Sydney WATER

28 August 2023

Grace Macdonald
ESR Australia Pty Ltd

Level 24, 88 Phillip Street
SYDNEY NSW 2000

Reference: Plan 110965-04 HSK01

In principle endorsement to relocate the trunk drainage channel within Lot 3 DP 250002, Mamre Road

Dear Grace,

I refer to the recent meeting and above-mentioned plan proposing to relocate the trunk drainage within Lot 3 DP 250002 Mamre Road. The information provided and discussion from the meeting has been reviewed. It is understood that you wish to relocate the naturalised trunk drainage to the northern edge of the lot. This has implications to management of upstream catchments and to Mamre Rd and private landholdings downstream.

While further modelling, information and design refinement is required to adopt the proposed trunk drainage relocation. We provide in principle endorsement for ESR progressing the trunk drainage relocation based on consideration of stormwater matters and fulfillment of design and documentation requirements provided in Attachment 1 of this letter.

Yours sincerely,

Anna Thompson
A/ Wianamatta Program Manager

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Attachment 1 – Trunk Drainage Realignment - Plan 110965-04 HSK01

This list defines what Sydney Water expect to be included in the SSD submission regarding the proposed realignment of trunk drainage. Additional documentation may be required during the assessment period.

Design Requirements

- Critical culvert levels should be obtained from TfNSW for the Mamre Road culverts and must be maintained as minimum levels and considered a design constraint unless otherwise agreed by TfNSW.
- The hydraulic performance of the Mamre Road culverts should be carefully assessed and may require a splayed entry do the angles surrounding the culvert. This should be assessed and the failsafe operation and potential overland flows for events greater than the design standard documented.
- Written in principle agreement is required from TfNSW and Transgrid regarding the potential realignment of the channel and culverts.
- At this stage no response has been received with regard to utilising the maintenance track for access to the IOP but it is suggested that as a minimum you should seek appropriate advice from your tankering company to include their requirements in design of the maintenance path.
- Adequate forward entry and exit must be designed for regarding maintenance track east of Mamre Rd. For example, this could be through turning head or loop road.

Drawing Requirements

- Proposed naturalised trunk drainage design must adhere to the design guidelines provided in Sydney Water's *Draft Stormwater Scheme Infrastructure Design Guidelines (Dec, 2022)*.
- The drawings for naturalised trunk drainage must demonstrate how the waterway integrates functionally into the surrounding development area and with existing surface levels downstream of the development site.
- As the proposal affects alignment downstream of the site, all drawings (as specified below) must demonstrate functional design resolution of the full length of proposed channel realignment.
- Plan drawings must show:

    - Alignment and relationship to adjacent development (including upstream and downstream of the subject site)
    - Corridor width per the Mamre Rd Precinct Stormwater Scheme Plan.
    - Low flow channel alignment showing sinuosity per guidelines.
    - Interface with any service utilities (note that sections must be provided where services intersect/run parallel within the trunk drainage corridor to demonstrate feasibility)
    - Indicative location of any proposed instream features e.g. Drop structures.
    - Location of proposed waterway crossings/paths/other social amenity features
    - Location of proposed access location and maintenance tracks including demonstration that max grades will not be exceeded.
    - Location of proposed stormwater connections to the naturalised trunk drainage
    - Location and spot heights of any retaining wall structures proposed along the corridor (these are to be minimised).
- Cross sections:
    - Cross sections of the trunk drainage channel to demonstrate the functional placement of the feature in the developed landscape, including adjacent property where the boundary is shared.
    - Cross sections should generally be provided at approximately 100m intervals or as required to highlight significant changes in site grades, alignment and any atypical situations.
    - Cross sections should show 'worst case situations' e.g. where retaining walls are unavoidable/highest point of a proposed retaining wall. Where necessary, cross sections should also be provided where services are proposed across the channel.
    - Cross sections must extend beyond the channel boundaries to show the proposed interface with development adjacent the trunk drainage corridor.
    - Where the proposed channel is higher than adjacent land details will be provided to demonstrated how this land will be drained without causing artificial ponding on the land.
    - Cross sections must show adherence to the typical detail for naturalised trunk drainage (compound channel) as provided in Appendix A of the *Draft Stormwater Scheme Infrastructure Design Guideline (Dec, 2022)*.

- Long sections
    - Long sections of trunk drainage channel inverts and top of bank along each reach that demonstrate adherence to max grades and/or inclusion of drop structures as required.
    - Long sections must demonstrate tie in with critical points i.e. existing grades at upstream and downstream points of the development.

