'dam break' conditions associated with overtopping of Constitution Road (achievable by a number of alternatives including lowering of Constitution Road). The modelling undertaken to date does not provide a definitive answer as to what is the most cost effective solution for managing stormwater in the Ann Thorn Catchment. Further modelling should be undertaken to ascertain the need for the lowering of Constitution Road given the proposed capacity of the trunk drainage, namely the 100 year ARI storm and the likelihood that, in order to install a pipe of sufficient size, it would be necessary to excavate a section of Constitution Road at which time a culvert or bridge structure could be installed to provide an overland flow path for any larger floods.

The existing downstream flooding risk is largely due to the previous construction of Constitution Road with inadequate provision for stormwater drainage. This also impacts on properties upstream of Constitution Road, which are flooded by water retained behind the embankment. Previous studies have indicated that the risks associated with the failure of Constitution Road in a 1 in 100 year flood event are high.

The provision of a new truck drainage system and/or the lowering of Constitution Road will decrease Ryde City Council's liability in relation to both upstream and downstream flooding risks.

If Constitution road was at pre-existing levels, local drainage within the proposed development would need to take account of overland flow reaching the site, with a stormwater drainage system in place to convey the peak runoff from a 50 year ARI storm in a piped drainage system with an overland flow path to convey any excess flow up to the 100 year ARI storm. The cost of all drainage and detention systems within the property should be dealt with by the proponent – and should not be eligible for a section 94 contribution credit.

City of Ryde Council as owner of Constitution Road has a duty of care to ensure that the risk associated with the structure is appropriately managed. The land downstream of Constitution Road, under this proposal, would be rezoned residential, this does not in itself create the risk associated with Constitution Road, however it does increase the risk as it would mean a larger population living in the 'at risk' area. The responsibility for minimising the flood risk, either through the removal of the detention basin (lowering the road), the re-engineering of the detention basin, or the bypassing of the detention basin (amplified trunk drainage) should sit with both Council (as the owner of the structure at risk) and the proponent (as their works increase the consequence level of risk).

It should also be noted that the ability to implement a solution that benefits the upstream properties is only possible due to the Proposed Development removing the factory at 33-37 Nancarrow Avenue.

Given the above factors it is considered fair and reasonable that the costs for the amplification of trunk drainage to the property boundary and eliminating the risk of embankment failure(either by

the lowering of Constitution Road or provision of a culvert to convey excess flow) should be born 50/50 by Council and the Proponent.

2. If these, or other works, are essential to the Development, at what stage do they need to be undertaken?

The flood modelling undertaken by Cardno indicates that under both existing and future conditions the areas of highest risk are immediately downstream of Ann Thorn Reserve, namely Stages 7-10 as documented on Figure 36 of the July 2012 Rev 2 Preferred Project Report (attached). Based on this information the proponent should have the Truck Drainage system installed prior to the commencement of Stages 7-10.

Summary and Recommendations

Evans & Peck recommends that the following Conditions of Consent be placed upon the Concept Plan approval:

1. Prior to the construction commencement of Stages 7-10 the Proponent shall install a piped drainage system and overland flow path from the existing grated stormwater intake within Ann Thorn Park to Parramatta River and shall undertake works to eliminate the risk of embankment failure (either by the lowering of Constitution Road or provision of a culvert to convey excess flow). The system shall be designed to convey the peak flow from a 20 year ARI storm in a piped drainage system with an overland flow path to convey any excess flow up to the 100 year ARI storm. The rainfall intensity adopted for design purposes shall be taken from the latest version of 'Australian Rainfall and Runoff'. Any consideration of existing 'baseline' flood conditions shall be based on the same rainfall intensity data.
2. Any consideration of climate change impacts on flow rates and hazard levels shall be based on a 30% increase in rainfall intensity.
3. A 16 m wide overland flow path traversing the proposed site from Constitution Road to the Parramatta River shall be provided to convey all flow between the 20 year ARI peak flow and the probable maximum flood in a manner that provides minimal risk to pedestrians (depth x velocity <0.4 m^2/s).
4. The Proponent shall bear the cost of the trunk drainage system from the Parramatta River outlet to the Property Boundary at Constitution Road.
5. The allocation of costs associated with works to Constitution Road and drainage costs upstream of the Constitution Road Property Boundary shall be agreed between Council and the Proponent.*

   **In view of the benefit of such works to both parties, it is recommended that a 50/50 split between Council and the Proponent be adopted for the cost of these works.*

6. All buildings within Stages 7-10 shall provide 500 mm freeboard above the 100 year flood level for residential floors and entrances to underground car parks. A minimum of 300 mm freeboard shall be provided for residential floors across the remainder of the proposed development.

Evans & Peck also recommends that:

- Further modelling be undertaken to ascertain the most cost effective means to manage stormwater issues across Constitution Road, specifically the 100 Year storm event. This modelling should include examining the need to lower Constitution Road, given the proposed capacity of the trunk drainage system, and to examine the results of installing a high level spillway for large floods or the installation of a large box culvert beneath the existing road.
- Any Drainage works upstream of the Proponent's Constitution Road Property Boundary be funded 50% by Ryde City Council and 50% by the Proponent. Any funding by the proponent above 50% of the costs should be eligible for a Section 94 Credit.

We trust this report has adequately closed out the major issues to be considered by the Department when determining approval and any associated conditions of approval.

Please do not hesitate to contact Derek Burrows (9495 0527) or myself (9495 0567) should you require any further clarification of the issues raised above.

Yours faithfully
EVANS & PECK PTY LTD

Dr Stephen Perrens

Principal