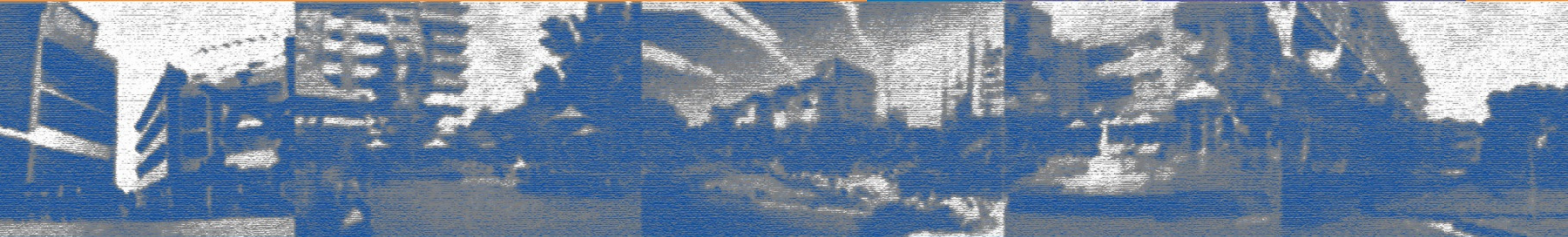
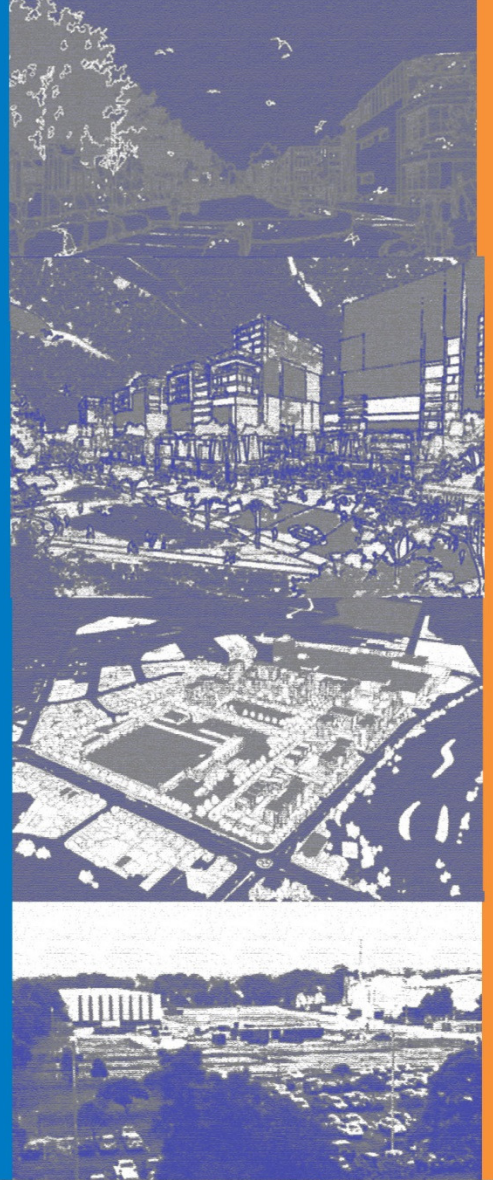


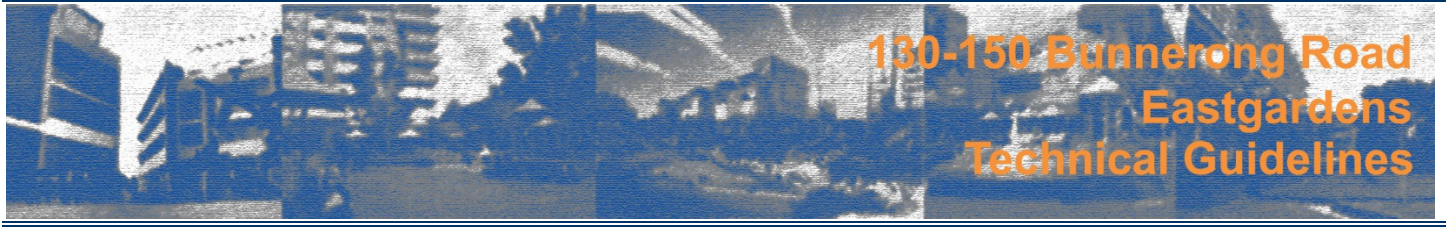
Technical Guidelines

130-150

Bunnerong Road
Eastgardens



Development Control Plan



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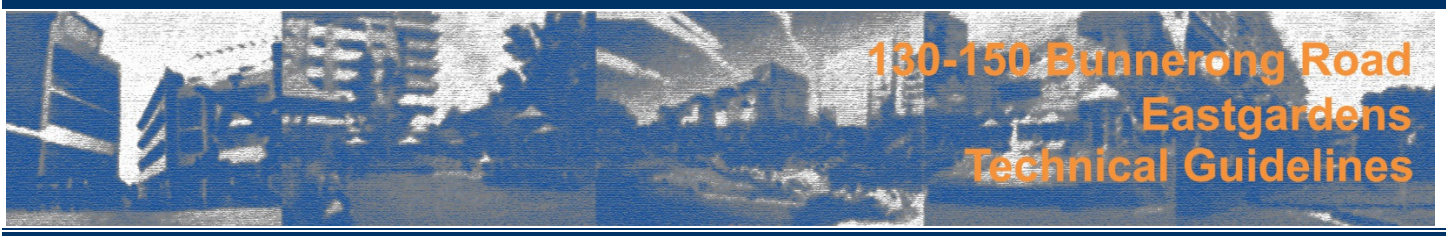
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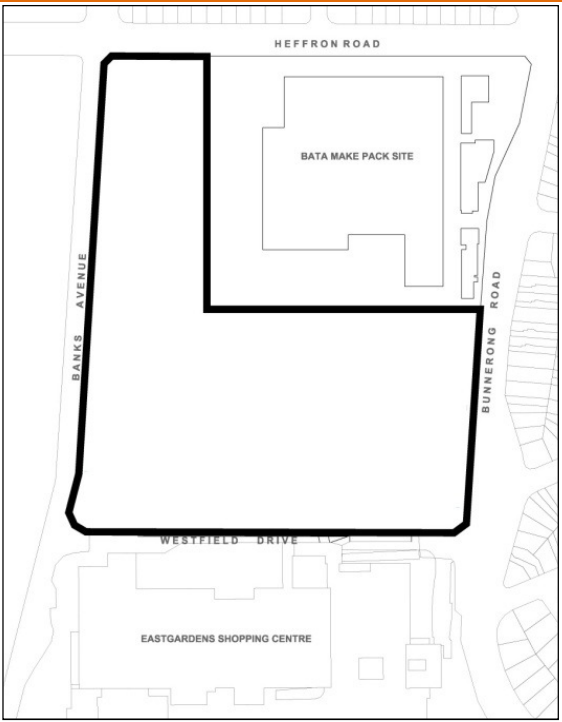
1 Introduction

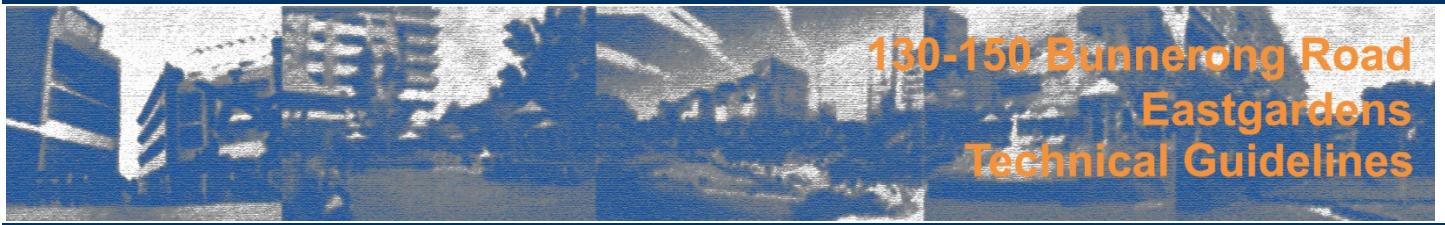
1.1 Land to Which this Part Applies

These Technical Guidelines apply to land legally described as Lot 2 in DP.1187426, bounded by Bunnerong Road, Westfield Drive, Banks Avenue and Heffron Road (refer to **Figure 1**). This land is also known as 130-150 Bunnerong Road, Eastgardens.

The land (bounded in black) is zoned Part B4 Mixed Use, Part R3 Medium Density Residential and Part IN1 General Industrial under the Botany Bay Local Environmental Plan 2013. The remainder of the site is zoned IN1 General Industrial (refer to **Part 6 - Employment Zones of the DCP**).

