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Contact: Dr Brett C. Phillips

27th November 2018

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Attention: Aaron Gadiel / Kalinda Doyle

Dear Aaron and Kalinda,

**WATERBROOK BAYVIEW PTY LTD V NORTHERN BEACHES COUNCIL
NSW LAND AND ENVIRONMENT COURT PROCEEDINGS NO. 2018/257108**

CONTENTION 12: FLOOD IMPACT

On 19 December 2017, Waterbrook Bayview Pty Ltd lodged Development Application DA2017/1274 with Northern Beaches Council ("Council"). The amended DA seeks consent for:

(i) Golf Course Upgrade

The works involve significant regrading and reconfiguration of the 18-hole golf course and flood mitigation works, including raising sections of the golf course. The development also includes revegetation, providing new pathways, and the construction of a new maintenance shed for the storing of maintenance equipment to replace the existing shed.

(ii) Senior's Housing

The proposal involves construction of seniors housing development to be located on the northern half of the golf course (being north-west of Cabbage Tree Road) comprising 85 'serviced self care housing' dwellings spread across seven separate buildings and associated landscaping works. The development also includes the construction of a new internal road to provide access into the proposed seniors housing development from Cabbage Tree Road, a round-about on Cabbage Tree Road (and associated pedestrian crossing), and construction of an access pathway from the site through to the bus stop on the eastern side of Annam Road

1. STATEMENT OF FACTS AND CONTENTIONS

On 14 November 2018 a Statement of Facts and Contentions was lodged by Northern Beaches Council.

One of the contentions that the application must/ought be refused is flood impact on the basis that the flood study report is of insufficient detail to inform an assessment of flooding impacts and flood management.

The particulars of Council's contention is reproduced as follows. Additional information which responds to each of the particulars is included are detailed below.

Contention 12: Flood Impact

The flood study report is of insufficient detail to inform an assessment of flooding impacts and flood management.

Particulars:

- a) *The level of detail in the report with relation to the model setup, assumptions and configuration is insufficient. It is unclear how infrastructure and drainage channels have been configured. Documentation is to be provided regarding whether these are represented in 1D or 2D, dimensions and invert levels.*

As described in the Flood Impact Assessment report:

The existing flood model developed by Royal HaskoningDHV for the Mona Vale, Bayview, and McCarrs Creek Flood Study Review has been updated as part this assessment. While the overall model has been based on LiDAR data, the levels on the subject site were updated based on a detailed ground survey undertaken by Grinsell and Johns Pty Ltd (02/10/15, Drawing 9-01-15) which is provided in Appendix A.

Detail Survey of the Seniors Living development site and Cabbage Tree Road prepared by Bee and Lethbridge (Aug 2017, Drawing 18990a) is provided in Appendix B.

The ground survey was added to the existing model's Digital Elevation Model (DEM) which was a 1.5 m x 1.5 m grid based on LiDAR data.

The Mona Vale Road upgrade works were also represented in the model.

Further details are provided as follows:

	Comments & Updates to Council 2017 model
Model Topography	Terrain updated using ground survey (refer Figure C26 for survey extents)
Drainage Network	- The drainage conduits included in the Existing Conditions model are identified in Figure C26 - The drainage conduits included in the Future Conditions model are identified in Figure C27 including details in the vicinity of the proposed Seniors Living development.

	- Blockage 0% for pipes and 30% for culverts is consistent between the Cardno and Council model (refer Section 7.1.1 in 2017 Royal HaskoningDHV report) - The 0.525m pipe downstream of study site under Cabbage Rd in supplied Existing Conditions model was modified to 0.375m diameter pipe based on the detailed survey (refer Figure C26) - Cardno modified the location of some pits, pipes and culverts based on survey data
Roughness Zones	- Roughness zones under Existing Conditions are mapped in Figure C28 - Roughness zones under Future Conditions are mapped in Figure C29
Initial Water Level	The Initial Water Level was modified to match the downstream tailwater level
Run Timestep	- Council's model had a timestep=1 s applied to both 1D and 2D domains. - Cardno applied a 2D timestep of 0.7s and a 1D timestep of 0.35s (noting that the user guide recommends that the 1D timestep be half of the 2D timestep).