- Long sections should include any proposed major infrastructure crossing or parallel with trunk drainage within the corridor.
- Pipe longsections for lines connecting to the trunk drainage channels.

Modelling Requirements

Hydrologic Modelling

- Sydney Water modelling indicates the peak 1% AEP as 4.3 m^3/s at the upstream end of the channel and 5.1 m^3/s at the Mamre Road culverts. Unless modelling indicates higher flowrates these values shall be used as the peak flows for channel design.
- Acceptable digital hydrologic methods are runoff routing, storage routing and time area models such as XP-Rafts, RORB, WBNM and Drains (ILSAX). Use of the Rational Method is not appropriate.
- ARR2019 methodology and rainfall data shall be used to assess the 5%, 1%, 0.2% AEP and PMF flowrates, although when assessing the function of the low flow channel more frequent storm events will be required. This can vary, depending on location in the catchment but will typically fall between the 12EY and 4EY critical events.
- Use IL/CL loss model

Rural Pervious	IL 37.1mm	CL 0.94mm
Developed Pervious	IL 14.8mm	CL 0.94mm
Impervious (All)	IL 1.0 mm	CL 0 mm

- Where the time of concentration is required, the minimum time is 5 minutes with a maximum of 20 minutes, noting that times over 14 minutes will require justification. Use of the Kinematic Wave equation is limited to flow paths no longer than 30m and shall be over surfaces that are homogeneous in surface and grade.
- Accurately drawn catchment sketches will be provided that show the natural catchments with the developed catchment overlaid, with clear definition between them. Each catchment area and changes between natural and developed to tabulated on the sketch.
- To facilitate effective operation of the Scheme Plan, wetlands and storage ponds catchments cannot be varied by more than ±10% of their area as shown in the Sydney Water wetland catchments layer.
- Critical 1% AEP hydrographs shall be provided at site upstream and downstream locations with the developed site hydrograph superimposed over the existing site hydrograph. Given the requirement of onsite stormwater detention, upstream developed catchment hydrographs cannot be assumed to match the natural hydrograph due to the additional volume of runoff discharge due to urbanisation. This information will be utilised in assessing any cumulative impacts of OSD.

Hydraulic modelling

The hydraulic operation of the trunk drainage system is important for the safety of the area being developed as well as for achieving the environmental, cultural and stream health benefits. Applying current best practice is a prerequisite to achieving sustainable and effective naturalised trunk drainage.

- Before final endorsement of any proposal, all flow paths and channels shall be modelled using industry standard 1D/2D models refined to a suitable resolution to define flood flow extents and provide accurate shear force representations. Acceptable hydraulic modelling software is TUFLOW, HEC-RAS 2D and Mike-21. Other software may be permissible but should be referred to the Regional Stormwater Authority before establishing the model.
- It is recommended that initial channel sizing justification could be undertaken using basic Mannings models with reference to the standard drawings in the Draft Stormwater Scheme Infrastructure Design Guideline (Dec, 2022). This publication also provides acceptable channel roughness values, grades and sinuosity requirements.
- As a minimum, trunk drainage channels shall be modelled using 5%, 1%, 0.2% AEP and PMF critical flows of the developed catchment. As described above, additional frequent flows are required to assess shear forces within the low flow channels. Shear flow modelling is only required for the developed case with the whole channel assessed using the 5% and 1% AEP critical flows.
- Drop structures must be supported by hydraulic modelling or calculations. Sydney Water's preferences are as follows:
    - Chutes – Chute (eWater), Hec-Ras (1D) or industry standard rock sizing calculations for chutes.
    - Vertical drop structures - Hec-Ras (1D)
- Result mapping of the channels shall show:
    - flood extents and velocities for 1%, 0.2% AEP and PMF flood extents.
    - flood planning area i.e. the area below the flood planning level.
    - flood hazard and the flood constraints that apply to the land – utilising ARR 2019 hazard definitions.
    - model topographical roughness mapping.
    - where naturalised channels interface with major creek systems hydraulic categories shall be mapped to ensure mainstream flood conditions are not adversely impacted.
- Climate change design flood modelling sensitivity analysis comparing the 0.2% AEP flood event as a proxy for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change.
- Street/site drainage, that connects to the trunk drainage, shall be modelled to ensure that it is not adversely impacted by 1% AEP critical flows in the trunk drainage channels. Points of connection shall be minimised with typical connection points on the downstream side of road crossings. On-grade pit inlet capacities should be carefully assessed as most "real life" kerb inlets have limited capacity, often not reflected in the curves provided in hydraulic models.