Figure 1 - Land to which this Part Applies





2 Civil Works

2.1 Objectives

- O1** To clearly convey the primary function to road users and encourage appropriate driver behavior;
- O2** To provide a road system and footpath area that delivers a high level of safety for all users and perform their designated functions within the road network;
- O3** To ensure acceptable levels of amenity and protection from the impact of traffic;
- O4** To achieve high standard of construction and minimise construction and life cycle costs; and
- O5** To provide opportunity for landscaping.

2.2 Requirements

- (1) Utility services within and adjacent to the Site shall be provided in accordance with the following:
 - All existing utility services on the road verge area adjacent to Site shall be relocated underground;
 - All new utility services in the site shall be provided underground and have adequate capacity to support the anticipated demand generated by the developments;
 - The Architectural, Landscaping and Engineering plans of any developments in the site shall include details of all utility services; and
 - All utility services shall be provided in accordance with guidelines and requirements of the relevant utility authorities.
- (2) All internal roads and associated stormwater drainage system within the site shall be completed and in function prior to issue of any consent for buildings in the Site.
- (3) Any internal roads, which form a junction or intersection with existing public roads, shall not be opened to public access until consents from the City of Botany Bay Council and Roads and Maritime Services are issued.
- (4) All civil works in the existing and proposed public domain area shall be inspected by Council's engineers during construction. Stages of mandatory construction inspections will be determined by Council prior to commencement of any works on-site.
- (5) Any new roads shall conform to any site specific development controls of the site, showing the road networks satisfies projected district and regional travel.
- (6) The provision of roads required for the development and at intersections with existing public roads shall be designed in accordance with the following standards and specifications:



- AUSTROADS (current version) - Guide to Road Design;
- AUSTROADS (current version) - Guide to Traffic Management;
- AUSTROADS (current version) - Guide to Pavement Technology;
- Roads and Maritimes Services (RMS) Road Design Guide;
- City of Botany Bay Council (2012) - Civil Works Specification; and
- Any relevant Council's Development Control Plans

(7) On-site detention (OSD) systems shall be provided in the public domain area to accommodate stormwater runoff generated from the Site. The design of the OSD system shall be in accordance with On-site Stormwater Management Section of this technical guideline.

(8) An Erosion and Sediment Control Plan shall be prepared in accordance to 'Do It Right On-Site' Soil and Water Management for the Construction Industry' and NSW EPA's Managing Urban Stormwater: Construction Activities. All erosion and sediment control measures shall be implemented prior to commencement of any site works or activities and shall be maintained at all times during the construction.

(9) Road Design Requirements

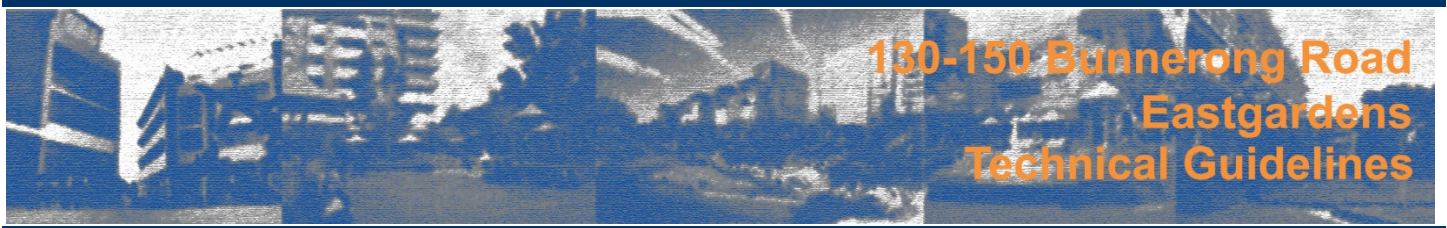
Road Design Plans shall be prepared by a qualified engineer experienced in road design and submitted to Council as part of Civil Works DA for the Site.

(i) Road Design Plans

The Road Design Plan shall be generally in accordance with the following format:

- Title sheet;
- Plans showing extent of works;
- Longitudinal sections details along the centreline of the roads and kerb lines;
- Cross sections details of roads at suitable intervals;
- Typical road cross section details;
- Kerb return details;
- Location and details of traffic calming devices, pathways and other miscellaneous road details;
- Permanent traffic warning, regulatory and parking restriction details;
- Drainage catchment plan;
- Drainage calculations;
- Drainage longitudinal section details;
- Other drainage details;
- Erosion and sediment control measures; and
- Detail of Traffic Control Measures, such as signage, line-marking and traffic signals.

(ii) Pavement Design



Pavement design for any internal roads shall be prepared by a registered N.A.T.A. laboratory based on sampling and testing of the subgrade materials from the site. Details of the pavement design, results of subgrade testing (including 4 day soaked CBR's) shall be submitted to Council for approval as part of Civil Works DA for the Site. The structural design of the pavement shall be in accordance with the following procedures:

- a) All roads shall be designed based on the anticipated design traffic loadings, but not less than 5×10^5 ESA;
- b) Pavement shall be designed in accordance with current version of AUSTROADS (current version) - Guide to Pavement Technology;
- c) The pavement shall contain at least one bound layer of either asphaltic concrete or portland cement concrete; and
- d) Asphaltic concrete pavements shall have two layers of AC10 totalling a minimum thickness of 50mm.

Minimum Pavement Thickness:

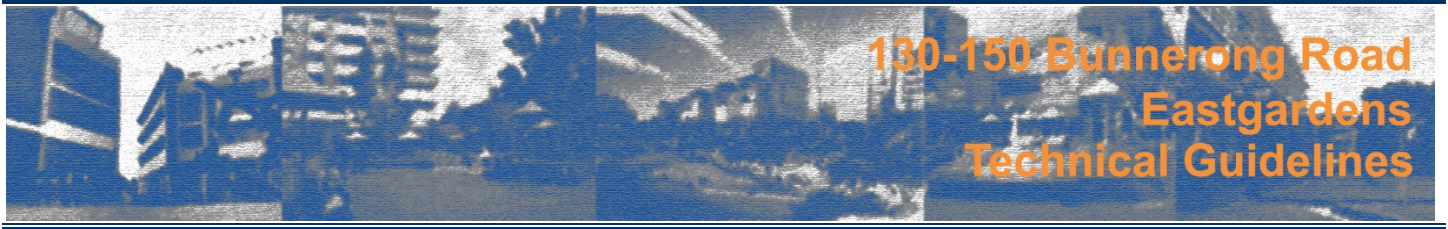
- In all cases of flexible pavement design, the minimum pavement thickness shall be 300mm, excluding the thickness of the final wearing course.

(iii) **Pavement Surfacing**

- All roads shall be surfaced with an initial course of 25mm thickness AC10 and the final wearing course of 25mm thickness of AC10 can be laid by the applicant at a later date subject to approval from Council's engineers

(iv) **Geometric Design**

- a) Carriageways shall provide a smooth, safe trafficable alignment and surface.
- b) Within the limitations of standard batter grades in cut or fill, suitable vehicular access shall be made available to building allotments across the street footway.
- c) Ponding of surface water shall be alleviated by site filling if practicable, the run-off being catered for in the street drainage system.
- d) Fill areas or regrading areas shall not concentrate flows but shall broaden surface flows having regard to levels. Alternative drainage schemes shall be designed if ponding is unavoidable.



- e) Over all areas of the site to be developed, the minimum finished surface slope shall be generally 1.0% oriented in any direction.
- f) Unless there are specific site requirements to excavate material for site filling and improvement works, excavation shall be kept to an optimum level commensurate with lot access and value.
- g) Sight distance, horizontal and vertical alignment of the roads shall be designed in accordance with AUSTROADS - Guide to Road Design, RTA Road Design Guide and Australian Standards (where applicable).
- h) Water Sensitive Urban Design (WSUD) features, e.g. bio-retention swales, shall be integrated into road geometry and pavement design.

(v) **Design Speed**

- Design speed shall be the speed applied to the design of a road's geometric elements to create and maintain a speed environment for 85% of drivers.
- Generally the following design speeds should be adopted, unless Council's traffic engineer stated otherwise:

Cul-de-sac and local access streets	40 km/h
Civic Avenue	40 km/h
East-West Boulevard	50 km/h

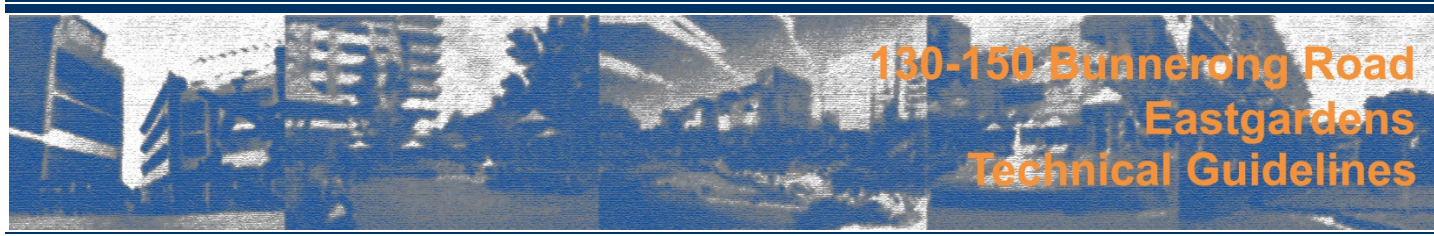
(vi) **Carriageway Cross fall**

- The normal crossfall of road pavement on a straight alignment shall be 3%.

