DRAFT PLANNING SCHEME POLICIES PUBLIC CONSULTATION

Objective Reference: **A2274677**

Attachment:

PSP1 – Environmental Significance
PSP2 – Infrastructure Works
Appendix A – Sediment and Erosion Control Forms and Certification
Appendix B – Tree Species List
Appendix C – On Maintenance Checklist and Certification
Appendix D – ADAC Data Capture Guidelines
Standard Drawings 8.1 – General
Standard Drawings 8.2 – Stormwater Drainage and Water Quality
Standard Drawings 8.3 – Roads
Standard Drawings 8.4 – Cycleways
Standard Drawings 8.5 - Landscaping
PSP3 – Flood and Storm Tide Hazard
PSP4 – Landslide Hazard
PSP5 – Structure Plans
PSP6 – Environmental Emissions

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PURPOSE

This report seeks Council's approval to proceed to public notification of the proposed Redland City Plan planning scheme policies (the proposed planning scheme policies) in accordance with section 118(b)(ii) of the *Sustainable Planning Act 2009* (SPA) and Statutory Guideline 01/16 'Making and amending local planning instruments'.

BACKGROUND

Council, at its meeting of 9 October 2013, resolved to prepare a new planning scheme. On 23 November 2014, Council resolved to submit the draft Redland City Plan to the Planning Minister for state interest review.

On 23 February 2015, Council resolved to submit the amended draft Redland City Plan to the Department of Infrastructure, Local Government and Planning having satisfactorily addressed the issues raised through the state interest review process.

On 20 August 2015, Council received written advice from the Deputy Premier and Minister for Infrastructure, Local Government and Planning that the Minister is satisfied the relevant State interests have been integrated and that Redland City Council may publicly consult on the Redland City Plan subject to conditions.

On 28 February 2017, after public notification and review of the submissions, Council resolved to proceed with the amended planning scheme and submit it to the Department of Infrastructure, Local Government and Planning to seek approval from the Minister to adopt the scheme.

The proposed planning scheme policies are intended to commence with the Redland City Plan.

ISSUES

Copies of the draft planning scheme policies are included as attachments to this report. It is recommended that Council resolve to proceed with public notification of the draft planning scheme policies in accordance with Statutory Guideline 01/16 'Making and amending local planning instruments'.

STRATEGIC IMPLICATIONS

Legislative Requirements

In accordance with section 3 of Statutory Guideline 01/16 'Making and amending local planning instruments', a planning scheme policy may do one or more of the following:

- State information a local government may request for a development application
- State the consultation the local government may carry out under section 256 of SPA
- State actions a local government may take to support the process for making or amending its planning scheme
- Contain standards identified in a code, or
- Include guidelines or advice about satisfying assessment criteria in the planning scheme.

To make a planning scheme policy, Council must:

Step1: Propose to make a PSP.
Step 2: Prepare a proposed PSP.
Step 3: Public consultation.
Step 4: Review submissions and decide how to proceed.
Step 5: Adoption.

Public consultation about the proposed planning scheme policies is under section 118(b)(ii) of the SPA and in accordance with Statutory Guideline 01/16 'Making and amending local planning instruments'.

This report includes a recommendation to make the planning scheme policies and proceed to public consultation.

Risk Management

The proposed planning scheme policies support the local dimension of the Redland City Plan and should take effect on commencement of the Redland City Plan. Should Council decide not to proceed with the proposed planning scheme policies, this may delay the commencement of the Redland City Plan.

Financial

Resources have been allocated in the 2016/17 budget for public consultation of the draft Redland City Plan planning scheme policies.

People

Information sessions will be held during the public consultation period utilising existing resources.

Environmental

No implications.

Social

No implications.

Alignment with Council's Policy and Plans

The proposal is consistent with Council's Corporate Plan 2015-2020:

Wise Planning and Design 5.1: Growth and development in the city is sustainably managed through the adoption and implementation of the Redland City Plan and Local Government Infrastructure Plan.

The proposal is consistent with Council's Operational Plan 2016-2017:

Wise Planning and Design 5.1.3: Finalise the Redland City Plan.

CONSULTATION

- City Infrastructure Group
- City Spaces Group
- City Planning and Assessment Group
- Environment and Regulation Group

Additionally, the policies have been workshopped with Councillors.

OPTIONS

1. That Council resolves to:

    a) Make the following planning scheme policies in accordance with Statutory Guideline 01/16 'Making and amending local planning instruments':

        i. PSP1 Environmental Significance;
        ii. PSP2 Infrastructure;
        iii. PSP3 Flood and Storm Tide Hazard;
        iv. PSP4 Landslide Hazard;
        v. PSP5 Structure Plans; and

vi. PSP6 Environmental Emissions

b) Carry out public consultation about the draft Redland City Plan planning scheme policies in accordance with section 118(b)(ii) of the Sustainable Planning Act 2009 (SPA) and Statutory Guideline 01/16 'Making and amending local planning instruments'.

2. That Council resolves not to make a planning scheme policy or proceed to carry out public consultation about the draft Redland City Plan planning scheme policies.

OFFICER'S RECOMMENDATION

That Council resolves to:

a) Make the following planning scheme policies in accordance with Statutory Guideline 01/16 'Making and amending local planning instruments':

i. PSP1 Environmental Significance;
ii. PSP2 Infrastructure;
iii. PSP3 Flood and Storm Tide Hazard;
iv. PSP4 Landslide Hazard;
v. PSP5 Structure Plans; and
vi. PSP6 Environmental Emissions.

b) Carry out public consultation about the draft Redland City Plan planning scheme policies in accordance with section 118(b)(ii) of the Sustainable Planning Act 2009 (SPA) and Statutory Guideline 01/16 'Making and amending local planning instruments'.

c) That this report and attachments remain Confidential until such time as public consultation commences.

1.0 PLANNING SCHEME POLICY 1 - ENVIRONMENTAL SIGNIFICANCE

1.1 RELATIONSHIP WITH THE PLANNING SCHEME

(1) This part sets out:

(i) particular standards called up as acceptable outcomes in 8.2.4 Environmental Significance Overlay Code. These are contained in the following subsections:
1.4 Environmental offsets

(ii) information council may request to demonstrate compliance with the performance outcomes of the code. These are contained in the following subsections:
1.3.1.1 Ecological report
1.4.2.1 Land based offsets management plan

(iii) guidance for applicants which is contained in the following subsections:
1.2.1 Compensatory planting
1.3.2 Minimising and mitigating impacts associated with development
1.4.3 Environmental offsets
1.5.1 Clearing thresholds
1.6.1 Mapping and data sources

1.2 COMPENSATORY PLANTING

(1) This section sets out guidance for applicants on how to achieve compliance with AO1.1 for self-assessable development in the Environmental Significance Overlay Code.

1.2.1 Guidance for applicants

(1) Where self-assessable clearing is undertaken in accordance with Table 5.10.1, compensatory planting should be provided for clearing between 500m^2 and 2500m^2 to the nearest equivalent square metre.

(2) Table 1 provides a list of tree and shrub species which are locally occurring in most regional ecosystems in the rural part of Redland City and can be utilised for replanting cleared areas.

Table 1: Replanting species

	Scientific name	Common name
Trees	*Corymbia intermedia*	Pink bloodwood
	Eucalyptus tereticornis	Queensland Blue Gum
	*Lophostemon confertus**	Brush Box
Shrubs	*Leptospermum polygalifolium*	Wild May
	*Jacksonia scoparia**	Dogwood

*Low flammability species (Table 8.2.2.3.2 of the planning scheme) recommended for use in areas identified in the bushfire hazard overlay, where planting within 10m of a building or structure.

(3) The above trees and shrubs should be planted at the following densities based on the area of compensatory planting required:
(a) 1 tree per 10m^2 of replanting area; and,
(b) 1 shrub per 2.5m^2 of replanting area.

(4) Applicants should refer to the Bushfire hazard overlay map to determine if there is a level of risk of bushfire hazard on the property. Replanting should be outside of any areas identified as being at risk of bushfire hazard, and be undertaken at least 10m from a building or structure. If bushfire hazard areas cannot be avoided, use low flammability species as indicated in the table above.

1.2.1.1 Additional information for replanting

(1) When undertaking compensatory planting, the species being removed should ideally be the species that is replaced. Species that will have the best chance of survival are locally occurring native species which are determined by Regional Ecosystem.

(2) In addition to the trees and shrubs listed in Table 1, locally occurring native species can be determined using Regional Ecosystem maps, available on Council's Red-E-Map, and Council's Regional Ecosystem Database.

(3) Compensatory planting should incorporate both tree and shrub species. Locally native groundcover (low-growing or spreading plants which might include grass or sedge species or herbaceous plants) could also be incorporated to enhance biodiversity value. Where locally native groundcover is included, it is suggested that the area be replanted using the proportions:
(a) 20% trees;
(b) 40% shrubs; and,
(c) 40% groundcovers.

(4) Plant spacing should be at a density that will result in rapid canopy closure as this is effective and minimising weed growth. The South East Queensland Ecological Restoration Framework advises allowing for planting of trees and shrubs placed at 1.5m centres.

1.3 MINIMISING AND MITIGATING IMPACTS ASSOCIATED WITH DEVELOPMENT

(1) This section identifies the preferred approach to undertaking assessments, which may be required to demonstrate compliance with the performance outcomes in the Environmental Significance Overlay Code.

1.3.1 Information that Council may request

1.3.1.1 Ecological Report

(1) An Ecological Assessment Report should be provided to address the provisions of the Environmental Significance Overlay Code. For consistency and context it should also include any assessment required under Federal or State legislation or another relevant code of the City Plan.

(2) The Ecological Assessment Report should identify and describe the site's natural environmental features, including:
(a) vegetation (including any weed infestations);
(b) fauna and habitat for fauna; and,
(c) any waterways or wetlands, including drainage lines (artificial or natural), where relevant.

(3) The level of detail in investigating these may vary, relative to the site and the development being proposed:
(a) For applications for vegetation clearing, it is necessary to provide details of the vegetation proposed to be cleared. It is recommended that this be provided in the form of an arborist report (refer to Planning Scheme Policy 2 – Section 4 for further information about Arborist reports).

(b) For applications for small-scale development or operational works with limited capacity to adversely impact on environmental values or processes (at the site and adjoining area), it is sufficient to provide a basic assessment to complete the ecological assessment report (site visit and desktop assessment).
(c) For more complex applications or applications for large-scale development with potential for significant adverse impacts on environmental values or where development is located in particularly significant or sensitive areas, a more detailed ecological assessment, including flora and fauna surveys, is required.

(4) This assessment should also consider the broader context of the proposal, including but not limited to:
(a) safe fauna movement for all native fauna (throughout the proposed development, and with adjacent or nearby habitat); and,
(b) upstream and downstream water quality.

(5) The Ecological Assessment Report should then provide an assessment and justification of the proposed development, including an assessment of how the development will avoid, minimise and mitigate impacts on the identified environmental values. Guidance on development design is provided in section 1.3.2. Incorporating these suggestions is one way that an applicant might demonstrate compliance with some of the performance outcomes in the overlay code.

(6) A vegetation management plan and wildlife habitat management plan may be required to support the ecological assessment along with any other relevant site surveys and management plans (e.g. traffic), as determined by the values identified in the report.

1.3.1.2 Vegetation Management Plan

(1) A vegetation management plan must clearly identify the vegetation to be retained on site and vegetation that is proposed to be cleared and should include:
(a) a tree management plan that demonstrates how retained trees are to be protected during construction (in accordance with Australian Standard 4970-2009 Protection of trees on development sites);
(b) details of the proposed landscaping and revegetation areas, including proposed species palettes and relevant ecosystem services that landscaping and revegetation is to provide (for example stormwater management or enhancing safe fauna movement); and,
(c) details of how weeds are to be managed on the site, by identifying any existing weed infestations and proposed actions to prevent weed incursion during construction.

1.3.1.3 Wildlife Habitat Management Plan

(1) A wildlife habitat management plan must be prepared by an ecologist with suitable experience and should address the survival and ongoing access to habitat during construction and operation of the development. This plan should indicate the broad range of fauna expected on the site, the proposed site preparation and construction methods (e.g. how the vegetation is to be cleared), as well as a summary of future on-site operations and any expected constraints. The plan must:
(a) identify habitat trees, including standing trees with hollows, ground logs and bush rocks, to be retained wherever possible;
(b) clearly identify vegetation to be removed to ensure minimal disturbance to the existing native vegetation, including any significant understorey species identified in the ecological assessment report, or otherwise identified, for translocation prior to clearing operations commencing; and,
(c) details on how fauna will be managed during construction (for example, engaging an accredited spotter and ensuring clearing is undertaken sequentially).

1.3.2 Guidance for applicants

(1) This section provides additional guidance for applicants, summarising development design considerations to assist in meeting the performance outcomes of the Environmental Significance Overlay Code. The additional guidance in this section can also be used to inform the ecological assessment report, as outlined in the previous section.

(2) **Values to be protected:** The site's existing values and constraints should be identified and considered during development design (refer to previous section). The development design should then demonstrate how this design achieves the performance outcomes of the Environmental significance code.

(3) These values and constraints should be taken into consideration in determining the 'development footprint'. The development footprint is the extent of the development and the location of works, including any proposed services and facilities that are incidental to the development. This development footprint should:

(a) avoid the need to clear vegetation, in particular habitat for priority species, mature trees, vegetation that is part of a corridor, or that is part of a larger contiguous patch of vegetation;
(b) avoid the need for excavation or fill works and,
(c) provide an appropriately sized buffer between development and areas of environmental significance. Further guidance on buffers is below in part 4(h).

(4) **Minimising and mitigating impacts:** Depending on the development being proposed, and the values and constraints that have been identified for protection, consideration should then be given to minimising and mitigating any impacts that may result from the development. These include:

(a) enhancement and landscaping planting should be directed to areas of environmental value or sensitivity, including riparian areas, to strengthen existing corridors or habitat (refer to section (5) below);
(b) pests and weeds should be removed, and future incursions prevented;
(c) stormwater quality and volume should be managed, in accordance with the Healthy Waters Code;
(d) the location of new potential noise sources should be determined as part of the Ecological Assessment report, and noise abatement measures applied to ensure that noise is not directed into habitat areas or where fauna movement is provided for;
(e) artificial light should not be directed into habitat areas. Particular consideration should be given to flying fox roost sites and turtle nesting areas:
    (i) Within 50m of flying fox roost sites (identified through the Ecological Assessment Report) artificial light should be limited, and mitigation measures (e.g. shielding) should be implemented.
    (ii) North Stradbroke Island - where development is in proximity to turtle nesting sites on beaches in and around Point Lookout:
        - within 1.5km - maintain a 'darkness zone' with no artificial light. This can be done by using 'low pressure sodium' (LPS) lights, using natural topography, vegetation and structures to shield the beach form light at turtle eye level, and by using directional lighting to directly light downwards and away from the beach;
        - between 1.5km and 5km - measures should be taken to limit the amount of artificial light used, by confining lighting to essential purposes only, and using LPS lighting, avoiding decorative or ultraviolet lights, and designing directed and shielded lights;

(f) safe fauna movement should be provided for. This might include road treatments, exclusion fencing, funnelling fences and structures, underpass structures, lighting, speed limits and street signage. Refer to 'Fauna Sensitive Road Design; volume 1 and 2' (DTMR) for more specific guidance. Where fauna underpasses are proposed, they must be designed, constructed and furnished to facilitate the movement of target species (identified through the Ecological Assessment Report);

(g) for Koalas, the Koala-sensitive Design Guideline (DEHP) provides guidance on appropriate measures to avoid and minimise impacts of development on koala movement;

(h) buffers may be used for a number of different reasons, for example to allow for fauna movement, to protect an existing habitat area, to protect a waterway or to protect adjacent land uses from impacts as a result of noise, light, vibration or other reason. The size of the buffer area will vary, depending on the type and scale of the development proposed, surrounding land uses and the existing natural features. The following should be used to guide the use of buffers:

  (i) buffers around waterways should provide an appropriate distance to allow for a diversity of flora species and provide for wildlife corridors, as well as accounting for any natural variation to the waterway over time (refer to Waterways and Wetlands Overlay Code);

  (ii) habitat areas being buffered should also include areas like grassland (e.g. coastal saltmarsh, claypans etc.) and foreshore areas;

  (iii) buffers should be sufficient to direct native animals away from those parts of development that potentially pose a threat and provide an effective separation between the source of the threat and habitat and movement networks;

  (iv) an effective width to minimise the edge effects[1] of weed infestation, pedestrian and vehicle access, fires, etc;

  (v) separate habitat areas from sensitive land uses. For example, sensitive land uses (e.g. childcare centres, vet clinics and retirement villages) should be located at least 300m from flying fox roost sites;

  (vi) measures should also be taken to protect identified areas of significance during the construction stage of any development, for example by ensuring safe fauna access to retained habitat in accordance with a wildlife habitat management plan (refer to section 1.3.1.3);

(5) **Corridors and enhancement planting:** Planting as part of a development could be undertaken as part of the site's landscaping, to enhance existing vegetation and habitat, or to replace habitat that was removed as part of the development. Applicants should consider at a minimum the following:

(a) ensure weed management is also undertaken;

(b) undertake regeneration, including active management to encourage regrowth of native plants from the seedbank and rootstock that exist in the soil. This can be done by stockpiling topsoil on site and later spreading it in cleared, degraded or bare areas in accordance with the ecological assessment report, or as determined through site assessment, to encourage regeneration of native plants. Topsoil contains important seed bank and plant regeneration material that may be used for regeneration at low cost following its removal from construction areas;

(c) undertake replanting, by planting seedlings or tubestock and undertaking active management to nurture them through the first twelve months (unless otherwise specified through a condition on the development approval) until they are well established;

[1] a commonly used term in ecology and related research and literature. In this context it is used to describe the impact of urban development adjoining habitat areas, and impacts that include things like physical disturbance to soil and vegetation, increased weed and exotic species, reduced fauna diversity and increased vulnerability of fauna to predation, and the impacts from things like light and noise.

(d) use native plants identified in the Redland City Council Regional Ecosystem (RE) Species Database as being suitable to the location of the planting; and,
(e) The South East Queensland Ecological Restoration Framework provides additional guidance for restoration planting and regeneration works in its 'Guideline' section.

1.4 ENVIRONMENTAL OFFSETS FOR MLES

(1) This section sets out the standards called up in AO17.1 in the Environmental Significance Overlay Code. These standards represent the acceptable outcome which meets the performance outcomes set out in the code.

1.4.1 Standards called up as acceptable outcomes

1.4.1.1 Relationship between MLES and MSES

(1) In accordance with the *Queensland Environmental Offsets Act 2014* (the Offsets Act), offsets may be required for identified matters of state environmental significance (MSES) and for matters of local environmental significance (MLES) [2]. Guidance on satisfying offset requirements for MSES can be found on the State government's offsets website.

(2) For the purposes of the Environmental Significance overlay, the matters mapped as MLES are outlined in section 1.6.

1.4.1.2 Types of offsets

(1) Offsets may be provided in accordance with the Offsets Act as either:
(a) financial settlement (calculator provided on the Queensland Government's offsets website); or
(b) land-based offsets (proponent driven).

(2) Offsets can be delivered as a combination of these, and offsets can also be provided as a 'staged offset' where the offset conditions specify this option. Staged offsets may be appropriate where a development that has a series of parts, or 'stages', and it is appropriate to deliver offsets at each stage of the development. The Queensland Environmental Offsets Policy (Version 1.2) provides more detail on delivering staged offsets.

(3) Offsets for MLES are to be calculated on the basis of 1:3 (1 tree removed: 3 trees planted). The Queensland Government's offsets website has information on how this metric is to be calculated.

(4) Land based offsets are to be provided as close as practicably possible to the development site, within the Redland City local government area.

(5) Offset restoration works are to establish a restored ecosystem which:
(a) incorporates assemblages of species replicating those in ecosystems being offset (as set out in Redland City Council's regional ecosystems species database and Appendix 1 of this policy), and taking into consideration local conditions to ensure survivability;
(b) has the potential to recruit further species by natural means;
(c) supports the same structure and function as ecosystems being offset; and
(d) do not include exotic and invasive species.

[2] s14(2)(b) of the *Environmental Offsets Act 2014* does not allow for an offset condition to be imposed on a prescribed environmental matter that is "the same, or substantially the same". Therefore, Redland City Council as the local authority cannot impose an offset where the MLES being impacted is the same prescribed environmental matter as the MSES listed in the *State Planning Policy 2014*.

1.4.1.3 Determining significant residual impact for MLES

(1) The State government's offsets policy (section 1.3) establishes a number of offsets principles and requires environmental impacts be avoided and then minimised before offsets can be considered for any remaining impact.

(2) Offsets are not always suitable. An application must comply with all of the performance outcomes in the environmental significance overlay code in order to comply. There may be instances where an offset is not sufficient to warrant approval.

(3) The ecological report (section 1.3.1.1 of this policy) should be used to demonstrate where environmental impacts have been avoided and minimised. It should also include details on the significant residual impact proposed to be offset.

(4) The following outlines the criteria to determine significant residual impact for MLES. This reflects the State guidelines used to assess significant residual impacts on MSES, adapted to apply to MLES.

(5) An action will have a significant residual impact on MLES if the action is likely to:
- (a) reduce the extent of the occurrence of a locally significant species;
- (b) lead to a decrease in the size of the local population of a locally significant species;
- (c) fragment an existing population for a locally significant species;
- (d) result in genetically distinct populations forming as a result of habitat isolation;
- (e) result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species habitat;
- (f) introduce disease that may cause a locally significant species population to decline;
- (g) interfere with the recovery of a locally significant species; or
- (h) cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a locally significant species.

(6) On-site mitigation is not considered an offset under the Environmental Offsets Act 2014.

1.4.2 Information the Council may request

1.4.2.1 Land based offsets management plan

(1) Where land based proponent driven offsets are proposed (either on private land or public land), a management plan is to be prepared which includes details (including costing) specifying:
- (a) written agreement with the landowner (if relevant);
- (b) how weeds and pests will be removed and prevented from re-infestation
- (c) management actions to reduce risk from hazards (e.g. fire and flood);
- (d) proposed maintenance periods;
- (e) regular auditing and reporting to be undertaken by the proponent;
- (f) ongoing management arrangements once the offset is established and the site/land has been legally secured;
- (g) time frames within which the offset is to reach the desired ecosystem species diversity and community structure; and
- (h) the conservation outcome to be achieved and how the outcome will be determined or measured and by whom (should be an appropriately qualified restoration ecologist and botanist).

1.4.3 Guidance for applicants

1.4.3.1 General

(1) Details of proposed offsets must be included with a development application. The State government provides a series of forms that can also be used for MLES offsets to assist applicants to work through and enter into an agreement with Redland City Council, including how to deliver offsets.

1.4.3.2 How to find a receiving site

(1) Once it has been determined by the applicant that there is a need for an offset, Council can assist in determining if a suitable receiving site is available. If an offset is not suitable or an offset site is not available, the proposal will need to be revised to reduce the level and/or area of impact or an alternative offset type provided.

(2) A Notice of Election will need to be prepared by the applicant which outlines how the offset is to be delivered and includes supporting information such as:
- (i) financial settlement details, and/or
- (ii) offset delivery plan
- (iii) offset area details (including how the offsets area is proposed to be secured in perpetuity)
- (iv) habitat quality details; and,
- (v) staged offset details (if relevant).

(3) The South East Queensland Ecological Restoration Framework provides further guidance relevant to the establishment of offset areas.

1.4.3.3 More information

(1) The State government has already drafted a number of supporting documents to guide applicants in determining what offsets they might be required to provide, and how those offsets are to be provided. Below is a summary of this offset framework:

Document	Summary
Environmental Offsets Act	Provides the framework for what an offset is and how it is to be delivered. Identifies the legal security mechanisms that may be used for offsets including the new 'environmental offset protection area' designation Establishes a head of power for the supporting regulation and offset policy
Environmental Offsets Regulation	Lists prescribed activities and prescribed environmental matters that may be subject to offset assessment requirements Provides further detail on other Act provisions.
Queensland Environmental Offsets Policy	Provides requirements for impacts on prescribed environmental matters Impacts on protected areas Advanced offsets Strategic offset investment corridors Outlines the types of offset delivery Describes direct benefit management plans
Queensland Environmental Offsets Policy Significant Residual Impact Guideline	Provides criteria for determining 'significant impact' sorted by prescribed environmental matters.

Draft guide to determining terrestrial habitat quality	Provides a step-by-step methodology explaining how to measure habitat quality for land-based offsets.

1.5 CLEARING

The tables of assessment in Section 5.10 'Environmental Significance overlay' make clearing assessable in certain circumstances. In some circumstances, a threshold is provided, and clearing below that threshold is not assessable development.

1.5.1 Guidance for applicants

(1) To calculate whether or not the application will trigger assessment against the Environmental Significance Overlay code, an applicant will need to calculate the area of vegetation being cleared. The area of vegetation being cleared may be a contiguous patch of vegetation, or a number of scattered trees, or a combination of both.

(2) If the development is over two or more property boundaries, the clearing thresholds apply to the whole development site, rather than applying to each individual property.

(3) The method to be used to calculate the clearing thresholds is the canopy cover method.

(4) The canopy cover method is based on measuring the canopy cover on an aerial photo using an appropriately calibrated GIS measuring tool and marking the canopy cover accurately on the ground.

(5) For clearing areas which approach the assessable clearing thresholds a licensed surveyor is to be engaged to accurately plot the area to be cleared.

(6) The area to be cleared relates to the extent of native vegetation. The planning scheme is concerned with the full canopy cover of the native vegetation whether or not exotic vegetation may co-exist within that area.

1.6 OVERLAY MAPPING AND DATA SOURCES

1.6.1 Guidance for applicants

(1) The Environmental Significance Overlay in City Plan 2015 has been developed in accordance with the State Planning Policy July 2014 (SPP).

(2) Matters of State environmental significance (MSES) were mapped using the State government databases supporting the SPP, in accordance with the SPP definition of MSES. These include:
- (i) wildlife habitat;
- (ii) regulated vegetation;
- (iii) protected areas;
- (iv) regrowth and remnant koala habitat;
- (v) urban trees that provide koala habitat; and
- (vi) regional ecosystems (including remnant and regrowth vegetation).

(3) This data is available on Redland City Council's website.

(4) There were some matters that, while defined as MSES, maps were not provided by the State. In these instances Council data has been used.

(5) Redland City Council also used improved mapping of habitat and vegetation on the mainland. This included locally refined mapping of urban koala trees and remnant and

regrowth regional ecosystems[3] and particular species (both flora and fauna).The regional ecosystem mapping was created by specialist ecological experts engaged by Council, using LiDAR, aerial photo interpretation as well as field data from a tailored field investigation.

(6) In accordance with the State's SPP and offsets framework the koala habitat and regional ecosystems are MSES. The remaining mapped values are matters of local environmental significance (MLES). Generally, MLES can be described as habitat for particular species (refer to 'locally significant species' in Appendix 1).

(7) Both MLES and MSES are dealt with in the same way in the Environmental Significance Code. However, offsetting requirements may differ (refer to section 1.4 of this planning scheme policy).

(8) Some areas mapped as MLES in the overlay may be found to have the attributes of MSES following more detailed investigation. In this event, these values are treated as MSES.

(9) Within urban areas[4] vegetation on lots less than 1000m^2 have not been included in the overlay, other than where the land is zoned for recreation and open space, conservation or environmental management.

[3] Urban koala habitat was mapped where the RE type that is present includes koala food tree species, drawn from the Australian Koala Foundation's *National Koala Tree Protection List; Recommended Tree Species for Protection and Planting of Koala Habitat,*

[4] Refer to the, section 1.7.3 of the planning scheme for a definition of the urban area.

Appendix 1 - Locally significant species

Species ID	Species Number	Kingdom	Family	Scientific_ Name	Common_ Name	Type	Status				RE habitat description	Non-RE habitat description	Non RE	Regional Ecosystems
							EPBC Act	NC Act	Back On Track	Endemic				
484	SP001	Plant	Mimosaceae	*Acacia baueri* subsp. *baueri*	Tiny Wattle	flora		V	H		Low Dry to Moist Wallum Heath			12.2.5,12.2.9,12.2.12,12.2.13,12.3.13,12.5.9
8	SP002	Animal	Accipitridae	*Accipiter novaehollandiae*	Grey/White Goshawk	fauna		NT			Wooded habitats, sparse in region - concentrated on Mt Cotton - Sheldon			12.11.10,12.11.3,12.3.1,12.11.23,12.5.2,12.2.5,12.11.5k,12.11.5e,12.3.3d,12.2.6,12.9-10.19a,12.11.3,12.11.5j,12.9-10.17d,12.2.8,12.3.11,12.5.3,12.11.3a,12.11.5a,12.11.23,12.9-10.4,12.3.11a,12.5.6c,12.9-10.17c
12	SP003	Animal	Orchidaceae	*Acrodipsas illidgei*	Illidge's ant-blue butterfly	fauna		V	C		*Casuarina glauca* and adjacent mangrove areas			12.1.1,12.2.5,12.2.6,12.2.7,12.2.8,12.2.9,12.2.10,12.3.1,12.3.5,12.3.6,12.3.11,12.5.2,12.5.3,12.9-10.4,12.11.3,12.11.23,12.12.14
13	SP004	Animal	Limnodynastidae	*Adelotus brevis*	Tusked Frog	fauna		V			Waterways and temporary and permanent pools		waterbody	12.1.1,12.2.1,12.2.2,12.2.5,12.2.6,12.2.7,12.2.8,12.2.9,12.2.10,12.2.12,12.2.13,12.3.1,12.3.5,12.3.6,12.3.11,12.3.13,12.5.2,12.5.3,12.9-10.4,12.11.3,12.11.10,12.11.23,12.12.14
611	SP005	Plant	Blandfordiaceae	*Blandfordia grandiflora*	Large Christmas Bell	flora		E	H		Moist to Wet Wallum Heath			12.2.12,12.3.13
66	SP006	Animal	Cacatuidae	*Calyptorhynchus lathami*	Glossy Black Cockatoo	fauna	E	V			*Allocasuarina* spp. and *C. glauca*			12.1.1,12.2.5,12.2.6,12.2.7,12.2.8,12.2.10,12.3.1,12.3.5,12.3.6,12.3.11,12.5.2,12.5.3,12.9-10.4,12.11.3,12.11.23,12.12.14
2081	SP007	Animal	Charopidae	*Charopid* BR38	A Land Snail	fauna				X	Eucalypt forest to Woodland containing *Eucalyptus racemosa* on Coastal Sands			12.2.10,12.2.6,12.2.8,12.2.1
723	SP008	Plant	Sparrmanniaceae	*Corchorus cunninghamii*	Native jute or Cunninghams jute	flora	E	E			Margins of Rainforest and Tall Eucalypt Forest			12.11.10,12.11.3,12.11.5,12.11.2
120	SP009	Animal	Myobatrachidae	*Crinia tinnula*	Wallum Froglet	fauna		V	H		Acid swamps and depressions			12.2.5,12.2.7,12.2.9,12.2.10,12.2.12,12.2.15,12.3.5,12.3.6,12.5.10
846	SP010	Plant	Rubiaceae	*Durringtonia paludosa*	Durringtonia	flora		N	C		Wet Wallum Heath and on Margins of Swamp Sclerophyll Forest E. robusta			12.2.5,12.2.7,12.2.12,12.2.15,12.3.4
861	SP011	Plant	Cyperaceae	*Eleocharis difformis*	Sunmerged Spikerush	flora		E		X	Submerged aquatic plant in Perched and Window Lakes restricted to Lacustrene wetlands 12.2.15a and 12.2.15f			12.2.15,12.2.15a,12.2.15f
470	SP012	Animal	Ciconiidae	*Ephippiorhynchus asiaticus*	Black-necked Stork	fauna		NT			Wetlands, rare visitor			12.1.1,12.1.2,12.1.3,12.2.12,12.2.15,12.2.15f,12.2.5,12.2.5a,12.2.7,12.3.11,12.3.13,12.3.5,12.3.6,12.3.8,12.5.9
51	SP013	Animal	Burhinidae	*Esacus magnirostris*	Beach Stone Curlew	fauna		V	H		Dunes, beaches		beach	12.2.14,12.2.16,12.2.9,12.2.10,12.2.13,12.2.7
955	SP014	Plant	Orchidaceae	*Genoplesium* sp. (Raby Bay J.Elsol AQ462423)	Raby Bay Midge Orchid	flora				X	Eucalypt forest to Woodland containing *Eucalyptus racemosa*			12.5.3,12.9-10.4,12.11.5j,12.12.14
2082	SP015	Animal	Charopidae	*Gyrocochlea myora*	Myora Springs Snail	fauna				X	Moist Coastal Forests including Littoral Rainforest			12.2.6

