



Flood Assessment and Water Cycle Management Strategy

Scope of Work

A significant amount of technical analysis has been prepared in recent years to investigate the development potential and constraints of the proposed Ingleside Release Area. The Precinct Working Group (PWG) is currently undertaking a gap analysis to confirm those elements of the previous work that are still valid and those areas where further investigation is required. Whilst not currently complete, it is envisaged that the gap analysis report will be available for review once the successful contractor is engaged to undertake this project.

Given the uncertainty of the gap analysis, the Department requires the successful contractor to undertake an initial scoping stage where the final detailed scope of works will be discussed and agreed with the PWG. The gap analysis will be undertaken with reference to the Detailed Scope of Works outlined at Stage 2 below.

Stage 1 – Initial Scoping Stage

The initial scoping stage will require the successful contractor to:

- meet with the PWG to discuss the gap analysis and understanding of the brief as part of the project inception meeting;
- review the completed gap analysis report and provide comment, as required;
- undertake a desktop review of relevant background material;
- discuss and agree with the PWG variations to the detailed scope of works (Stage 2), as necessary;
- prepare a brief report confirming the proposed approach to the Stage 2 works.

Note that the outcomes of this phase of work may result in a variation to the scope of the contract, which will be set on the basis of an upper limiting fee.

Stage 2 – Detailed Scope of Works

The following detailed scope of works will ultimately need to be fulfilled by the successful contractor and should form the basis of quotations.

Water Cycle Management Strategy

The Water Cycle Management Strategy should address OEH and Council policy, infrastructure and service requirements and WSUD principles, and recommend planning controls and land management strategies.

The development of the Water Cycle Management Strategy shall include the following:

- identification of water management objectives (including water quality, water quantity, and ecological & social objectives);
- consideration of Council and regional stormwater targets;



- water cycle assessment/long-term water balance modelling (including contributions from groundwater sources) for pre and post development scenario conditions;
- consideration of ecological impacts including providing sustainable environmental flows to Warriewood Wetlands;
- consideration of downstream flow impacts on Warriewood Valley/Elanora Heights areas and the provision of measures to ensure no additional flow impacts from potential redevelopment areas;
- a water quality monitoring plan (as a determinant of pre- and post-development impacts) and any required new infrastructure to carry out the plan;
- assess site constraints and opportunities:
 - identify and develop potentially feasible strategies;
 - identify opportunities to manage environmental flows in creeks;
 - identify (storm)water reuse options;
 - identify source control measures, including 'best planning practices';
 - identify water sensitive urban design options;
 - identify strategies that reduce the need for development contributions for infrastructure;
 - identify stormwater management measures (both public domain and assumed/indicative private domain) and assess performance against (storm) water management objectives; and
 - determine (in broad terms) maintenance requirements and arrangements.
- prepare a preliminary strategic-level water cycle management strategy for incorporation into the early phase of ILP design;
- define and refine the preferred option:
 - screen/evaluate potentially feasible strategies to identify a preferred option (in terms of, for example, compliance with management objectives, life-cycle costs, reliability, ongoing operation and maintenance requirements, land-take and likely level of community acceptance);
 - further develop/refine the preferred option; and
 - finalise the preferred option (and document preceding process).
- prepare a number of typical concept designs for water quantity and quality measures to assist in the preparation of infrastructure costs for development contributions, as required; and
- provide advice to the PWG on the possible differentiation between 'regional' and 'local' level infrastructure, in line with the NSW Government's White Paper.

The Contractor is encouraged to consider modifications to this process to ensure the development of the Water Cycle Management Strategy will best achieve the objectives for the study. The Contractor will liaise with Sydney Water to understand Sydney Water's water and sewer servicing strategy for the Precinct.

Riparian corridors

The Contractor will be required to review the Riparian Corridor Assessment to integrate the Water Cycle Management Strategy and flood risk management strategy with planning controls for riparian lands, which will be included in the draft DCP and EPI.



Cross sectional diagrams should be provided that indicate the suggested riparian footprint, existing vegetation and areas to be rehabilitated or restored, channel form changes, flood risk and bushfire management implications, locations and treatment of stormwater, roads and paths.

Design of crossings of water courses is to meet the specific objectives of the Water Cycle Management Strategy with consideration of environmental guidelines of the NSW Government and the principles of ecological sustainable design. There are numerous guidelines prepared by the OEH which aim to assist contractors design their development proposals in a way that minimises impacts on and rehabilitates streams and riparian lands.

The drafts of the cross sections are to be integrated with the Riparian Corridors and Bushfire Assessment to be provided to OEH and the PWG. A field inspection may need to be carried out with OEH officers and the PWG to discuss these products and agree on any changes needed to finalise them.

Quantities and costing for Development Contributions Plan (or similar)

The Contractor should ensure that all modelling and concept design is completed to an appropriate level of detail to allow accurate quantities and costing to be prepared for the major drainage works and flood risk management measures. Concept design drawings shall be in Autocad.dxf format.

The contractor shall provide costing spreadsheets in Microsoft Excel format and advice to Council's development contributions planner, with allowance for at least three iterations (design and cost).

Where open space for water cycle management purposes also serves an open space role, design and costs should also include open space embellishment. Cost estimates of such works shall be capable of being separately attributable to open space or water management facilities for the purpose of the Contributions Plan.