(vii) **Kerb and Gutter**

- a) Standard 150mm integral concrete kerb and gutter in accordance with Council's standard drawings and specifications shall be provided on both sides of roads, adjacent to public open space and for roundabout kerb returns.
- b) Longitudinal grades of the kerb and gutter shall be provided at minimum 1%.
- c) Pedestrian ramps shall be provided at all intersections in accordance with Council's standard drawings and specifications.

(viii) **Footpath**



- a) Except at the location indicated by Council, concrete footpath with minimum width of 1.2m and 100mm thick shall be provided on both sides of the roads.
- b) Footpath areas shall be sloped towards the road to ensure water does not drain onto adjoining properties. A desirable grade of 2.5% shall be provided. This may be reduced to a minimum grade of 2.0% to accommodate existing vehicular crossing and other facilities. The maximum grade shall generally not be more than 3% unless approval has been given by Council's engineers.

(ix) **Cycleway**

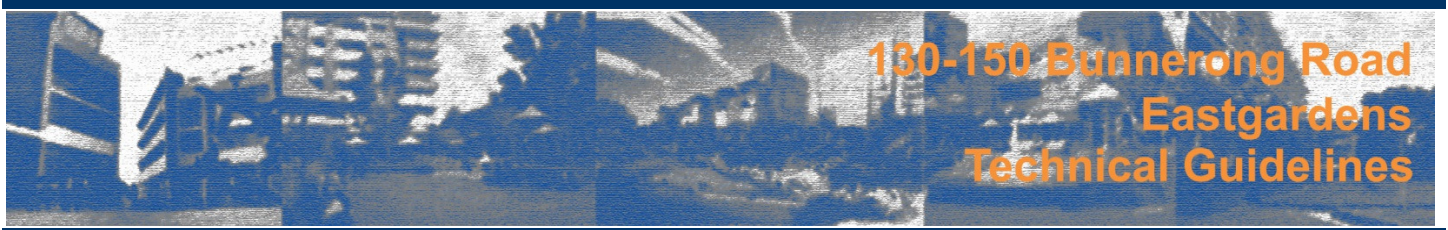
- Cycleway designed and constructed in accordance with AUSROADS requirements shall be provided to the Site. Final location of the cycleway will be determined by Council.

(x) **Batters**

- If batters are required to support the road reserve area, the following requirements shall be complied with:
 - a) All batters shall be wholly located outside the existing or proposed road reserve boundary.
 - b) The maximum slopes of batter shall be in accordance with the following table:

Batter Type	Desirable Maximum Slope (V:H)	Absolute Maximum Slope (V:H)
Earth	1:5	1:4
Rock	1:0.5	1:0.25

- c) The use of rock batters will be Subject to approval from Council's engineer.
- d) The need for constructing retaining walls should be avoided wherever possible. Should a retaining wall be necessary, full engineering details of the proposed structure, including elevation, typical cross-section and structural certification by a registered structural engineer shall be submitted to Council for assessment and approval. All retaining walls shall be located wholly outside the existing or proposed road reserve boundary.
- e) For any batters and retaining walls supporting the carriageway and footpath area in the road reserve, easement of batter and / or easement of support shall be created in the titles of affected lots accordingly.

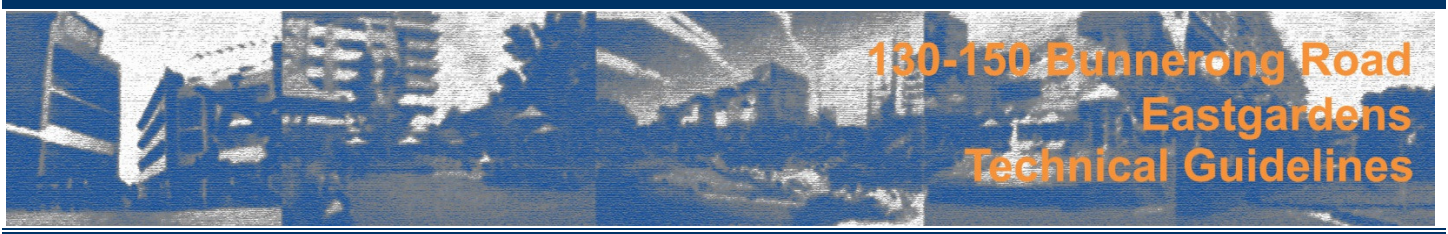


(xi) **Intersections**

- The design of intersections or junctions shall be in accordance with AUSTROADS - Guide to Road Design, Part 4, Intersections and Crossings – General and RTA Road Design Guide and /or the requirements set by Council's engineers.
- Intersections should generally be located so that streets intersect at right angles. Adequate stopping and sight distances should be provided on each of the approach legs of an intersection and for any horizontal or vertical curves.
- Turning movements shall be accommodated by using AUSTROADS Design Vehicles and Turning Templates as follows:
 - a) For turning movements involving East-West Boulevard, (except at the intersection of Bunnerong Road and East-West Boulevard), the design "single unit truck/bus (12.5m)" with turning path radius 12.5 metres shall be used to enable turns to be made in a single forward movement;
 - b) For turning movements involving cul-de-sac and local access streets, the design "service vehicles (8.8m) with turning path radius 9 metres shall be used to enable turns to be made in a single forward movement;
 - c) For turning movements on Civic Avenue, the design "car (B99)" with turning path radius 6.3 metres shall be used; and
 - d) Special approval shall be obtained from Council's traffic engineer if the above requirements be varied due to the size of largest vehicles anticipated using the road.

(xii) **Kerb Returns**

- a) The design of kerb returns is necessary for all road junctions to ensure a smooth trafficable surface around the return and where necessary to locate low points for drainage purposes.
- b) The standard radius of a kerb return is generally 8.5m for Civic Avenue, cul-de-sac and local access streets. Any variation to the above radii shall be approved by Council and should accommodate the intended vehicular movement using AUSTROADS Design Vehicles and Turning Templates.
- c) The geometry of kerb returns at the intersection of Bunnerong Road and East-West Boulevard shall be designed to allow for the turning circle of 25m B-Doubles.
- d) Crests and low points shall be defined by chord distances to the nearest tangent point.
- e) As far as practicable low points within the kerb return shall be avoided to eliminate the use of pits with curved lintels.



(xiii) **Vehicular crossings and laybacks**

- a) Except for single dwelling, all vehicular crossings for B99 vehicles (defined in AS2890.1) shall be designed to have minimum width of 3 metres (one-way) or 5.5 metres (two-way) at the proposed property boundary of the site.
- b) Vehicular crossing for commercial developments shall be designed in accordance with AS2890.2.
- c) All vehicular crossing shall be designed and constructed at 90o to the property boundary line in plain concrete (minimum 150mm thick and F82 mesh).

(xiv) **Traffic Calming Devices**

- Any traffic calming devices associated with the developments in the Site shall be designed in accordance with AUSTROADS - Guide to Traffic Management and shall be assessed and approved by Council.

(xv) **Traffic Signals**

- All traffic signals associated with the developments in the Site shall be designed in accordance with RMS Traffic Signal Design Guidelines and approved by RMS and Council.

(xvi) **On-Street Parking**

- All on-street parking facilities associated with the developments in the site shall be designed and provided in accordance with AS2890.5 and shall be approved by Council.

(xvii) **Landscaping and Street furniture**

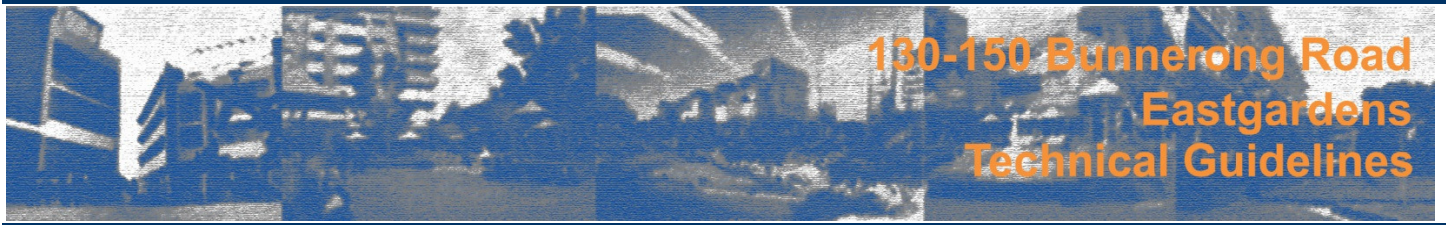
- All landscaping and street furniture within the road verge area shall be designed and approved by Council.