Species ID	Species Number	Kingdom	Family	Scientific_ Name	Common_ Name	Type	Status				RE habitat description	Non-RE habitat description	Non RE	Regional Ecosystems
							EPBC Act	NC Act	Back On Track	Endemic				
203	SP016	Animal	Haematopodidae	*Haematopus fuliginosus*	Sooty Oystercathcer	fauna		NT			Rocky coasts, coarse beaches		beach	12.2.14,12.12.19
393	SP017	Animal	Rallidae	*Lewinia pectoralis*	Lewin's Rail	fauna		NT			Riparian - with cover			12.1.1,12.1.2,12.1.3,12.2.12,12.2.15,12.2.15f,12.2.5,12.2.5a,12.2.7,12.3.11,12.3.13,12.3.5,12.3.6,12.3.8,12.5.9,12.3.1,12.3.11a
2083	SP018	Animal	Hylidae	*Litoria cooloolensis*	Cooloola Sedgefrog	fauna		NT			Sandy coastal freshwater lakes and stream - North Stradbroke Island			12.2.1,12.2.7,12.2.15
2084	SP019	Animal	Hylidae	*Litoria freycineti*	Freycinet's Frog	fauna		V			Open, vegetated coastal swamps and depressions			12.2.2,12.2.5,12.2.7,12.2.12,12.2.13,12.2.15,12.3.5,12.3.6,12.3.13,12.5.9,12.9-10.22
2085	SP020	Animal	Hylidae	*Litoria olongburensis*	Wallum Sedge Frog	fauna	V	V			Wallum sedgelands subject to indundation			12.2.5,12.2.7,12.2.12,12.2.15
1861	SP021	Animal	Accipitridae	*Lophoictinia isura*	Square-tailed Kite	fauna		NT			Eucalypt woodland and open forest, rare and breeding in area			12.1.1,12.2.1,12.2.2,12.2.5,12.2.6,12.2.7,12.2.8,12.2.10,12.3.1,12.3.5,12.3.6,12.3.11,12.5.2,12.5.3,12.9-10.4,12.11.3,12.11.10,12.11.23,12.12.14
1135	SP022	Plant	Proteaceae	*Macadamia integrifolia*	Macadamia	flora	V	V			Dry Rainforests and Riparian Forests			12.3.1,12.11.3,12.11.10
1136	SP023	Plant	Proteaceae	*Macadamia tetraphylla*	Rough Shelled Macadamia	flora	V	V			Rainforests and Riparian Forests			12.11.10,12.3.1
2086	SP024	Plant	Apocynaceae	*Marsdenia coronata*	Slender Milk Vine	flora	V	V			Eucalypt Forests to Woodlands and Rainforest Margins Particularly associated with Lophostemon confertus in Whipstick Growth Habit (see BAAM point records at Mt Cotton Quarry)			12.3.11,12.11.3,12.11.10,12.11.5e
2087	SP025	Plant	Apocynaceae	*Marsdenia longiloba*	Clear Milk Vine	flora	V	V			Moist Tall Open Forest and rainforest margins (see BAAM point records at Mt Cotton Quarry)			12.11.10,12.11.3,12.11.23,12.3.8,12.3.2
2088	SP026	Plant	Juncaginaceae	*Maundia triglochinoides*	Maundia	flora		V			Wetlands including Paperbark Swamps Found At Karawatha and Woodforde	Wetland Mapping including Non Rem but only good quality so not used in waterbody designation		12.2.5a,12.2.7,12.3.5,12.3.5a,12.3.6
1557	SP027	Plant	Myrtaceae	*Melaleuca irbyana*	Swamp Tea-tree	flora		E	H		Woodland to Open forests on plains to riparian areas partiularly on sedimentary soils LZ 10			12.3.3,12.3.6,12.9-10.19a,12.9-10.17c

Species ID	Species Number	Kingdom	Family	Scientific_ Name	Common_ Name	Type	Status				RE habitat description	Non-RE habitat description	Non RE	Regional Ecosystems
							EPBC Act	NC Act	Back On Track	Endemic				
2089	SP028	Animal	Meliphagidae	*Melithreptus gularis*	Black-chinned Honeyeater	fauna		NT			Eucalypt woodland and open forest, occasional visitor			12.2.5,12.2.6,12.2.8,12.3.3d,12.3.11,12.3.11a,12.5.2,12.5.3,12.5.6c,12.9-10.4,12.9-10.17c,12.9-10.17d,12.9-10.19,12.11.3,12.11.5a,12.11.5e,12.11.5h,12.11.5k,12.11.23,12.12.14
2090	SP029	Animal	Percichthyidae	*Nannoperca oxleyana*	Oxleyan Pygmy Perch	fauna	E	V	C		Pristine watercourses in wallum			12.1.1,12.1.2,12.1.3,12.2.12,12.2.15,12.2.15f,12.2.5,12.2.5a,12.2.7,12.3.11,12.3.13,12.3.5,12.3.6,12.3.8,12.5.9,12.3.1,12.3.11a
2091	SP030	Animal	Anatidae	*Nettapus coromandelianus*	Cotton Pigmy Goose	fauna		NT			Wetlands, occasional			12.1.1,12.1.2,12.1.3,12.2.12,12.2.15,12.2.15f,12.2.5,12.2.5a,12.2.7,12.3.11,12.3.13,12.3.5,12.3.6,12.3.8,12.5.9
1551	SP031	Animal	Strigidae	*Ninox strenua*	Powerful Owl	fauna		V			Larger bushland areas containing patches of moderately dense cover			12.1.1,12.2.1,12.2.2,12.2.5,12.2.7,12.2.8,12.3.1,12.3.5,12.3.11,12.5.3,12.9-10.4,12.11.3,12.11.10,12.11.23
300	SP032	Animal	Scolopacidae	*Numenius madagascariensis*	Eastern Curlew	fauna		NT			Mudflats		intertidal_ flat	12.1.2,12.1.3
1198	SP033	Plant	Asteraceae	*Olearia hygrophila*	Swamp Daisy	flora	E	E		X	Wet Wallum Heath and on Margins of Swamp Sclerophyll Forest E. robusta			12.2.7,12.3.4
2092	SP034	Animal	Papilionidae	*Ornithoptera richmondia*	Richmond Birdwing Butterfly	fauna		V	H		Rainforest associated with Pararistolochia praevenosa			12.11.10,12.3.1
2022	SP035	Plant	Polygonaceae	*Persicaria elatior*	Glandular Knotweed	flora	V	V			Wetlands and Swamp Forests	Wetland Mapping including Non Rem		12.2.15,12.3.4,12.3.5,12.3.6,12.3.8
1260	SP036	Plant	Orchidaceae	*Phaius australis*	Southern Swamp Orchid	flora	E	E	C		Swamp Forests especially those with rainforest elements in understorey where fires are less intense			12.2.5,12.2.7
1261	SP037	Plant	Orchidaceae	*Phaius bernaysii*	Yellow Swamp Orchid	flora	E	E	C	X	Swamp Forests especially those with rainforest elements in understorey where fires are less intense			12.2.7,12.3.4,12.3.5
2033	SP039	Plant	Orchidaceae	*Prasophyllum exilis*	Thin Leek Orchid	flora		NT			Wallum Heath			12.2.12,12.3.13,12.2.9,12.2.10,12.2.6
403	SP040	Animal	Rostratulidae	*Rostratula australis*	Australian Painted Snipe	fauna	V	V			Wetland edges, edge vegetation			12.1.1,12.1.2,12.1.3,12.2.12,12.2.15,12.2.15f,12.2.5,12.2.5a,12.2.7,12.3.11,12.3.13,12.3.5,12.3.6,12.3.8,12.5.9
1397	SP041	Plant	Cyperaceae	*Schoenus scabripes*	Rough Bog Sedge	flora		NT			Wallum Heath to Woodland and Wet Wallum			12.2.12,12.2.15,12.3.5,12.3.13
418	SP042	Animal	Laridae	*Sternula albifrons*	Little Tern	fauna		E	H		None	Sand banks	sandbank	
425	SP043	Animal	Anatidae	*Stictonetta naevosa*	Freckled Duck	fauna		NT			Wetlands, rare visitor			12.1.1,12.1.2,12.1.3,12.2.12,12.2.15,12.2.15f,12.2.5,12.2.5a,12.2.7,12.3.11,12.3.13,12.3.5,12.3.6,12.3.8,12.5.9

Species ID	Species Number	Kingdom	Family	Scientific_ Name	Common_ Name	Type	Status				RE habitat description	Non-RE habitat description	Non RE	Regional Ecosystems
							EPBC Act	NC Act	Back On Track	Endemic				
1465	SP044	Plant	Thelypteridaceae	*Thelypteris confluens*	Marsh Fern	flora		V			Swamps and Wetlands in Coastal Dunes			12.2.15
2094	SP045	Plant	Santalaceae	*Thesium australe*	Austral Toadflax	flora	V	V			Grasslands Woodlands and Forests associated with Themeda triandra as it parisitises the roots of this grass			12.12.19,12.3.11,12.5.2
462	SP046	Animal	Tytonidae	*Tyto tenebricosa*	Greater Sooty Owl	fauna		NT			Closed forests [debateable whether this should be included]			12.2.1,12.2.2,12.3.1,12.11.10
471	SP047	Animal	Muridae	*Xeromys myoides*	False water rat	fauna	V	V	C		Tidal areas away from human habitation			12.1.1,12.1.2,12.1.3,12.2.5,12.2.6,12.2.7,12.2.8,12.2.9,12.2.10,12.2.12,12.2.13,12.2.15,12.3.1,12.3.5,12.3.6,12.3.8,12.3.11,12.3.13,12.5.2,12.5.3,12.5.9,12.9-10.4,12.11.3,12.11.23,12.12.14,12.12.19
2095	SP048	Plant	Orchidaceae	*Pterostylis chaetophora*	Bug Lipped Greenhood Orchid	flora		E			Grassy and shrubby areas in open forest and woodland known from Cedar Ck Falls Near Mt Tamborine and Coochiemudlo Is			12.5.3

PLANNING SCHEME POLICY 2 – INFRASTRUCTURE WORKS

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1.0 HEALTHY WATERS

1.1 RELATIONSHIP WITH THE PLANNING SCHEME

(1) This part sets out:

(i) particular standards called up as acceptable outcomes in 9.2.5 Healthy Waters Code. These are contained in the following subsections:
1.2.1 Stormwater drainage design

(ii) information council may request to demonstrate compliance with the performance outcomes of the code. These are contained in the following subsections:
1.2.2 Stormwater quantity management plans
1.3.1 Stormwater quality management plans
1.4.2 Artificial waterbody (AWB) assessment
1.5.2 Erosion and sediment control assessment

(iii) guidance for applicants on approaches to stormwater management and erosion and sediment control. These are contained in the following subsections:
1.2.3 Upstream connections
1.3.2 Water quality
1.4.2 Artificial waterbodies
1.5.2 Erosion and sediment control

1.2 STORMWATER DRAINAGE DESIGN

1.2.1 Standards called up as acceptable outcomes

This section sets out the standards called up in AO1.2, AO3.1 and AO6.1 in the Healthy Waters Code. These standards represent the “acceptable outcome” which meets the performance outcomes set out in the code.

1.2.1.1 General

(1) Stormwater drainage is designed using the following standards unless otherwise specified or modified by the requirements set out in this section:

- Queensland Urban Drainage Manual (current edition)
- Australian Rainfall and Runoff (current edition)

(2) Use of the standard drawings in section 8 of this policy will be deemed to satisfy the acceptable outcomes required by QUDM, unless otherwise specified or modified by the requirements set out in this section.

(3) The following standards can be used where the standards listed above do not provide adequate information to satisfy the requirements of stormwater drainage design unless otherwise specified or modified by the requirements set out in this section:

- Austroads Guide to Road Design Part 5: Drainage - General and Hydrology Considerations (current edition).

(4) The minimum pipe size for all stormwater infrastructure to be transferred into council ownership is 375mm diameter.

(5) Where scour protection around structures is required it must be in the form of grouted stone pitching.

(6) Private inter-allotment drainage is restricted to a maximum of 4 allotments after which it must discharge to a lawful point of discharge (refer section 1.2.1.2 of this policy).

1.2.1.2 Lawful point of discharge

(1) In addition to section 3.4 and 3.5 of QUDM, designs that require downstream properties to accommodate stormwater flows to allow stormwater to discharge at a particular location (the lawful point of discharge) must provide written consent from downstream property owner/s and private easements over the drainage system provided in accordance with section 1.2.1.5 of this policy.

1.2.1.3 Design standards

(1) The design storm event for the minor drainage system is in accordance with Section 7.3.1 of QUDM.

(2) The design storm event for the major drainage system is the 1% annual exceedance probability (AEP) (100 year ARI).

1.2.1.4 Hydrology and hydraulics

(1) Increased runoff from a development site must be mitigated on site unless it can be demonstrated that there is capacity within the existing stormwater network or at the lawful point of discharge to cater for the additional runoff in the major design storm event (1% AEP).

(2) Design calculations are undertaken in accordance with the requirements in Section 4 of QUDM unless otherwise specified below.

(3) Where determining the time of concentration in urban and rural catchment areas the following applies:
- (i) the kinematic wave equation is not to be used to estimate overland flow time;
- (ii) unless the actual velocity in the piped drainage system is determined, the adopted pipe velocity must not be less than 3m/s for the purpose of estimating pipe travel time; and,
- (iii) for small open creek catchments (<100 ha), minor channel or creek flow times may be initially determined by assuming an average stream velocity of 1.5 m/s.

1.2.1.5 Easements

(1) Easements over stormwater drainage are in accordance with section 3.8 of QUDM unless otherwise specified below.

1.2.1.5.1 Easements in favour of Council

(1) Stormwater drainage infrastructure to be transferred into council ownership is to be located on council managed land that has direct access from adjoining council managed land or a road reserve and should not rely on drainage easements.

(2) In circumstances where this is not possible and council stormwater infrastructure must be located on private property, the following easements in favour of Council are required:

- (i) for single pipes 375mm-900mm (inclusive) in diameter, a minimum 3m wide easement;

- (ii) for pipes larger than 900mm in diameter, multi-cell pipes or box culverts, an easement that allows 1m clearance from the outside edge of the pipe/culvert on both sides, or 3m total easement width, whichever is the greater;

(iii) for easements over open drains or channels, a width which can accommodate maintenance berms along the top of the channel in accordance with section 9.7.2 of QUDM;

(iv) for overland flow paths, a width which accommodates the full design flow width and takes into account freeboard.

(3) Where Council stormwater infrastructure is located within private property and access from a road reserve is not available, a 3.0m wide access easement is provided between the road reserve and the drainage easement to provide maintenance access to the infrastructure.

1.2.1.5.2 Private easements

(1) For inter-allotment drainage (where required in accordance with section 7.13.3 of QUDM), a private easement minimum 1.5m wide is required over the drainage in favour of upstream property owners.

1.2.1.6 Safety fencing

(1) Safety fencing is provided in accordance with sections 5.11 and 12.4 of QUDM unless otherwise specified below.

(2) Safety fencing in accordance with IPWEA standard drawing GS-044 is to be provided for hard drainage structures where a fall of 1m or more could be reasonably expected.

1.2.1.7 Alignment

(1) Where stormwater drainage infrastructure is located within the road reserve it is in accordance with standard drawings R-RCC-9 and R-RCC-10, in all other circumstances infrastructure should be located:
(a) generally within the properties they serve;
(b) 0.7 metres to 1.2 metres (measure from the centre of access chambers) from property boundaries, clear of fences and sewer maintenance holes;
(c) for connection points, located 0.5 metres to 1.0 metres from the lowest property boundary; and,
(d) for inter-allotment drainage, 0.5 metres from the side and rear property boundaries.

(2) Gully pits are located as required in accordance with QUDM and generally on the projection of the lot side boundaries.

1.2.1.8 Overland flow

(1) The width of overland flow paths located between lots or within park land is a minimum of 15 metres and should be determined by the calculation of the flows during the major storm event (1% AEP) for the contributing catchment.

1.2.2 Information that Council may request

This section sets out information that Council may request to demonstrate compliance with the performance outcomes for stormwater drainage design in the Healthy Waters Code.

1.2.2.1 Stormwater quantity management plan

(1) A stormwater quantity management plan may be required to demonstrate how stormwater will be managed within a catchment where development is likely to alter the stormwater runoff, volume, velocity, duration or frequency.

(2) Stormwater management plans should be prepared in accordance with Section 2 of QUDM unless otherwise specified below.

(3) All stormwater drainage investigations and designs must be undertaken by a suitably qualified Registered Professional Engineer Queensland (RPEQ).

(4) An electronic copy of all modelling files used to demonstrate compliance with the design objectives must be provided to the council with the development application.

1.2.2.2 Concept site-based stormwater quantity management plan

(1) A conceptual site based stormwater management plan must include:
- (a) an assessment of the site which includes:
  - (i) a site plan showing:
    - contours;
    - development boundaries;
    - catchment details (including sub-catchments where relevant);
    - flow paths;
    - existing and proposed drainage infrastructure;
    - overland flow path areas;
    - drainage invert levels;
    - stormwater detention systems;
    - easements;
    - the lawful point of discharge;
    - flood levels for the 10, 5, 2 and 1% AEP flood;
    - details of the proposed impervious/pervious surfaces (%)
  - (ii) earthworks details including:
    - conceptual earthworks;
    - cross-sections at regular intervals showing the extend of cut and fill works to confirm earthworks and no loss of floodplain storage (where relevant);
  - (iii) development scale plan layout indicating:
    - catchment details;
    - conceptual drainage network with invert levels;
    - location of stormwater treatment/detention measures;
    - location of other existing and proposed services;
  - (iv) information on pre and post development flood volumes.

- (b) the lawful point of discharge (including consent from downstream properties where required);
- (a) proposed no-worsening measures;
- (b) the pre-development and post-development stormwater quantity characteristics and any potential development impacts assessed;
- (c) a description of the modelling method and methodology used in any hydraulic or hydrologic modelling, or in the sizing of infrastructure;
- (d) a description of all stormwater and overland flow management measures and stormwater infrastructure; and,
- (e) future ownership details of stormwater and drainage infrastructure.

1.2.2.3 Detailed site-based stormwater quantity management plan

(1) In addition to 1.2.2.2 above, a detailed site based stormwater management plan must include:
- (a) a detailed design of all stormwater quantity management methods and infrastructure;
- (b) the location and connection details;
- (c) detailed engineering drawings showing:

(i) the areas of earthworks including cross-sections at regular intervals showing the extend of cut and fill works to confirm earthworks and no loss of floodplain storage (where relevant);
(ii) proposed site contours, road layout and lot arrangement;
(iii) location, size and type of proposed stormwater quantity management measures including all invert levels;
(iv) maintenance access; and,
(v) location of lawful points of discharge.

1.2.3 Guidance for applicants

This section sets out guidance for applicants to assist in achieving compliance with PO5 (6) of the Reconfiguring a Lot Code.

1.2.3.1 Upstream connections

(1) Where a neighbouring property capable of further development upstream of the subject site falls to the rear, an easement for stormwater drainage purposes in accordance with section 1.2.1.4.2 of this policy is provided in favour of upstream properties to facilitate access to a lawful point of discharge (refer section 3.4 of QUDM for further information).

1.3 WATER QUALITY

1.3.1 Information that Council may request

This section sets out information that Council may request to demonstrate compliance with the performance outcomes for water quality in the Healthy Waters Code.

1.3.1.1 Stormwater quality management plans

(1) A stormwater quality management plan may be required to demonstrate how the development can achieve the load reduction requirements in AO9.1 of the Healthy Waters Code.

(2) Stormwater treatment devices are to be designed in accordance with the following standards:
- Water by Design Water Sensitive Urban Design Technical Design Guidelines
- Water by Design Bioretention Technical Design Guidelines
- Water by Design MUSIC Modelling Guidelines
- Water by Design Maintaining Vegetated Stormwater Assets
- Water by Design Transferring Ownership of Vegetated Assets

(3) Use of the standard drawings in section 8 of the policy will be deemed to satisfy the acceptable outcomes.

(4) In lieu of modelling, the default bio-retention treatment area to comply with load reduction targets in AO9.1 of the Healthy Waters Code is 1.5% of the contributing catchment area.

(5) A stormwater quality management plan must include:
(a) where modelling had been undertaken, an electronic copy of the MUSIC model;
(b) a summary of the MUSIC analysis results including descriptions of each treatment train for each sub-catchment;
(c) details of each treatment device including the treatment area and design flows;
(d) a scale plan and section drawings showing:
(i) how stormwater is conveyed to the stormwater treatment devices;
(ii) the location of all stormwater treatment devices including filter areas and batters;

(iii) conceptual design levels for each treatment device and receiving drainage invert levels;
(iv) scour protection and coarse sediment management devices;
(v) batters and embankments;
(vi) maintenance access;
(vii) likely maintenance intervals;

(e) details of the required monitoring and maintenance of the device;
(f) proposed measures to protect water quality during the construction phase; and,
(g) details of whether the stormwater treatment system will be privately maintained or transferred into Council ownership.

1.3.2 Guidance for applicants

(1) Stormwater treatment devices are generally not to be constructed within the road reserve.

1.4 ARTIFICAL WATERBODY ASSESSMENT

1.4.1 Information that Council may request

This section sets out information that Council may request to demonstrate compliance with PO2 in the Healthy Waters Code.

(1) Where an artificial waterbody exists within a development site and it is proposed to be retained, an assessment of the value and risk of the waterbody along with any proposed changes to the configuration of the waterbody will be required. The assessment must include the following:

(a) Determine the value of the waterbody using the Table 1 – Determining the relative value of an artificial waterbody.

Council may request an ecological report to assist in supporting the flora and fauna associations score. This report must contain (at minimum):
(i) details of any ecological corridors and connections in the area;
(ii) types of flora and fauna;
(iii) habitat value of the dam and surrounding vegetation; and,
(iv) impacts on flora and fauna.

(b) Determine the risk of the waterbody based on its current function and proposed future use using Table 2 – Determining the relative risk of an artificial waterbody.

Council may require the following to be submitted:
(a) a geotechnical report signed by an RPEQ to assist in supporting the structural integrity score;
(b) water quality testing of the parameters listed in Table 3 from a NATA qualified laboratory to assist in supporting the water quality score.

(c) Where the score for value is 14 or more and the score for risk is 9 or less, the waterbody should be retained in its current configuration and any proposed remedial works undertaken as required. Details of the proposal must be submitted to Council as part of the development application.

In all other circumstances (i.e. where the value is less than 14 and/or the risk is more than 9) the waterbody should not be retained in its current configuration. In this instance an alternative solution must be provided (refer section 1.4.2 of this policy).

Table 1: Determining the relative value of an artificial waterbody

Type of Value	Score	Criteria
Connectivity	7	The waterbody provides an essential link for ecological connectivity and native wildlife movement.
	4	The waterbody provides a desirable/potential link for ecological connectivity and/or native wildlife movement.
	1	The waterbody provides no ecological connectivity and does not provide a functional corridor for native wildlife movement.
Flora and Fauna Associations	7	The waterbody provides essential flora and fauna associations which must be maintained.
	4	The waterbody provides flora and fauna associations which are desirable to be maintained.
	1	The waterbody provides low/no flora and fauna associations.
Amenity	5	The waterbody in its current configuration provides the community with an asset that can be used for passive recreation.
	3	The waterbody in its current configuration (or as a result of rectification works proposed) will provide the community with an asset that can be used for passive recreation.
	1	The waterbody provides a low level of amenity and would not be an asset to the community.

Note: Waterbodies to be retained in their current configuration must be high value and low risk.

Table 2: Determining the relative risk of an artificial waterbody

Type of Risk	Score	Criteria
Structural Integrity	5	The waterbody is not structurally sound.
	1	The waterbody is structurally sound or works proposed will ensure the waterbody is structurally sound and can be certified as such.
Water Quality	5	Water quality is within the acceptable range for all testing parameters.
	3	Water quality is within the acceptable range for the majority of the testing parameters or remedial works can be undertaken to ensure that the water quality is within the acceptable range for the majority of the testing parameters.
	1	Water quality is not within the acceptable range for most testing parameters.
Safety	5	When assessed against the method outlined in Appendix A of *Rectifiying Vegetated Stormwater Assets* (Water by Design), a score of 22 or more is achieved.
	4	When assessed against the method outlined in Appendix A of *Rectifiying Vegetated Stormwater Assets* (Water by Design), a score of 17-21 is achieved.
	3	When assessed against the method outlined in Appendix A of *Rectifiying Vegetated Stormwater Assets* (Water by Design), a score of 12-16 is achieved.
	2	When assessed against the method outlined in Appendix A of *Rectifiying Vegetated Stormwater Assets* (Water by Design), a score of 7-11 is achieved.
	1	When assessed against the method outlined in Appendix A of *Rectifiying Vegetated Stormwater Assets* (Water by Design), a score of less than 7 is achieved.
Maintenance Access	5	Appropriate maintenance access is not and cannot be provided.
	3	Appropriate maintenance access is (or will be) provided to three or fewer of the following: inlets, outlets, body of water and perimeter of the waterbody.
	1	Appropriate maintenance access is (or will be) provided to all of the inlets, outlets, body of water and perimeter of the waterbody.
Weeds and Pests	5	The waterbody contains declared weeds and/or pests.
	3	The waterbody contains weeds and/or pests and works are proposed to remove these weeds and/or pests.
	1	The waterbody contains no weeds or pests.

Note: Waterbodies to be retained in their current configuration must be high value and low risk.

Table 3: Water quality indicators for artificial waterbodies

Total N (ug/L)	Total P (ug/L)	Chl-a (ug/L)	Do % sat	Turb (ug/L)	pH	Cond (uS/com)
720	28	9	57-90	5-10	6.3-7.1	167

1.4.2 Guidance for applicants

(1) Where an artificial waterbody exists within the limits of a development, consideration should be given as to whether the waterbody can be reconfigured to form part of the stormwater drainage design and/or treatment using the criteria outlined in Table 2.7 of the *Water by Design Waterbody Management Guideline 2013 Module 2*.

(2) Where a waterbody is not retained in its current configuration, details of the proposed changes to the waterbody should be provided to Council including an assessment of:
   (a) any impacts to the surrounding environment as a result of the works associated with the proposal including during the construction phase as well as long term as a result of changes to the existing waterbody;
   (b) any downstream impacts associated with the removal/reconfiguration of the waterbody; and,
   (c) the expected whole-of-life maintenance requirements.

1.5 EROSION AND SEDIMENT CONTROL

1.5.1 Information that Council may request

This section sets out information that Council may request to demonstrate compliance with the performance outcomes for erosion and sediment control in the Healthy Waters Code.

(1) Erosion and sediment control is to be undertaken in accordance with the following standard:

- IECA (2008) - Best Practice Erosion and Sediment Control published by the International Erosion Control Association (Australasian Chapter).

1.5.1.1 Erosion Hazard Assessment (EHA)

(1) An erosion hazard assessment must be undertaken to determine the degree of risk and to identity the documents required to be submitted to Council.

(2) The erosion hazard assessment should be undertaken in accordance with Appendix A of this policy and must be undertaken by a person with suitable qualifications or experience in erosion and sediment control, which include:
   (i) completed training or qualifications in soil erosion and sediment control such as an advanced specialised training course in erosion and sediment control, provided under the auspices of a reputable body such as the International Erosion Control Association (IECA); or
   (ii) professional affiliation with engineering, soil science or scientific organisation (e.g. International Erosion Control Association, Engineers Australia, Australian Water Association, Stormwater Industry Association); or
   (iii) at least two years' experience in the management of erosion and sediment control that can be verified by an independent third party.

(3) Where low erosion risk is identified, best practice erosion and sediment control must be implemented in accordance with IECA (2008) (to assist refer to IECA – Book 5 – Field Guide).

(4) Where a medium or high degree of risk is identified, a concept erosion and sediment control plan should be submitted at the operational works application stage.

1.5.1.2 Erosion and Sediment Control Plan/Program

1.5.1.2.1 General

(1) The erosion and sediment control assessment process (in regard to submission of documentation to Council) is depicted in Table 3 below.

Table 3: The erosion and sediment control (ESC) assessment process

Prior to lodging an application		At application Stage	5 days prior to the pre-start meeting or works commencing, whichever is the sooner.	During construction
Determine erosion risk by conducting an EHA	Low Risk Site	Submit EHA forms	No further action	Follow IECA – BPESC document and refer to field guides
	Medium Risk Site	Submit EHA forms and concept ESC plan	Submit ESC program prepared by an RPEQ[1] or CPESC Provide contact details[2]	Provide inspection certificates at hold points as conditioned in development approval and/or at the request of Council. The inspection certificate must be certified by an RPEQ[1] or CPESC.
	High Risk Site	Submit EHA forms and concept ESC plan	Submit ESC program prepared by an RPEQ[1] or CPESC & certified by a CPESC Provide contact details[2]	Provide inspection certificates at hold points as conditioned in development approval and/or at the request of Council. The inspection certificate must be certified by an RPEQ[1] and a CPESC.

EHA - Erosion hazard assessment,
IECA - International erosion control association
CPESC - Certified professional in erosion and sediment control
BPESC - Best practice erosion and sediment control

1.5.1.2.2 Concept erosion and sediment control plan

(1) A concept erosion and sediment control plan must demonstrate the following:
- (a) the design, intensity, configuration and establishment of development is compatible with the physical constraints of the site and receiving environment;
- (b) the feasibility of effective erosion and sediment control measures being implemented is substantiated, throughout construction including consideration of the impacts of the overall development until permanent stabilisation of the site occurs;
- (c) overview strategy for the site outlining the sequence of development, and temporary and permanent management mechanisms, until commissioning of permanent design features (staging summary);
- (d) whether sediment control devices will be located within the future stormwater treatment systems (i.e. bioretention basins and wetlands); and

[1] Where engineering structures (either temporary or permanent) such as inlets, outlets, spillways and sediment basin embankments form part of an Erosion an Sediment Control Plan/Program, the design certification and inspection of such structures must be undertaken and certified by a Registered Professional Engineer of Queensland (RPEQ).
[2] The name and contact details of the landowner, superintendent and principal contractor must be provided including the registered business name and ABN/ACN for each party and after hours contact details of a representative of the site. Any changes to these parties during construction must be notified to Council in writing within 5 business days of the change occurring.

(e) a contoured site plan(s) showing a conceptual treatment train, the natural features of the site and proposed control structures, including the proposed location and preliminary size of:
  (i) area of disturbance;
  (ii) stockpiling locations;
  (iii) external catchment diversions;
  (iv) sediment basins;
  (v) channels which convey site runoff to sediment basins; and
  (vi) compensatory erosion and sediment controls for areas which cannot be drained to the sediment basin.

(2) Additional information requirements are listed in Table 4.

Table 4: Additional requirements of the concept erosion and sediment control plan

Where	Demonstrate
Located within a waterway corridor mapped within the relevant overlay maps of the planning scheme	• How impacts on the waterway have been minimised through appropriate route selection and type of crossing and how construction of the crossing will be managed in accordance with the IECA 2008, Best Practice Erosion and Sediment Control – Appendix I.
External contributing stormwater catchment area of 1 ha or greater.	• That clean stormwater from up-slope external catchment(s) can be diverted around or through the site without causing either an increase in sediment concentration of the flow, or erosion on site or off site. Alternatively, if it is not feasible to divert clean stormwater from up-slope external catchment(s) around or through the site, the Concept ESC Plan must demonstrate that there is sufficient land area available to install and operate a sediment basin which is sized to accommodate the stormwater run-off from the whole up-slope catchment.
Land disturbance of 1 ha or greater	• There is sufficient land area available to install and operate an appropriately sized sediment basin. • The run-off from all disturbed areas can be directed to a sediment basin throughout construction and until such time as the up-slope catchment is adequately stabilised against erosion.
Proposing works below 5 m AHD	• There is sufficient land area available to install and operate an appropriately sized sediment basin. • The run-off from all disturbed areas can be directed to a sediment basin throughout construction and until such time as the up-slope catchment is adequately stabilised against erosion. • It is feasible to install sediment basins which will have sufficient storage volume to contain the design storm event i.e. the sediment basin will not be inundated with groundwater.
Proposed works on land having a slope of greater than 15% or mapped within the landslide hazard overlay of the planning scheme	• There is sufficient land area available to install and operate an appropriately sized sediment basin. • The run-off from all disturbed areas can be directed to a sediment basin. • Preliminary engineering sections of proposed sediment basins showing that they may be practically implemented on the slopes proposed. • Preliminary earthworks plan showing proposed extent of land disturbance. • Geotechnical report which assesses the probability of landslip instability as a result of the construction phase ESC measures.