In relation to the Seniors Living development the earthworks and drainage works at the entry to the Seniors Living development and augmentation of the Cabbage Tree Road crossing and the downstream drainage line was based on the civil works drawings prepared by Marchese Partners. As indicated in **Figure C29** Block A was blocked out in the Future Conditions model due to its proximity to the proposed drainage works while the remainder of the development is represented as a high roughness zone in accordance with the practice adopted for adjacent residential development.

- b) *Blockage is considered a key risk to flooding. Details on what degree of blockage was adopted is required for any drainage where blockage may have an impact on infrastructure or buildings, e.g. the driveway crossing.*

As noted above blockage 0% for pipes and 30% for culverts was adopted which is consistent with the approach adopted by Council as described in Section 7.1.1 in 2017 Royal HaskoningDHV report.

A sensitivity test was undertaken by assessing the impact of 30% blockage of the proposed twin 750 diameter pipes conveying flow to Cabbage Tree Road (refer **Figure C27**).

The resulting 1% AEP flood depths, velocities, hazards and floodways are mapped in **Figures C11A, C12A, C13A and C14A** respectively.

The 1% AEP flood level differences are plotted in **Figure C21A**. A comparison with **Figure C21** in our Seniors Living FIA report discloses small differences in the vicinity of Building A. It is concluded that the detailed design of the inlet to the twin 750 mm diameter stormwater pipes should include provision to withstand 30% blockage of the inlet without diminishing the capacity of the conduits to limit any minor impacts that might arise from partial blockage of the inlets.

- c) *The flood study has not defined the overland flood risk associated with runoff from the golf course, through the development, particularly when local channels are surcharged (possibly after considering blockage). The development could redirect distributed overland flows with potential impact on Cabbage Tree Road or offsite. In addition, Block A and B could be at risk from surcharged overflow associated with the eastern drainage channel. Elaboration is required.*

Please refer to the sensitivity assessment of a blockage scenario as described under item (b).

Please refer to the re-mapping of the flood modelling results as described under item (d).

- d) *The figures supporting the flood study report require a more detailed mapping scale that shows the local site in better detail. In addition the developed scenario plans should show the contours and line-work associated with the proposed works (building pads, creeks and culverts). It is noted that the plans have been filtered with respect to flood depth and velocity. This may be appropriate for mainstream flooding, however for this assessment the filter categories are too coarse. It is noted that flood impact calculations, after filtering flood depths, could result in understating flood impacts. Clarification is required.*

At Council's request a different set of filters were applied to the flood modelling results to identify any shallow overland flows that may need to be managed by the internal site drainage works. The filters which were adopted were as adopted for the 2013 Dee Why South Catchment Flood Study (refer Figure 5-3 in the Stage 3 Flood Study Report).

The Seniors Living building footprints are also included as requested.

The re-mapped 1% AEP flood depths, velocities and hazards under Future Conditions are given in **Figures C30, C31 and C32** respectively.

The re-mapped PMF depths, velocities and hazards are given in **Figures C33, C34 and C35** respectively.

It is concluded that the re-mapping discloses that there are no significant external overland flowpaths which convey flow from uphill into the Seniors Living development and that rather runoff will need to be managed locally within the development in accordance with current practices.

- e) *The Flood Impact Assessment Report states that the development results in increases in velocity in the road reserve as a result of the development. Clarification on the potential impact of these adverse impacts is required.*

This comment relates to two small areas of local velocity increase adjacent to Cabbage Tree Road (refer Figure C23 in our Seniors Living FIA report). These two locations align with the new stormwater pits located upstream and downstream of Cabbage Tree Road. While these are located within the road reserve the local changes in velocity in these locations does not pose a risk to vehicles.



The proposed drainage works lead to a significant reduction in overland flows across Cabbage Tree Road in a 1% AEP flood (as disclosed in Figure C21 in our Seniors Living FIA report) which reduces the hazard in this location to motorists driving along Cabbage Tree Road.

Yours faithfully

A handwritten signature in black ink that reads 'Brett C. Phillips'.

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Dr Brett C. Phillips
Director, Water Engineering
for **Cardno**