(xviii) **Street Lighting**

- Street lighting shall be provided for all internal roads and intersections within and adjacent to the Site to minimum Category P2 lighting in accordance with AS1158. Street lighting along Bunnerong Road will be subject to the RMS requirements.

(10) Road Drainage Design Requirements

Road Drainage Design Plan shall be prepared by a qualify engineer experienced in road drainage design and submitted to Council as part of Civil Works DA for the Site.



(i) **Road Drainage Plan**

The Road Drainage Plan shall be generally incorporated the following:

- Location of roads and pathways
- Location of all road drainage structures, including pits, pipes and discharge points;
- Drainage lines and pit numbers;
- Catchment area of each kerb inlet pit;
- Proposed / existing contours;
- Direction of flow along the flow paths of the longest times of concentration;
- Construction details of the kerb inlet pits and other road drainage structures;
- Features affecting the catchment boundaries; and
- Schedule of drainage structures.

(ii) **Road Drainage Longitudinal Sections**

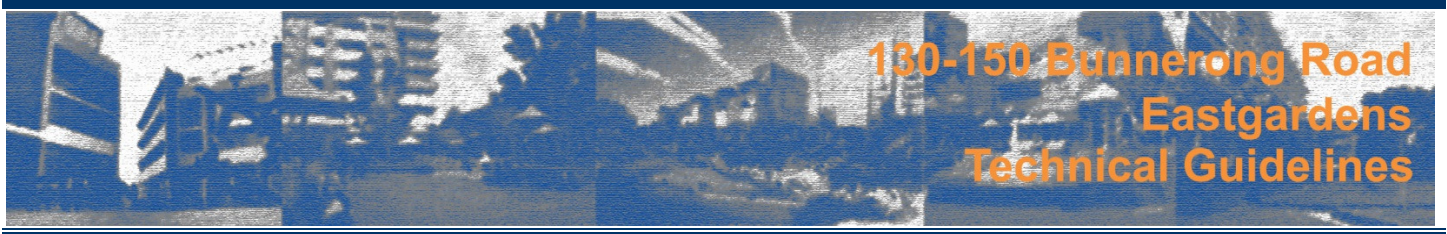
The longitudinal section of each drainage pipeline shall be shown on the plans, together with the following information and details:

- Pipe size, type and class
- Pipe chainages
- Pipe flows and capacities
- Drainage line numbers
- Design invert levels
- Pipe grade (%) - minimum 1%
- Pit numbers
- Pit and lintel size
- Design surface levels of pits
- Road chainages
- Hydraulic grade line (HGL) plot for the pipeline
- Water surface levels in receiving water
- Pipeline junctions
- Details of utility services to be shown along with the level where they cross pipelines

(iii) **Drainage calculations**

- The drainage report showing all the calculations in the road drainage design, such as HGL, flow rate etc.

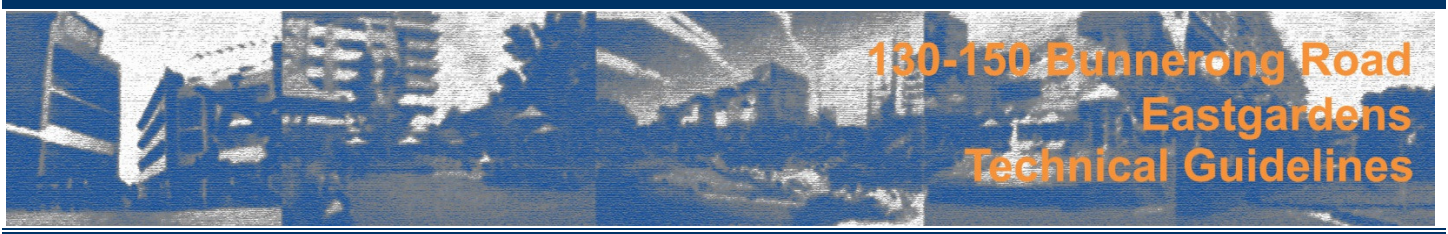
(iv) **Road Drainage Design**



- The design of road drainage system shall be in accordance with Australian Rainfall and Runoff (AR&R).

(v) **Underground road drainage system:**

- a) All underground road drainage systems shall be designed to accommodate stormwater runoff for 1 in 20 year ARI peak design flow for the catchment concerned.
- b) The overland flow path, together with the underground piped road drainage system shall be designed to accommodate stormwater runoff for a 1 in 100 year ARI peak design flow for the catchment concerned.
- c) The overland flow path shall be kept entirely within the road reserve area and velocity-depth ratio shall not be more than 0.4.
- d) Hydraulic Grade Line (HGL) analysis shall be provided for each drainage pipeline in accordance with Australian Rainfall & Runoff.
- e) For the purpose of HGL analysis, water surface levels in receiving water shall be either:
 - 1 in 100 year ARI water level or
 - assumed to be the top of kerb (when downstream water level is unknown.)
- f) All pipes within the proposed public roads /public domain shall be minimum 375mm diameter Type 3 Rubber Ring Joint (RRJ) reinforced concrete pipes (RCP).
- g) Drainage pits within the proposed public roads /public domain shall be designed to have adequate inlet capacity and in accordance with Council's standard drawings and specifications. Lintel shall be minimum 2.4m long (3.6m for East-West Boulevard). Pre-cast concrete pit can be used subject to Council approval.
- h) Minimum pipe cover shall be provided in accordance with AS3500.3 and shall not be less than 500mm.
- i) Subsoil drainage shall be provided to road drainage pipelines for area above groundwater level.
- j) WSUD principals shall be integrated in the road drainage design.



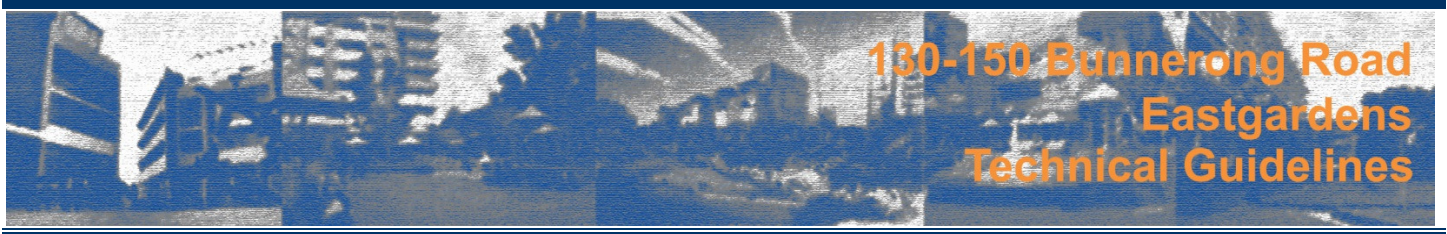
3 Stormwater Management

3.1 Objectives

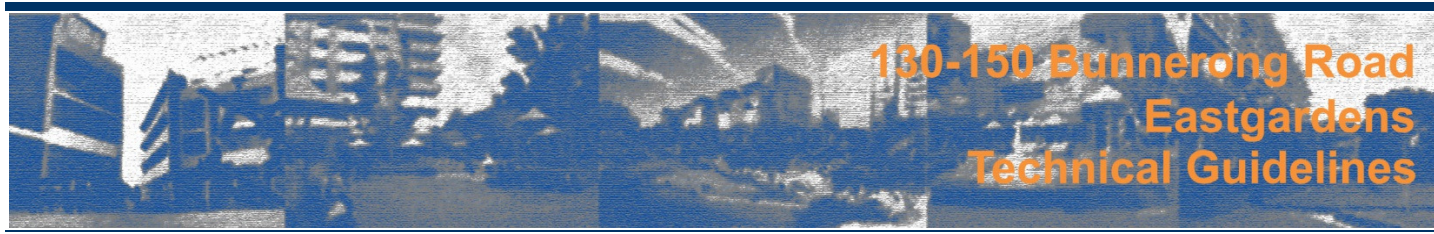
- O1** To provide for effective, sustainable and safe disposal of stormwater generated by developments in the site;
- O2** To incorporate the principles of Water Sensitive Urban Design; and
- O3** To reduce the drainage impacts of the development on adjoining and downstream properties.