1.5.1.2.3 Detailed erosion and sediment control plan/program

(1) A detailed erosion and sediment control program must contain information on what controls are required to be implemented throughout all stages of the development from site establishment to project completion. Typically a separate plan is required for each phase of the development including:
- (a) site clearing;
- (b) bulk earthworks;
- (c) civil construction;
- (d) services installation
- (e) final stabilisation including decommissioning of sediment basins.

(2) A detailed erosion and sediment control plans must:
- (a) be based on an assessment of the physical constraints and opportunities of the development site, including soil, landform type, gradient and hydrology;
- (b) be supported by analysis of on-site soils undertaken in accordance with IECA (as amended), Chapter 3.5 and Appendix C;
- (c) provide a set of contour drawings showing existing and design contours, the real property description, north point, roads, site layout, boundaries and features. Contours surrounding the site should also be shown so that catchment boundaries can be considered;
- (d) be at a suitable scale for the size of the project (as a guide around 1:1000 at A3 for a 2 hectare development and 1:500 at A3 for a 3000m^2 development);
- (e) provide background information including site boundaries, existing vegetation, location of site access and other impervious areas and existing and proposed drainage pathways including discharge points;
- (f) show the location of stormwater drainage systems;
- (g) include details on the nature and specific location of works and controls (revegetation, cut and fill, run-off diversions, stockpile management, access protection, site office location), timing of measures to be implemented and maintenance requirements (extent and frequency);
- (h) show all areas of land disturbance, the way that works will modify the landscape and surface and subsurface drainage patterns (adding new, or modifying existing constraints);
- (i) for each phase of the works (including clearing, earthworks, civil construction, services installation and landscaping) detail the type, location, sequence and timing of measures and actions to effectively minimise erosion, manage flows and capture sediment, including the stabilisation of up-slope catchments prior to sediment basin removal;
- (j) identify the riparian buffers and areas of vegetation which are to be protected and fenced off to prevent vehicle access;
- (k) indicate the location and provide engineering details with supporting design calculations for all necessary sediment basins and ESC-related drainage structures;
- (l) indicate the location and diagrammatic representations of all other necessary erosion and sediment control measures;
- (m) identify the clean and disturbed catchments, and flow paths, showing:
  - (i) diversion of clean run-off;
  - (ii) collection drains and banks, batter chutes and waterway crossings;
  - (iii) location of discharge outlet points; and
  - (iv) water quality monitoring locations;
- (n) show calculated flow velocities, flow rates and capacities, drain sizing and scour/lining protection, and velocity/energy checks required for all stormwater diversion and collection drains, banks, chutes, and outlets to waterways;
- (o) show waterways (perennial and non-perennial) and detail of stabilisation measures for all temporary waterway crossings;
- (p) locate topsoil and/or soil stockpiles;
- (q) prescribe non-structural controls where applicable, such as minimising the extent and duration of soil exposure, staging the works, identifying areas for protection, delaying clearing until construction works are imminent etc;

(r) include a maintenance schedule for ensuring ESC and stormwater infrastructure is maintained in effective working order at all times, particularly just prior to, during and after wet weather (refer IECA 2008, Chapter 6 and Chapter 7);
(s) include an adaptive management program to identify and rectify non-compliances and deficiencies in environmental performance (refer IECA 2008, Chapter 6 & Chapter 7), including notification to City of any non-compliance and the corrective actions taken by the applicant within 48 hours of the non-compliance;
(t) provide details of chemical flocculation proposed, including equipment, chemical, dosing rates and procedures, quantities to be stored and storage location, and method of decanting any sediment basin;
(u) demonstrate how post-construction bioretention devices will be adequately protected against sediment ingress during land-disturbing activities, including where applicable the transition from construction-phase sediment basins to post-construction phase bioretention basins.

1.5.1.2.4 Inspections/hold points

(1) For medium and high risk development sites, inspection certification must be provided to Council in the form provided (Appendix A) within 5 business days of the inspection.

(2) Inspection certificate must be produced at the nominated hold points below and at any other time in accordance with the conditions of the development approval (refer to IECA 2008 Chapter 7.8 for discussion on hold points and using inspection and test plans):
(a) immediately prior to the commencement of bulk earthworks;
(b) immediately prior to live connection of new stormwater drainage infrastructure works to the existing stormwater/waterway system;
(c) immediately prior to any instream works or disturbance within a waterway;
(d) immediately prior to decommissioning of any sediment basin or transitioning from a sediment basin to a water sensitive urban design bioretention device;
(e) immediately prior to any request for survey plan sealing, on defect or off defect inspection; and,
(f) at intervals not exceeding 1 month.

(3) The inspection certificate must be true and accurate assessments of the findings and a copy must be kept on site together with copies of all specific directions issued in relation to the certification.
(a) Where inspection indicates a non-conformance, a non-conformance report is to be provided to Council which includes: details of the nature and cause of non-conformance;
(b) details of the required corrective actions; and,
(c) corrective actions which must be carried out within 24 hours where practicable or as agreed with the construction superintendent.

1.5.2 Guidance for applicants

1.5.2.1 Erosion Control

(1) In addition to IECA 2008, design to avoid non-essential exposure of soil, development should:
(a) restrict the extent of clearing to that necessary for access to, and safe construction of the approved works;
(b) protect vegetative cover in all other areas of the site; and
(c) minimise the duration of soil exposure by:
(i) only clear vegetation immediately prior to an area being actively worked;
(ii) stage works to minimise the area of soil exposed at any one time;
(iii) effectively stabilise[3] cleared areas if works are delayed or works are not intended to occur immediately;

[3] An effectively stabilised surface is defined as one that does not:

(a) have visible evidence of soil loss caused by sheet, rill or gully erosion; or

(iv) effectively stabilise areas at finished level without delay and prior to rainfall;
(v) In areas being actively worked and effective stabilisation is not feasible, implement a full suite of erosion and sediment controls, to maximise sediment capture and minimise erosion; such that all forms of erosion, other than splash erosion (raindrop impact) and sheet erosion, do not occur. Where such controls would impede construction activities, ensure contingency measures are available on site and are implemented that are sufficient to achieve the same outcome, prior to rain;
Note: this does not apply to major erosion and sediment controls such as sediment basins. Major controls should be installed before other works commence; and,
(vi) effectively stabilise steep areas, such as stockpiles, batters and embankments, without delay and prior to rainfall. Staged stabilisation is expected on large batters and embankments. In areas being actively worked, where this is not feasible, ensure that sediment controls are installed and surface stormwater flows are managed such that erosion of stockpiles, batters or embankments is not caused.

(2) Erosion and sediment controls should not be constructed within the riparian zone, unless it is not feasible to locate them elsewhere. Work within waterways is only to be:
(a) undertaken in accordance with IECA 2008 Best Practice Erosion and Sediment Control, Appendix I – Instream works;
(b) undertaken during the lower rainfall months; and,
(c) disturbance is promptly rehabilitated, conforming to the natural channel form, substrates and riparian vegetation as far as possible.

(3) Prior to the sealing of the plan of survey for the development, all site surfaces are to be effectively stabilised[3] using methods that will continue to achieve effective stabilisation in the medium to long term. A site is determined to be effectively stabilised if at the time of the plan sealing inspection if stabilisation methods are:
(a) consistent with IECA 2008;
(b) appropriate for slopes and slope lengths;
(c) providing a minimum of 70% soil coverage (when viewed perpendicular to the soil surface) across any square metre of the site disturbance area and;
(d) have no evidence of erosion, sedimentation or water contamination

(4) If at the time of request for plan sealing, the method of stabilisation has not achieved a stability that has a high probability of enduring in the medium to long term (for example, inadequate grass cover or permanent landscape works are incomplete) the following will be taken into consideration in determining whether the site is capable of achieving medium- to long-term stability:
(a) evidence of soil amelioration having been adequately undertaken;
(b) evidence of an adequate seed mix of annual and perennial grass species being applied at an adequate rate;
(c) evidence that appropriate grass strike and growth has been achieved for the type of stabilisation method selected.

(5) Where hydromulch is used as the method of temporary stabilisation, it is important that perennial as well as annual grasses are well established at the time of plan sealing to reduce the risk of instability of the site in the medium to long term.

(b) lead to sedimentation; or

(c) lead to water contamination.

1.5.2.2 Drainage Control

(1) Ensure that all concentrated stormwater flows including drainage lines, diversion drains, channels, spillway and batter chutes are managed onto, through, and at release points from the site in all rain events up to and including the average recurrence interval defined within IECA 2008 Table 4.3.1 without causing:
   (a) water contamination;
   (b) sheet, rill or gully erosion; and,
   (c) sedimentation; or damage to structures or property.

(2) In addition to IECA 2008 design to:
   (a) ensure clean stormwater is diverted or managed around or through the site without increasing the concentration of total suspended solids or other contaminants in the flow and without causing erosion (on site or off site). Were this cannot occur ensure that sediment controls are to be designed with sufficient capacity to accommodate the additional volume (diverting clean stormwater runoff into a sediment basin is not acceptable because it will cause an increase in the volume and frequency of contaminated releases from the sediment basin); and,
   (b) ensure sheet flows of stormwater are managed such that sheet and rill erosion is prevented or minimised.

(3) Temporary vehicular crossings of waterways should be designed and constructed to convey pipe flows as defined within IECA 2008 Table 4.3.1, and remain structurally stable for all rainfall events up to the 10-year average recurrence interval event of critical duration.

1.5.2.3 Sediment Control

(1) Sediment control to be based on monthly rainfall erosivity ratings as defined within IECA 2008 Table 4.5.2.

(2) Ensure measures have been implemented such that the runoff from all disturbed areas flows to a sediment basin or basins. Where it is not feasible to divert runoff from small disturbed areas of the site to a sediment basin, implement compensatory[4] erosion, drainage and sediment controls prior to rainfall to ensure that erosion of those of areas does not occur.

(3) Ensure sediment does not leave the site on the tyres of vehicles.

(4) Sediment basins are to be designed in accordance with Appendix B – Sediment basin design and operation, IECA (2008), unless noted otherwise in this policy:
   (a) ensure each sediment basin has the capacity to treat flows to current best-practice standards[5] and as a minimum to contain all the stormwater run-off from the 85th percentile five day rainfall depth equal to 40 mm, unless a higher standard is prescribed in the development approval condition(s);
   (b) provide sediment storage volume in accordance with Table B8 (Appendix B, IECA 2008) or as a minimum store at least 2 months sediment from the receiving catchment, as determined using the Revised Universal Soil Loss Equation (RUSLE);
   (c) ensure sediment basins are maintained with sufficient storage capacity to capture and treat the run-off for the design rainfall depth. Where sediment basins are proposed to be oversized for storage of captured water for re-use, install survey markers in each such basin to clearly indicate the level that water within the basin must be lowered to, in order to meet the storage capacity specified in requirement above;

[4] Compensatory controls are erosion, drainage and sediment controls which compensate for the lack of sediment basin and are applied such that the type, timing, placement and management of controls minimise the potential for water contamination and environmental harm. This is primarily achieved by reducing the risk of erosion and subsequent sediment release, for example by turfing or mulching and managing concentrated flows in the area.

(d) ensure sediment basins are dewatered to the appropriate level as soon as practicable after each rainfall event and no longer than 5 days after a rainfall event (see also below);
(e) ensure stormwater captured in sediment basins is treated prior to discharge to minimise the concentration of contaminants released from the site, having due regard to forecast rainfall, and ensuring that releases are in accordance with the release limits specified below;
(f) ensure sediment basins and associated structures such as inlets, outlets and spillways are effectively stabilised and structurally sound for ARI rainfall events defined within Appendix B, IECA 2008; and,
(g) ensure accumulated sediment from basins and other controls is removed and disposed of appropriately without causing water contamination.

(5) All releases of stormwater captured in a sediment basin, unless otherwise noted in this policy, should not exceed the following limits:
(a) 50 mg/L of total suspended solids (TSS) as a maximum concentration;
(b) turbidity (nephelometric turbidity units or NTU) value less than 10% above background[6]; and,
(c) pH value must be in the range 6.5 to 8.5 except where, and to the extent that, the natural receiving waters lie outside this range.

(6) The concentration of TSS released by dewatering may only exceed 50 mg/L where it can be demonstrated and supported through documentation that:
(a) further significant rainfall is forecast to occur before the TSS concentration is likely to be reduced to 50 mg/L;
(b) releasing a higher concentration of total suspended solids will result in a better environmental outcome by providing storage for the capture and treatment of run-off from the imminent rainfall and run-off;
(c) all reasonable and practicable steps have been taken to treat the water within best-practice time frames;
(d) flocculent has been appropriately applied and the concentration of TSS in the captured water has already significantly decreased;
(e) the development is in full compliance with this policy;
(f) the water treatment and release is supervised by an appropriate experience person; and,
(g) written notice of the release is provided to Council within 24 hours of the release.

(7) It is recommended that a site-specific relationship between turbidity and suspended solids is determined for each sediment basin. Where an appropriately qualified person has demonstrated a significant relationship between NTU and TSS, testing for compliance with release limits, can be conducted on site with a calibrated turbidity meter. A report showing relationship results must be provided to Council prior to any water releases occurring based on turbidity. This has the advantage of providing immediate assessment to justify a release rather than waiting for laboratory results to confirm concentration levels and compliance. A sample of release water is to be kept on site and provided to Council on request. Note that post-release TSS validation is appropriate to demonstrate that the NTU/TSS correlation is being maintained.

[6] Background refers to receiving water quality immediately upstream of the site water entry point at the time of the release. Where there is no immediate upstream receiving water at the location and time of the release, then a point immediately upstream of the sites receiving water that is not influenced by the site. When water is not present at this point the turbidity release limit (NTU) will be equal to the release limit for 50 mg/L total suspended solids (TSS) based upon the onsite correlation between TSS and NTU or site based historical data obtained prior to the release.

2.0 INFRASTRUCTURE WORKS

2.1 RELATIONSHIP WITH THE PLANNING SCHEME

(1) This part sets out:

(i) particular standards called up as acceptable outcomes in 9.2.7 Infrastructure Works Code. These are contained in the following subsections:
2.2.1 Electrical reticulation and telecommunications infrastructure
2.3.1 Street and path lighting
2.4.1 Waste management

(ii) information council may request to demonstrate compliance with the performance outcomes of the code. These are contained in the following subsections:
2.4.2.1 Waste management plan
2.4.2.2 Construction management plan

2.2 ELECTRICAL RETICULATION AND TELECOMMUNICATIONS INFRASTRUCTURE

2.2.1 Standards called up as acceptable outcomes

This section sets out the standards called up in AO12.1 in the Infrastructure Works Code. These standards represent the “acceptable outcome” which meets the performance outcome set out in the code.

(1) In addition to the standards of the relevant authority and the Queensland Public Lighting Construction Manual, the following additional standards apply.

(2) Electricity reticulation is to be provided as an underground service in urban areas, with overhead supply being permitted only in rural areas or in the following circumstances:
(a) where an existing dwelling house is to remain within the limits of a development or reconfiguration, then any existing overhead electricity services to the building do not need to be converted to underground services; or,
(b) where a reconfiguration creates no more than 2 lots (1 into 2 lot reconfiguration or boundary realignment); or,
(c) where a reconfiguration in an area where overhead power is existing creates 3 or more lots (1 into 3 lot reconfiguration or more) and:
(i) overhead electricity reticulation is already established;
(ii) no new property poles or poles within the road reserve are required to service the sites;
(iii) there is no extension to the overhead mains or any “flying fox” overhead service connection;
(iv) the proposed overhead service connection does not cross a road; and,
(v) the proposed overhead service connection does not cross a premises, other than the premises being serviced.

(3) All existing conductors of 33kV and higher may remain overhead. However if the developer wishes to remove high voltage feeder lines, the necessary approvals are obtained direct from the relevant authority. New or relocated 33kV or higher systems may be overhead at the discretion of the relevant authority.

(4) Electricity and telecommunications services are located in accordance standard drawing R-RCC-6 and R-RCC-7.

(5) The quantity of conduits installed within a development must cater for future adjacent developments and/or mains upgrades. For infill development where underground electricity is required, conduits must be extended along the full frontage to cater for future extension of the underground network.

(6) For rear lots with access easements, conduits must be installed for the full length of the access easement.

(7) Water meters, where possible, are located on alternate boundaries to electrical pillar boxes. Where these services are located on the same boundary, the water meter must be located a minimum of 600mm from the electrical pillar box.

(8) Where underground electrical infrastructure is required to cross a road carriageway it is –
(i) at right angles where possible;
(ii) in no case less than 45 degrees to the road axis;
(iii) located on boundaries alternate to water reticulation crossings.

(9) Development involving the dedication of parks provides electrical infrastructure pillars on the verge of the road reserve adjoining the park to provide power supply for lighting or other services and facilities.

(10) New transformers are pad-mount transformers and are located within road reserves excised from properties.

2.3 STREET AND PATH LIGHTING

2.3.1 Standard called up as acceptable outcomes

This section sets out the standards called up in AO13.1 in the Infrastructure Works Code. These standards represent the “acceptable outcome” which meets the performance outcome set out in the code.

(1) Street and path lighting is designed in accordance with the following standard unless otherwise specified below:
- AS1158 – Lighting for Roads and Public Spaces (as amended)

(2) The location of new lighting within the road reserve and parks must take into account existing houses and light spillage must be minimised through street lighting layout and the use of shields.

(3) Street lights are to be located on alternate boundaries to fire hydrants.

(4) Lighting within parks is to be provided:
(a) at intervals along paths that traverse parkland;
(b) at points of conflict; and,
(c) at park entrances.

2.3.2 Guidance for applicants

(1) The required street lighting category may be required to minimise the effects on adjacent fauna and marine life.

2.4 WASTE MANAGEMENT

2.4.1 Standards called up as acceptable outcomes

This section sets out the standards called up in AO14.1 and AO15.1 in the Infrastructure Works Code. These standards represent the “acceptable outcome” which meets the performance outcomes set out in the code.

2.4.1.1 Waste Generation

(1) Waste generation is calculated in accordance with the generation rates for each use in Table 1 below.

(2) For other uses not contained within Table 1, a waste management plan (in accordance with section 2.4.2.1 of this policy) may be required to establish the expected waste generation for the particular use.

Table 1: Waste generation rates

Use	General waste[7] generation	Recycling waste[8] generation	Other requirements
Multiple dwelling **Retirement facility** **Residential care facility**	120L/dwelling/week	60L/dwelling/week	Green waste[9] bins are to be provided at the rate of 1 x 240L green waste bin per 100m^2 of communal open space and landscaping
Multiple dwellings (3 stories or more)	100L/dwelling/week	70L/dwelling/week	Green waste[9] bins are to be provided at the rate of 1 x 240L green waste bin per 100m^2 of communal open space and landscaping
Short term accommodation	60L/occupant/week	30L/occupant/week	
Office	30L/100m^2 GFA/ day	40L/100m^2 GFA/day	
Hotel/Club: • **residential portion** • **dining areas** • **licensed bar area**	• 5L/bed/day • 50L/100m^2 GFA/day • 50L/110m^2 GFA/day	• 5L/bed/day • 50L/100m^2 GFA/day • 25L/100m^2 GFA/day	Allow for waste oil storage Allow for baling of paper and cardboard
Food and drink outlet	660L/100m^2 GFA/day	330L/100m^2 GFA/day	Allow for waste oil storage Allow for baling of paper and cardboard
Shop and other business premises	50L/100m^2 GFA /day	25L/100m^2 GFA /day	Allow for baling of paper and cardboard
Industrial premises/ warehouse	60L/100m2/day	30L/100m^2 GFA /day	

[7] General waste – waste, other than domestic clean-up waste, greenwaste, recyclable waste, interceptor waste or waste discharged to a sewer, produced as a result of the ordinary use or occupation of domestic or commercial premises.

[8] Recyclable waste – means clean and inoffensive waste that is declared by the local government to be recyclable waste for the area. Examples of waste that may be declared to be recyclable waste— glass bottles, newspaper, cardboard, steel and aluminium cans

[9] Green waste – means grass cuttings, trees, bushes, shrubs, loppings of trees, bushes or shrubs, or similar matter produced as a result of the ordinary use or occupation of premises.

2.4.1.2 Waste Bins

(1) The required container sizes should be calculated based on the following collection frequencies:
   (a) maximum of one collection per week for non-residential developments;
   (b) one collection of waste per week for residential developments; and
   (c) one collection of recycling per fortnight for residential developments.

(2) The size of wheelie bins and bulk bins available is in accordance with Table 2 below.

Table 2: Waste bins sizes

Bin type	Bin capacity (L)	Truck type	Length (mm)	Width (mm)	Height (mm)
Wheelie bin[10]	140 (waste only)	Side lift	560	610	920
	240	Side lift	740	580	1100
	340 (recycling only)	Side lift	840	650	1080
Bulk bin[11]	660	Rear lift	1260	780	1400
	1100	Rear lift	1240	1070	1330
	1500	Front lift	2040	1041	1330
	2250	Front lift	2020	1441	1430
	3000	Front lift	2040	1441	1460
	4000	Front lift	2040	1631	1700

2.4.1.3 Bin Storage Areas

(1) The wheelie bin and bulk bin storage point is the area allocated to the permanent storage of waste bins and may or may not be where the bin is serviced. A storage point may be a common or an individual storage point however bin storage areas are to remain separate for residential and commercial components of a development.

(2) Storage areas are to be designed to accommodate the types of waste bins available from Council as set out in Table 2.

(3) Wheelie bin and bulk bin storage points must;
   (a) allow the bins to be serviced in-situ or easily transported to a separate servicing point;
   (b) be located a minimum of 5 metres from any window, door or fresh air intake within the development or any adjoining site;
   (c) be screened with outward opening doors or a roller door to ensure bins are not visible from a public place;
   (d) not be located in a structure unless it is in:
      (i) a purpose built storage area, which is air locked, fly and vermin proofed and used solely for the storage of waste; or
      (ii) a well-ventilated area of a basement and not within 30m of an opening to a food premises or food handling area; or
      (iii) an open-air carport;
   (e) have safe access for residents and bin collection contractor;
   (f) be of a sufficient size to accommodate the required number of bins and allow for access and manoeuvring of the bins as follows:
      (i) wheelie bins – allow $1m^2$ per bin;
      (ii) bulk bins – allow a minimum of 0.5m clearance around each bin.

[10] These are two wheeled mobile garbage bins, made from high density polyethylene (HDPE).
[11] Bins open along length.

(4) Additionally, bulk bins storage areas must:
- (a) be constructed with a hardstand concrete base with a maximum surface gradient of 1:20;
- (b) be roofed and designed to prevent entry of rainwater;
- (c) for bins greater than 1.5m^3, be a servicing point (unless the bins are proposed to be mechanically towed to the servicing point by the property manager).

(5) Where a common storage point for wheelie bins for two or more dwellings is proposed, it must be constructed with a concrete base and store no more than 10 waste and 10 recycling bins.

2.4.1.4 Bin Servicing Points

(1) For multiple dwellings with 10 or fewer dwellings where wheelie bins are proposed, the bin servicing location is in accordance with Table 3 below.

Table 3: Multiple dwelling bin servicing location

Number of Multiple Dwellings	Road Frontage	Bin servicing point
1-10	Minor[12]	Kerbside
	Major[13]	Kerbside or On-site
11+	Minor12	On-site
	Major13	

(2) On-site wheelie bin and bulk bin servicing points must:
- (a) be constructed with a hardstand concrete base with a maximum surface gradient of 1:20 (excludes kerbside servicing points) ;
- (b) be constructed so that all internal roads/accessways can withstand the weight of the fully loaded waste collection vehicle;
- (c) allow for a 0.5m clearance from all obstructions;
- (d) not obstruct parking areas, loading zones and pedestrian areas while servicing the bins;
- (e) where a development site fronts more than one road, the waste collection vehicle must access the site from the lower order road;
- (f) be clearly separated from car parking bays, loading bays, footpaths and pedestrian areas;
- (g) be clear of speed control devices; and,
- (h) be located a minimum of 5 metres from any window, door or fresh air intake within the development or any adjoining site.

(3) On-site and kerbside wheelie bin servicing points must:
- (i) for kerbside collection, allow 1m of road frontage per wheelie bin directly in front of the development (if this cannot be provided the bins must be serviced internally);
- (j) enable all wheelie bins to be serviced by the waste collection vehicle without the need for the operator to leave the vehicle; and,
- (k) allow adequate unobstructed overhead space for the swinging arm action of the side-lift waste collection vehicle (refer Table 4 for servicing height).

(4) On-site and kerbside bulk bin servicing points must allow adequate unobstructed overhead space for the swinging arm action of the front-lift or rear-lift (depending on the size of the bulk bin) waste collection vehicle (refer Table 4 for servicing height).

(5) The waste collection vehicle operating dimensions and required clearances listed in Table 4 are used when designing and locating servicing points.

(6) Where roads temporarily terminate (eg. for staged development), a temporary turning solution which can accommodate the waste collection vehicle must be provided.

[12] Minor roads include rear laneways, access places, access streets and collector streets.
[13] Major roads include major collector streets, sub-arterial and arterial roads.

Table 4: Waste collecting vehicle clearances (not including obstructions)

Collection vehicle type	Travelling height (m)	Width (m)	Length (m)	Servicing height[14] (m)	Total tonnage (max)	Turning radius (m)
Side load (wheelie bins)	4.0	2.5	10.3	5.2	23	11.5 (wall–wall[15]) 10.5 (kerb-kerb[16])
Front lift (bulk bins)	4.3	2.5	10.5	6.4	27.5	13.2 (wall–wall[15]) 12.3 (kerb-kerb[16])
Rear lift (bulk bins)	4.0	2.5	9.9	4.0	22.5	11.2 (wall-wall[15]) 10.5 (kerb-kerb[16])

2.4.1.5 Waste Carting

(1) Waste carting for wheelie bins and bulk bins is required where bins are not serviced in-situ and must be transported from the bin storage area to the bin servicing point.

(2) Bulk bins up to and including 1.5m^3 in size can be manoeuvred to the servicing point for collection by the property manager.

(3) Bulk bins greater than 1.5m^3 in size requiring manoeuvring to the servicing point must be mechanically towed by the property manager.

(4) The waste carting route must:
- (a) not extend through any habitable portion of a building, a food premises, or any other place that the person carting the bin would not have authority to enter or through any visitor or resident designated car park;
- (b) be constructed with a hardstand surface that allows for easy and smooth bin movement and must not have any steps or lips; and,
- (c) be located no more than 20m from the storage area.

2.4.1.6 Bin Wash Down Facilities

(3) Spill and bin wash down facilities are provided as follows:
- (a) residential development – access to a grassed area for washing of bins; however, if it is necessary for a bin wash facility to be connected to sewer it must be constructed as for a commercial development;
- (b) commercial development – the storage area is graded to fall to a drainage point which is connected to sewer, is roofed and bunded to prevent stormwater ingress; and,
- (c) bin storage area is to be provided with a hose cock for the cleansing of bins.

(4) Waste removal systems within buildings meet the following requirements:
- (a) developments 3 storeys or more in height must utilise a waste chute to transport waste from each floor to a waste storage point;
- (b) developments 3 storeys or more in height must utilise either a recyclables chute or a recycling bin located on each floor adjacent to the waste chute to transport recyclables from each floor to the waste storage point; and,
- (c) where used, waste chutes must meet the requirements set out in Table 7:

[14] Servicing height – means the height required for vehicles to service the bins (including bin height).
[15] Wall to wall – means the minimum radius required for the body of the vehicle to turn (i.e. within an enclosed/walled area).
[16] Kerb to kerb – means the minimum radius required for the wheels of the vehicle to turn (i.e. body of vehicle will overhang roadway during turn).

Table 7: In-building waste removal systems

Design element	Requirement
Waste Chute[17]	Waste chutes (including the shaft) must: (a) be compliant with the National Construction Code (NCC); (b) have adequate strength for its purpose, including additional reinforcing where necessary at joins, bends and hopper intersections; (c) be insect and vermin proof; (d) be constructed and installed to prevent the following during use and operation of the system: (i) transmission of vibration to the structure of the premises; (ii) excessive odour – there must not be a noticeable odour beyond the waste disposal and storage points; (iii) excessive noise to the occupants of the building; (e) comply with the waste chute manufacturer's technical specifications and/or operational limitations, including installation design features and ancillary equipment required to prevent blockages and noise disturbances; (f) be fitted with a shutter at the base of the chute for closing off the chute manually during bin exchange and automatically in case of fire; (g) be fitted with fire sprinklers; and, (h) have chute pipes with access provided at appropriate levels and a nylon brush or similar appliance on a pulley system, for clearing obstructions and cleansing.
Waste disposal point[18] (at the chute)	The waste disposal point must: (a) be located on each residential floor in a position which is: (i) freely ventilated in the open-air (sheltered balconies), or in a dedicated room or compartment; (ii) easily accessible by the occupants of each apartment; (iii) separated from any habitable portion of a building or place used in connection with food preparation or storage; (iv) located to ensure the handle of the hopper is at least 1200 millimetres above finished floor level. (v) be fitted with a hopper door that automatically returns to the closed position after use; (vi) designed to permit free flow of waste into the chute; (vii) constructed so that the diameter or largest dimension of the service opening (the diagonal of a rectangular opening) does not exceed three-quarters (3/4) of the diameter of the chute with which the hopper is connected; (viii) the floor adjacent to the hopper is paved with a durable impervious material with a smooth finished surface; and, (ix) chute door is two hour fire rated.
Waste storage room[19]	The waste storage room must: (a) allow unobstructed access for removal of the containers to the service point and for positioning of the containers correctly in relation to the waste chute; (b) provide additional space for compactors (where required); (c) not be located adjacent to or within any habitable portion of a building or place used in connection with food preparation (including food storage); (d) be fitted with doors that are wide enough to allow for the easy removal of the largest container to be stored; (e) be designed and constructed of impervious material with a smooth

[17] Waste Chute - A duct in which waste descends from one point to another

[18] Waste disposal point - The point where waste is disposed of into the chute, also known as the waste hopper. It consists of a fixed frame and hood unit, covered with a hinged or pivoted door.

[19] Waste storage room - The room at the base of the chute used for the storage of waste bins.

Design element	Requirement
	finish (including the walls, ceiling, floor) to allow for easy cleaning; (f) be provided with a hose cock immediately outside the room for cleaning bins and the room; (g) be insect and vermin proof; (h) have a constructed hardstand floor area which is graded to fall to a drainage point/s and is connected to sewer in accordance with trade waste requirements; (i) have adequate artificial lighting; (j) where refrigerated rooms are fitted, provide an approved alarm device outside which is controllable only from within the room; and, (k) bins must have a reinforced bottom plate.

2.4.2 Information that Council may request

This section sets out information that Council may request to establish the waste requirements for a development.

2.4.2.1 Waste Management Plan

(1) A waste management plan may be requested by Council to support a development application and demonstrate that the proposed development can comply with the standards called up in AO14.1 and AO15.1 of the Infrastructure Works Code.

(2) A waste management plan must provide the following information:
- (a) a brief description of the development and site location;
- (b) identification of wastes generated during the construction and demolition (if applicable) phases including;
  - (i) a list of activities that may generate wastes;
  - (ii) types and estimated volumes of materials generated from each activity including hazardous characteristics;
  - (iii) how waste materials will be dealt with;
  - (iv) the disposal point or method for the disposal of each waste type;
  - (v) details of how waste materials will be separated on site.
- (c) a site plan (with dimensions) showing:
  - (i) the location of existing and proposed buildings;
  - (ii) landscaping areas;
  - (iii) site access points;
  - (iv) bin storage points;
  - (v) bin servicing point;
  - (vi) where bins are to be collected on site, the swept path of waste collection vehicle;
  - (vii) turning circle for each turn within the development required to be performed by waste collection vehicle showing clearance dimensions from buildings, fences, infrastructure and landscaping;
- (d) an estimate of weekly volumes of waste material generated in accordance with Table 1 – waste generation rates;
- (e) the proposed bin types and sizes at each storage point;
- (f) allocation of responsibility for waste management;
- (g) bin carting routes and distances (where applicable); and,
- (h) a chute diagram from top storey to waste storage room and location on each floor (where applicable).

2.5 CONSTRUCTION MANAGEMENT

2.5.1 Information that Council may request

This section sets out information that Council may request to demonstrate compliance with the performance outcomes for construction management in the Infrastructure Works Code.