It is the aim to minimise financial risks associated with the management of development contributions. To this end, direct provision of infrastructure or at source provision should be explored.

Flooding Assessment

Several detailed flood assessments have been undertaken by Pittwater Council identifying the flood affected areas across most of the Precinct. These include the Draft Pittwater Overland Flow Mapping and Flood Study (Cardno, 2012) and Draft Narrabeen Lagoon Flood Study (BMT WBM, 2013). Pittwater Council has also applied for grant funding from Office of Environment and Heritage (2013-14) to undertake a detailed hydrological and hydraulic for the McCarrs Creek catchment. This will supersede the information within the Draft Overland Flow Flood Study.

These existing Flood Studies will need to be reviewed and any gaps or inconsistencies in assumptions identified. This existing modelling data will be made available to the Contractor to utilise, refine and augment where necessary. It is therefore not envisaged that new models will need to be developed for the purposes of this study.

The Flooding Assessment should involve sufficient work to determine and map where appropriate, a flood planning area along with the provisional flood hazards and hydraulic categories (e.g. floodway, flood fringe, and flood storage areas). These hazard and hydraulic categories will assist in a determination of land uses,



compatible with such hazards and flow behaviour, during the Master Planning process.

In order to be consistent with Council's requirements for new development, the flood analysis will require appropriate hydrologic and hydraulic modelling and will involve consultation with relevant Council staff. Tenderers should demonstrate their capacity to comprehensively undertake the required flood analysis and modelling.

The Contractor will ultimately need to fulfil the following scope of works:

- Collect and review existing data, including:
 - previous flood and floodplain risk management studies as well as Trunk Drainage and local Hydraulic Specification studies (including all relevant model data) for the study area and nearby areas;
 - Council data and information, which includes aerial photography, ALS, ground survey and flood data;
- Collect/survey additional information relating to critical crossings and pit and pipes;
- Determine the hydrology of watercourses and catchments under present land use patterns;
- In addition to rainfall runoff routing modelling, other methods such as flood frequency analysis are to be used if sufficient data is available;
- Predict the hydrology of the catchment under ultimate development conditions and model the changing regime as the catchment develops from present to ultimate conditions. Regional flood mitigation measures to offset any impacts from ultimate development are to be investigated. In this regard, detention basins will be strategically located in the development to ensure that post-development flows do not exceed pre-development flows for 2 year ARI and 100 year ARI design floods;
- In accordance with "Floodplain Risk Management Guideline: Practical Consideration of Climate Change" (DECC 2007), the hydrologic impacts of increased rainfall intensities are to be considered to allow optimisation of land use decisions undertaken throughout the Master Planning process;
- Determine the water surface profiles along all of the existing creek systems for current land uses for the 2 year, 20 year, 100 year, 200 year and 500 year Average Recurrence Intervals (ARIs) flood events along with the PMF event;
- Model the flood profiles and performance for different development scenarios to achieve an optimal mix between efficient and effective development and the maintenance of target waterway objectives. Include both local catchment and backwater flooding impacts (including those to both people and property). The study should also consider appropriate modifications to the floodplain outside the riparian zones to optimise land use, while minimising any impacts on flow behaviour and flood risk. The model should:
 - Describe the changed flow regime which results from any modification of the catchment as the development of the land unfolds. This process should consider and model appropriate filling opportunities while minimising any impacts on flow behaviour and flood risk as well as any proposed regional structural flood risk management measures, such as detention basins to attenuate peak flows to those from pre-developed conditions for 2 year ARI (representing bank-full flows) and 100 year ARI design floods;



- Preferably be a 2D hydrodynamic type of model. The model must be able to describe the changed hydraulic characteristics which result from the modification of the floodplain as the progressive development unfolds. It must be able to accurately show the impact of any filling of the floodplain margins associated with additional development. It must also be able to predict the dynamics of floodplain storages and hydraulic structures. ALS data is available for the hydraulic study area from Council;
- Be calibrated and validated using historical rainfall and (peak) flood mark level data from relevant, recent flood events. In this regard, allowance should be made for some consultation with Council and the local community. Sensitivity testing of model outputs to key input parameters is to be undertaken to ensure the adequate robustness of all model results.
- Hydraulic model results for low flow regimes including 1 year and 2 year ARI design flood events (representing bank-full flows) are to be made available to the Contractor undertaking the Riparian Corridor Assessment, so that geomorphic processes and erosion hazard potential may be assessed; and
- Contractors will be required to submit all hydrologic and hydraulic model input data and result files with their reports. Digital versions of all GIS mapping layers will also be required to be submitted.

Flood evacuation

Whilst it is not envisaged that flood evacuation will be a major concern, the flood evacuation requirements of the State Emergency Service must be addressed. In particular, consideration is to be given to any road evacuation route strategies that are proposed as part of the precinct planning process.

The flood evacuation component of the study will assess regional flood evacuation or new flood evacuation routes in light of the proposed development, having regard to the need for all key flood evacuation routes to not be cut by local 500 year ARI flooding and the PMF event. Options for steadily rising evacuation routes, pedestrian and/or vehicular, should be considered for those areas within the Precinct affected by flooding (for both local and backup flooding) to ensure that there are no local trap points.

The assessment of regional flood evacuation needs must account for the cumulative impact of the future development on surrounding areas.