3.2 Master Plan Requirements

- (1) Master Plan Stormwater Management Strategy, prepared and signed by a qualified practicing civil engineer experienced in design and analysis of stormwater drainage systems, shall be submitted to Council as part of Master Plan Development Application of the Site.
- (2) **Master Plan Stormwater Management Strategy: General Design Requirements**
- a) The Permissible Site Discharge (PSD) of the entire Site is 5,849 litres per second (i.e. 5,849L/s), with no less than 2,970 cubic metres (2,970m³) Site Storage Requirements (SSR).
 - b) No buildings/structures shall be located within 1m of Sydney Water stormwater asset or within the existing easement (whichever is the greater clearance). This includes provision of underground or overhead services other than those directly (nearly perpendicular) crossing the asset/easement and expensive very high quality landscaping elements, such as constructed ponds.
 - c) No filling shall be carried out within 3m from the outside edge of the existing Sydney Water stormwater asset / easement.
 - d) Any structure within the zone of influence of the existing Sydney Water stormwater asset shall require approval from Sydney Water.
 - e) Any proposals that impinge on Sydney Water or Council stormwater system or are affected by local or mainstream flooding shall obtain confirmation from Sydney Water or Council that the system is suitable for connection to the proposal.
 - f) The existing distribution of stormwater runoff between catchments shall generally remain and any proposed developments in the Site to redistribute runoff between existing catchments are not encouraged. However, should redistribution runoff between existing catchments is required, hydraulic analysis of the capacity of existing stormwater system (including overland flow paths) and its ability to accept additional flows shall be carried out by a qualified practising Civil Engineer and will require assessment and approval by Sydney Water and Council.



- g) Any proposal for filling against the natural fall of lands shall fully address the impacts associated with the redistribution runoff between existing catchments onto the receiving stormwater system and adjoining and downstream properties, as well as the amenity of adjoining properties, including impact on privacy.
- h) All drainage works and floodway / overland flow paths shall be designed in accordance with the requirements detailed in this document and the current edition of Australian Rainfall and Runoff (AR&R). Impacts from climate change to stormwater drainage system and floodway / overland flow paths shall be considered in design.
- i) Stormwater runoff generated from the entire Site shall be retained on site for up to and including 1 in 100 year Average Recurrence Interval (ARI) design storm events. Consideration shall also be given to the impact from climate change.
- j) All stormwater drainage systems shall make provision for surface flow path routes to the street system or through drainage easement in accordance with the minor/major design concept defined in the AR&R.
- k) It is the applicant's / owner's / developer's responsibility to:
 - i.) Verify and locate common drainage lines, Council and Sydney Water stormwater drainage system (including floodways and overland flow paths) and their size. These information and details shall be verified by a Registered Surveyor.
 - ii.) Investigate the suitability and availability of Council's infrastructure for drainage. Where such infrastructure is unavailable, Council does not undertake to provide or assist in the provision of such infrastructure to facilitate any proposed developments.
- l) The Stormwater Management Strategy shall consider the design elements in the Stormwater Management and Flooding Report for the site, prepared by Aurecon Australia Pty Ltd, Reference No. 211530, Revision 8, dated 10 Oct 2011, especially the increase in permeable area of the entire site from 26.5% (pre-development) to 41.5% (post-development).
- m) The Stormwater Management Strategy shall be consistent with the Council's stormwater management policies and guidelines to ensure that:
 - i.) The proposed on-site stormwater management system for each individual stage of Master Plan will result in no adverse effect on Sydney Water's and Council's stormwater systems, public roads, development itself and adjoining and downstream properties **at all times**.
 - ii.) Proposed buildings in each individual stage of Master Plan shall not be subject to stormwater inundation from runoff generated by the developments for all storms events up to 1 in 100 year ARI design storm and climate change impact.

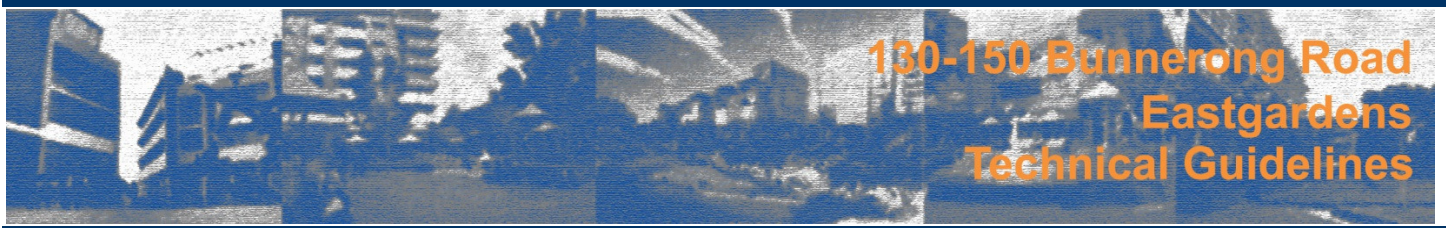


(3) Master Plan Stormwater Management Strategy: Stormwater Quality Requirements

- a) The Stormwater Management Strategy shall set out stormwater treatment measures, such as bio-retention swales, gross pollutant traps, rain gardens, rainwater tanks, infiltration basins etc, to be utilised across the Site based upon Section 2 of Stormwater Management and Flooding Report, Reference No. 211530, Revision 8, dated 10 Oct 2011. The following pollutant load reduction targets shall be complied with:

Stormwater Pollutant	All developments in the site
Gross Pollutants	90%
Total Suspended Solids (TSS)	85%
Total Phosphorus (TP)	60%
Total Nitrogen (TN)	45%

- b) Model for Urban Stormwater Improvement Conceptualisation (MUSIC) shall be used to demonstrate the pollutant load reduction targets stated above has been met. The MUSIC modelling shall be prepared generally in accordance with “Draft NSW MUSIC Modelling Guidelines”, dated Aug 2010 from CMA Sydney Metropolitan and its subsequent final version.
- c) The WSUD measures shall design and construct generally in accordance with WSUD Guidelines for Western Sydney and the following design elements shall be adopted and incorporated in the Stormwater Management Strategy:
- Integrating the design;
 - Respecting the site;
 - Conserving water;
 - Preventing increased flooding;
 - Preventing increased stream erosion;
 - Maintaining water balance;
 - Reducing eco-toxic risk;
 - Controlling stormwater pollution;
 - Managing the construction site; and
 - Ensuring long-term effectiveness.
- d) The following requirements applies to all new WSUD basins swales and other treatment measures:
- i.) WSUD basins shall be constructed with bio-filtration and active and passive areas.

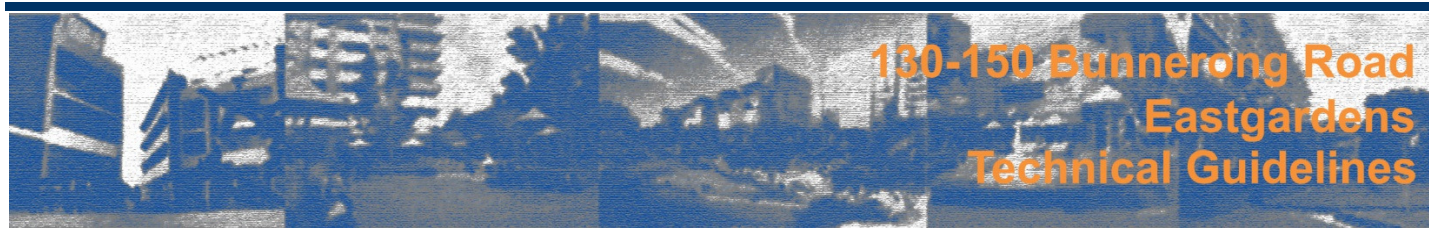


ii.) Planting within WSUD measures shall be designed to incorporate vegetation that enhances biodiversity and habitat by giving preference to locally indigenous plant species. The following species are acceptable:

- *Baumea artilulata*
- *Baumea rubiginosa*
- *Bolboschoenus fluviatilis*
- *Carex appresa*
- *Cyperus exaltatus*
- *Eleocharis acuta*
- *Eleocharis sphacelata*
- *Juncu usitatus*
- *Isolepsis inundata*
- *Phragmites australis*
- *Schoenoplectus mucronatus*
- *Schoenoplectus validis*

(4) Master Plan Stormwater Management Strategy: On-Site Detention (OSD) Requirements