2.5.1.1 Construction Management Plan

(1) A construction management plan may be required for developments involving construction and/or demolition activities which may impact the surrounding environment and residents. The plan must address the proposed measures to these impacts and must include the following:
- (a) public safety, amenity and site security;
- (b) construction hours;
- (c) noise and vibration management;
- (d) air and dust management;
- (e) stormwater and sediment control;
- (f) waste management;
- (g) traffic management; and,
- (h) schedule of works.

2.6 EXCAVATION AND FILLING

2.6.1 Guidance for applicants

This section provides guidance for applicants on how to achieve compliance with PO1 of the Infrastructure Works Code and PO4 of the Landscaping Code.

2.6.1.1 General

(1) Where located adjacent to Council managed land, all retaining walls (including any associated footings) must be wholly located with private property.

2.6.1.2 Retaining walls between lots

(2) Retaining walls located between lots within a development that are greater than 1.5m in height must be stepped/terraced to incorporate a minimum of 0.75m of landscaping between the two walls. The lower wall and landscaping area should be fully contained within the lower lot and should be of a height which allows maintenance of the landscaping area from the ground level of the property on the low side and the upper wall (including any associated footings) and fence should be fully contained within the upper lot.

3.0 TRANSPORT, SERVICING, ACCESS AND PARKING

3.1 RELATIONSHIP WITH THE PLANNING SCHEME

(2) This part sets out:

(iv) particular standards called up as acceptable outcomes in 9.4.5 Transport, Servicing, Access and Parking Code. These are contained in the following subsections:
3.2.1 Driveways
3.3.1 Road Design
3.4.1 Internal Accessways
3.5.1 Pedestrian and Cycle Path Design
3.6.1 Car Parking, Servicing and Site Access Design

(v) information council may request to demonstrate compliance with the performance outcomes of the code. These are contained in the following subsections:
3.3.2 Traffic Impact Assessment

(vi) further guidance for applicants is contained in the following subsections:
3.2.2 Driveways

3.2 DRIVEWAYS

3.2.1 Standards called up as acceptable outcomes

This section sets out the standards called up in AO1.1 in the Transport, Servicing, Access and Parking Code. These standards represent the "acceptable outcome" which meets the performance outcome set out in the code.

(1) Driveways are designed in accordance with standard drawings in section 8 of the policy and the following standards unless otherwise specified below.

- Australian Standard 2890: 2009 - Parking facilities
- Austroads: Guide to Road Design

(2) Driveway crossovers are located:
(a) a minimum of 1m from the kerb transition of a stormwater gully pit;
(b) a minimum of 1m from power poles and street lights;
(c) a minimum of 300mm from any utility infrastructure, access covers or other infrastructure;
(d) a minimum of 2m from existing street trees;
(e) to allow a minimum of 10m of uninterrupted kerb length approaching a bus stop; and,
(f) in accordance with Table 1.

Table 1: Driveway Access Locations

Type of Frontage Road	Adjacent Feature	Minimum Separation of Driveway from Adjacent Feature
Access Place and Access Street	Minor intersection	6 metres from kerb tangent point
	Major intersection	20 metres from kerb tangent point
	Median island Other driveways	10 metres from island nose 3 metres along kerb
Collector, Major Collector, Sub-Arterial and Arterial Roads	Minor intersection	10 metres from kerb tangent point
	Major intersection	30 metres from kerb tangent point
	Median break	15 metres from median nose
	Other driveway	15 metres along kerb
	Traffic signals	Clear of queue areas and turning lanes

(3) Driveway crossovers must be finished with a non-slip surface material which does not create an uneven or slippery hazard for pedestrians.

3.2.2 Guidance for applicants

(1) For reconfiguring a lot applications where the location of domestic driveways is considered to be constrained or requires more than one lot to share a driveway, driveways may be required to be constructed prior to the development being accepted on maintenance.

3.3 TRAFFIC IMPACT

3.3.1 Information that Council may request

3.3.1.1 Traffic impact assessment

This section sets out information that Council may request to demonstrate compliance with PO3 and PO4 of the Transport, Servicing, Access and Parking Code.

(1) Where applicable, a detailed traffic impact assessment and report may be required to assess the impact that traffic associated with the proposed development will have on the adjoining road network.

(2) All traffic impacts assessments and reports must be prepared by a suitably qualified Registered Professional Engineer of Queensland (RPEQ).

(3) A traffic impact assessment must include (at minimum):
- (a) details of the traffic impact on surrounding development and the adjacent transport network including:
  - (i) design year covering a 10 year planning horizon from the date of completion of the development;
  - (ii) clearly presented statistical details of the proposed development;
  - (iii) traffic generations of the proposed development, both daily and peak hours;
  - (iv) directional distribution of generated traffic, travel pattern and vehicle classification;
  - (v) current traffic volume/full turning movement volumes on affected existing roads and intersections. Vehicular volumes are classified into cars and commercial vehicles and are projected forward at appropriate growth rates;

(vi) impact of the development on pedestrian and bicycle movements, including access to existing linkages;
(vii) analysis of intersections using the computer software program SIDRA or similar. Details to include:
(viii) intersection treatment;
- method of control;
- delay;
- capacity;
- traffic volume;
- saturation levels;
- queue lengths; and,
- copies of input, output and graphical intersection layout from SIDRA or equivalent;

(b) conceptual plan of intersection configurations showing:
(i) lane layouts;
(ii) turning radii;
(iii) storage lengths;
(iv) auxiliary lanes;
(v) medians;
(vi) shoulders;
(vii) footpaths/bikeways and other relevant information;
(viii) for signalised intersections, the same analyses and conceptual plans as per item (a)(vii); together with signals phasing diagrams from SIDRA or similar output;
(ix) any adverse effects on safety issues, capacities and levels of service of intersections and the road network and appropriate ameliorative measures suggested;
(x) all assumptions and references made in the traffic analyses.
(c) proposed access to the development;
(d) maintenance of traffic flow efficiency and safety standards;
(e) maintenance of pedestrian and bicycle flow efficiency;
(f) parking impacts associated with the proposed development; and,
(g) any proposed upgrades/changes to the road network including the timing of these works.

3.4 ROAD DESIGN

3.4.1 Standards called up as acceptable outcomes

This section sets out the standards called up in AO4.1 in the Transport, Servicing, Access and Parking Code. These standards represent the “acceptable outcome” which meets the performance outcome set out in the code.

3.4.1.1 General

(1) Roads are design in accordance with standard drawings in section 8 of the policy and the following standards unless otherwise specified by the requirements set out in this section:
- IPWEAQ Complete Streets
- Austroads: Guide to Road Design
- Austroads: Guide to Traffic Management
- Austroads: Guide to Pavement Technology
- DTMR Manual of Uniform Traffic Control Devices (MUTCD)

3.4.1.2 Road Hierarchy

(2) The purpose and function of the road hierarchy is detailed in Tables 2 and 3.

Table 2: Functional characteristics of road types - residential

	Access Laneway	Access Place	Access Street	Collector Street	Major Collector Street	Sub-Arterial Road	Arterial Road
Network	Local				Strategic		
Function	Rear access to lots fronting road with restricted property access Refuse collection	Local access to properties Shared traffic, pedestrian and recreational uses	Access to properties and local neighbourhoods with shared traffic, pedestrian and recreational uses	Access to properties and other roads. Access to local neighbourhoods	Transport of people and goods within suburbs District movement	Transport of people and goods between suburb Connects suburbs to activity centres, local education community and health facilities	Transport of people and goods through and around the local government area

Table 3: Functional characteristics of road types - industrial

	Industrial Access Street	Industrial Collector Street
Function	Vehicular access to industrial properties.	Vehicular access to industrial properties and other roads.

(3) Council's adopted road design standards are shown in Table 4 and Table 5.

Note: All measurements are taken from lip of kerb and channel unless otherwise specified.

(4) Any required landscaping buffers do not form part of the road reserve and as such are in addition to the minimum required road reserve width.

Table 4: Road design standards – residential

Street Type	Access Laneway	Access Place	Access Street	Collector Street	Major Collector Street	Sub-Arterial	Arterial
Maximum traffic volume (vpd)	150	150	1,000	3,000	10,000	2 lanes – 15,000 4 lanes – 20,000	20,000 - 30,000
Design traffic volume	10 vpd detached 6 vpd attached	10 vpd detached 6 vpd attached	10 vpd detached 6 vpd attached	10 vpd detached 6 vpd attached	10 vpd detached 6 vpd attached	10 vpd detached 6 vpd attached	10 vpd detached 6 vpd attached
Traffic catchment	25 dwellings	15 lots	100 lots	300 lots	1,000 lots	2,000 lots	N/A
Direct property access	Yes	Yes	Yes	Yes	No	No	No
Posted speed	30km/h	40km/h	40km/h	50km/h	60km/h	60-80km/h	60-80km/h
Reserve width	8m	15m	15m (18m required in MDR zoned areas of Kinross Road and South East Thornlands)	18m	23m (plus cycle lanes if required)	2 lanes – 29m (plus cycle lanes if required) 4 lanes – 36m (plus cycle lanes if required)	Refer to DTMR design standard
Number of traffic lanes	N/A – total carriageway width min. 5.5m	2	2	2	2	2 or 4	
Traffic lane width	N/A	3m	3m	3.5m	3.5m	3.5m	
Number of auxiliary lanes	Nil (parking not permitted)	Nil	Nil	2	2	2	
Auxiliary lane width	N/A	N/A	N/A (2m auxiliary lane required in MDR zoned areas of Kinross Road and South East Thornlands)	1m	2.5m	2.5m	
Number of dedicated on road cycle lanes	Informal	Informal	Informal	Informal	As required by the LGIP	As required by the LGIP	As required by the LGIP
Cycle lane width	N/A	N/A	N/A	N/A	As required by the LGIP	As required by the LGIP	As required by the LGIP
Min verge width	Minimum 1.2m (dependant on services within the verge)	4m	4m	4.5m	5.5m	5.5m	Refer to DTMR design standard
Median width	N/A	N/A	N/A	N/A	N/A	6m central median	
Intersection spacing	N/A	75m	60m same side 40m opposite side	60m same side 40m opposite side	100m same side 60m opposite side	500m	700m
Min Footpath	Full concrete 1.2m verge	No	1.5m (one side) (1.5m path on both sides required in MDR zoned areas of Kinross Road and South East Thornlands)	1.5m (one side)	2.0m (both sides)[20]	2.0m (both sides)20	2.0m (both sides)20

[20] Unless otherwise required by the Local Government Infrastructure Plan

Table 5: Road design standards - industrial roads

	Industrial Access Street	Industrial Collector Street
Design Speed	60km/h	60km/h
Reserve width	20m	22m
Carriageway width	11m	13m
Number of traffic lanes	2	2
Width of traffic lanes	3.5m	3.5m
Number of parking lanes	2	2
Width of parking lanes	2m	3m
Verge width	4.5m	4.5m
Footpath	Both side 1.5m	Both sides 1.5m
Grade	Maximum 10% Minimum 2.5%	Maximum 8% Minimum 0.4%

3.4.1.3 Geometric Design

(1) The geometric design of all roads is in accordance with *Austroads Guide to Road Design: Part 3 – Geometric Design*. The design is to be in accordance with the 'desirable' ranges of minimum and maximum design limits, except where varied below.

3.4.1.3.1 Cross Falls

(1) All intersections and cul-de-sac heads are to be contoured to prevent ponding of water. Where minimum cross fall cannot be achieved the longitudinal grades must be used to shed water.

(2) A cross fall of 2% is permissible when joining to existing road construction with a flatter cross fall.

3.4.1.3.2 Truncations

(1) A corner truncation of the real property boundary for roads, streets and accessways is provided at each intersection to maintain sight distance. The size of the truncation must be in accordance with Table 6.

Note: where streets of a different hierarchy intersect, the truncation required is that of the higher order road.

Table 6: Truncation According to Street Type

Street Type	Truncation
Rear Laneway, Access Street, Access Place, Collector Street, Major Collector Street	6m x 6m 3 chord
Sub Arterial	10m x 10m 3 chord
Arterial	25m x 25m 5 chord
Industrial	8m x 8m 3 chord

3.4.1.3.3 Turning Areas

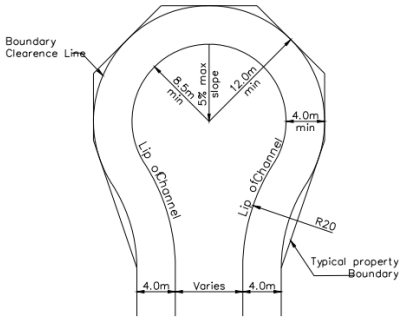
(1) Culs-de-sac are to be provided to facilitate turning movements at the end of a road.

(2) The road reserve width at cul-de-sac is to provide a minimum 4m verge from the lip of the channel to the property boundary.

(3) The provision of alternative cul-de-sac design to accommodate additional on street car parking (eg. using a centre island with parking spaces) must be considered where more than 4 properties adjoin the head of a cul-de-sac.

(4) The minimum radius at the head of a cul-de-sac in a residential area is 8.5m to the lip of the channel generally in accordance with the diagram below.

Diagram 1 – Residential Cul-de-sac Treatment



(5) For industrial areas, the cul-de-sac head must be designed to accommodate the design vehicle appropriate to the use.

(6) Where a temporary turning facility is required (generally for staged construction) the preference is for a cul-de-sac.

3.4.1.4 Kerb and Channel

(1) The types of kerb and channel to be used are listed in Table 7.

Table 7: Kerb and channel types

Road Type	Kerb and Channel Type (refer IPWEAQ standard drawing RS-080)
Access Place Access Street Collector Street	M1
Major Collector Street Sub-arterial Road Arterial Road	B1 (450mm channel)
Industrial Road	B1 (450mm channel)
Bridges and Culverts	B1 (450mm channel)

(2) In addition to the table above the following are to be applied:
- (a) type B1 barrier kerb and channel is to be used where a road adjoins open space;
- (b) type B1 barrier kerb and channel is to be used at bus stops;
- (c) edge restraints are to be used in residential areas where one way cross falls are used;
- (d) on medians and traffic islands, semi mountable type SM4 and SM5 are used with concrete median and landscaped median respectively;
- (e) semi mountable type SM5 is to be used for roundabout centre island (75mm high kerb may be adopted where the roundabout lies on a minor (local) road which is unlikely to be a bus route;
- (f) kerb ramps are provided adjacent to all kerb returns, at entrances to parks and where required to support pedestrian access.

3.4.1.5 Road edge guide posts

(1) Road edge guide posts are in accordance with DTMR standard drawings and are provided at all location where concrete kerb and channel is not constructed, such as half road construction, tapers and ends of roads.

3.4.1.6 Service conduits

(1) Service conduits for rear lots are extended along the full length of the accessway and a locator post provided.

3.4.1.7 Entry treatments, signage and barriers

(1) All entry treatments (where approved) are to be placed on private property and the land owner is to be responsible for their ownership and maintenance.

(2) For major traffic routes, safety barriers are to be identified and designed in accordance with the *DTMR Road Planning and Design Manual - Volume 3, Part 6: Roadside Design, Safety and Barriers*. Appropriate risk assessment is to be undertaken using the DTMR Road Side Impact Severity Calculator and a report provided to justify the design.

(3) Barriers and guardrails are to be in accordance with DTMR standard drawings. Covers must be provided to protect road users from sharp and protruding edges.

3.4.1.8 Threshold Treatments

(1) Threshold treatments are to be provided where major roads intersect local streets to highlight the change in the road environment. The typical treatment is coloured stamped AC and the depth of the AC in the location of the treatment must be increased by the depth of the stamp. Coloured pavement treatments are to be undertaken in accordance with Brisbane City Council – Reference Specifications for Civil Engineering Work – S155 Road Pavement Marking.

3.4.1.9 Pavement Design

(1) Pavements are designed in accordance with the following standards unless otherwise specified below:

- Austroads Guide to Pavement Technology
- DTMR Pavement Design Supplement
- BCC Reference Specifications for Civil Engineering Work

(2) The traffic design loadings are to be based on the ultimate traffic generation for the catchment area, originating from:

(a) ultimate development of current zoned land; and,
(b) staging of works and the resultant development and construction traffic.

3.4.1.9.1 Flexible pavements

(1) The minimum design traffic loadings in equivalent standard axles (ESA) for the various road classifications are defined in Table 8. Where appropriate, Council may nominate a higher ESA value based on a traffic impact assessment, predicted traffic or increased percentage of heavy vehicles.

Table 8: Design Equivalent Standard Axles

Road Type	Design ESA (20 years)
Access Street Access Place	1×10^5
Collector Street	5×10^5
Major Collector Street	1×10^6
Sub-Arterial Road	2×10^6
Arterial Road	Refer to DTMR design standards
Industrial Roads	2×10^6

(2) The assessment of the supporting subgrade strength is to be in accordance with *DTMR Pavement Design Supplement 'Supplement to Part 2: Pavement Structural Design' of the Austroads Guide to Pavement Technology* with the following considerations:

(a) in deep cuttings, fills or other instances where testing of the subgrade is not possible until the completion of bulk earthworks, the pavement design or re-evaluation of designs may be required upon achieving subgrade level;

(b) the subgrade must be tested at the following frequencies:

(i) road length $\leq$ 120m: 1 test for each subgrade type (minimum of 2 test locations)

(ii) road length $>$ 120m: 1 test for each subgrade type and/or 1 test for every 60m or part thereof, but not less than 3 tests for each subgrade type;

(iii) spacing of test sites must be selected to suit subgrade, topographic and drainage characteristics;

(c) a maximum subgrade CBR of 10 is to be used for design purposes;

(d) if the CBR determined for the subgrade is less than CBR 3 for flexible (granular and full depth asphalt) pavement or CBR 5 for concrete pavement, the minimum depth of subgrade replacement is to be increased by 100mm for each 0.5% reduction in the CBR value. After subgrade improvement, the pavement design should be based on subgrade CBR 3 for flexible pavement and CBR 5 for concrete pavement. Other techniques such as rock spalls on geotextile and geogrids together with correctly sized gravel blanket course will be considered for CBR values less than 1.

(e) design gravel depths for flexible pavements with thin bitumen surfacing for light-traffic roads with loading of up to and including 2×10^6 ESAs is to be assessed from subgrade strength and in accordance with Table 9. The minimum total pavement gravel depth is 250mm.

Table 9: Minimum flexible pavement gravel depth (mm) with thin AC surfacing

CBR	1×10^5	5×10^5	1×10^6	2×10^6
3	380	480	520	560
4	330	410	440	480
5	290	360	390	420
6	260	330	350	380
7	250	300	320	350
8	250	270	300	320
9	250	260	280	300
10	250	250	260	280

(f) The minimum total pavement thickness is shown in the Table 10 below, in addition:

(a) all granular pavements must be sealed with a prime coat (C170) or a primer seal (C170 with 7mm chip – assumed ALD 5mm) prior to surfacing with asphalt;

(b) continue pavement at least 150mm past the back of the concrete kerb and channel to ensure stability of the pavement edge;

(c) pavement depths are increased by an additional 100mm for 10m on either side of slow points, traffic calming devices, traffic islands adjacent to intersections, cul-de-sac heads and all intersections;
(d) roundabouts have a minimum 40mm AC surfacing with a 7mm chip seal where a flexible pavement is used;

Table 10: Total Pavement Thickness

	Up to 5.0 x 10^5 ESAs	**1.0 x 10^6 ESA and greater**
Composition	**Minimum course thickness (mm)**	
Asphalt	30mm	45mm
Primer coat/seal	Yes	Yes
Base (CBR 80)	125	125
Sub-base (CBR 45)	125	125
Sub-base (CBR 15)	As required to obtain the minimum pavement depth	
Minimum total pavement (including AC)	280	295

(g) subsoil drainage is to be constructed in accordance with the standard drawings in section 8 of this policy and located:
(a) under all kerb and channel, and median kerbs;
(b) in areas where landscaping could affect the road pavement;
(c) at the end of a road at the end of a stage boundary; and,
(d) where the pavement is affected from springs or the ingress of water. These areas may require the use of mitre drains for a satisfactory solution.

3.4.1.9.2 Rigid pavements

(1) Rigid pavements for lower order roads (rear laneways, access places, access streets) are designed in accordance with the following standard:

- Cement and Concrete Association of Australia Guide to Residential Streets and Paths

3.4.1.10 Bridges and major culverts

(1) Bridges and culverts and associated elements are designed in accordance with the following standards unless otherwise specified below:
- Austroads: Guide to Bridge Technology
- Austroads: Guide to Road Design
- AS5100 Bridge Design
- AS3845 Road Safety Barrier Systems
- AS1428 Design for Access and Mobility

(2) Road bridges and major culverts (RCP≥1800mm, RCBC span≥1800mm and height≥1500mm) must also be design in accordance with the standards set out in section 1.2.1 of this policy.

(3) To minimise Council's future maintenance responsibilities the following must be adhered to:
(a) timber must not be used for structural components;
(b) steel pipe or arch culverts are not used for stormwater management purposes; and,
(c) masonry block structures are not permitted.

(4) Minimum vertical clearances for bridges must be in accordance with *Austroads: A Guide to Bridge Technology* and *Austroads: A Guide to Road Design* and must consider the requirements for:
(a) road clearance;
(b) power lines and other service authorities;
(c) waterways clearance:
(i) flood immunity clearance;

(ii) waterway navigation freeboard.

(5) Design life for the main components of the bridge and culvert structures is to achieve a minimum of 100 years.

(6) The design of bridge and culvert structures must take into account accessibility for inspection, maintenance and replacement as follows:
- (a) structures are designed so that all corrosion protection systems including concrete covers can be easily inspected, maintained and replaced;
- (b) bridges are designed to enable items such as bearings, expansion joint seals, railings and drains to be readily accessible for inspection, maintenance and replacement;
- (c) culverts are designed to enable items such as tidal flaps debris grates, silt traps, railings and drainage connections to be readily accessible for inspection, maintenance and replacement.

(7) Bridge barriers designed in accordance with the *DTMR Road Planning and Design Manual* and must meet the regular performance level as in *AS5100 Bridge Design* as a minimum. Where a bridge structure is over permanent water deeper than 300mm or where the drop height exceeds 1.2 m, vertical balustrade pedestrian handrails with appropriate bicycle offset rail or equivalent must be provided on the structure's outer edge.

(8) Proposals must not include slip forming of concrete bridge barriers or use of timber bridge barriers.

(9) Bridges and culverts are designed to accommodate present and future requirements for services crossing the structure.

(10) If future widening of a bridge or culvert may be required, allowance must be made in the design for connection of the future widening.

(11) Applied loads are to be determined in accordance with *AS5100 Bridge Design*, unless otherwise specified below:
- (i) For pedestrian loads:
  - (a) isolated pedestrian and bikeway bridges protected by 'deflection rails' with maximum 1.5 m clearance against vehicle access are designed to accommodate a minimum 1,800kg GVM mini tractor, ride-on mower or equivalent, assuming a 1.2 m track width and 2 m wheel base are situated anywhere on the deck;
  - (b) where full width access greater than 1.8 m is possible, the structure accommodates either a 6,100kg GVM full size tractor, 2,500kg utility vehicle or a mini tractor as described above.

(12) For road bridges, the deck wearing surface must:
- (a) for asphaltic concrete, be constructed of dense graded asphalt with a minimum design life of 20 years;
- (b) achieve a minimum thickness of 60 mm in any traffic lane;
- (c) achieve a minimum thickness of 45mm in any other area.

(13) Notwithstanding the requirements set out by the standards listed above, Council requires the following in the design and construction of pedestrian bridges:
- (a) that the minimum clear width must be 2.5 m, unless Council requires the use of maintenance vehicles, in which case the minimum clear width requirement must be 3.5m;
- (b) designed for a 5.0kPa live load and a 20KN concentrated load;
- (c) to increase and prolong the structural integrity and durability of the structure, Council does not recommend the use of timber in the construction of bridge structures. This will prolong the life of the structure and also assist in reducing future maintenance costs:
  - (i) however if timber is the chosen material for pedestrian bridge construction, the timber elements must be designed in accordance with:
    - AS1720 – Timber Structures Design Code;

- AS3660 – Termite Management to incorporate Termite Management Systems and;
- must satisfy the durability requirements stated in the bridges and large culverts section of this document.

3.4.2 Guidance for applicants

3.4.2.1 Street naming

(1) Street names are to be submitted to Council for approval to comply with Council's Policy and Guidelines on street naming and numbering, in accordance with section 60 of the *Local Government Act 2009*. Sections of streets that have the same street name should not be isolated. Isolated sections should have different names to provide clarity to road users.

3.5 INTERNAL ACCESSWAYS FOR LARGE RESIDENTIAL DEVELOPMENTS

3.5.1 Standards called up as acceptable outcomes

This section sets out the standards called up in AO5.1 in the Transport, Servicing, Access and Parking Code. These standards represent the "acceptable outcome" which meets the performance outcome set out in the code.

(1) Internal accessways are designed in accordance with the following standard unless otherwise specified below:
- AS2890.1 – Off-street car parking

(2) Internal accessways are designed in accordance with Table 11 below.

Table 11: Internal Accessways for Development with a Community Management Statement (CMS)

	Type 1[21]	**Type 2**[22]	**Type 3**[23]
Maximum design speed	35km/h	25km/h	15km/h
Minimum carriageway width	6 metres	5.5m	5m at entrance to public road, otherwise 4.5m
Minimum shoulder width	1.5m	1m	1m
Minimum total accessway reserve	10m	8m	8m
Verge width	1.5m	N/A	N/A
Design for service vehicle	3 point turn	3 point turn	3 point turn

[21] Minor loop road not exceeding 200 metres in length and serving not more than 100 car parking spaces.
[22] Road for vehicular and pedestrian use not exceeding 100 metres in length and serving not more than 50 car parking spaces.
[23] Road for vehicular and pedestrian use not exceeding 50 metres in length and serving not more than 25 car parking spaces.

3.6 PEDESTRIAN AND CYCLIST FACILITIES

3.6.1 Standards called up as acceptable outcomes

This section sets out the standards called up in AO7.1 in the Transport, Servicing, Access and Parking Code. These standards represent the “acceptable outcome” which meets the performance outcome set out in the code.

(1) Pedestrian and cyclist facilities are designed in accordance with the standard drawings in section 8 of the policy and the following standards unless otherwise specified below:
- IPWEA Complete Streets: Guide for Urban Street Design
- Austroads Guide to Road Design Part 6A: Pedestrian and Cyclist Paths
- DTMR Manual of Uniform Traffic Control Devices
- AS1428 – Design for Access and Mobility
- AS2890.3 - Parking facilities – Bicycle parking

(2) Footpaths, shared paths and cycle paths within the road reserve are required as set out in Table 4 and Table 5.

(3) Footpaths and shared paths in the verge are to be located 1.5m from the property boundary.

(4) Pathways are to be supported by kerb ramps and fencing to assist pedestrian movements and safety.

(5) Special cycleway design consideration should be applied at the following locations:
(i) pinch points;
(ii) traffic calming devices;
(iii) roundabouts; and,
(iv) high speed / high volume traffic interfaces.

3.6.2 Guidance for applicants

(1) Consideration must be given to the effect of cycleway surface treatments at change of directions under wet conditions.

3.7 ON-SITE PARKING

3.7.1 Standards called up as acceptable outcomes

This section sets out the standards called up in AO9.1, AO9.2 and AO9.3 of the Transport, Servicing, Access and Parking Code. These standards represent the “acceptable outcomes” which meet the performance outcomes set out in the code.

(1) Car parking and internal circulation is designed in accordance with the following standard:
- AS2890 – Parking Facilities

3.8 SITE ACCESS

3.8.1 Standards called up as acceptable outcomes

This section sets out the standards called up in AO18.1 of the Transport, Servicing, Access and Parking Code which meet the performance outcome set out in the code.

(1) Queuing area is designed in accordance with the following standards unless specified below:
- AS2890 – Parking Facilities

(2) Where food and drink outlets have a drive-through facility, queuing space for a minimum of 10 vehicles is provided measured from the order point.

3.9 SERVICING AND MANOEUVRING AREAS

3.9.1 Standards called up as acceptable outcomes

This section sets out the standards called up in AO19.1, AO20.1 and AO20.2 of the Transport, Servicing, Access and Parking Code. These standards represent the "acceptable outcomes" which meet the performance outcomes set out in the code.

(1) Manoeuvring area is designed in accordance with the following standards unless specified below:

- AS2890 – Parking Facilities

(2) Manoeuvring areas for non-residential uses are designed to accommodate the service vehicle appropriate to the use nominated in Table 12 below.

Table 12: Service vehicle for non-residential uses

Use	Service Vehicle
Animal keeping	SRV
Bar	WCV
Bulk landscape supplies	AV
Car wash	MRV
Child care centre	SRV
Educational establishment	HRV
Emergency services	HRV
Food and drink outlet	HRV
Function facility	WCV
Funeral parlour	WCV
Garden centre	HRV
Educational establishment	HRV
Hardware and trade supplies	HRV
Healthcare services	SRV
High impact industry	AV
Hospital	HRV
Hotel	HRV
Indoor sport and recreation	HRV
Low impact industry	HRV
Marine industry	AV
Market	SRV
Medium impact industry	AV
Nightclub entertainment facility	WCV
Office	SRV
Outdoor sales	AV
Outdoor sport and recreation	HRV
Place or worship	SRV
Service industry	HRV
Service station	AV
Shop/shopping centre	SRV for 200m^2 or less gross leasable area
	HRV for 201m^2 – 2,000m^2
	AV for 2,001m^2 – 20,000m^2
	AV for 20,001m^2 or more gross leasable area
Showroom	HRV
Tourist park	HRV
Veterinary services	SRV
Warehouse	AV
Any other non-residential use	As determined by council

Note:
AV = Articulated vehicle[24]
HRV = Heavy rigid vehicle[24]
MRV = Medium rigid vehicle[24]
SRV = Small rigid vehicle[24]
WCV = Waste Collection Vehicle – refer to Table 4 in Section 2.4.1.4 of this policy for the dimensions of the appropriate WCV.

(3) Manoeuvring areas (where required) for residential uses are designed to accommodate the service vehicle appropriate to the use nominated in Table 13 below.

Table 13: Service vehicle for residential uses

Use	Service Vehicle
Multiple dwelling	WCV where on site waste servicing is required
	SRV where waste collection is from the kerbside
Relocatable home park	HRV
Resort complex	WCV
Retirement facility	WCV
Short-term accommodation	WCV

Note:
SRV = Small rigid vehicle[24]
WCV = Waste Collection Vehicle – refer to Table 4 in Section 2.4.1.4 of this policy for the dimensions of the appropriate WCV.

[24] Refer AS2890.2: Off-street commercial vehicle facilities for vehicle dimensions and manoeuvring requirements.

4.0 LANDSCAPING

4.1 RELATIONSHIP WITH THE PLANNING SCHEME

(1) This section sets out:

(i) particular standards called up as acceptable outcomes in 9.4.3 Landscape Code. These are contained within the following subsections:
4.2.1 Plant species
4.2.2 Street planting
4.2.3 Street furniture

(ii) information council may request to demonstrate compliance with the performance outcomes of the code. These are contained in the following subsections:
4.6.1.1 Arborist reports
4.6.1.2 Tree management plans

(iii) guidance for applicants contained in the following subsection:
4.3.2 Street tree planting

4.2 PLANT SPECIES

4.2.1 Standards called up as acceptable outcomes

This section sets out the standards called up in AO9.1 in the Landscaping Code. These standards represent the “acceptable outcome” which meets the performance outcome set out in the code.

(1) Plant species for conservation and rehabilitation areas are to be selected from the Regional Ecosystem Species Database as applicable to the regional ecosystem shown in Council’s red-e-map.

http://indigiscapes.redland.qld.gov.au/Plants/Pages/Regional-Ecosystems.aspx

(2) Plant species for open space and other landscaped areas to be transferred into council ownership are to be selected from Appendix B.

4.3 STREET TREE PLANTING

4.3.1 Standards called up as acceptable solutions

This section sets out the standards called up in AO16.1 in the Landscape Code. These standards represent the “acceptable outcome” which meets the performance outcome set out in the code.

(1) Street trees are to be selected from the species listed in Appendix B.

(2) For narrow verges or verges with pathways with less than 2m between the edge of the footpath and the back of kerb, street tree species selected from Appendix B must be from the narrow verge column.

(3) Street trees listed in Appendix B as feature trees are suitable for entry statements or for limited use within parkland areas.

(4) A variety of street trees are to be selected to create a visually interesting streetscape.

(5) Planting is to be undertaken in accordance with the following:
   (a) street trees are planted a minimum of:
      - 4 metres from driveways, fire hydrants, water valves, other infrastructure pits and stormwater infrastructure;
      - 8 metres from power poles and street lights;
      - 10 metres from a departing corner; and
      - 15 metres from an approaching corner and bus stop;
   (b) root barriers are provided where the trunk diameter will be greater than 100mm at maturity; and,
   (c) root directors appropriate to the species are used to protect pavements and hard landscaped areas where the width or the planted area is less than 2m.

(6) Verge areas are turfed with a minimum depth of 100mm friable organic soil.

(7) Landscaped medians, traffic islands and round-a-bouts provide (subject to council approval):
   (a) type SM5 semi-mountable kerb keyed a minimum of 135mm into the pavement;
   (b) adequate site preparation and soil depths with a minimum soil depth of 400mm friable organic soil;
   (c) root barriers where the trunk diameter will be greater than 100mm at maturity; and,
   (d) sub-soil drainage.

(8) Planting on centre islands and adjacent to round-a-bouts must take into account the provision of adequate sight distance in accordance with *Austroads: Guide to Road Design Part 3: Geometric Design*.

4.3.2 Guidance for applicants

(1) Street trees are planted at the latest possible stage of development, after all other infrastructure has been completed to minimise damage to the trees.

4.4 RETAINED VEGETATION

4.4.1 Information that Council may request

This section sets out information that may be requested to demonstrate compliance with the performance outcomes in the Landscape Code.

4.4.1.1 Arborist's reports

(1) An arborist's report may be required to determine the condition of existing vegetation, recommend vegetation to be removed or retained and provide parameters to minimise the risk to, and long term viability of, retained vegetation.

(2) All arborist's reports must be undertaken by a qualified arborist (AQF level 5) with membership of a relevant association and relevant local experience.

(3) An arborist's report must include:
   (a) an assessment of tree characteristics, current health and defects of all significant trees and any other trees and shrubs which overhang from neighbouring properties. A proforma format is acceptable provided it is accompanied by relevant discussion and photos and includes scientific reasoning to support statements;
   (b) a contextual analysis which describes, in text and with photos, the tree as an element of an ecological unit, cultural landscape, or historic listing such as a vegetation protection ordinance;
   (c) photographs of any disease, damage or defect with descriptions and annotated photos showing recommendations and actions for remediation and an estimate of the remaining lifespan of tree or major branch affected, and relative risk to human safety or property;

(d) photographs and a scale tree plot showing canopy height and root zone spread in relation to any existing or proposed building/driveway, calliper of trunk at chest height, spot height of trunk, botanical name and common name;
(e) the extent of any earthworks in the vicinity;
(f) any weed and invasive species as nominated in local government's pest management plan and proposed weed removal methods;
(g) protection measures during construction phase which should include tree protection zones and structural root zones and protective barriers for tree trunks and root zones;
(h) methods for trimming of tree roots and canopy in accordance with *AS4970-2009 - Trees on Development Sites*;
(i) disturbance to tree root zone for hard landscape works such as cultivation for new plant material;
(j) the impacts of proposed materials for hard landscape works, such as permeable paving and retaining edges;
(k) proposed irrigation and fertilizer/nutrient regime; and,
(l) recommendations for removal/retention, protection and/or pruning of trees including any required inspections and monitoring.

5.0 PARKS

5.1 RELATIONSHIP WITH THE PLANNING SCHEME

(1) Desired standards of service for Redland's trunk park network are established under the local government infrastructure plan (LGIP).

(2) This section sets out:

(iv) particular standards called up as acceptable outcomes in 9.4.3 Landscape Code. These are contained within the following subsections:
- 5.2.1 Paths in parks and open spaces
- 5.4.1 Utilities in parks
- 5.5.1 Park furniture

(v) information council may request to demonstrate compliance with the performance outcomes of the code. These are contained in the following subsections:
- 5.6.2.1 Open space management plans
- 5.6.2.2 Tree management plans

(vi) guidance for applicants contained in the following subsections:
- 5.2.2 Paths in parks and open spaces
- 5.3.1 Signage in parks
- 5.6.1 Earthworks, topsoiling, turf and landscaping
- 5.7.1 Types of parks

5.2 PATHS IN PARKS AND OPEN SPACES

5.2.1 Standards called up as acceptable outcomes

(1) Paths in parks and open space areas are designed in accordance with the standard drawings in section 8 of this policy.

5.2.2 Guidance for applicants

(1) Paths in parks and open space areas are to be designed to avoid proximity to thick vegetation and large trees (existing and future) to avoid damage to the path, protect vegetation and maintain adequate sight distance for cyclists.

5.3 SIGNAGE IN PARKS

5.3.1 Guidance for applicants

(1) Signage is provided in a park to facilitate land identification, and to promote safe and appropriate use.

(2) Signage should be placed in front of vegetation or other background landscaping to reduce the landscape impact.

(3) All parks signs are designed to the standards specified in *Redland City Council Parks and Conservation & Corporate Style Manual* (March 2008) which will comply with Australian Standards.

(4) Signage should include:
- (i) an approved park name sign, directional signs and information signs at the primary public access point/s to the park;
- (ii) information and directional sign should also be provided at the primary access point/s to the park and any sites of special interest or key points of access within the park;
- (iii) warning signs are to be installed at sites of potential public risk in the park such as at creeks liable to flooding.

(5) The content of proposed descriptive and interpretive signage should be submitted for approval with the landscape plan.

5.4 UTILITIES

5.4.1 Standards called up as acceptable outcomes

This section sets out the standards called up in AO8.1, AO10.1 AO12.1 and AO13.1 of the Infrastructure Works Code. These standards represent the “acceptable outcome” which meets the performance outcome set out in the code.

(1) Parks are to be provided with a water supply that is a minimum of:
- (i) one 25mm diameter water service for each hectare (or part) of park areas;
- (ii) one water meter in all park.

(2) Sewer connections are to be provided where public toilets are likely to be installed, in accordance with the embellishment standards set out in the LGIP.

(3) Underground power reticulation is to be provided and the power supply is to be metered.

(4) Lighting is to be provided within parks:
- (d) at intervals along paths that transverse parkland;
- (e) points of conflict; and,
- (f) at park entrances.

5.5 PARK FURNITURE

5.5.1 Standards called up as acceptable outcomes

This section sets out the standards called up in AO17.1 in the Landscape Code. These standards represent the “acceptable outcome” which meets the performance outcome set out in the code.

(1) All park furniture is designed, constructed and located in accordance with relevant Australian standards and the following principles:
- (a) complements and enhances other recreation opportunities in the park;
- (b) is served by a continuous accessible pedestrian path;
- (c) uses low maintenance materials; and,
- (d) where possible, uses alternative technology such as durable recycled materials, solar energy and rainwater harvesting.

(2) Seats are:
- (a) located in areas with interesting outlooks and where they can obtain maximum shade;
- (b) provided in proximity to playgrounds or active recreation nodes, around sports fields, at viewpoints and at resting points along paths; and,
- (c) constructed on a concrete pad.

(3) Seating and tables complement and enhance other recreational opportunities in the park, and:
- (a) are to be provided in conjunction with a playground or other activity space;
- (b) are located at attractive and accessible locations or at places of special interest;
- (c) have vehicular access for cleaning and maintenance purposes; and,
- (d) generally include electric barbeques.

(4) Waste bins are:
- (a) provided in fire proof wheelie bin enclosures;
- (b) where practical, bins are located near a road or the perimeter of the park where they can be serviced without the need to drive the refuse collection truck into the park;
- (c) located near BBQ areas and seats and tables; and,
- (d) include dog refuse bins in adjacent to walking trails and dog off leash areas.

(5) Drinking bubblers and fountains are provided near seats and tables, playgrounds, BBQ areas, active recreation pathways, sporting nodes and dog off leash areas where visitor use is high.

(6) Playground equipment conforms to:
- AS/NZS 4486.1 - Playground and playground equipment - Development, installation, inspection, maintenance and operation; and,
- AS/NZS 4422 - Playground surfacing - Specifications, requirements and test methods.

(7) Shade structures are provided using shade ports (not sails) and are:
(a) offset to the north and west of the play elements in order to maximise the shade benefits;
(b) vandal resistant, meaning not able to be climbed on, burnt, torn, ripped or stolen;
(c) designed so that the roof is not accessible by persons at any point, particularly when standing on the highest part of the playground equipment or furniture;
(d) certified as designed and constructed in accordance with the relevant Australian Standards and the *Building Code of Australia* by a Registered Professional Engineer Queensland (RPEQ).

(8) Approved tree species may be planted where appropriate to complement the shade port and ultimately, to replace the need for shade structures.

(9) Public toilets are located and designed to:
(i) be easily maintained;
(ii) to avoid nuisance to neighbours;
(iii) within reasonable proximity to a car park or other demand source;
(iv) on suitable terrain to facilitate an accessible path of travel;
(v) provide convenient access for the elderly and disabled to the toilet facility and into at least one cubical; and,
(vi) allow for casual surveillance from surrounding streets or other sites with frequent public use.

(10) Bollards:
(i) may be required in association with infrastructure such as playground equipment; and,
(ii) should be provided at park entry points in the form of a lockable fold-down metal bollard.

5.6 EARTHWORKS, TOPSOILING, TURF AND LANDSCAPING

5.6.1 Guidance for applicants

(1) Proposed park areas are to be levelled to provide a final landform suitable for ease of maintenance and practical use by the public.

(2) Where filling is required, sufficient topsoil is provided in order to:
(i) support the growth of flora that is compatible with the proposed use of the parkland; and,
(ii) minimise the effects of gases, minerals, and salts in the underlying layers of earth, whether these are naturally occurring or imported.

(3) Seventy-five (75) mm compacted thickness of approved topsoil is provided over all disturbed areas within parks. Soils to be used under turfed areas needs to meet *AS 4419 – Soils for landscaping and garden use*. Such areas are to be turfed, fertilised, watered regularly and maintained.

(4) Parks are to be provided with a turf grass cover over all areas not retained as native vegetation or provided with softfall in association with play equipment. Turf is to be:

(i) Cynodon spp (green couch) or common species eg. Wintergreen; and,
(ii) cut from a weed free environment and is not to include any viable weed seed.

(5) Species used in landscaping within public parks is to be undertaken in accordance with Appendix B of this planning scheme policy.

5.6.2 Information that Council may request

5.6.2.1 Open space management plan

(1) An open space management plan may be required for areas of open space to be transferred into Council ownership to provide information of the ongoing maintenance and management requirements and to assist Council in determining the maintenance program and associated costs.

(2) An open space management must address:
- identification of the purpose of the open space area;
- future management and maintenance regimes for the protection of significant vegetation area, ecological systems, waterways and fauna;
- future management of bush fire hazard (where appropriate);
- ongoing management and control of weeds and pests;
- tree management procedures (refer section 5.6.2.2 Tree management plans);
- maintenance of any structures and hard surfacing; and,
- management of rubbish.

5.6.2.2 Tree management plans

(1) A tree management plan may be required to provide direction for the management of the seasonal growth of mature/maturing trees including existing trees and new tree plantings. The tree management plan must address:
- (a) tree growth to achieve the intent of the landscape design and vegetation; management plan through correct and uniform practices;
- (b) reduction of hazard development, branch failure, fungal infection or premature tree death;
- (c) reduction of the likely impact of storm damage after the site has been occupied;
- (d) formative pruning of young and developing trees where deemed necessary in accordance with *AS4373 - Pruning of Amenity Trees*;
- (e) the minimisation of any potential risk to people and property;
- (f) change of any conditions around the site during the development stages, and how changes are to be managed; and
- (g) a process for annual technical reports (generally initiated annually in May/June prior to the spring growth period) and is to include provision for the supervision of any annual pruning, crown modification in accordance with *AS4373 - Pruning of Amenity Trees.*

5.7 PARK TYPES AND FUNCTIONS

5.7.1 Guidance for applicants

(3) The park function and type referred to in this section relates to the components of the open space network described in part 10.5.6 of the local government infrastructure plan (LGIP). Park functions may include:
- (ii) sport;
- (iii) recreation;
- (iv) community;
- (v) recreation corridor;
- (vi) ecological;
- (vii) amenity;
- (viii) public utility; or
- (ix) unallocated.

(4) Recreation parks have the hierarchy:
- (i) Type 1—destination parks
- (ii) Type 2—community parks
- (iii) Type 3—neighbourhood parks
- (iv) Type 4—meeting place parks
- (v) Type 5—civic spaces

(5) These are described generally as follows:

(i) Type 1 – Destination parks

Type 1 parks have very high levels of visitation. Some type 1 parks may experience very high levels of visitation for short periods of time such as for an event or over a holiday season while others tend to have a more consistent level of visitation over the year, though there may well be variations during the week.

Major parks are provided where the opportunity arises—they may not be distributed equitably across the city. They have unique values that differentiate them from other types of recreation park.

They are usually associated with attractive natural landscapes or historic, or unique man-made features that make them very popular with residents and visitors. They may also be developed to preserve Indigenous heritage.

The level of embellishment needs to be able to support the high loads so there is often a higher level of hard surfacing, signage, barrier controls and similar. Type 1 parks generally require good public transport access or be capable of supporting significant car parking.

Type 1 parks may well have commercial ventures within or adjacent to the park and have areas suited to licensing for events.

(ii) Type 2 – Community parks:

Type 2 parks are spread throughout the city with most urban residents being within a short drive. All type 2 parks are, or will eventually be, connected into the city's cycleway and pedestrian network so that they are easily accessed by these forms of transport.

These parks offer a variety of activities sufficient to keep visitors entertained for several hours. They may range between 2ha and 10ha in size.

Typically the park will offer higher order play experiences for toddlers through to teenagers. Picnic facilities such as barbecues and shelters, and clean, contemporary public amenities allow for extended family and group visits.

Community events that require a park-based setting such as car rallies, markets, musical events and film nights will usually be accommodated in a type 2 park.

(iii) Type 3 – Neighbourhood parks

In suburban areas type 3 parks are the most common park type. Type 3 parks are usually accessed by walking or cycling and appeal to the people living within that walk or cycle catchment. The park area is usually smaller than type 1 and 2 parks and the park is often located within a residential setting. They generally range between 5000m^2 and 2ha in size.

Embellishment will be focussed on a theme such as youth play, natural area play, community gardening, exotic trees or quiet contemplation to add variety across the park type. Some parks may have relatively little embellishment whereas others are highly embellished.

Any theme-based development of this park type will be driven by the demographics and the wants and needs of the catchment community.

(iv) Type 4 – Meeting place parks

Type 4 parks are small green spaces located within concentrated industrial estates and commercial areas. They serve as meeting points for workers and their families or attractive places for lunch or "smoko" for outdoor workers, sales people and similar occupations who work from their vehicle during the day.

Type 4 parks are usually quite small with shaded and sunny spaces to suit the seasons. Seats, tables, rubbish bins and water are the primary embellishments. An area for a food or coffee concession-van may be set aside if required.

(v) Type 5 – Civic spaces

Civic spaces are relatively small areas that are used for organised community events, rallies, performances and similar that attracts a significant crowd. As the use is often very intense there are often high levels of hard surfacing and minimal use of grass.

6.0 DOCUMENTATION

(1) This part of the policy sets out the requirements for drawing standards, design calculations, inspections, quality assurance documentation and as constructed plans.

6.1 DESIGN DRAWING STANDARDS

This part sets out the required drawing standards for engineering and landscape design drawings.

6.1.1 General

(1) Scales used for all drawings are those recommended by the Standards Association of Australia which are 1:1, 1:2.5, and 1:5 and multiples of 10 of these scales. 1:2 or multiples thereof are not desirable.

The following scales are suggested but these may be varied, as appropriate to the works concerned:

(a) plan - 1:1000 or 1:500;
(b) longitudinal section:
    (i) horizontal - 1:1000 or 1:500;
    (ii) vertical - 1:100 or 1:50;
(c) cross sections - 1:100;
(d) intersection details - 1:250;
(e) engineering details - 1:25 or 1:10.

(2) Landscape plan scales are to match with site plans, architectural and/or engineering drawing scales as applicable.

(3) Linear dimensions on all drawings are in metres, with the exception of some detail drawings of small structures such as access chambers, which may be in millimetres.

(4) Sufficient survey information/levels are obtained to enable:
(a) long sections to be shown for the centreline of all roads, stormwater drainage lines and sewerage lines, with natural surface levels nominally shown at twenty (20) metre intervals and at significant changes of grade on the natural surface;
(b) cross sections are drawn for roads and open drains nominally at twenty (20) metre intervals and at significant changes of grade on the longitudinal section; and,
(c) contours of 0.5 metre maximum intervals are drawn representing the natural surface of the land.

6.1.2 Engineering Design Drawings

(1) All engineering drawings and calculations are signed as checked and approved by a Registered Professional Engineer of Queensland (RPEQ) (Civil).

(2) Street lighting and electricity reticulation is prepared and certified by a RPEQ (Electrical) and co-ordinated and lodged by the RPEQ (Civil) who will act as the principal consulting engineer.

(3) The design includes sufficient information outside the boundaries of the premises as determined by the local government to verify that future extension of the proposed works can proceed in accordance with local government standards and without any undue cost to future development.

(4) Where the local government has approved staged development, the local government may require engineering design and construction to include the whole of the land, or such additional parts of the land as will enable the local government to maintain the works in a satisfactory condition if the balance of the development does not proceed to completion.

(5) Engineering drawings, in general include the following:
- (a) title block;
- (b) locality plan;
- (c) layout and stage plan;
- (d) plan of each new road;
- (e) detail plans of each intersection and cul-de-sac;
- (f) longitudinal section of each road;
- (g) type cross sections;
- (h) cross sections of each road;
- (i) signs and pavement marking plan;
- (j) longitudinal section of each drainline;
- (k) stream and open channel drainage plans;
- (l) stormwater drainage catchment plan;
- (m) stormwater drainage calculations;
- (n) earthworks plan;
- (o) sewerage reticulation plan;
- (p) longitudinal section of each sewer line;
- (q) water reticulation plan;
- (r) landscape plan;
- (s) erosion and sediment control plan;
- (t) water quality control provisions; and,
- (u) electrical reticulation, street lighting and conduit plan.

(6) The following information must be included on all plans:
- (a) the local government's file reference number;
- (b) development name, if any;
- (c) real property description;
- (d) locality;
- (e) developer's name;
- (f) scales;
- (g) origin permanent survey mark for level datum and level;
- (h) drawing number and sheet number;
- (i) schedule and date of amendments;
- (j) signed design certification;
- (k) signed check certification; and,
- (l) signed approval certification, by the relevant qualified person.

6.1.2.1 Layout and stage plan

(1) For large developments, the layout plan shows the relationship of all new roads to each other, and to existing roads adjoining the development.

(2) Where development is planned in stages, the boundaries of proposed stages are shown on the plan, and the stages identified by numbering.

(3) Existing and proposed streets which are adjacent to or fronting the proposal are included on the layout plans.

(4) All services, natural features, significant trees and the like are shown on existing road reserves.

(5) Details of the permanent survey mark, including the AHD level from which the levels were transferred, are included.

6.1.2.2 Plan of each new road

(1) The plan of each road includes:
- (a) road boundaries;
- (b) lot boundaries, both existing and proposed;
- (c) centreline or other construction line;
- (d) chainages on centreline or construction line;
- (e) bearings of the centreline or construction line;
- (f) offsets if the construction line is not the centreline;
- (g) tangent point chainages of each curve;
- (h) radius and tangent length of each curve;
- (i) road boundaries, centreline, and bearing of each intersecting road;
- (j) chainage of the intersection point of road centrelines;
- (k) channel lip lines, kerb types, lip radii and chainage of all tangent points of lip lines;
- (l) edge of pavement, where no kerb and channel is proposed;
- (m) dimensioned road, verge, footpath and pavement widths, where these differ from the standard cross section;
- (n) location and details of signs and road markings proposed;
- (o) drain line locations and diameters of pipes;
- (p) access chamber locations;
- (q) gully location tabulated to include type, chainage, centre of grate lip level, pipe diameter and invert levels;
- (r) location of existing utilities or other existing works within the site;
- (s) limits and levels of lot filling or grading;
- (t) co-ordinates of all set out points;
- (u) origin permanent survey mark for AHD and level;
- (v) origin permanent survey marks for horizontal datum and coordinates;
- (w) location and levels of survey control stations reference marks on AHD; and,
- (x) north point.

6.1.2.3 Detail plans of intersections, culs-de-sac or the like

(1) Intersection detail plans include all relevant information required for plans together with additional details such as channel lip levels on all kerb and channel returns, pavement contours and channelisation works.

(2) Lip level longitudinal grading plots for kerb returns and culs-de-sac are shown on the drawing or alternatively, photocopies of plots may be submitted for examination.

6.1.2.4 Longitudinal sections of roads

(1) The longitudinal section of each road includes:
- (a) chainages;
- (b) peg levels;
- (c) design road centreline levels;
- (d) a plot of the existing surface on the construction centreline;
- (e) design grades;
- (f) chainage and level of tangent points of vertical curves;
- (g) sight distance diagram for each direction of travel (for collector or higher order roads only); and,
- (h) line marking where applicable.

6.1.2.5 Type cross sections of roads

(1) A standard cross section is shown for each road, including:
- (a) road width;
- (b) pavement widths, lip to lip dimension;
- (c) road verge widths;
- (d) concrete footpath and cycle paths;
- (e) crossfalls of pavement and road verges;

(f) pavement depth;
(g) type of kerb and channel; and,
(h) type of pavement surfacing.

6.1.2.6 Cross sections of roads

(1) A cross section is shown for each chainage on each road.

(2) Cross sections show:
(a) road boundaries;
(b) pavement centreline, or other construction lines;
(c) natural surface;
(d) design cross section; and,
(e) crossfall of pavement and road verge, pavement and road verge widths, and pavement depths, wherever these differ from the standard cross section.

(3) When existing bitumen sealed roads are widened, cross sections include the full existing sealed pavement cross section at not more than 10 metre intervals.

(4) Each cross section shows the percentage crossfall on the existing bitumen surface and the design crossfall to the lip of the proposed kerb and channel.

(5) Notations on drawings also require the supervising engineer to check for any errors between the design and the set out of the kerb and channel before the kerb and channel is constructed.

6.1.2.7 Signs and road pavement marking plans

(1) These plans show all necessary traffic lights, warning signs, regulatory signs, direction signs and pavement marking details, adequately dimensioned for accurate setting out. The sign and line marking information is on a separate set of plans to other plans referred to above.

6.1.2.8 Longitudinal sections of stormwater drain lines

(1) A longitudinal section of each drain line is shown, including:
(a) chainages;
(b) existing surface levels;
(c) design invert levels;
(d) access chamber chainages, inlet and outlet invert levels, and finished surface levels of
(e) structures;
(f) distances between access chambers;
(g) grade of each pipe in percent;
(h) diameter of each pipe length;
(i) class of each pipe, length and type of pipe;
(j) design discharge;
(k) design velocity; and,
(l) design hydraulic grade line.

(2) All piped drainage and constructed or natural channels used to convey runoff as part of the development are shown on drawings.

(3) Longitudinal sections and cross sections of all channels show the calculated hydraulic grade line for the design frequency.

(4) Piped drainage is included either on the road longitudinal sections where applicable or detailed separately.

6.1.2.9 Stormwater drainage catchment plan

(1) The catchment plan shows all catchments, including external areas contributing to the stormwater drainage design, and the following:
- (a) road boundaries;
- (b) lot boundaries;
- (c) peg lines and chainages;
- (d) finished surface contours at not more than 2 metres vertical interval or 30 metres horizontal interval with spot levels where 0.5 metre contours are more than 30 metres apart, all on AHD;
- (e) identification of drainlines;
- (f) access chambers, catchpits, location and type of stormwater improvement devices or associated infrastructure; and,
- (g) drainage easements where required over underground drainlines and outlets.

(2) Waterway longitudinal sections and cross sections are included in the drainage plans at intervals not exceeding 100 metres in order to determine flood levels.

6.1.2.10 Waterway and open channel plans

(1) Engineering drawings for waterways and open channels, whether natural or constructed, include the following information:
- (a) longitudinal and cross sections with invert levels, 50 percent AEP and 1 percent AEP flood levels, and where applicable, existing and proposed surface profiles;
- (b) plans showing existing and proposed surface contours, where applicable, and 1 percent and 50 percent AEP flood lines. Additionally, show 10 percent AEP flood lines in parkland; and,
- (c) details of all proposed construction, landscaping and maintenance.

6.1.3 Landscaping Design Plans

(1) The preferred scales of landscape drawings are as follows:
- (a) concept plans - minimum 1:500 preferred 1:100/1:250;
- (b) sketch plans and working drawings - minimum 1:250; and,
- (c) construction details - minimum 1:50;

(2) Landscape design plans must include (where relevant):
- (a) north point;
- (b) plan scales that are compatible with site plans, architectural and engineering drawings;
- (c) existing site information including, but not limited to, significant vegetation, boundaries;
- (d) contours, easements and drainage lines;
- (e) the proposed site layout (including proposed building footprint/s, heights and finished floor levels);
- (f) adjoining structures including trees that overshadow the site;
- (g) existing vegetation that is to be retained and/or removed;
- (h) location of identified areas of ecological value and/or ecological corridors;
- (i) location of adjoining pedestrian, bikeway and vehicular linkages;
- (j) proposed planting themes and entry treatments;
- (k) proposed surface treatments including paths and driveways;
- (l) proposed site contours and any retaining structures
- (m) location of proposed recreation facilities and/or infrastructure;
- (n) drainage and open space corridors;
- (o) bushfire hazard zones and fire trails;
- (p) entry statements and signage treatment;
- (q) indicative positions of all street furniture;
- (r) proposed lighting
- (s) communal and private open space areas;
- (t) external storage spaces and structures, including pergolas and sheds;
- (u) utility areas, clothes drying, waste and recycling storage collection areas; and,
- (v) fencing height and style;

6.2 DESIGN CALCULATIONS

(1) All engineering designs are to be fully documented and include all information necessary for interpretation of design. Proprietary computer software is supported by verification procedures and details of their theoretical basis. All software used is well documented and is an extensively used product.

(2) The consulting engineer must provide an electronic copy of the data and output files for the engineering design where appropriate.

(3) Tabulated calculations for urban drainage are required, including the same information and similar format as that shown in the Queensland Urban Drainage Manual (QUDM).

(4) Revised stormwater drainage calculations are resubmitted where the drainage is redesigned.

6.3 INSPECTIONS

(1) Prior to or during the construction phase inspections must be undertaken at the hold points nominated below and at any other time in accordance with the conditions of the development approval.

6.3.1 Prestart meeting

(1) Where required, a prestart meeting between the local government's representative/s and the consulting engineer, principal contractor and other relevant parties is to be undertaken prior to any works commencing on site.

(2) The consulting engineer is to allow a minimum of five business days from the date of the inspection request and that of the prestart meeting.

(3) At the time of or prior to requesting a prestart meeting, the consulting engineer must ensure all relevant documents have been submitted to Council including any permits and payment of any bonds in accordance with the conditions of the development approval.

6.3.2 Compliance inspection

(1) Upon completion of the development, a compliance inspection is to be undertaken with the consulting engineer and other relevant parties. The compliance inspection must be undertaken prior to sealing of the survey plan or the use of the development commencing, whichever is the soonest.

(2) All relevant documentation must be provided to council five business days prior to the inspection.

6.3.3 Works to be transferred into council ownership

(1) Where works involve the construction of assets to be transferred into council ownership the following inspections and/or submission of documentation may be required.

6.3.3.1 Roads

6.3.3.1.1 Pavement design

(1) Prior to commencing any pavement works, the consulting engineer must submit to council the subgrade test results including a plan showing the location of the tests and a proposed pavement design in accordance with section 3.4.1.10 of this policy for council approval.

6.3.3.1.2 Sub grade inspection

(1) A sub-grade inspection is required with council representatives after boxing out of the road for proof rolling of the subgrade and confirmation of the depth.

(2) The consulting engineer must contact council a minimum of 24hrs prior to the proposed inspection time to request a sub-grade inspection with council representatives.

(3) Pavement works may not proceed any further until a successful sub grade inspection has been undertaken.

6.3.3.1.3 Minus 250 inspection

(1) Where the proposed pavement is greater than 400mm in depth, a minus 250 inspection must be undertaken at 250mm below the final pavement level (280mm below the final AC surface level) for proof rolling, depth confirmation and inspection of the side drains.

Note: For pavements less than 400mm a minus 250 inspection is not required, the next hold point is the pre-seal inspection.

(2) The consulting engineer must contact council a minimum of 24hrs prior to the proposed inspection time to request an inspection with council representatives.

(3) Pavement works may not proceed any further until a successful minus 250 inspection has been undertaken.

6.3.3.1.4 Pre-seal inspection

(1) A pre-seal inspection is required with council representatives at the final pavement surface level for proof rolling of the pavement and checking of the shape.

(2) The consulting engineer must contact council a minimum of 24hrs prior to the proposed inspection time to request a pre-seal inspection with council representatives.

(3) AC surfacing works may not commence until a successful pre-seal inspection has been undertaken by council.

6.3.3.2 On-maintenance Inspection

(1) An on-maintenance inspection must be undertaken upon the completion of all civil and landscaping works that are to be transferred into council ownership. All required documentation and as-constructed drawings (in accordance with section 6.4 of this policy) must be submitted to the local government a minimum of five business days prior to requesting an inspection.

(2) Once the development is accepted on maintenance the defect liability period commences which is the period for which the applicant will be liable for any defects in materials, construction, maintenance (in the case of landscaping) and/or design intent of any works that are to be transferred into council ownership.

(3) As a result of council's review of the as-constructed information and an on-maintenance inspection of the completed works, the as-constructed information or documentation may require amendment. Where amended as constructed information is required, the applicant must either submit the amended drawings or lodge a bond for the security of the preparation and submission of as-constructed information prior to on-maintenance being formally accepted by council (refer to section 7.2.5 of this policy for information regarding bonding of as-constructed information).

6.3.3.3 Defect Liability Period

(1) The defect liability period for assets to be dedicated to Council is a minimum of twelve months from the date at which the works are accepted on maintenance by Council except for:
   (a) sewage pumping stations where the on-maintenance period is a minimum of 12 months commencing after a minimum of 15 equivalent tenements have been completed;
   (b) landscaping works where the period may vary from a minimum of six months to a maximum of 24 months depending on the scale of development and in order to ensure establishment and survival of planted species through varying seasonal conditions; and,
   (c) stormwater treatment devices where the period may vary from a minimum of 12 months to a maximum of 24 months depending on the scale of development and in order to ensure establishment and effective operation of the asset due to seasonal variations.

6.3.3.4 Off-maintenance Inspection

(1) An off maintenance inspection must be undertaken after the defect liability period has been completed and prior to formal acceptance of the works off maintenance by council.

(2) All required documentation must be provided to council a minimum of 5 days prior to requesting an off maintenance inspection.

(3) Any outstanding amended as constructed information must be finalised prior to off maintenance being accepted.

6.4 QUALITY ASSURANCE DOCUMENTATION AND TESTING

6.4.1 Documentation

(1) The following documentation must be submitted to the local government prior to requesting an on maintenance inspection:
   (a) conformance certificates for products and materials;
   (b) operating manuals;
   (c) inspection and testing certification;
   (d) copies of relevant test results (refer to checklist in Appendix C);
   (e) copies of stormwater quality device testing and certification
   (f) certification that any playground equipment or other park embellishment/street furniture has been installed or constructed in accordance with the relevant standards; and,
   (g) any other site specific testing required by the local government.

(2) An electronic copy of all documentation is to be provided in one complete assembled PDF document including a table of contents.

(3) Should any of the above test results fail to meet the local government's requirements the consulting engineer must include details of re-testing/rectification.

6.4.2 Certified Design As-Constructed Drawings

(1) Design drawings associated with the operational works approval are to be amended to reflect the final constructed works and submitted to the local government in digital (PDF) format.

(2) The following list includes specific drawings required in this format. Other drawings may be required as determined by the local government on an individual project basis:
   (a) cover sheet - locality plan, notes and details;
   (b) roadway and earthwork layout plans;
   (c) road longitudinal and cross sections;
   (d) road intersection details;
   (e) stormwater longitudinal sections;
   (f) stormwater details including access chambers, stormwater treatment devices and/or other associated infrastructure;

(g) drainage catchment plans including plot of relevant flood lines of waterways;
(h) drainage calculation sheets;
(i) signing and line marking plans;
(j) erosion and sediment control plans (final phase only);
(k) earthworks;
(l) landscaping plans;
(m) level datum, permanent survey mark number and reduced level adopted from which the site datum was determined; and
(n) the location, number and reduced level of all permanent survey marks located within the development.