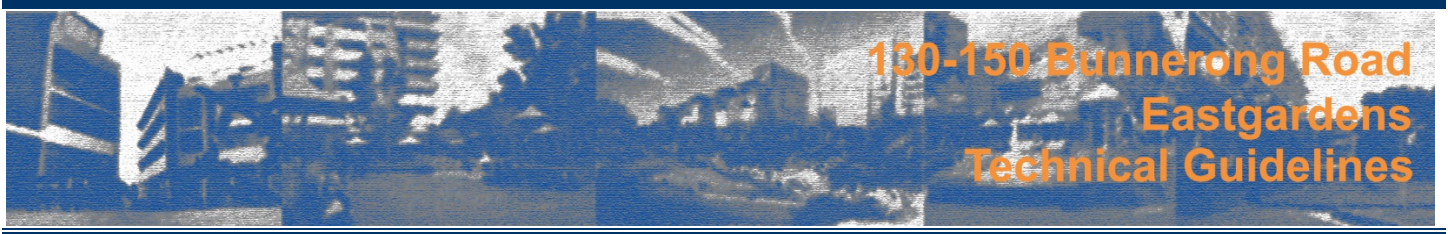
- a) Stormwater Management Strategy shall outline measures associated with the provision of on-site stormwater detention (OSD) storages for the entire Site to prevent increase in flood hazard and damage to existing developments by limiting surface runoff.
- b) Minimum 75% of OSD storage for the entire Site shall be provided in the open space area between Civic Avenue and East-West Boulevard. Any other proposed OSD storage shall be located in the common area, separately from any natural watercourses and overland flow paths, and not be inundated by any events up to and including a 1 in 100 year ARI design storm events.
- c) OSD storage volume shall be provided such that the combined flows (pipe outflows plus weir overflows) of OSD systems and total bypass flows (not exceed 15% of the total site area) do not exceed the maximum PSD allowed for the entire Site.
- d) Submerged outlet shall be considered in determining the required storage volume.
- e) Site stormwater drainage system for each individual stage of Master Plan shall connect to the OSD storage.
- f) Stormwater runoff from the upstream catchments of the Site shall be collected separately and conveyed around the site without detention.
- g) Distinct overland flow paths shall be created free of obstructions such as fences, buildings, etc. and maintained to accommodate stormwater runoff in excess of the capacity of the site stormwater drainage and OSD systems.



- h) Design flow rates of the OSD system shall be computed by a time-area hydrograph method such as ILSAX, DRAINS, etc. The use of triangular hydrograph methods [such as RARE] is not permitted.
- i) Runoff times of concentration for pervious areas are preferably calculated using the kinematic wave equation recommended in AR&R. A minimum time of concentration of 5 minutes is acceptable for paved / impervious areas.
- j) Any proposed buildings/structures adjacent to the OSD system or affected by overland flow path shall be minimum 300mm (habitable area) and 150mm (non-habitable area) above the maximum design water surface level.
- k) Where overflow paths required to be conveyed over private properties, piped overflow system (including associated drainage easements) with 1 in 100 year ARI capacity shall be provided.
- l) In the interests of safety and amenity, ponding of water shall not exceed depths as follows:

	Desirable Max. (mm)	Absolute Max. (mm)
Parking Areas	150	200
Public Landscaped Area	600	1200
Covered/Fenced Storage	600	1200
Underground with sealed access	No limit	

- m) Where ponding depth exceeds 300mm, flood warning signs shall be erected in such storage areas
- n) Design storages provided in landscaped area may require to be increased to accommodate construction irregularities and vegetative growth.
- o) The surface of the landscaped area where detention storage is proposed shall be limited to grass surface / stone gravels only and the location of the OSD shall be consistent with the Landscape Plan and clear of areas containing landscaping mulch garden beds.
- p) To ensure the continued function, maintenance and amenity of developments, OSD storage areas shall not be located within privately controlled areas (e.g. private courtyards). All OSD structures shall be constructed to minimise or prevent modification or removal.
- q) All discharge control pits shall:
 - Minimise the risk of becoming blocked by debris;
 - Be located in a suitable position;



- Be readily inspected;
- Be accessed readily for cleaning; and
- Have a minimal risk of being tampered with.

r) The Discharge Control Pit shall comply with the following:

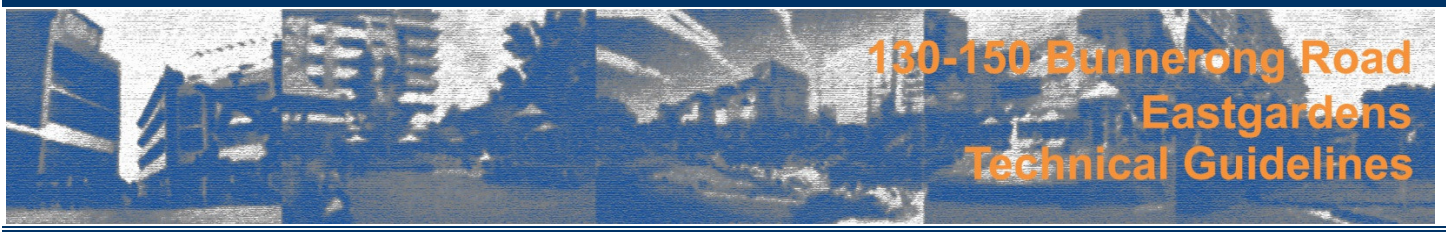
- The minimum size is:
 - 900 x 600mm for pits up to 1200mm depth.
 - 900 x 900mm for pits greater than 1200mm depth.
- The discharge control pit shall be a separate compartment to the storage volume
- Pit covers should be capable of being opened by one person.
- Step irons are required for pits greater than 900mm depth. The step irons shall be placed in a wall clear of the flow if possible
- All discharge control pits shall be fitted with orifice plates. Orifice plates shall be:
 - manufactured from corrosion resistant stainless steel plate with a minimum thickness of 3mm (5mm where orifice diameter exceeds 150mm), with a central circular hole machined to 0.5mm accuracy.
 - machined hole shall retain a sharp edge.
 - permanently fixed to the pit wall and be epoxy sealed to prevent the entrance of water around the edges.
 - engraved with the orifice diameter and an identifying mark
 - The orifice diameter shall not less than 25mm.

s) All discharge control pits shall be fitted with an internal trash screen which shall:

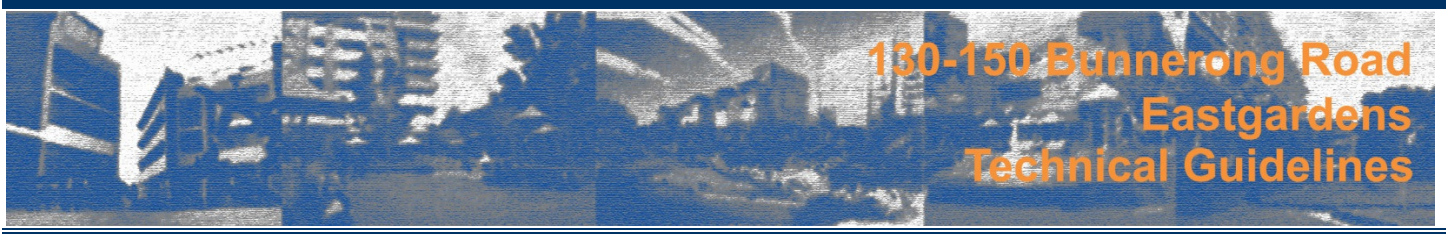
- Be manufactured from galvanised Lysaght RH3030 Maxi-mesh (or approved equivalent) with galvanised angle steel frame.
- Screen all pit inflows to the orifice.
- Have screen area be 50 times the orifice area.
- Be located to a minimum distance of 150mm from the outlet orifice.
- Be positioned as close to vertical as possible.
- Include handle(s) for easy removal.

(5) Master Plan Stormwater Management Strategy: Floodways and Overland Flow Paths Requirements

- a) Should each individual stage of Master Plan be identified by Council being likely affected by stormwater inundation, local or major overland flow paths, flood study / overland flow path study may be required to carry out for such stage to determine 1 in 100-year ARI flood extent and water surface level.
- b) Relocation of Council's stormwater drainage systems and overland flow paths to allow for intensification of development will generally not be permitted; applicant proposes to vary this requirement shall apply to Council and may only be approved at the sole discretion of Council.