(3) Each amended drawing is to show the following:
(a) the development name and stage;
(b) the name of the consulting engineer submitting the information;
(c) the local government's development reference file number;
(d) certification in accordance with the requirements above;
(e) property and easement boundaries as shown on the approved calculated lot layout;
(f) lot numbers as shown on the approved calculated lot layout; and
(g) approved road names.

6.4.3 Certified Digital As-Constructed Drawings

(1) Digital as-constructed information is to be submitted in accordance with the ADAC Data Capture Guidelines in Appendix D except for sewer and water assets which is in accordance with the SEQ Water Supply and Sewerage Design and Construction Code.

(2) All as-constructed engineering drawings must be certified as-constructed works by a registered professional engineer Queensland (RPEQ) in the form of a note on each drawing which confirms that it is a true and correct record of the works constructed. The required certificate is:

As-Constructed Works

It is certified that works herein have been constructed to relevant approved specifications and the operational works approval. The as-constructed drawings for these works constitutes a true and correct record of the works constructed and complies with the design intent.

Signature …… RPEQ No. ……
Date of Practical Completion……..
Company Title . . . . . .

(3) All as-constructed drawings are certified as-constructed works by a registered surveyor (Queensland), in the form of a note on each drawing. This will indicate that the location, the levels and the dimensions shown thereon are a correct record of an as-constructed survey performed in accordance with the prescribed accuracy standards. The required certificate is:

As-Constructed Works

It is certified that the locations, levels and dimensions of the infrastructure shown herein are a true representation of the constructed works and that the as-constructed survey was performed to the prescribed accuracy standards.

Registered Surveyors signature……
Company Title . . . . . .

Note: A registered surveyor is a person or a body corporate registered as a surveyor by the Surveyors Board of Queensland under the Surveyors Act 2003.

(4) The accuracy of surveyed as-constructed features is ± 0.05 metres horizontally and ± 0.01 metres vertically (at 3σ).

(5) The licensed/registered surveyor's certification provided to the local government must confirm that:
   (a) the road construction provides minimum verge widths and pavement widths in accordance with the approved engineering drawings;
   (b) the stormwater drainage pipes and access chambers are within easements and/or drainage reserves provided in accordance with the development approval; and,
   (c) the roof water and inter-lot drainage construction and sewerage construction are in correct relationship to property boundaries as required by the local government's standards.

6.4.4 Manuals for mechanical and electrical equipment

(1) Operation and maintenance manuals are provided covering the installation, commissioning, operation and maintenance of equipment supplied.

6.4.4.1 Standards

(1) Manuals comply with the current editions of all applicable Australian Standards, and in particular:
   (a) *AS1000: 1998 - The International System of Units, SI, and its Application;*
   (b) *AS1100: 1992 - Technical drawing - General principles;*
   (c) *AS1101: 1993 - Graphical Symbols for General Engineering;*
   (d) *AS1102: 1989 - Graphical Symbols for Electro-technology.*

6.4.4.2 Manual Detail

(1) Manuals are sufficiently comprehensive to enable local government staff to operate and maintain the equipment in an efficient and workmanlike manner.

(2) Manuals include descriptive information relating to individual items of equipment to assist personnel in becoming familiar with the equipment and its operation.

(3) Manuals include clear and concise instructions so as to allow proper and safe installation, commissioning, operation, correct maintenance, and compliance with the Manufacturer's Warranty.

(4) Such information relates specifically to the equipment as supplied. Any information which does not pertain to the equipment supplied is removed or deleted. Maintenance instructions are in sufficient detail to enable overhaul and replacement of all parts.

6.4.4.3 Submission

(1) One draft copy of the manual is submitted to the local government for review and approval. The local government will return a copy of this draft with appropriate comments. These comments are incorporated into a revised draft manual, one copy of which is re-submitted for a second review.

(2) This review by local government will not relieve the Developer of the responsibility to provide a useful and professionally prepared document.

(3) At such time when the local government's comments confirm that the manual is acceptable, the Contractor is to prepare the final manual.

(4) Provide an electronic (PDF) copy of the final manual to the local government before the works are accepted on-maintenance.

6.4.4.4 Addenda

(1) Should it become necessary to modify the final manual at some later stage, such as the inclusion of as-constructed information, the developer is to issue copies of the addenda to the local government for inclusion within the existing manuals.

(2) If, in the opinion of the local government, the addendum modifies the existing manuals extensively, the developer must re-issue the manuals completely.

6.4.4.5 Manual Construction

(1) All units are SI units.

(2) All information is in English.

(3) All data sheets for proprietary equipment plant are clearly reproduced and are to indicate the appropriate information pertinent to the installation.

(4) The title and drawing number, issued by the local government, is displayed on the front cover and spine of the document to enable the manual to be included in the drawing register.

6.4.4.6 Content

(1) As a minimum, the document contains:
- (a) equipment specification, including a complete system description and a full specification for each individual item of equipment;
- (b) a complete listing of the plant, equipment, valves, pipes and other items supplied and installed, including model and serial numbers;
- (c) functional description of its operation;
- (d) erection, assembly, installation, pre-commissioning and commissioning instructions and diagrams;
- (e) detailed operating instructions;
- (f) service and maintenance schedule and instructions including dismantling/assembly procedures and a table of maintenance tasks showing recommended time intervals between carrying out these tasks;
- (g) lubrication schedule, including details of lubricant types, grades and trade names, initial fill quantities, and re-lubrication quantities and intervals;
- (h) tabulation of all consumables excluding lubricants but including fuel type and quantity, electrical components, chemicals and other relevant data; and,
- (i) performance specification, including commissioning data.

6.5 SURVEY CONTROL

6.5.1 Horizontal Control

(1) The local government will supply without charge, the co-ordinates to be adopted for three or more survey control points, within the survey control network, adjacent to the development site.

(2) Where coordinated permanent survey marks are not available within 500 metres of the premises, the developer is responsible for:
- (a) establishing at least two permanent survey marks not less than 200 metres apart. Existing permanent survey marks, where available, may be adopted where ever they are secure;
- (b) coordination of these permanent survey marks on MGA coordinates to 3rd order, class C accuracy standards (< 0.03m positional uncertainty horizontally) as per the Inter-governmental committee on surveying and mapping standards and practices for control surveys (SP1); and,

(c) informing the local government and Department of Natural Resources and Mines (DNRM) of the method used in coordination, accuracy of coordinates and the coordinates determined for each of these permanent survey marks.

(3) All digital as-constructed information is supplied MGA coordinates.

6.5.2 Level Datum

(1) All levels supplied with As-Constructed information are reduced to and presented on Australian Height Datum (AHD).

(2) The local government will provide the reduced level to adopt for a permanent survey mark. The value provided is obtained from the local government's listing of DNRM survey control database and may vary from the value shown on the permanent survey mark sketch plan.

(3) For the extension of an existing development, as in staging, the reduced level provided for the initial permanent survey mark is adopted for the extension unless directed otherwise by the local government.

6.5.3 Permanent Survey Marks

(1) Permanent survey marks are placed on each development. Permanent survey marks are placed such that their spacing is not greater than 500 metres and not less than 100 metres.

(2) All permanent survey marks are connected to the cadastral boundaries of the development site and such connections are shown on the relevant cadastral survey plan. This is to include those marks used as horizontal control for the development works.

(3) Permanent survey marks are levelled to 4th order, class D (< 0.02m positional uncertainty horizontally) as per the Inter-governmental committee on surveying and mapping standards and practices for control surveys (SP1).

(4) A permanent mark sketch plan is completed and lodged with DNRM for each permanent survey mark placed. A copy of the sketch plan is submitted to the local government before the development will be approved for off-defect.

(5) Any permanent survey marks that cannot be located or are lost due to any associated development works are reported to the local government and DNRM for update of their Survey Control Database.

6.5.4 Survey Plans

(1) Survey plans submitted for sealing and registration must show the approved road names.

7.0 BONDING

7.1 RELATIONSHIP WITH THE PLANNING SCHEME

(1) This part sets out:

(i) guidance for applicants on the requirements for submission and return of security bonds. This is contained in the following subsections:
- 7.2.1 Types of security bonds
- 7.2.2 Performance bonds
- 7.2.3 Significant vegetation protection bonds
- 7.2.4 Uncompleted works bonds
- 7.2.5 As-constructed information bonds
- 7.2.6 Defect liability bonds
- 7.2.7 Form of security bonds
- 7.2.8 Deeds of agreement

7.2 SECURITY BONDS

7.2.1 Types of Security Bonds

(1) The five broad categories of security bonds are:
(a) performance bonds;
(b) significant vegetation protection bonds;
(c) uncompleted works bonds;
(d) as-constructed information bonds; and,
(e) defect liability bonds.

7.2.2 Performance Bonds

(1) Performance bonds are security bonds submitted to the local government prior to development works commencing, to secure the completion and fulfilment of specific conditions/works.

(2) The bond amount is subject to the type and scale of works carried out.

(3) Performance bonds must be submitted with the relevant submission of security bonds form and any other required documentation as outlined in the condition prior to a pre-start meeting or prior to development works commencing in the case where a pre-start meeting is not required.

(4) Performance bonds are refundable once the development is formally accepted on maintenance and the relevant refund of security bonds form is submitted to council.

(5) Where the condition/works are not completed to the satisfaction of the local government and in accordance with any relevant standards, the bond may be forfeited to cover the cost of the works.

7.2.3 Significant Vegetation Protection Bonds

(1) Significant vegetation protection bonds are security bonds submitted to the local government prior to the commencement of development works to secure and protect significant vegetation which has the potential to be detrimentally affected by the works.

(2) The bond amount is calculated by Council using tree evaluation methods which includes the cost to cover removal of the vegetation and replacement with the same species and maturity of vegetation (where this is possible).

(3) Significant vegetation protection bonds must be submitted with the relevant submission of security bonds form and any other required documentation prior to a pre-start meeting or prior to development works commencing in the case where a pre-start meeting is not required.

(4) Significant vegetation protection bonds are refundable upon completion of a minimum 12 month post-construction monitoring period (unless otherwise determined by the arborist) from the date all construction works are completed.

(5) Prior to the return of the bond, a report from a suitably qualified arborist (AQF level 5) must be provided which states that the vegetation is in sound health and confirms that the construction works have not had an adverse impact on the viability of the protected significant vegetation.

(6) Where the tree is found to be in poor health, and where recommended by the arborist, a further monitoring period may be agreed to by Council.

(7) In the event of decline or death of the vegetation, the bond will be forfeited to cover the cost of removal of the vegetation and replacement (where possible).

7.2.4 Uncompleted Works Bonds

(1) Uncompleted works bonds are security bonds submitted to the local government prior to the completion of development works, to cover the costs of all uncompleted works to enable council approval of the survey plan.

(2) Council may accept an uncompleted works bonds subject to (but not limited to) completion of the following level of works as detailed in the table below.

Table 1 - Level of Completion of Works

Type of Works	Level of Completion of Works
Construction and Earthworks	(1) 100 percent of bulk earthworks are completed and stabilised to the local government's satisfaction including the completion of any retaining walls; (2) 100 percent of the kerb and channel is completed to the local government's satisfaction; (3) Roads are certified by an authorised surveyor that the roads are within the correct alignment, where applicable; (4) 50 percent of the total value of construction works are completed to the local government's satisfaction; (5) All testing results (including RPEQ certification for retaining structures) and preliminary as-constructed information is provided to the local government.
Sewerage and Water Supply Works	(1) 100 percent of the total value of sewerage and water supply works, including external and internal reticulation, are completed to the local government's satisfaction; (2) All testing results and preliminary as-constructed information is provided to the local government.

(3) The bonding of uncompleted works relating to erosion and sediment control is generally not permitted.

(4) Prior to approval of the survey plans, council must be satisfied that all works and services will be completed and operational within three months of the date of approval of the plan of survey. A written undertaking from the supervising RPEQ to this effect will be required at the time of submission of the bond request.

(5) The uncompleted works bond is to the greater value of either -
(a) 150 percent of the estimated uncompleted works costs; or
(b) $5000.

(6) For all uncompleted works council requires a fully priced bill of quantities[25] certified by an RPEQ detailing the works completed and the works still outstanding.

(7) The applicant must lodge a formal request with council which must include the following (where applicable):
(a) the relevant bond submission form;
(b) all QA documentation for the completed works;
(c) as constructed plans for the completed works; and,
(d) a bill of quantities (signed by an RPEQ).

(8) After the bond submission is reviewed, council will confirm agreement of the proposed security bond amount with the applicant.

(9) Uncompleted works bonds are refundable once the development has been accepted on maintenance and all uncompleted works finalised and the relevant return of security bonds form is submitted to council.

(10) Where the works are not completed to the relevant standard within a reasonable timeframe, the bond may be forfeited to cover the cost of the works.

(11) Where agreed to by Council, bond reductions may be accepted. A request for a bond reduction must be accompanied by a fully price bill of quantities, updated as constructed plans and quality assurance documentation (where relevant) and the relevant return of security bond form.

7.2.5 As-Constructed Information Bonds

(1) As constructed information bonds are security bonds submitted to the local government prior to formal acceptance of the development works on maintenance, to secure the completion of the associated as constructed plans. Once the bond is received and reviewed, the development may be accepted on maintenance by council.

(2) The bond amount is calculated in accordance with Table 1 below.

[25] a bill of quantities is a fully priced itemised list, certified by an RPEQ, of the assets to be transferred to council ownership.

Table 1: As-constructed bond calculation

ROL or MCU	
Number of lots or units	**Charge per lot or unit**
Up to 5	$ 550
6 – 10	$ 500
11 – 40	$ 450
40 – 60	$ 440
Over 60	$27,000 flat rate
Non-residential MCU	$2,500 or 2.5% of the civil construction costs (whichever is greater)

(3) Amendments to as-constructed drawings or documentation required by council are to be completed and the information resubmitted to the satisfaction of council a maximum of 1 month after the date of on maintenance.

(4) As-constructed bonds must be submitted with the relevant submission of security bonds form.

(5) The bond will be returned upon acceptance of the final as-constructed plans and submission of the relevant return of security bonds form.

(6) Non-compliance with resubmission of amended as-constructed information within this period may result in:
- (a) the defect liability period being extended until the as-constructed data is submitted to council; or
- (b) the as-constructed information bond being forfeited to cover all costs incurred by council for the capture and presentation of the information.

7.2.6 Defect liability bonds

(1) Defect liability bonds are security bonds submitted to council prior to formal acceptance of the development on maintenance for all assets to be transferred into council ownership and cover the cost of repair/replacement of defective assets and landscaped areas, during the defect liability period.

(2) All assets and landscaped areas that are to be transferred into council ownership must undergo a defect liability period as specified by the conditions of the development approval/s.

(3) For landscaped areas, the areas must be maintained during the defect liability period in accordance with the approved maintenance program and any applicable condition of approval. Where there is a significant loss of plants (as determined by council), the plants must be replaced and a minimum 3 month establishment period undergone prior to the landscaping being accepted off maintenance.

(4) For civil works, all assets to be transferred into council ownership must be repaired/replaced where there is any defective work or where the assets do not meet the design intent prior to the development being accepted off maintenance.

(5) The defect liability period commences following formal acceptance of the works on maintenance by council.

(6) The defect liability bond is the greater value of either:
(a) 10% of the contributed assets; or
(b) $2500.

(7) A fully priced bill of quantities certified by a RPEQ must be submitted to council detailing the development works that are to be transferred into council ownership.

(8) Defect liability bonds are refundable upon council acceptance of the development off maintenance and submission of the relevant return of security bonds form.

(6) In the event that there are defective works that are not rectified the bond may be forfeited to cover the cost of the works.

7.2.7 Form of security bonds

(1) Security bonds submitted to the local government may be in the form of either:

(a) cash; or
(b) bank guarantees.

(2) Cash security bonds may be paid in the form of a cheque. However, in the case of the personal cheque, the security bond will not be processed and approved until the cheque amount is cleared.

(3) The local government will not accept any other form of security bonds other than those outlined above unless detailed in an infrastructure agreement or conditioned under a development approval.

(4) The local government requires security bonds to be submitted to the local government in the form of cash for the following development works:

(a) road cleaning;
(b) road opening;
(c) vegetation protection for amounts of $10 000 and less.

(5) The local government requires bank guarantees that:

(a) are irrevocable guarantees from a recognised trading bank;
(b) are open ended with no expiry date;
(c) are unconditional;
(d) detail the full and correct name of the customer/applicant;
(e) detail the full and correct real property description to identify the property for which the security bond is for;
(f) where applicable, detail the different types of bonds, the relevant amounts covered by the guarantee, and a statement describing the specific purpose(s) of the bond;
(g) give the council development approval number/s; and,
(h) are for the total secured sum.

7.2.8 Deeds of Agreement

(1) For security bond amounts:

(a) between $250 000 and $500 000 - the local government requires a standard deed of agreement to be signed by the applicant and a delegate of the council which specifies the required security bond amount/s; or

(b) greater than $500 000 - the local government requires a security bond agreement, prepared by the local government's solicitors, to be signed by the applicant, any party holding a mortgage over the property and a delegate of the council which specifies the required security bond amount/s. The cost of the preparation of the security bond agreement is to be borne by the applicant.

8.0 STANDARD DRAWINGS

8.1 GENERAL

Topic	Drawing No	Title
Fencing	IPWEA GS-042	Fencing – Log Barrier and Alternative Hardwood Timber Bollard
	IPWEA GS-043	Fencing – Locking Rail Types 1, 2 and 3
	IPWEA GS-044	Fencing – Tubular Steel Fence With & Without Chain Wire
	IPWEA GS-045	Fencing – Welded Mesh Fencing and Control Fence
	IPWEA GS-047	Fencing – Entrance Barrier – Single Swing Gate
	IPWEA GS-048	Fencing – Entrance Barrier – Double Swing Gate

8.2 STORMWATER DRAINAGE AND WATER QUALITY

Topic	Drawing No	Title
Access chamber	IPWEA DS-010	Access Chamber – Stormwater Access Chamber Details – 1050 to 2100 dia.
	IPWEA DS-015	Access Chamber – Manhole Frame – Roadway and Non-Roadway – 1050 to 2100 dia.
	IPWEA DS-018	Access Chamber – Manhole Riser Details (Roadway)
	IPWEA DS-019	Access – Chamber – Manhole Cover (Roadway) 1050 to 2100 dia
	IPWEA DS-020	Access Chamber – Manhole Cover (Non -Roadway) 1050 to 2100 dia
	IPWEA DS-021	Access Chamber – Manhole Cover Concrete Infill (Pedestrian Traffic) 1050 to 2100 dia
Bedding and backfilling	IPWEA DS-030	Excavation, Bedding and Backfilling Rigid & Flexible Drainage Pipes
	IPWEA DS-031	Excavation, Bedding and Backfilling Precast Box Culverts
Erosion and sediment control	IPWEA DS-040	Sediment Control – Sediment Control Devices – Sediment Fence – Entry/Exit Sediment Trap
	IPWEA DS-041	Sediment Control – Sediment Control Devices – Kerb and Field Inlets – Check Dams & Straw Bales
Drainage pits	IPWEA DS-050	Drainage Pits – Field Inlet – Type 1 and Type 2
	IPWEA DS-061	Drainage Pits – Kerb Inlet – Precast Lintel Details
	IPWEA DS-062	Drainage Pits – Kerb Inlet – Grate and Frame
	IPWEA DS-063	Drainage Pits – Kerb Inlet – Lip in Line – General Arrangement
	IPWEA DS-069	Drainage Pits – Field Inlet Pit – Dome Top Cover (900 x 600)
Bioretention	IPWEA DS-070	Bioretention Drainage Profile – Type 1 – Saturated Zone – Unconstrained
	IPWEA DS-071	Bioretention Drainage Profile – Type 1 – Saturated Zone – Constrained
	IPWEA DS-072	Bioretention Drainage Profile – Type 2 – Sealed
	IPWEA DS-073	Bioretention Drainage Profile – Type 3 – Conventional
	IPWEA DS-074	Bioretention Drainage Profile – Type 4 – Pipeless
	IPWEA DS-075	Large Bioretention Sediment Forebay
	IPWEA DS-076	Bioretention Weir
	IPWEA DS-077	Bioretention Street Tree
	IPWEA DS-078	Bioretention Standard Notes
Inlet screen	IPWEA DS-082	Drainage Details – Culvert Inlet Screen

8.3 ROADS

Topic	Drawing No	Title
Driveways	R-RCC-1	Domestic Driveway Crossover
	R-RCC-2	Commercial/Industrial/Multiple Dwelling/Apartment Building Driveway Crossover (Type A)
	R-RCC-3	Commercial/Industrial Driveway Crossover (Type B)
	IPWEA RS-056	Driveways – Rural Driveway
Footpaths	R-RCC-4	Concrete Footpath and Shared Use Paths
	R-RCC-5	Footpath Profile
Utilities in road reserve	R-RCC-6	Public Utilities in Road Reserve – corridors and alignments
	R-RCC-7	Public Utilities in Road Reserve – conduit sections
Kerb and channel	IPWEA RS-080	Kerb and Channel – Profiles and Dimensions – Including Edge Restraints, median & Channel
	IPWEA RS-081	Kerb and Channel – Residential Drainage Connections
Kerb ramps	IPWEA RS-090	Kerb Ramps – Ramped Pedestrian Crossings
	IPWEA RS-091	Kerb Ramps – Ramped and Cut Through Treatments – For Pedestrian Crossings, Slip Lanes and Medians
	IPWEA RS-092	Kerb Ramps – Installation of TGSIs – on Ramped Kerb Crossings
	IPWEA RS-093	Kerb Ramps – Installation of TGSIs – on Ramped Kerb Crossings – Application Examples
	IPWEA RS-094	Kerb Ramps – Locations and Configurations
Signs	IPWEA RS-130	Road Furniture - Street Name Sign and Location (Fingerboard)
	IPWEA RS-131	Road Furniture – Traffic Sign Installation Details
Subsoil drains	IPWEA RS-140	Subsoil Drains – Details and Location
	IPWEA RS-142	Subsoil Drains – Access Points
Pavement trenching and widening	IPWEA RS-170	Pavement Extension – Trenching and Widening

8.4 CYCLEWAYS

Topic	Drawings No	Title
Entrance control	IPWEA PS-010	Bikeway Entrance Control – Type 1 – Low Volume
	IPWEA PS-011	Bikeway Entrance Control – Type 2 – High Volume
	IPWEA PS-013	Bikeway Slowdown Control – Reverse Curve
	IPWEA PS-015	Bikeway Entrance Control – Offset Chicane
Deflection rail	IPWEA PS-016	Bikeway Furniture Details – Deflection and Rest Rail Detail

8.5 LANDSCAPING

Topic	Drawings No	Title
Street tree planting	IPWEA GS-010	Landscaping – Street Tree Planting Details Including Root Barrier
	IPWEA GS-011	Landscaping – Street Tree Planting Details Wide Median
	IPWEA GS-012	Landscaping – Street Tree Planting Details Narrow Median

APPENDIX A

EROSION AND SEDIMENT CONTROL FORMS AND CERTIFICATION

REDLAND CITY COUNCIL

Erosion Hazard Assessment

Redland City Council (RCC), *Erosion Hazard Assessment* must be read in conjunction with the *Erosion Hazard Assessment-*

What is an Erosion Hazard Assessment (EHA)?
Soil erosion and sediment from urban development, particularly during construction activities, is a significant source of sediment pollution in Redland's waterways. The Erosion Hazard Assessment determines whether the risk of soil erosion and sediment pollution to the environment is 'low' , 'medium' or 'high'.

When is the EHA required?
An *Erosion Hazard Assessment* form must be completed and lodged with RCC for any Development Application (ie MCU or ROL) that will result in soil disturbance OR Operational Works or Compliance Assessment Application for 'Filling' or Excavation.

Failure to submit this form during lodgement of an application may result in assessment delays or refusal of the application.

Assessment Details

1 Please turn over and complete the erosion hazard assessment.

2 Based on the erosion hazard assessment overleaf, is the site:

☐ ***A 'low' risk site***

Best practice erosion and sediment control (ESC) must be implemented but no erosion and sediment control plans need to be submitted with the development application. Field guides for best practice ESC can be found at http://www.austieca.com.au/publications/book-5-field-guides

☐ ***A 'medium' risk site***

If the development is approved, the applicant will need to engage a Registered Professional Engineer (RPEQ) or Certified Professional in Erosion and Sediment Control (CPESC) to prepare an ESC Program and Plan and supporting documentation — in accordance with the requirements of the Infrastructure Works Planning Scheme Policy.

☐ ***A 'high' risk site***

If the development is approved, the applicant will need to engage a RPEQ and CPESC to prepare an ESC Program and Plan and supporting documentation — in accordance with the requirements of the Infrastructure Design Planning Scheme Policy. The plans and program will need to be certified by a CPESC.

Taken and modified from Brisbane City Councils EHA

3 Site Information and Certification

Application number (if known)

Site address

Postcode

I certify that:

☐ I have made all relevant enquiries and am satisfied no matters of significance have been withheld from the assessment manager.

☐ I am a person with suitable qualifications and/or experience in erosion and sediment control.

☐ The Erosion Hazard Assessment was completed in accordance with the RCC Infrastructure Design Planning Scheme Policy.

☐ The Erosion Hazard Assessment accurately reflects the site's overall risk of soil erosion and sediment pollution to the environment.

☐ I acknowledge and accept that the RCC, as assessment manager, relies, in good faith, on this certification as part of its development assessment process and the provision of false or misleading information to the RCC constitutes an offence for which RCC may take punitive steps/ action against me/ enforcement action against me.

Certified by *Print name*

Certifier's signature

Date

/ /

Assessment Table

Table 1: Low Risk Test

		Yes	*No*
1.1	Is the area of land disturbance > 1000 m^2		
1.2	Does any land disturbance occur in a RCC Waterways, Wetland and Moreton Bay overlay area.		
1.3	Does any land disturbance occur in a RCC Landslide Hazard overlay or is there any slope on site during or after construction that is steeper than 15%, and longer than 3 m in length.		
1.4	Does any land disturbance occur below 5 m AHD		
1.5	Does development involve endorsement of a staging plan		
1.6	Is there an upstream catchment passing through the site > 1 hectare		

Have you answered 'yes' to any of the questions in Table 1?	*Yes*	*No*	**If '*No*' then site is low risk with respect to erosion and sediment control**

If '*Yes*' then proceed to Table 2

Table 2: Medium Risk Test

		Yes	*No*	
2.1	Is the area of land disturbance > 1 hectare			**If '*No*' then site is <u>medium risk</u> with respect to erosion and sediment control**

If '*Yes*' then proceed to Table 3

Table 3: High Risk Test

3.1	Is there an upstream catchment passing through the site > 1 hectare		
3.2	Have you answered yes to 1.2 above (Water ways)		
3.3	Have you answered yes to 1.3 above (Steep Slope)		

Have you answered 'yes' to any of the questions in Table 3?	*Yes*	*No*	**If '*No*' then site is <u>medium risk</u> with respect to erosion and sediment control**

If '*Yes*' then site is <u>high risk</u> with respect to erosion and sediment control

REDLAND CITY COUNCIL
DESIGN CERTIFICATE

Erosion and Sediment Control

This form is to be completed and signed by the suitably qualified and experienced professional responsible for the preparation of the Erosion and Sediment Control Plan (ESCP).

Name of Development: _____

Location of Development: _____

Land Owner: _____

Supervising Engineer: _____

Related or Higher-Order Approval Number: _____

Operational Works Approval Number: _____

Drawing/Report Numbers for documents associated with this Certification: _____

MANDATORY INFORMATION: You are required to answer the following question. If the answer to the question is "NO", provide details of how compliance with the Conditions of the Development Permit will be achieved

	YES	NO
Is the ESCP and associated documentation in accordance with the requirements of the Conditions of the Development Permits which apply to the site	❑	❑

DETAILS IF THE QUESTION IS ANSWERED "NO": (Provide details of how compliance with the Conditions of the Development Permits and obligations of the *Environmental Protection Act 1994* will still be achieved). Use separate sheet if necessary.

_____

_____

_____

_____

CERTIFICATION

I certify that this information has been provided in accordance with Council's requirements and that, having made all relevant enquiries, I am satisfied that no matters of significance have been withheld from Council's Delegate. This form was completed by myself, or under my direct supervision, and I am suitably qualified and/or experienced to provide such certification. The information submitted is, to the best of my knowledge and belief, true, accurate and complete. I acknowledge and accept that the Council, as the administering authority relies, in good faith, on this certification as part of its development approval process and that the provision of false or misleading information to the Council constitutes an offence against the *Sustainable Planning Act 2009.*

Certified By (print name in full): _____

RPEQ No or CPESC No: _____

P.I. Insurance No. & Company: _____

_____

Certifier's Signature: _____ **Date:** _____

REDLAND CITY COUNCIL
INSPECTION CERTIFICATE

Erosion and Sediment Control

This form is to be completed and signed by a suitably qualified and experienced professional.

Name of Development: _____

Location of Development: _____

Land owner: _____

Inspected by (Name/Company): _____

Related or Higher-Order Approval Number: _____

Operational Works Approval Number: _____

Construction Stage/Hold Point: _____

Time and Date of inspection: _____

MANDATORY INFORMATION: You are required to answer the following question:

	YES	NO
(a) In regard to erosion and sediment control, at the time of inspection, was the development site in compliance with the development permits applicable to the works.	❑	❑

If answered "NO" to Question a) then complete Question b)

(b) Has specific advice been given to the applicant, which if implemented, will achieve compliance with the development consent and the obligations and duties of the *Environmental Protection Act 1994*	❑	❑

DETAILS IF QUESTION a) ANSWERED "NO": Provide a summary of the advice issued to the Land owner to ensure compliance with the Conditions of the Development Permit and obligations under the *Environmental Protection Act 1994* will be achieved. Use separate sheet if necessary _____

_____

_____

CERTIFICATION

I certify that this information has been provided in accordance with Council requirements and that, having made all relevant enquiries, I am satisfied that no matters of significance have been withheld from Council's Delegate. This form was completed by myself, or under my direct supervision, and I am suitably qualified and/or experienced to provide such certification. The information submitted is, to the best of my knowledge and belief, true, accurate and complete. I acknowledge and accept that the Council, as the administering authority relies, in good faith, on this certification as part of its development process and that the provision of false or misleading information to the Council constitutes an offence against the *Sustainable Planning Act 2009.*

Certified By (print name in full): _____

RPEQ No or CPESC No: _____

P.I. Insurance No. & Company: _____

_____

Certifier's Signature: _____ **Date:** _____

APPENDIX B

Tree Species List

Botanical Name	Common Name	Height	Canopy Width	Canopy Type				E/green	Endemic	Planting Location			Soil Type			Plant under P/lines	Flower Characteristics	
				S	M	L	U			Street	Narrow Verge (<2m)	Park	Coastal	Alluvial	Hilly Terrain of Hinterland		Colour	Months
Acmena hemilampra	Broad Leaved Lilly Pilly	6-12m	5m		●			●		●			●				White	O,N
Acmena smithii	Lilly Pilly	5-8m	3m		●			●		●			●	●			White	S,O,N,D,J,F
Agathis robusta	Kauri Pine	20m	8m				●	●		F		●		●	●			
Alectryon connatus	Grey Bird's Eye	18m	6-8m		●			●		●			●				Yellow	F,M
Alectyron coriaceus	Beach Bird's Eye	4-5m	2-3m	●				●	●	●	●		●				Yellow	D,J,F
Allocaasuarina littoralis	Coastal Sheoak	10m	3-5m		●			●				●	●				Red	M,A,M
Allocasuarina torulosa	Forest Oak	10-15m	5-8m		●			●				●		●			Red	S,O,N,D,J,F
Araucaria cunninghamii	Hoop Pine	50m	6-8m				●	●		F		●	●	●	●			
Araucaria hetrophylla	Norfolk Island Pine	60m	8-10m				●	●		F		●	●					
Backhousia citriodora	Lemon Scented Myrtle	3-6m	2-4m	●				●		●	●		●	●	●		White	D,J,F,M
Banksia aemula	Wallum Banksia	5m	2-3m	●				●		●	●			●			Yellow	M,A,M,J
Banksia integrifolia	Coastal Banksia	5m	2-3m	●				●		●	●	●	●				Yellow	J,F,M,A,M,J
Banksia oblongifolia	Fern Leaved Banksia	2m	1-2m		●			●				●	●				Yellow	M,A,M,J,J
Brachychiton acerifloius	Illawarra Flame Tree	10m	4-6m		●							●		●	●		Red	D,J,F
Brachychiton bidwillii	Little Kurrajong	6-8m	2-3m		●							●		●	●		Red/Pink	D,J,F
Buckinghamia celsissima	Ivory Curl	5-8m	2-4m	●	●			●		●	●			●	●	●	Cream/Yellow	J,F,M
*Callistemon viminalis**	Weeping Bottlebrush	2m	3m					●		●			●	●			Red	O,N,D,J,F
*Callistemon viminalis**	Dawson River'	5m	2-3m	●				●		●	●		●	●	●	●	Red	S,O,N,D,J,F
*Callistemon viminalis**	Hannah Ray'	5m	2-3m	●				●		●	●		●	●	●	●	Red	S,O,N,D,J,F
Callitris columellaris	Bribie Island Pine	10m	4-6m			●		●				●	●					
Casuarina equisetifolia	Horse tail Sheoak	10-15m	4-6m		●			●				●	●				Red	S,O
Casuarina glauca	Swamp Oak	10-20m	4-8m		●			●				●	●	●			Red	S,O
Corymbia cirtriodora	Lemon Scented Gum	30m	10-15m			●		●				●		●	●		Cream/White	D,J,F,M
Corymbia intermedia	Pink Bloodwood	30m	10-12m			●		●	●			●		●	●		Cream/White	D,J,F
Cryptocarya laevigata	Glossy Laurel	6m	2-3m		●			●				●		●			Cream/White	O,N
Cryptocarya triplinervis	Three Veined Laurel	12m	4m		●			●	●			●		●			Green	S,O,N
Cupaniopsis anacardioides	Tuckeroo Tree	8-12m	4-5m		●			●		●		●	●			●	Yellow	D,J,F
Delonix regia	Poinciana Tree	8-15m	8-10m			●		●		F		●	●	●	●		Red/Orange	N,D,J
Elaeocarpus eumundii	Eumundii Quandong	8-12m	4m				●	●		●				●	●		Cream	N,D
Elaeocarpus grandis	Blue Quandong	15-25m	8m			●		●				F		●	●		White	M,A,M
Elaeocarpus obovatus	Hard Quandong	10-15m	4-5m		●			●		●			●	●			White	D,J,F,M
Elaeocarpus reticulatus	Blueberry Ash	5-6m	3-4m	●	●			●		●	●			●	●		White/Pink	D,J,F
Eucalyptus microcorys	Tallow wood	30m	5-10m			●		●				●		●	●		White	J,A,S,O,N
Eucalyptus pilularis	Blackbutt	25m	10m			●		●				●		●	●		White	S,O,N,D,J,F,M
Eucalyptus resinifera	Red Mahogany	15-20m	5-10m			●		●				●		●	●		White	O,N,D.J.F
Eucalyptus tereticornis	QLD Blue Gum	20m	5-10m			●		●				●		●	●		White	J,J,A,S,O,N
Corymbia tessellaris	Moreton Bay Ash	35m	10-15m			●		●				●		●	●		White	J,A,S,O,N
Ficus macrophylla	Moreton Bay Fig	30m	20m			●		●	●			F	●	●	●			
Ficus obliqua	Green Leafed MB Fig	10m	5-8m		●			●	●			F		●	●			
Flindersia australis	Crows Ash	10m	5-8m		●			●		●							Cream/White	S,O,N

Botanical Name	Common Name	Height	Canopy Width	Canopy Type				E/green	Endemic	Planting Location			Soil Type			Plant under P/lines	Flower Characteristics	
				S	M	L	U			Street	Narrow Verge (<2m)	Park	Coastal	Alluvial	Hilly Terrain of Hinterland		Colour	Months
Flindersia brayleana	Queensland Maple	10m	4-8m		●			●		●				●	●		Cream/White	S,O,N,D,J,F
Flindersia xanthoxyla	Yellow wood	10m	4-8m		●			●	●	●				●	●		Cream/White	D,J,F
Gmelina leichardtii	White Beech	6m	3-4m		●			●				●		●	●		Cream	S,O,N
Grevillea baileyana	White Oak	6m	2-4m	●	●			●		●	●			●	●		White	M,J,J
Guoia semiglauca	Guoia / White Quince	5-6m	2-3m	●	●			●	●	●	●		●	●		●	White	S,O,N
Harpullia pendula	Tulipwood	5-6m	2-3m	●	●			●		●	●			●	●		Yellow/Green	S,O,N,D
Hibiscus tiliaceus	Cottonwood	10m	5-10m		●			●				●	●				Yellow	D,J,F
Lepiderma pulchella	Fine Leaf Tuckeroo	5m	2-3m	●	●			●		●	●		●	●			Yellow	D,J,F
Leptosernum petersonii	Lemon Scented Tea Tree	5m	2-3m	●				●		●	●		●	●		●	White/Pink	D
Lophostemon confertus	Brushbox	8m	4-5m		●			●				●		●	●		White	O,N,D
Lophostemon suaveolens	Swamp Mahogany	15m	5-8m		●			●				●		●	●		White	D,J,F
Magnolia grandiflora 'Little Gem'	Magnolia 'Little Gem'	6m	2-4m	●	●			●		●	●			●	●	●	White	S,O,N
Melaleuca linarifolia	Snow in Summer	12m	5m	●	●			●		●	●	●		●		●	Cream/White	S,O,N
Melaleuca quinquenervia	Broad leafed paperbark	10-15m	5-10m			●		●	●			●	●	●			Cream	S,O,N,D,J,F,M,A
Melia azederach	White Cedar	10m	2-4m		●							●		●			Mauve	S,O,N
Pandanus pendunculatus	Screw Pine	7m	4-6m		●			●				F	●					
Peltophorum pterocarpum	Yellow Flame Tree	15-20m	10-15m			●						F		●	●		Yellow	O,N,D,J,F
Podocarpus ellatus	Brown Pine	10m	2-3m		●			●		F		F		●	●			
Syzygium australae	Shrub Cherry	8m	2-3m		●			●		●		●	●	●	●		White	S,O,N
Syzygium jambos	Rose Apple	8m	4-6m			●		●		●		●		●	●		White	O,N,D
Syzygium leuhmanii	Riberry	8m	2-4m		●			●	●	●		●	●	●	●		White	O,N,D
Syzygium oleosum	Blue Lilly Pilly	8m	2-4m		●			●	●	●		●		●			White	N,D,J,F,M,A,M
Tabebuia chrysanthus	Yellow Tabebuia	8m	3-5m	●	●					●	●		●	●			Yellow	S,O,N
Tabebuia palmeri	Pink Trumpet Tree	8m	3-5m	●	●					●	●		●	●			Pink	S,O,N
Tabebuia rosea	Pink Trumpet Tree	8m	3-5m		●					F			●	●			Pink	S,O,N
Tristaniopsis laurina	Water Gum	8m	4-6m		●			●		●			●	●			Yellow	D,J,F
Waterhosia floribunda	Weeping lilly Pilly	10m	5-6m		●			●		●				●			White	S,O,N,D,J,F
Xanthostemon chrysanthus	Golden Penda	5-6m	2-3m	●	●			●		●	●		●	●		●	Yellow	S,O,N,D,J,F

Legend

Canopy Width

S - up to 6m

M - 6 to 15m

L - Larger than 15m

U - Upright tree habit

Only on North Stradbroke Island

Only for Main Road Wellington Point, Colburn Ave Vic Point, Wellington St Ormiston, Bloomfield St Cleveland

Planting Location

F - Feature tree

Appendix C

On-Maintenance Checklist and Certification

Development Application Number: .....

Address:……..

	N/A	Attached
Certified As-Constructed Drawings		
Digital (ADAC) as-constructed drawings	☐	☐
Design as-constructed drawings	☐	☐
Inspection and Testing Documentation		
General		
RPEQ certification	☐	☐
Earthworks		
Compaction of fill	☐	☐
Level 1 report (certified by an RREQ)	☐	☐
Retaining wall certification	☐	☐
Roadworks		
Sub grade compaction	☐	☐
CBR 15 material quality	☐	☐
CBR 15 compaction-100 percent standard	☐	☐
Subgrade course material quality	☐	☐
Subgrade course compaction-100 percent standard	☐	☐
Base course material quality	☐	☐
Base course compaction-98 percent modified	☐	☐
Bituminous (chip) seal application rates	☐	☐
AC core compactions-92 percent	☐	☐
AC core depth-25mm/40mm	☐	☐
Water (in accordance with SEQ Code)		
Grading to water main bedding/surround material	☐	☐
Water main pressure tests	☐	☐
Water main bacteria test	☐	☐
Water meter installation details	☐	☐
Water main trench compaction	☐	☐

	N/A	Attached
Sewer (in accordance with SEQ Code)		
Grading to sewer bedding/surround material	☐	☐
Sewer pressure tests	☐	☐
Sewer main trench compaction	☐	☐
Sewer main closed circuit television report	☐	☐
Drainage		
Grading to stormwater drainage bedding material	☐	☐
Stormwater main trench compaction	☐	☐
Stormwater main closed circuit television report	☐	☐
Stormwater Treatment Device		
Subsoil drain filter media grading	☐	☐
Filter media certification (refer section 4 of Water by Design – Bioretention Technical Design Guidelines)	☐	☐
Maintenance plan	☐	☐
Other		
Concrete testing	☐	☐
Acoustic fence certification (form 15 and 16)	☐	☐
Operating manuals	☐	☐
Dust complaint resolved	☐	☐
Lots effectively stabilised	☐	☐
Other complaints resolved	☐	☐
Payments		
Defect liability bond	☐	☐
Sewer connection	☐	☐
Water connection	☐	☐
Other bonds/payments-	☐	☐

Other Items:…….....
……..
……..
……..
……..
……..

Note – This is not a comprehensive list and the applicant is requested to include additional items when applicable.

Verification by Consultant…….Date……

RPEQ Certification

It is hereby certified that all inspections and supervision were carried out at the appropriate stages of construction. The supervision and testing associated with the works are in accordance with the specifications, documentation and requirements of the relevant local government codes and policies. The Supervisor possesses appropriate recognised qualifications and experience.

Name:…… Company ……..

Signature…….. Date……RPEQ No……..

AILA Landscape Certification

It is hereby certified that all inspections and supervision were carried out at the appropriate stages of construction. The supervision and testing associated with the works are in accordance with the specifications, documentation and requirements of the relevant local government codes and policies. The Supervisor possesses appropriate recognised qualifications and experience.

Name:…… Company ……..

Signature…….. Date……AILA No…….

APPENDIX D

ADAC Data Capture Guidelines

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1. Purpose

The purpose of this document is to provide practical guidelines and general assistance with respect to the creation and provision of compliant ADAC XML files. ADAC XML files are to accompany any associated bundle of "As-Constructed" plans, drawings, schedules and associated information reflecting newly constructed civil infrastructure and associated assets handed over to Redland City Council.

On completion of physical works and prior to asset handover, "As-Constructed" (also known as "As-Built") information is used to indicate the locations of infrastructure installed as a part of the physical works. The final "As-Constructed" data should accurately reflect material types, specifications and other asset-specific information. The digital ADAC XML file is a complete and detailed digital record of "As-Constructed" Plan information and is used by Council to populate its asset system.

Specific details regarding the preparation and presentation of any required "As-Constructed" drawings and plans accompanying the ADAC XML can be accessed via the *Redlands Planning Scheme Policy 2 – Infrastructure Works*.

2. Introduction to ADAC XML

ADAC XML files are an accompaniment to the "As-Constructed" bundle of information required by Council as part of the final approval and handover of associated civil infrastructure and associated assets constructed.

Compliant ADAC XML files contain a structured and precise digital record of the assets described in the "As-Constructed" plans and other associated engineering documentation. Details include survey-accurate cadastral and boundary references, geometries and relative levels as well as detailed records of the new assets including accompanying attribute information.

ADAC XML files may also be used as a cross-check on accuracy and completeness of the "As-Constructed" information provided. The digital files afford a further confirmation of compliance with development approval conditions as well as helping to verify engineering specifications and other design-related requirements.

Depending on the tools (XML generator) being used to generate the ADAC XML, compliant files may be initially created during survey capture and then finalised in conjunction with the creation of the "As-Constructed" drawings. Alternatively the XML files may be generated after the electronic "As-Constructed" drawings have been finalised. It is essential that the "As-Constructed" drawings are created using complete and accurate information to correctly identify the assets and the locations being represented in the ADAC XML file.

On receipt of the "As-Constructed" bundle of information, Council will undertake data format and conformance checks on the ADAC XML file to confirm the completeness and validity of the details. Should significant anomalies, errors or missing information be identified during these checks, the ADAC XML file(s) may be returned to the provider for correction and resubmission in accordance with applicable conditions, potentially delaying the progress of the asset handover process.

Once the ADAC XML file(s) are accepted by Council, they are then uploaded to various internal systems and used to assist in the long-term management of the infrastructure. The detailed asset and location data is also available to external agencies in the future via various digital formats.

3. General Requirements

The ADAC XML file shall be produced using the most recent ADAC XML schema release (e.g. Version 4.1) and should be "validated" for compliance before being submitted to Council. Details on the data schema (attributes and mandatory status) describing the asset classes and sub-classes to be addressed by the ADAC capture process can be found throughout this document.

4. Datum Information

Data contained in the ADAC XML file(s) must reflect the survey details of the assets exactly as found in the real world and as accurately reflected in the "As-Constructed" drawings. Unless otherwise specified, survey details must be derived from permanent survey marks (PSMs), with Map Grid of Australia (MGA Zone 56 – GDA 94) co-ordinates and AHD levels to be to fourth order standard as defined by ICSM Standard for the Australian Survey Control Network Special Publication 1 (SP1) Version 2.0 October 2013.

5.0 Asset Capture Guidelines

The following section is intended to provide guidance on the capture of assets within the ADAC XML in a manner which is acceptable to Redland City Council.

The physical nature of assets will determine where/if assets are captured separately within the ADAC XML file. For example, a pathway would be captured as individual and separate features to reflect any changes in physical properties, such as width or material type. Where possible, diagrams and images have been supplied in this document to assist in asset capture.

5.1 Global Asset Attribution

Mandatory Attribution: The following attribution covered under the Global Types section of ADAC is mandatory for all assets:

Element Name	Mandatory (Y/N)
InfrastructureCode	N
Owner	N
Status	Y
Notes	N
SupportingFiles	N

The **Notes** element should be used to record any additional information regarding the asset, or to record attribute information which isn't available within the defined enumerations in the schema.

The **Status** is a critical element within the XML, as it is what Council uses to load new and dispose existing assets into the asset register. Please note the descriptions for each status below:

Status	Description
As-Constructed	New asset described as constructed
Existing	Existing asset described as encountered
Design	Future asset described as a design
Removed	Previously existing asset described as it was prior to removal
Retired	Pre-existing asset no longer in use, but left in-situ.
Rehabilitated	Existing asset repaired, refitted or refurbished as part of works project.

5.2 Cadastre assets

5.2.1 Cadastral Connection

Asset Capture: Simple linear feature capturing the cadastral connections as deduced from observations and the survey reference mark(s).

Spatial Relationship: Must be coincident to the vertices that define the Cadastre Lot boundary features and relevant PSMs.

Mandatory Attribution: The following attribution is mandatory for *Cadastral Connections*:

Element Name	Mandatory (Y/N)
Bearing	N
Distance_m	N

5.2.2 Easement

Asset Capture: Multi-patched area feature representing a new or existing Easement.

Spatial Relationship: May share boundaries with WaterCourseReserve, LotParcels or RoadReserve. Node points between shared boundaries must be coincident i.e. no overlaps or "slivers".

Mandatory Attribution: The following attribution is mandatory for *Easements*:

Element Name	Mandatory (Y/N)
LotNo	N
PlanNo	N

5.2.3 Lot Parcels

Asset Capture: Multi-patched area feature representing the boundary of a titled or proposed Cadastral Lot.

Spatial Relationship: May share boundaries with RoadReserves, WaterCourses or Easements. Node points between shared boundaries must be coincident i.e. no overlaps or "slivers".

Mandatory Attribution: The following attribution is mandatory for *Lot Parcels*:

Element Name	Mandatory (Y/N)
LotNo	N
PlanNo	N
CancelledLotPlan	N
TitledArea_sqm	N

5.2.4 Road Reserve

Asset Capture: Multi-patched area feature representing a gazetted or soon to be gazetted Road reserve boundary.

Spatial Relationship: May share boundaries with WaterCourseReserve, LotParcels, other RoadReserve or Easements. Node points between shared boundaries must be coincident i.e. no overlaps or "slivers".

Mandatory Attribution: The following attribution is mandatory for *Road Reserves*:

Element Name	Mandatory (Y/N)
Name	Y

5.2.5 Survey Mark

Asset Capture: Simple point feature representing a Permanent Survey Mark.

Spatial Relationship: May be used in a Cadastral Connection (as in lot parcels, noted above).

Mandatory Attribution: The following attribution is mandatory for *Survey Marks*:

Element Name	Mandatory (Y/N)
MarkName	Y

5.2.6 Water Course Reserve

Asset Capture: Multi-patched area feature representing the boundary of a Water Course reserve.

Spatial Relationship: May share boundaries with RoadReserves, LotParcels or Easements. Node points between shared boundaries must be coincident i.e. no overlaps or “slivers”.

Mandatory Attribution: The following attribution is mandatory for *Water Course Reserves*:

Element Name	Mandatory (Y/N)
Name	Y

5.3 Open Space Assets

5.3.1 Activity Area

General Information: Examples include: Sports Fields, Courts, Playgrounds and Animal Agility Areas.

Asset Capture: Multi-patched area feature representing different activity areas. For playgrounds, this will often align with the soft fall boundaries. For animal agility areas, this will often align with the fencing surrounding the area. For sports fields and courts, this will often align with the marked boundaries of the area, or the edge of the material. Please refer to the dashed yellow line in the example shown below in **Figure 1** representing activity areas for dedicated purposes.

Figure 1

Spatial Relationship: Feature must be totally within the Parent Open Space Activity Area feature.

Mandatory Attribution: The following attribution is mandatory for *Activity Areas*:

Element Name	Mandatory (Y/N)
Use	Y
Type	N
UnderSurfaceMaterial	Y
EdgeType	N

Positional Accuracy: The minimum accepted horizontal accuracy for *Activity Areas* is **± 5m.**

5.3.2 Activity Point

General Information: Includes individual pieces of playground, fitness, animal agility or sports equipment.

Asset Capture: Simple point feature representing individual activity assets that typically fall within an Activity Area. Playground modules should be represented as a single feature, located by its approximate centre point. Please refer to the yellow dots in the example shown in **Figure 1**.

Spatial Relationship: Should typically fall within a defined Activity Area feature.

Mandatory Attribution: The following attribution is mandatory for *Activity Points*:

Element Name	Mandatory (Y/N)
Use	Y
Type	Y
Material	Y
Theme	N
Units	N
Manufacturer	N
ModelNumber	N

Positional Accuracy: The minimum accepted horizontal accuracy for *Activity Points* is **± 5m.**

5.3.3 Artwork

General Information: Includes Entry Statements, Memorials, Monuments, Plaques, Sculptures & Statues.

Asset Capture: Simple point feature representing the centre of an asset.

Spatial Relationship: Not applicable.

Mandatory Attribution: The following attribution is mandatory for *Artwork*:

Element Name	Mandatory (Y/N)
Type	Y
Material	N

Positional Accuracy: The minimum accepted horizontal accuracy for *Artwork* is **± 5m.**

5.3.4 Barbeque

General Information: Not applicable.

Asset Capture: Simple point feature representing the centre of the barbeque. Any hot water units, taps, lighting or shelters associated with the barbeque should be captured as separate features. The slab the barbeque is installed on is **not** considered part of the asset and needs to be separately captured.

Spatial Relationship: Not applicable.

Mandatory Attribution: The following attribution is mandatory for *Barbeques*:

Element Name	Mandatory (Y/N)
EnergySource	Y
Plates	Y
SurroundingMaterial	Y
TopMaterial	Y
Manufacturer	N
ModelNumber	N

Positional Accuracy: The minimum accepted horizontal accuracy for *Barbeques* is **± 5m.**

5.3.5 Barrier Continuous

Asset Capture: Complex linear feature (polylines including curves but not bézier curves) representing a barrier type asset (e.g. fences, bollards, guardrails, pedestrian fall protection). Please refer to the dashed yellow line in the example shown below in **Figure 2**.

Guardrails should be captured under *Barrier Continuous*. When capturing guardrails, the attribution should be populated as follows:

- **Type:** ”Vehicle Barrier”
- **UprightMaterial:** Material of the posts
- **LinkMaterial:** Material of the rail
- **TopMaterial**: None
- **Length:** Length of the railing, including end treatments
- **Height:** Height of the railing
- **Notes:** Include the following:
  - Armour Rail / Steel Wire Rope / Wall
  - Leading & trailing end treatments

Spatial Relationship: None.

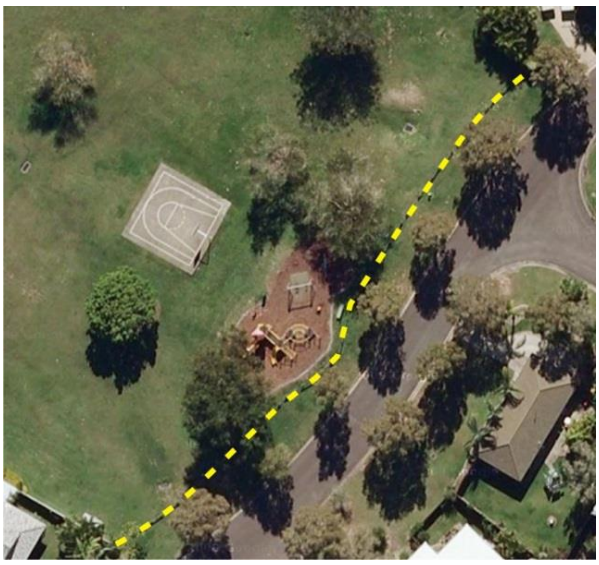


Figure 2

Mandatory Attribution: The following attribution is mandatory for *Barrier Continuous*:

Element Name	Mandatory (Y/N)
Type	Y
UprightMaterial	Y
LinkMaterial	Y
TopMaterial	N
Length_m	Y
Height_m	Y
UprightNumber	N

Positional Accuracy: The minimum accepted horizontal accuracy for *Barrier Continuous* is **± 5m.**

5.3.6 Barrier Point

General Information: Includes bollards and locking posts.

Asset Capture: Simple point feature representing the centre of an asset. Road guide posts are not to be captured as Barrier Points (not captured by Redland City Council).

Spatial Relationship: Not applicable.

Mandatory Attribution: The following attribution is mandatory for *Barrier Points*:

Element Name	Mandatory (Y/N)
Type	Y
UprightMaterial	Y

Positional Accuracy: The minimum accepted horizontal accuracy for *Barrier Points* is **± 5m**.

5.3.7 Bicycle Fitting

General Information: Not applicable.

Asset Capture: Simple point feature representing the centre of a bicycle fitting. Any slab the bicycle fitting is installed on is **not** considered part of the asset and needs to be captured separately.

Spatial Relationship: Not applicable.

Mandatory Attribution: The following attribution is mandatory for *Bicycle Fittings*:

Element Name	Mandatory (Y/N)
Type	Y
Material	Y
Manufacturer	N
ModelNumber	N

Positional Accuracy: The minimum accepted horizontal accuracy for *Bicycle Fitting* is **± 5m**.

5.3.8 Boating Facility

General Information: Not applicable.

Asset Capture: Area feature representing an individual boating facility such as a pontoon, ramp or jetty.

Spatial Relationship: Not applicable.

Mandatory Attribution: The following attribution is mandatory for *Boating Facilities*:

Element Name	Mandatory (Y/N)
Type	Y
Material	Y

Positional Accuracy: The minimum accepted horizontal accuracy for *Boating Facilities* is **± 5m**.

5.3.9 Building

General Information:

Asset Capture: Area feature (closed polygon) representing the vertical Building footprint for a structure other than a shelter.

Spatial Relationship: Not applicable.

Mandatory Attribution: The following attribution is mandatory for *Buildings*:

Element Name	Mandatory (Y/N)
Type	Y
Material	N

Positional Accuracy: The minimum accepted horizontal accuracy for *Buildings* is **± 5m**.

5.3.10 Electrical Conduit

General Information: Not applicable.

Asset Capture: Complex linear feature (polylines including curves but not bézier curves) representing a conduit run.

Spatial Relationship: Conduit shown as a polyline starting and finishing at coincident points with each associated fitting.

Mandatory Attribution: The following attribution is mandatory for *Electrical Conduits*:

Element Name	Mandatory (Y/N)
Type	Y
Material	Y
Diameter_mm	Y
Length_m	Y
Protection	N

Positional Accuracy: The minimum accepted horizontal accuracy for *Electrical Conduits* is **± 5m**.

5.3.11 Electrical Fitting

General Information: Includes Lights, Pits, Poles, Power Outlets and Switchboards.

Asset Capture: Simple point feature representing the centre point of the asset. Council requires all Rate 3 lighting installed to be included in the XML. For lights affixed to a pole, a separate Pole feature does not need to be captured. Bollard lighting does not require a separate Pole feature to be captured.

Spatial Relationship: Must be coincident to Electrical Conduit polylines. Lights with poles will have coincidence geometry.

Mandatory Attribution: The following attribution is mandatory for *Electrical Fittings*:

Element Name	Mandatory (Y/N)
Type	Y
Base	N
Material	Y
EnergySource	N
Manufacturer	N
ModelNumber	N

Positional Accuracy: The minimum accepted horizontal accuracy for *Electrical Fittings* is **± 5m**.

5.3.12 Fixture

General Information: Includes Dog Bag Dispensers, Fish Cleaning Stations, Goal Posts, Planter Boxes, Flag Poles, Scoreboards and Dog Bowls fixed to taps or drink fountains.

Asset Capture: Simple point feature representing the centre of an asset. Dog bag dispensers including a pole do not require the pole to be separately captured. The slab the fixture is installed on is **not** considered part of the asset and needs to be separately captured.

Spatial Relationship: Not applicable.

Mandatory Attribution: The following attribution is mandatory for *Fixtures*:

Element Name	Mandatory (Y/N)
Type	Y
Material	Y
Manufacturer	N
ModelNumber	N

Positional Accuracy: The minimum accepted horizontal accuracy for *Fixtures* is **± 5m**.

5.3.13 Landscape Area

General Information: Not applicable.

Asset Capture: Multi-patched area feature representing the “footprint” of a landscaped area. Individual areas are required where the type of Landscaping changes (e.g. garden beds, grass). Only Gardens, Grass and Synthetic Grass are required to be included in the XML.

Spatial Relationship: Not applicable.

Mandatory Attribution: The following attribution is mandatory for *Landscape Areas*:

Element Name	Mandatory (Y/N)
Type	Y
EdgeMaterial	N
RootBarrier	N

Positional Accuracy: The minimum accepted horizontal accuracy for *Landscape Areas* is **± 5m**.

5.3.14 Open Space Area

General Information: Examples include areas such as Parks or Bushlands.

Asset Capture: Multi-patched area feature representing the complete "footprint" of the Open Space area and enclosing relevant Open Space assets. For example, parks will often align with the cadastral *Lot Parcels*, in which case the lot boundaries can be used to represent the Open Space feature. Please refer to the dashed red line in the example shown in **Figure 1**.

Spatial Relationship: Not applicable

Mandatory Attribution: The following attribution is mandatory for *Open Space Areas*:

Element Name	Mandatory (Y/N)
Name	Y
Type	Y

Positional Accuracy: The minimum accepted horizontal accuracy for *Open Space Areas* is **± 5m.**

5.3.15 Retaining Wall

General Information: Not applicable.

Asset Capture: Complex linear feature (polylines including curves but not bézier curves) representing a retaining wall. While recognised as a three dimensional object, the retaining wall is typically captured as a linear course where the wall intersects the ground. Figure 3 shows the capture location of a new retaining wall (red hatched). Where the retaining wall gradually changes height over its length, the height is to be taken from the highest point of the wall.

Figure 3

Spatial Relationship: Not applicable.

Mandatory Attribution: The following attribution is mandatory for *Retaining Walls*:

Element Name	Mandatory (Y/N)
Use	Y
Material	Y
Construction	N
Length_m	Y

Element Name	Mandatory (Y/N)
Height_m	Y

Positional Accuracy: The minimum accepted horizontal accuracy for *Retaining Walls* is **± 5m.**

5.3.16 Seat

General Information: Not applicable.

Asset Capture: Simple point feature representing the centre of a seat. Seating associated with a table are not to be captured separately. The slab the seat is installed on is **not** considered part of the asset and needs to be separately captured.

Spatial Relationship: Not applicable.

Mandatory Attribution: The following attribution is mandatory for *Seats*:

Element Name	Mandatory (Y/N)
SeatType	Y
Places	N
Material	Y
Manufacturer	N
ModelNumber	N

Positional Accuracy: The minimum accepted horizontal accuracy for *Seats* is **± 5m**.

5.3.17 Shelter

General Information: Not applicable.

Asset Capture: Simple point feature representing the centre of a shelter. Any lighting, tables, seats or barbeques located underneath the shelter are to be captured as separate assets. Shade sails which share a common pole should be treated as the one feature. Poles associated with shade sails / shelters do not need to be captured separately. The slab the shelter is installed on is **not** considered part of the asset and needs to be separately captured.

Spatial Relationship: Not applicable.

Mandatory Attribution: The following attribution is mandatory for *Shelters*:

Element Name	Mandatory (Y/N)
Type	Y
ConstructionType	N
FloorMaterial	Y
WallMaterial	Y
RoofMaterial	Y
Manufacturer	N
ModelNumber	N

Positional Accuracy: The minimum accepted horizontal accuracy for *Shelters* is **± 5m**.

5.3.18 Sign

General Information: Not applicable.

Asset Capture: Simple point feature representing the centre of a sign. Poles associated with the sign do not need to be separately captured.

Spatial Relationship: Not applicable.

Mandatory Attribution: The following attribution is mandatory for *Signs*:

Element Name	Mandatory (Y/N)
Type	Y
Material	Y
Structure	N
SignText	Y
Rotation	N
Manufacturer	N
ModelNumber	N

Positional Accuracy: The minimum accepted horizontal accuracy for *Signs* is **± 5m**.

5.3.19 Table

General Information: Not applicable.

Asset Capture: Simple point feature representing the centre of a table.

Spatial Relationship: Not applicable.

Mandatory Attribution: The following attribution is mandatory for *Tables*:

Element Name	Mandatory (Y/N)
Type	Y
SeatType	N
Places	N
Material	Y
Manufacturer	N
ModelNumber	N

Positional Accuracy: The minimum accepted horizontal accuracy for *Tables* is **± 5m**.

5.3.20 Waste Collection Point

General Information: Includes any poles, stands or enclosures associated with a bin.

Asset Capture: Simple point feature representing the centre of the asset.

Spatial Relationship: Not applicable.

Mandatory Attribution: The following attribution is mandatory for *Waste Collection Points*:

Element Name	Mandatory (Y/N)
Type	Y
Material	Y
Manufacturer	N
ModelNumber	N

Positional Accuracy: The minimum accepted horizontal accuracy for *Waste Collection Points* is **± 5m**.

5.5 Stormwater

5.5.1 End Structure

General Information: Represents a stormwater headwall / end wall.

Asset Capture: Simple point feature representing the top of the headwall (refer **Figure 4**). Fences surrounding the end structure should be captured separately as *Barrier Continuous*.

Spatial Relationship: Should be coincident to a stormwater pipe.

Figure 4

Mandatory Attribution: The following attribution is mandatory for *End Structures*:

Element Name	Mandatory (Y/N)
StructureID	N
StructureLevel_m	Y
EndWallType	N
EndWallConstruction	N
WingWallType	N
WingWallConstruction	N
ApronType	N
ApronConstruction	N
GrateType	N
TideGate	N
PredominantMaterial	Y
OutletProtectionType	N
Rotation	N

Positional Accuracy: The minimum accepted horizontal accuracy for *End Structures* is **± 0.1m**.

5.5.2 Fitting

General Information: Represents a stormwater end cap.

Asset Capture: Single point feature representing the centre point of the fitting.

Spatial Relationship: Must be coincident to the end point a Stormwater pipe feature.

Mandatory Attribution: The following attribution is mandatory for *Fittings*:

Element Name	Mandatory (Y/N)
FittingType	Y
Rotation	N

Positional Accuracy: The minimum accepted horizontal accuracy for *Fittings* is **± 0.1m**.

5.5.3 GPT Complex

General Information: Not applicable.

Asset Capture: Single point feature located at the centre of chamber on the top surface. Capturing centre of lid is appropriate only when the lid is centred over the chamber.