- c) For developments affected by Council's (or Sydney Water's) stormwater drainage systems, overland flow paths and flooding, site levels shall incorporate an unobstructed floodway of adequate capacity over the surface.
- d) Any overland flow paths should be directed along carriageways/driveways and through public / common landscaped areas.
- e) Overland flow paths from upstream catchments should not pass through private courtyards as fences obstruct the passage of stormwater.
- f) Any alteration to existing surface levels in proposed/ existing Council drainage easement, drainage reserve, or floodway, will be subject to written approval by Council.
- g) Landscaping within overland flow path/ floodway shall be limited to grassed or paved surfaces only at levels to be approved by Council.
- h) Boundary fencing across Council's drainage easement/ overland flow path/ floodway shall incorporate provision for the passage of overland stormwater runoff to the 100-year ARI water surface level to the satisfaction of Council.
- i) Easements, Restrictions on Use of Land and Positive Covenants shall be placed on the Title of the property to ensure that no structure shall be erected or placed over the overland flow path/ floodway and the fence specifications necessary to establish the floodway are maintained in the future.
- j) All flood studies or overland flow path studies shall be prepared and signed by qualified practising Civil Engineers experienced in flood modelling and hydraulic analysis.
- k) For flood study or overland flow path study, blockage factors are to be applied to the flow into all inlet pits in the catchment. Pits on grade are to have a minimum of 20% blockage, and sag pits are to have a minimum blockage factor of 50%. A 50% blockage factor shall always apply to the hydraulic analysis of the underground drainage system.
- l) The maximum rise in upstream water surface level (i.e. increase from previous developed condition to proposed development condition) shall not exceed 50mm, provided there is no significant effect on the upstream or other affected properties including minimum freeboard between water surface level and finished floor level. Upstream rises in water surface level greater than 50mm will not be permitted.
- m) The Manning's equation may be used where the total depth of water flow over the area to be designated for floodway does not exceed 300mm. Where the Manning's equation is used, the design maximum water depth shall be equal to the calculated maximum water depth (measured from the invert of the flow path) multiplied by a factor of 1.5.



- n) Where the total depth of water flow over the area designated for floodway exceeds 300mm, steady flow computer based models such as HEC-RAS, shall be used, as calculations assuming normal depth conditions [for example, Manning's equation] are not considered suitable for larger flows due to the complexities needed to accurately model floodway restrictions.
- o) Design overland flow path/ floodway shall be determined by ensuring that the velocity – depth product does not exceed 0.4m/s.
- p) The proposed finished floor levels of buildings/structures adjacent to flooding/overland flow path shall be minimum 500mm (habitable) and 300mm (non-habitable, including garage, ramps to the basement car parking area etc.) above the 1 in 100 year ARI design floodwater levels.
- q) All modelling data shall be retained by Council to assist in developing stormwater floodway strategies.

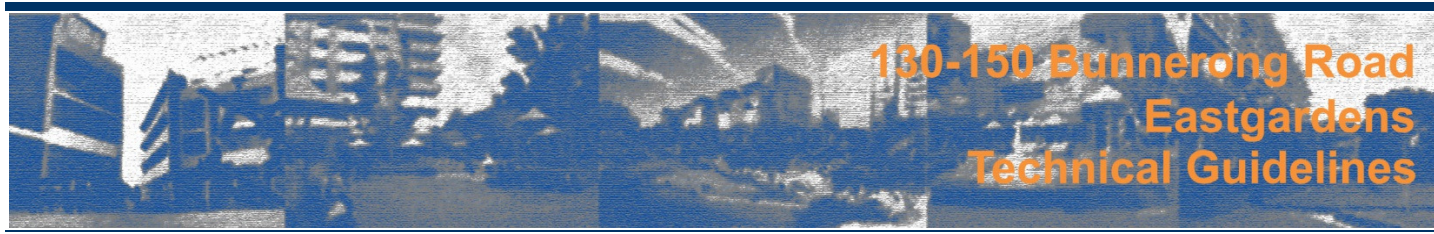
(6) Master Plan Stormwater Management Strategy: Minimum Finished Floor Levels Requirements

The following requirements about the finished floor levels of the structures shall be complied with:

- a) For developments adjacent to Bunnerong Road, Heffron Road, Westfield Drive and Banks Avenue:
 - 1) Habitable Area
 - Minimum 500mm above the 1 in 100 year ARI water surface levels in the flood study report for the site, prepared by Aurecon Australia Pty Ltd, Reference No. 211530FSR, Reversion 1, dated 2 Nov 2011
 - 2) Garages / crest at the basement car parking ramp
 - Minimum 300mm ARI water surface levels in the flood study report for the site, prepared by Aurecon Australia Pty Ltd, Reference No. 211530FSR, Reversion 1, dated 2 Nov 2011
- b) For developments in the site:
 - 1) Habitable Area
 - Minimum 500mm above the top of kerb or adjoining ground level at the lowest corner or point of discharge for the site
 - 2) Garages / crest at the basement car parking ramp
 - Minimum 150mm above the top of kerb or adjoining ground level at the lowest corner or point of discharge for the site

(7) Master Plan Stormwater Management Strategy: Easements Requirements

- a) Where the conveyance of stormwater involves the provision of stormwater drainage system across different lots, then easements to drain stormwater shall be created over the downstream lots, in favour of the upstream lots.
- b) Plan showing the creation of proposed drainage easements shall be submitted as part of Master Plan Development Application of the Site.



- c) Any proposed Council and inter-allotment drainage easements shall be able to accommodate overland flow from the upstream catchments up to and including 1 in 100 year ARI storm event.
- d) All proposed Council drainage easements shall be provided with an unobstructed floodway of adequate capacity over the surface. No Structures shall be erected or placed over the Council drainage easement. Drainage Easement benefiting Council shall have the width as follow:

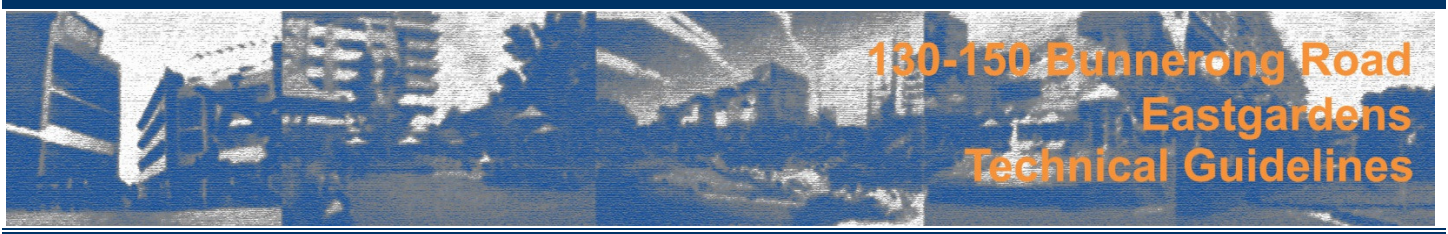
Pipe diameter	Minimum Easement Width
$\leq 900\text{mm}$	3 m
$> 900\text{mm}$	Width of the drainage structures plus 1 metres

- e) The following minimum width of the inter-allotment drainage easement shall apply:

Pipe diameter	Minimum Easement Width
$\leq 300\text{mm}$	1 m
$> 300\text{mm}$ and $\leq 750\text{mm}$	2.5 m
$> 750\text{mm}$ and $\leq 1200\text{mm}$	3 m
$> 1200\text{mm}$	Width of the drainage structures plus 1 metres

3.3 Requirements for Development DAs for Each Stage identified in Master Plan DA approval

- (1) Stormwater Management Plan, prepared and signed by a qualified practicing civil engineer experienced in design and analysis of stormwater drainage systems, shall be submitted to Council as part of Development Application for each stage identified in the Masterplan DA approval of the Site.
- (2) The Stormwater Management Plan shall include the following details:
- Site layout;
 - site contours and final design levels;
 - Catchment area draining to site drainage system
 - Finished floor levels and footprints of the proposed development/ structures;
 - Location, size and details of the site drainage infrastructure;
 - Levels and location of discharge points of site drainage system
 - Overflow structures and surcharge/overflow paths;
 - Locations and details of the pump-out system (if any);
 - Location and extent of any overland flow path/ floodway through the site (if any);
 - Location and type of stormwater quality improvement devices; and



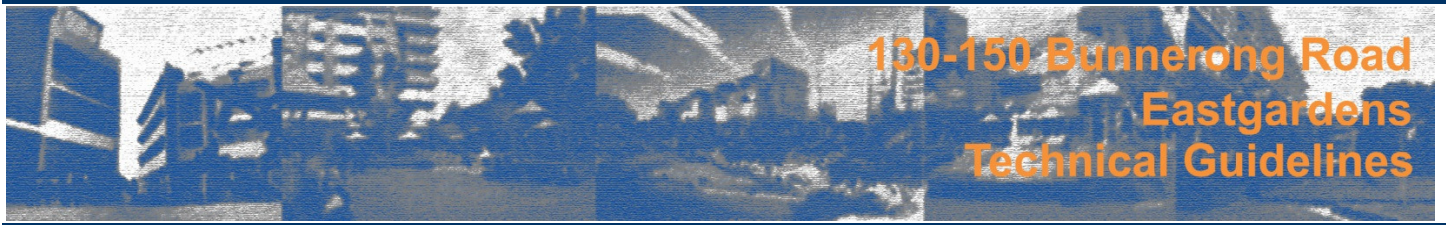
- k) Cross-sections details of the site drainage infrastructure.

(3) Roof and Pipe Drainage Design

- a) All roof drainage system shall be designed and constructed in accordance with AS 3500.3.
- b) Minimum cover requirements on pipelines shall be in accordance with the relevant Australian Standards and the manufacturer's specifications.
- c) For developments whose total catchment area (i.e. site area plus other areas draining to the site) is not more than 3000sq.m (0.3ha), pipe sizes can be determined from AS3500.3 or HGL analysis, subject to the following conditions:
 - d) The minimum diameter of any pipeline draining a roofed area shall be 100 mm.
- e) All uPVC pipes shall be Sewer Extra Heavy Grade, subject to minimum recommended cover requirements in accordance with AS3500.3 being met.
- f) The minimum diameter of any pipeline draining a paved, grassed or landscaped area shall be 150 mm.
- g) Pipes shall be designed to cater for the likely construction and traffic loads. Allowance should be made for situations where cover during construction may be less than finished cover.
- h) Pipes contained in drainage easements shall be RRJ reinforced concrete/FRC pipes where minimum cover of 500mm cannot be provided.
- i) For developments whose total catchment area (i.e. site area plus other areas draining to the site) is more than 3000sq.m (0.3ha), a full Hydraulic Grade Line (HGL) analysis of the proposed stormwater system shall be submitted to Council.
- j) HGL analysis shall also be required for the pipe reaches connecting to a receiving system other than the street kerb. All pit grates shall be minimum 100mm above the HGL.
- k) The downstream water level in the HGL analysis shall either be assumed to be the top of kerb or downstream 1 in 100 year water level.

(4) Site Drainage Connection to Street Kerb and Gutter or Public Stormwater Drainage System

- a) Each stage of the development shall demonstrate to Council by hydraulic analysis that the proposed site drainage connection to street kerb and gutter or public stormwater drainage system will have no adverse impact to the system, other than those identified in Master Plan.
- b) Grated boundary pit (min. 450mm x 450mm) shall be provided for any stormwater outlet discharging from the site.



- c) All stormwater runoff from each stage of the development shall be conveyed under gravity to the OSD systems proposed in Master Plan via street kerb and gutter or public stormwater drainage system. Charged system will not be permitted
- d) Where site discharge from any storm event is greater than 20 L/s, connection shall be made to public underground stormwater drainage system.
- e) The number of stormwater outlets to kerb and gutter for each building / structure shall not be more than two and be minimum 15 metres apart.
- f) The point of connection for site stormwater runoff to the public stormwater drainage system will be determined and specified by Council. Any direct connection to a Sydney Water stormwater system will require specific approval from Sydney Water.
- g) Stormwater connection to public stormwater drainage system shall be by means of a junction pit for any pipes larger than 150mm diameter. The design drawings shall show plan view and longitudinal sections of the pipeline and connection details at a suitable scale.
- h) All drainage pipelines connecting to street kerb and gutter or public stormwater drainage system shall be constructed to Council's standards.
- i) Any stormwater drainage pipelines connecting to street kerb and gutter or public stormwater drainage system shall satisfy the following criteria:
 - 1) Under the footpath area:
Minimum 125 x 75 x 4 galvanised Rectangular Hollow Section (RHS)
Note: The applicant shall locate all utility services within the footway and show the information on the submitted plans.
 - 2) Under kerb and gutter and road pavement:
Minimum 375mm diameter RRJ RCP/ FRC pipes
 - 3) Within Council's drainage easement:
Minimum 375mm diameter RRJ RCP/ FRC pipes
 - 4) Within Parks and Reserves:
Minimum 375mm diameter RRJ RCP/ FRC pipes
- j) Should developments requiring construction of additional drainage infrastructure in public domain area other those identified in the Master Plan, Council reserves the right to approve or reject the proposal on its merits based on criteria including but not limited to environmental assessment, site conditions.



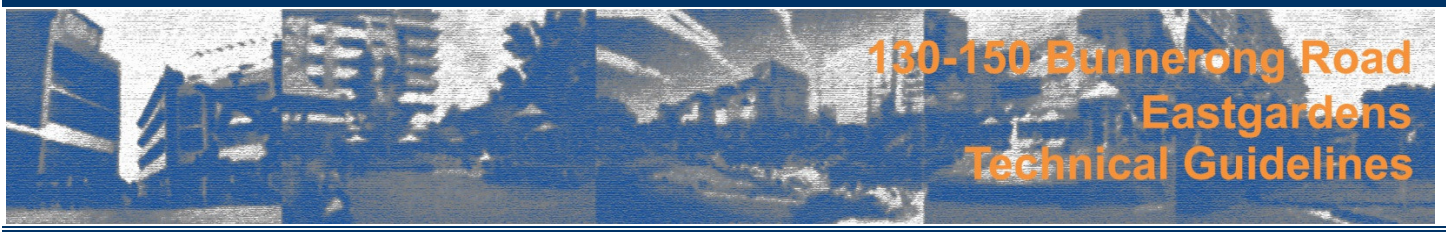
(5) Rainwater Tanks

Rainwater tanks or water-reuse device shall be incorporated in stormwater drainage system under the following guidelines:

- a) For multi-unit residential and commercial developments, it is compulsory to provide total minimum 10,000 litres capacity rainwater tank despite of BASIX requirements.
- b) Only roof water shall be collected into the rainwater tanks or water-reuse device and connection to the main water supply will be used as a top up system during extended periods of dry weather.
- c) An overflow pipe from the rainwater tanks shall connect to site drainage system.
- d) The rainwater tank or water re-use device shall be installed in accordance with Sydney Water requirements and the Building Code of Australia, with the overflow connected into site drainage system.
- e) Tank water taps shall be marked "Tank Water – Not To Be Used For Human Consumption". Re-use of stormwater for potable use such as cooking, drinking and hot water systems **shall not be permitted**.
- f) Elevation and site plan showing location, setback and overflow disposal shall be provided to Council. Rainwater storage tanks shall be installed in accordance with the manufacturer's specification, Sydney Water's requirements and the relevant Australian Standards.
- g) All rainwater tanks shall be located minimum 500mm from the property boundary and not be seen directly from the street frontage.
- h) In order to reduce pollutants entering the tank, a first flush device to divert minimum 1mm initial runoff from the roof area bypassing the tank shall be provided
- i) All rainwater tanks shall service outdoor irrigation. However, it is recommended the tanks shall also service laundry and toilet flushing, wherever possible.
- j) Appropriate measure/s shall be incorporated into the design of the tank, pipe and gutter system to exclude vermin and prevent the breeding of mosquitoes.

(6) Pump-out systems

- a) Pump-out systems are not permitted, except for the basement car parking area, with approval from Council.
- b) If portion of the access ramp to the basement car parking area cannot be drained by gravity then disposal of stormwater runoff via a pump-out system may be permitted, subject to the following requirements:



- c) The basement car parking area shall be graded to fall to the sump pits and pump-out system.
- d) The contributing catchment area to the pump-out system shall be limited to the basement access ramps only, and /or subsoil drainage (subject to groundwater level is one (1) metre or more below the bottom of basement slab). Generally no more than 100 sq. metres of access ramp catchment shall be allowed to drain to the pump-out system. Surface flow paths from remainder of site should be diverted away from the basement area.
- e) Two (2) submersible type pump units shall be installed and designed to work in tandem to ensure that both pumps receive equal usage and neither pump remains continuously idle. Each pump shall have a minimum capacity of 10L/s or be based on flow rate generated from the 1 in 100 year ARI 5-minutes duration design storm event of the access ramp area draining into the system, whichever is greater.
- f) The pump-out system shall be designed that a minimum volume of water is retained in the sump when the pumps are in the “off” position.
- g) The volume of the pump-out storage tank shall have sufficient storage capacity equivalent to the runoff volume generated from the area draining into the tank for the 1 in 100 year ARI 2-hours duration storm event.
- h) The pump-out system shall be independent of any gravity drainage lines.
- i) Discharge outlet of the pump-out system shall connect to the site boundary grated pit (minimum 450mm x 450mm) and the surface level of the suite boundary grated pit shall be designed and construction to the satisfaction of Council’s Engineer. Non-return flap valve shall be provided accordingly.
- j) Any storage areas in the basement car park and area adjacent to the lifts shall be constructed to a minimum of 150mm above the surface grates of the pump-out system to achieve freeboard above the water level in the pump-out storage tank.
- k) An alarm warning device (including signage and flashing strobe light) shall be provided to the pump-out system to advise the occupant of pump failure. The location of the signage and flashing strobe light shall be shown on the stormwater management plans.
- l) Engineering details and manufacturers specifications for the pumps and switching system and sump shall be indicated on the stormwater management plans.