Gross Pollutant Trap (GPT) Complex assets are Commercial or Custom built devices (e.g. Humes Interceptor).

Spatial Relationship: GPT Complex assets must be coincident to pipe features as per Pits/Manhole features.

Mandatory Attribution: The following attribution is mandatory for *GPT Complexes*:

Element Name	Mandatory (Y/N)
Sqid_Id	N
Manufacturer	Y
ModelNumber	Y
Length_mm	Y *(if rectangular)*
Width_mm	Y *(if rectangular)*
Diameter_mm	Y *(if circular)*
Function1	Y
Function2	N
Function3	N
US_PipeDiameter_mm	N
DS_PipeDiameter_mm	N
SurfaceLevel_m	Y
CleanoutLevel_m	N
Depth_m	Y
SumpDepth_m	N
HasFilterMedia	N
HasBasket	N
HasBoards	N

Element Name	Mandatory (Y/N)
DesignFlow_m3s	N
MaxContaminantVolume_m3	N
MaxInternalVolume_m3	N
MaintenanceCycle_mnths	N
Rotation	N

Positional Accuracy: The minimum accepted horizontal accuracy for *GPT Complexes* is **± 0.1m**.

5.5.4 GPT Simple

General Information: Not applicable.

Asset Capture: Single point feature located at the centre of chamber on the top surface. Capturing centre of lid is appropriate only when the lid is centred over the chamber.

Gross Pollutant Trap (GPT) Simple assets are “in pit” basket or “end of line” devices.

Spatial Relationship: A GPT Simple asset’s spatial location must correlate with a Pit/Manhole asset as they are housed within those structures and can be removed for maintenance or relocation.

Mandatory Attribution: The following attribution is mandatory for *GPT Simple*:

Element Name	Mandatory (Y/N)
Sqid_Id	N
Construction	N
Manufacturer	N
ModelNumber	N
TreatmentMeasure	Y
Function1	Y
Length_mm	N
Width_mm	N
MaintenanceCycle_mnths	N
Rotation	N

Positional Accuracy: The minimum accepted horizontal accuracy for *GPT Simple* is **± 0.1m**.

5.5.5 Non GPT Simple

General Information: Not applicable.

Asset Capture: Single point feature located at the centre of chamber on the top surface. Capturing centre of lid is appropriate only when the lid is centred over the chamber.

Non GPT Simple assets represent basic and minor sand filtration storage.

Spatial Relationship: Non GPT Simple assets must be coincident to pipe features as per Pits/Manhole features.

Mandatory Attribution: The following attribution is mandatory for *Non GPT Simple*:

Element Name	Mandatory (Y/N)
Sqid_Id	N
Construction	N
Manufacturer	N
ModelNumber	N
TreatmentMeasure	Y
Function1	Y
Function2	N
Function3	N
Length_mm	Y
Width_mm	Y
MaintenanceCycle_mnths	N
Rotation	N

Positional Accuracy: The minimum accepted horizontal accuracy for *Non GPT Simple* is **± 0.1m**.

5.5.6 Pipe

General Information: Not applicable.

Asset Capture: A simple linear feature representing the invert of the pipe or midpoint of a box asset. Multiple-celled culverts & pipes should always be represented individually; therefore the number of cells attribute should always be "1". Line direction should be enforced from Gravity Upstream (higher AHD level) to Gravity Downstream (lower AHD level) due to gravitation flow. Pipe features are captured from the intersection of pipe material and chamber wall. Refer to **Figure 5** and **Figure 6**.

Figure 5 represents a single-celled pipe asset where vertices one and four represent the maintenance hole capture and vertices two and three are the intersection of the Pipe material and the chamber wall.

Figure 6 represents an irregular shaped pit with multiple multi-celled pipes entering the pit asset and a large single-celled asset exiting the pit with an outlet through an End Structure.

Pipes are to be captured based on their physical and spatial properties and attributes. For example, if a pipe changes size, material, class, embedment or direction etc. then it must be broken and captured separately.

Spatial Relationship: May be coincident to Stormwater point features.

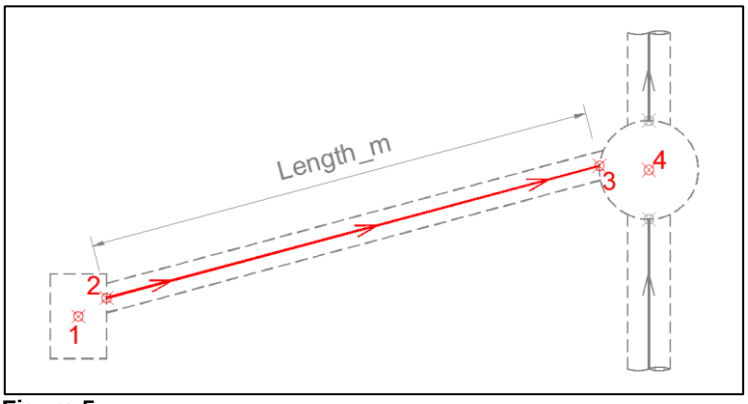


Figure 5

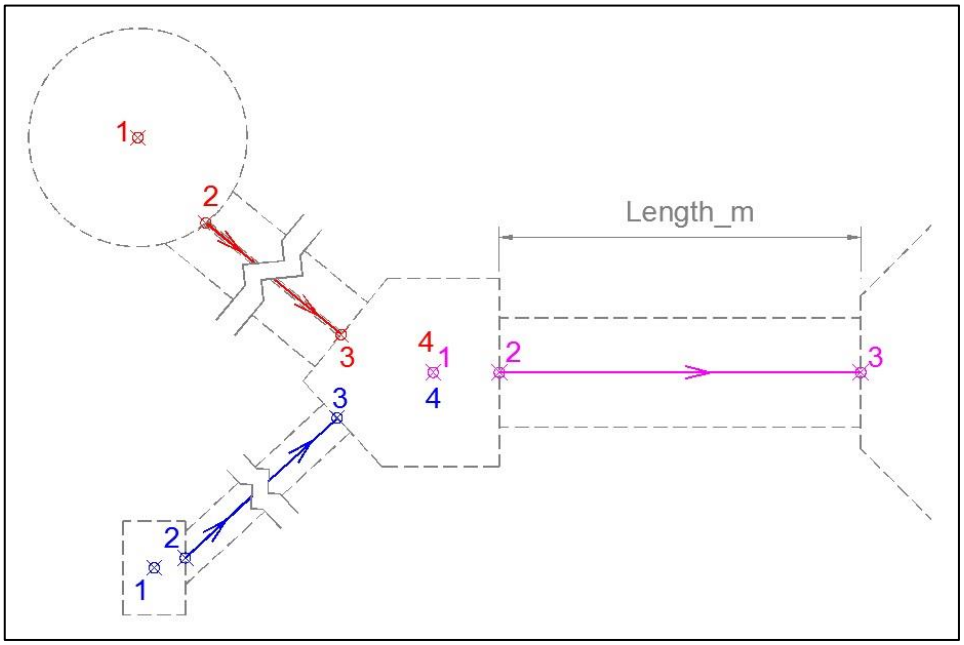


Figure 6

Mandatory Attribution: The following attribution is mandatory for *Pipes*:

Element Name	Mandatory (Y/N)
US_InvertLevel_m	Y
DS_InvertLevel_m	Y
US_SurfaceLevel_m	Y
DS_SurfaceLevel_m	Y
Diameter_mm	Y *(if circular)*
Height_mm	Y *(if box)*
Width_mm	Y *(if box)*
Material	Y
Class	Y *(if circular)*
JointType	Y *(if circular)*
Cells	N

Element Name	Mandatory (Y/N)
ConcreteCoverType	N
Grade	Y
Length_mm	Y

Positional Accuracy: The minimum accepted horizontal accuracy for *Pipes* is **± 0.1m**.

5.5.7 Pit

General Information: Not applicable.

Asset Capture: Simple point feature representing the centre of chamber of a pit or manhole. If the asset's Use = "Pit" then the InletType element must be populated. If the Lintel element is not nil, then the InletConfig element must be populated. The InletConfig's Left/Centre/Right is referenced from the road crown looking at the lintel.

Spatial Relationship: Not Applicable.

Mandatory Attribution: The following attribution is mandatory for *Pits*:

Element Name	Mandatory (Y/N)
PitNumber	N
Use	Y
ChamberConstruction	N
Length_mm	Y *(if rectangular)*
Width_mm	Y *(if rectangular)*
Diameter_mm	Y *(if circular)*
Radius_mm	Y *(if extended)*
Extension_mm	Y *(if extended)*
LidType	Y
SurfaceLevel_m	Y
InvertLevel_m	Y
Depth_m	Y
InletConfig	N
InletType	Y *(if inlet exists)*
LintelConstruction	Y *(if lintel exists)*
LintelLength_m	Y *(if lintel exists)*
OutletType	N
FireRetardant	N
Rotatation	N

Positional Accuracy: The minimum accepted horizontal accuracy for *Pits* is **± 0.1m**.

5.5.8 Surface Drain

General Information: Not applicable.

Asset Capture: Simple linear feature representing the invert of the channel. Surface Drains are to be captured based on their physical and spatial properties and attributes. For

example, if a surface changes size, material, shape etc. then it must be broken and captured separately. Figure 9 indicates the capture of a major surface drain as well as a smaller surface drain feeding into it. The main surface drain has been broken into separate features where the main change of width occurs. The smaller surface drain ends at the intersection of the main surface drain's outer edge.

Figure 7

Spatial Relationship: May be coincident to End Structures and WSUD regions/polygons.

Mandatory Attribution: The following attribution is mandatory for *Surface Drains*:

Element Name	Mandatory (Y/N)
Type	Y
Shape	Y
LiningMaterial	Y
LinedWidth_m	N
BatterMaterial	Y
BatterWidth_m	N
US_InvertLevel_m	N
DS_InvertLevel_m	N
AverageGrade	N
Length_m	Y

Positional Accuracy: The minimum accepted horizontal accuracy for *Surface Drains* is **± 1m**.

5.5.9 WSUD Complex Area

General Information: Not applicable.

Asset Capture: Water Sensitive Urban Design (WSUD) areas such as kerbside bio-filtration beds or purpose built drainage swales should be captured individually as a region/polygon. Individual areas are to be recorded within the ADAC data capture fields defining class type (e.g swale, buffer strip, bio-retention basin). Any associated infrastructure with the WSUD (e.g. vehicle accesses, fences, gates, etc.) should be captured separately. **Figure 8** demonstrates the capture of a WSUD and associated infrastructure, including a Vehicle Access (red polygon) and a gate (blue hatched line).

Figure 8

Spatial Relationship: Not Applicable.

Mandatory Attribution: The following attribution is mandatory for *WSUD Complex Areas*:

Element Name	Mandatory (Y/N)
Sqid_Id	N
TreatmentMeasure	Y
Function1	Y
Function2	N
Function3	N
PondingArea_m2	N
PondingDepth_m	N
FilterArea_m2	N
FilterDepth_m	N
TransitionDepth_m	N
DrainageDepth_m	N

Element Name	Mandatory (Y/N)
MacrophyteZoneArea_m2	N
MacrophyteZoneDepth_m	N
CoarseSedimentArea_m2	N
SedimentVolume_m3	N
MinSurfaceLevel_m	N
PermanentPondLevel_m	N
OutletLevel_m	N
DesignFlow_m3s	N
HasSpillway	N
MaintenanceCycle_mnths	N

Positional Accuracy: The minimum accepted horizontal accuracy for *WSUD Complex Areas* is **± 5m**.

5.6 Supplementary

Supplementary features are used to record additional asset types or points of reference which isn't otherwise covered under the ADAC schema. Redland City Council has specified additional asset types required to be supplied in the XML under its *As-Constructed Data Standard.* The details for these asset types have been supplied below:

5.6.1 Point Feature / Polyline Feature / Polygon Feature (Additional Information)

Asset Capture: Simple Point, Complex Polyline or Multipatch Area feature (depending on the feature type) representing additional reference information that add clarity or context to the strict ADAC features.

Spatial Relationship: Not applicable**5.6.2 Artificial Fauna Habitat (Polygon Feature)**

General Information: Represents artificial fauna habitats such as glider poles, nesting platforms and ground hollows.

Asset Capture: Multi-patched area feature representing the footprint of the artificial fauna habitat. These are to be recorded with a **Class** element of "Artificial Fauna Habitat".

Spatial Relationship: Not applicable.

Attribution: The following attribution is to be recorded against features identified as *Artificial Fauna Habitats*:

Attribute	Description	Type	Mandatory?	Allowable Values
Type	The type of Habitat eg: glider pole and ground hollow	TextValue	Y	Glider Pole
				Glider Rope
				Ground Hollow
				Log
				Nesting Platform
				Rock
Material	The predominant material	TextValue	Y	Concrete
				Fibreglass
				Masonry
				Plastic
				Rock
				Steel Galvanised
				Steel Powder Coated
				Timber
				Combination
Height	The height of the habitat in metres (2 decimal places).	DecimalValue	Y	
Pole Mounted	Is the feature mounted to a pole?	TextValue	N	Yes
				No

Positional Accuracy: The minimum accepted horizontal accuracy for *Artificial Fauna Habitats* is **± 5m**.

5.6.3 Bridge (Polygon Feature)

General Information: Not applicable.

Asset Capture: Multi-patched area feature representing the footprint of the bridge, from abutment to abutment (refer **Error! Reference source not found.**). These are to be recorded with a **Class** element of "Bridge". For road bridges which include a separated footbridge, the footbridge is considered part of the road bridge if it shares the same load bearing structure.

Figure 9

Spatial Relationship: Not applicable.

Attribution: The following attribution is to be recorded against features identified as *Bridges*:

Attribute	Description	Type	Mandatory?	Allowable Values
Bridge Name	Bridge descriptor name.	TextValue	N	
Deck Width	Deck width measured from outside to outside.	DecimalValue	Y	
Deck Length	Deck length measured from abutment to abutment.	DecimalValue	Y	
Deck Area	Deck area in square metres.	DecimalValue	Y	
Vertical Clearance	Vertical clearance under the bridge, measured from the highest astronomical tide or the crown of the road.	DecimalValue	Y	
Design Load	Maximum design load limit of the	DecimalValue	N	

Attribute	Description	Type	Mandatory?	Allowable Values
	bridge, in tonnes			
Actual Load Allowance	Maximum actual load limit of the bridge in tonnes, where differs from the design load.	DecimalValue	N	
Bridge Crossing Type	What is the bridge crossing?	TextValue	Y	Over Road Under Road Over Water Over Rail Under Rail Other
Footpath	Are there footpaths fixed to the bridge?	TextValue	Y	Nil One Side Both Sides
Span Type	The type of span used on the bridge.	TextValue	Y	Arch Beam girder Box girder Composite slab Concrete portal Truss
Span Length	Maximum length of each span, in metres.	DecimalValue	Y	
Span Quantity	Number of spans.	IntegerValue	Y	
Primary Bridge Use	The primary purpose of the bridge.	TextValue	Y	Pedestrian Vehicular Cycleway Rail
Lanes	Number of trafficable lanes on the bridge.	IntegerValue	N	

Positional Accuracy: The minimum accepted horizontal accuracy for *Bridges* is **± 5m**.

5.6.4 Fire Management (Polyline Feature)

General Information: Represents Fire Control Lines and Fire Trails.

Asset Capture: Complex linear feature (polylines including curves but not Bezier curves) representing the centre longitudinal axis of a fire trail or fire control line. These are to be recorded with a **Class** element of "Fire Management".

Spatial Relationship: Not applicable.

Attribution: The following attribution is to be recorded against features identified as *Fire Management*:

Attribute	Description	Type	Mandatory?	Allowable Values
Type	The type of Fire Management feature (e.g. fire trail, fire control line).	TextValue	Y	Fire Control Line Fire Trail
Trail Category	The type of fire trail. Only applicable when the Type is "Fire Trail"	TextValue	N	1 2

Attribute	Description	Type	Mandatory?	Allowable Values
	Refer below for a description of each category.			3a
				3b
				4
				5
Surface Material	The surface material of the fire trail or control line	TextValue	Y	Bitumen
				Concrete
				Exposed Aggregate
				Grass
				Gravel
				Pavers
				Natural
				Sand
				Timber
Length	Length in metres (2 decimal places).	DecimalValue	Y	
Width	Width in metres (2 decimal places).	DecimalValue	N	

Trail Categories:

1: strategically important fire control line (sealed or well-formed road)
2: major control line (well formed, 10% gradient)
3a: permanent medium fire control line (4x4 vehicle on 10% - 17% gradient)
3b: permanent minor fire control line (4x4 vehicle 17% - 38% gradient)
4: temporary fire control line (4x4 vehicle 17% - 38% gradient)
5: dormant fire control line (4x4 vehicle 20% - 45% gradient)

Positional Accuracy: The minimum accepted horizontal accuracy for *Fire Management* is **± 5m**.

5.6.5 Foreshore Protection (Polygon Feature)

General Information: Represents seawalls, groynes & artificial reefs.

Asset Capture: Multi-patched area feature representing the footprint of the foreshore protection asset. These are to be recorded with a **Class** element of "Foreshore Protection".

Spatial Relationship: Not applicable.

Attribution: The following attribution is to be recorded against features identified as *Foreshore Protection*:

Attribute	Description	Type	Mandatory?	Allowable Values
Type	The type of foreshore protection (e.g. seawall, groyne, artificial reef).	TextValue	Y	Seawall
				Groyne
				Artificial Reef
Material	The predominant material of the foreshore protection asset.	TextValue	Y	Geotextile
				Clay Shale
				Mass Concrete Block
				Clay Shale / Geotextile

Attribute	Description	Type	Mandatory?	Allowable Values
				Armour Rock/Boulder
				Boulder
Length	Length in metres (2 Decimal Places)	DecimalValue	N	
Width	Width in metres (2 Decimal Places)	DecimalValue	N	
Height	Height in metres (2 Decimal Places)	DecimalValue	Y	
Top Reduced Level	Level of the top of the asset in metres AHD.	DecimalValue	N	
Base Reduced Level	Level of the base of the asset in metres AHD.	DecimalValue	N	
Surface Material	Only required when there is pedestrian access over the asset.	TextValue	N	Bitumen
				Concrete
				Gravel
				Sand

Positional Accuracy: The minimum accepted horizontal accuracy for *Foreshore Protection* is **± 5m**.

5.6.6 Platform (Polygon Feature)

General Information: Not applicable.

Asset Capture: Multi-patched area feature representing the footprint of the platform. These are to be recorded with a **Class** element of "Platform".

Spatial Relationship: Not applicable.

Attribution: The following attribution is to be recorded against features identified as *Platforms*:

Attribute	Description	Type	Mandatory?	Allowable Values
Function	Primary purpose of the platform.	TextValue	Y	Viewing
				Fishing
				Other
Deck Material	Predominant material of the platform deck.	TextValue	Y	Timber
				Paved
				Concrete
Substructure Material	Predominant material of the platform substructure.	TextValue	N	Timber
				Concrete
				Steel
External Handrail Material	Predominant material of the platform handrails.	TextValue	N	Timber
				Metal
				None
Maximum Height	The maximum distance between the deck and the ground in metres (2 decimal places).	DecimalValue	N	
Length	Length in metres (2 decimal places)	DecimalValue	N	
Width	Width in metres (2 decimal places)	DecimalValue	N	
Area	Area in square metres (2 decimal places)	DecimalValue	N	

Positional Accuracy: The minimum accepted horizontal accuracy for *Platforms* is **± 5m**.

5.6.7 Prepared Surface (Polygon Feature)

General Information: Represents a slab, pad or prepared surface other than an activity area.

Asset Capture: Multi-patched area feature representing the footprint of the prepared surface. These are to be recorded with a **Class** element of "Prepared Surface".

Spatial Relationship: Not applicable.

Attribution: The following attribution is to be recorded against features identified as *Prepared Surfaces*:

Attribute	Description	Type	Mandatory?	Allowable Values
Function	The purpose of the prepared surface.	TextValue	Y	Annex Slab
				Hose Down Pad
				Recreational
				Storage
				Various/Other
Material	The material of the prepared surface.	TextValue	Y	Bitumen
				Concrete
				Exposed Aggregate
				Gravel
				Other
				Synthetic Grass
				Pavers
Length	Length in metres (2 decimal places)	DecimalValue	N	
Width	Width in metres (2 decimal places)	DecimalValue	N	
Area	Area in square metres (2 decimal places)	DecimalValue	N	

Positional Accuracy: The minimum accepted horizontal accuracy for *Prepared Surfaces* is **± 5m**.

5.6.8 Swimming Pool (Polygon Feature)

General Information: Not applicable.

Asset Capture: Multi-patched area feature representing the footprint of the pool shell. These are to be recorded with a **Class** element of "Swimming Pool".

Spatial Relationship: Not applicable.

Attribution: The following attribution is to be recorded against features identified as *Swimming Pools*:

Attribute	Description	Type	Mandatory?	Allowable Values
Type	The type of swimming pool.	TextValue	Y	Wading
				Lap

Attribute	Description	Type	Mandatory?	Allowable Values
				Hydrotherapy
				Recreational
				Diving
				Learn to Swim
Indoor or Outdoor	Is the swimming pool located indoors or outdoors?	TextValue	Y	Indoor
				Outdoor
Material	Material of pool shell.	TextValue	N	Fibreglass
				Concrete
Finish	Finish applied to the pool shell material.	TextValue	Y	Fibreglass
				Paint
				Pebble Crete
				Tile
Lanes	The number of lanes.	IntegerValue	N	
Length	Length of the pool in metres.	DecimalValue	Y	
Width	Width of the pool in metres.	DecimalValue	Y	
Volume	Volume of the pool in cubic metres.	DecimalValue	Y	
Minimum Depth	The minimum depth of the pool, in metres.	DecimalValue	Y	

Positional Accuracy: The minimum accepted horizontal accuracy for *Swimming Pools* is **± 5m**.

5.6.9 Swimming Pool Heating Equipment (Point Feature)

General Information: Not applicable.

Asset Capture: Point feature representing the centre of the pool heating equipment. These are to be recorded with a **Class** element of "Pool Heating Equipment".

Spatial Relationship: Not applicable.

Attribution: The following attribution is to be recorded against features identified as *Pool Heating Equipment*:

Attribute	Description	Type	Mandatory?	Allowable Values
Type	The power source of the equipment.	TextValue	Y	Gas
				Electric
				Solar
Component	The type of pool heating equipment.	TextValue	Y	Exchanger
				Pump
				Valve
				Controller
				Solar Collector

Positional Accuracy: The minimum accepted horizontal accuracy for *Pool Heating Equipment* is **± 5m**.

5.6.10 Swimming Pool Fixture (Point Feature)

General Information: Not applicable.

Asset Capture: Point feature representing the centre of the pool fixture. These are to be recorded with a **Class** element of “Pool Fixture”.

Spatial Relationship: Not applicable.

Attribution: The following attribution is to be recorded against features identified as *Pool Fixture*:

Attribute	Description	Type	Mandatory?	Allowable Values
Type	The type of pool fixture.	TextValue	Y	Tower Springboard Lifeguard Tower/Chair Access Ladder Starting Podium
Material	The material type of the pool fixture.	TextValue	Y	Aluminium Concrete Plastic Stainless Steel Steel Timber Masonry Fibreglass Combination
Finish	The finish applied to the pool fixture material.			Painted Polished Powdercoated Galvanised Stained PVC/Rubberised Coating

Positional Accuracy: The minimum accepted horizontal accuracy for *Pool Fixtures* is **± 5m**.

5.6.11 Water Body (Polygon Feature)

General Information: Represents man-made water bodies. Not to be used to represent WSUD areas.

Asset Capture: Multi-patched area feature representing the footprint of the water body. These are to be recorded with a **Class** element of “Water Body”.

Spatial Relationship: Not applicable.

Attribution: The following attribution is to be recorded against features identified as *Water Body*:

Attribute	Description	Type	Mandatory?	Allowable Values
Maximum Depth	Maximum depth of the water body, in metres.	DecimalValue	N	

Positional Accuracy: The minimum accepted horizontal accuracy for *Water Bodies* is **± 5m**.

5.6.12 Weighbridge (Polygon Feature)

General Information: Not applicable.

Asset Capture: Multi-patched area feature representing the footprint of the weighbridge. These are to be recorded with a **Class** element of "Weighbridge".

Spatial Relationship: Not applicable.

Attribution: The following attribution is to be recorded against features identified as *Weighbridge*:

Attribute	Description	Type	Mandatory?	Allowable Values
Total Length	Total length of weighbridge in metres (2 decimal places).	DecimalValue	N	
Width	Width of weighbridge in metres (2 decimal places).	DecimalValue	N	
Number of Lanes	Number of lanes on the weighbridge.	IntegerValue	N	
Number of Decks	Number of separate weighing decks.	IntegerValue	N	
Maximum Weight	Maximum weight limit, in tonnes.	DecimalValue	N	
Deck Material	Material type of the weighbridge deck(s).	TextValue	Y	Concrete
				Concrete / Steel

Positional Accuracy: The minimum accepted horizontal accuracy for *Weighbridge* is **± 5m**.

5.7 Surface

5.7.1 Contour

Asset Capture: Linear feature capturing a single contour feature.

Spatial Relationship: Not applicable.

5.7.2 Spot Heights

Asset Capture: Simple point feature representing a single elevation point.

Spatial Relationship: Not applicable.

5.8 Transport

5.8.1 Flush Point

Asset Capture: Simple point feature representing the outlet of sub-soil drains into drainage pits/maintenance holes.

Spatial Relationship: Must be coincident to Sub Soil Drain assets.

Mandatory Attribution: The following attribution is mandatory for *Flush Points*:

Element Name	Mandatory (Y/N)
Function	N

Positional Accuracy: The minimum accepted horizontal accuracy for *Flush Points* is **± 1m**.

5.8.2 Parking

Asset Capture: Multi-patch region/polygon feature representing the area of Parking. Asset capture is based on physicality therefore separate regions/polygons are required if any part of the pavement profile changes i.e. Surface, Base, Sub-Base, Lower Sub-Base and/or Subgrade.

Spatial Relationship: Must be coincident to other regions representing pavement / parking where there is a common boundary (e.g. no slivers/overlaps).

Mandatory Attribution: The following attribution is mandatory for *Parking*:

Element Name	Mandatory (Y/N)
Name	Y
NoOfCarparks	N
OnOffStreet	Y
SurfaceType	Y
SurfaceThickness_mm	Y
SurfaceArea_sqm	Y
PavementType	N
BaseLayerType	Y
BaseLayerDepth_mm	Y
BaseStabilisation	Y *(if Base stabilised)*
SubBaseLayerType	Y (*if SubBase exists)*
SubBaseLayerDepth_mm	Y (*if SubBase exists)*
SubBaseStabilisation	Y (*if SubBase stabilised)*
LowerSubBaseLayerType	Y (*if Lower SubBase exists)*
LowerSubBaseLayerDepth_mm	Y (*if Lower SubBase exists)*
LowerSubBaseStabilisation	Y (*if Lower SubBase stabilised)*
PavementGeoTextile	N
SubgradeCBR	Y
SubgradeStabilisation	N

Positional Accuracy: The minimum accepted horizontal accuracy for *Parking* is **± 5m**.

5.8.3 Path Structure

Asset Capture: Complex linear feature (polylines including curves but not Bezier curves) representing the centre longitudinal axis of a path structure.

Spatial Relationship: Changes in surface types or widths must be represented as separate features.

Mandatory Attribution: The following attribution is mandatory for *Path Structures*:

Element Name	Mandatory (Y/N)
Use	Y
Structure	Y
SurfaceMaterial	Y
SubStructureMaterial	Y
Width_m	Y

Positional Accuracy: The minimum accepted horizontal accuracy for *Path Structures* is **± 5m**.

5.8.4 Pathway

Asset Capture: Complex linear feature (polylines including curves but not Bezier curves) representing the centre longitudinal axis of a pathway. Changes in surface types or widths must be represented as separate features.

Figure 10

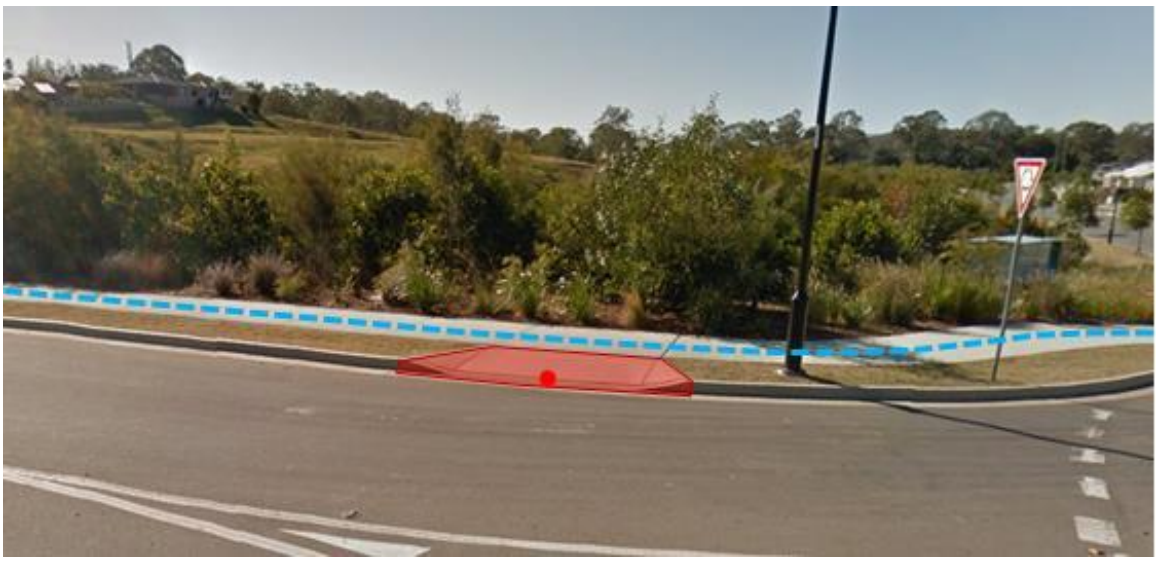


Figure 11

Spatial Relationship: **Figure 10** and **Figure 11** are examples of the capture of a pathway (blue hatched line) and its relationship with pram ramps (red point).

Mandatory Attribution: The following attribution is mandatory for *Pathways*:

Element Name	Mandatory (Y/N)
Use	Y
Structure	N
SurfaceMaterial	Y
Width_m	Y
Depth_mm	N

Positional Accuracy: The minimum accepted horizontal accuracy for *Pathways* is **± 5m**.

5.8.5 Pavement

Asset Capture: Multi-patch region/polygon feature representing the area of Pavement. Asset capture is based on physicality therefore separate regions/polygons are required if any part of the pavement profile changes i.e. Surface, Base, Sub-Base, Lower Sub-Base and/or Subgrade. **Figure 12** demonstrates the capture locations of a Pavement. The blue line represents the capture location where kerb exists (back of kerb), the yellow line represents where no kerb exists (edge of seal) and the red line represents where separate pavement areas are recorded for each road.

Spatial Relationship: Must be coincident to other regions representing pavement / parking where there is a common boundary- no slivers/overlaps.

Mandatory Attribution: The following attribution is mandatory for *Pavements*:

Element Name	Mandatory (Y/N)
Name	Y
SurfaceType	Y

Element Name	Mandatory (Y/N)
SurfaceThickness_mm	Y
SurfaceNomWidth_m	Y
PavementType	N
BaseLayerType	Y
BaseLayerDepth_mm	Y
BaseStabilisation	Y *(if Base stabilised)*
SubBaseLayerType	Y (*if SubBase exists)*
SubBaseLayerDepth_mm	Y (*if SubBase exists)*
SubBaseStabilisation	Y (*if SubBase stabilised)*
LowerSubBaseLayerType	Y (*if Lower SubBase exists)*
LowerSubBaseLayerDepth_mm	Y (*if Lower SubBase exists)*
LowerSubBaseStabilisation	Y (*if Lower SubBase stabilised)*
PavementGeoTextile	N
SubgradeCBR	Y
SubgradeStabilisation	N

Positional Accuracy: The minimum accepted horizontal accuracy for *Pavements* is **± 5m**.

Figure 12

5.8.6 Pram Ramp

Asset Capture: Simple point feature representing a pram ramp. Typically captured in the centre of Pram Ramp where it transitions to a Kerb/Road. Refer to **Figure 10** and **Figure 11** for the capture of Pram Ramps. The pram ramp (which is highlighted by the red polygon) is captured based on the red point.

Spatial Relationship: May be coincident with a Road Edge feature.

Mandatory Attribution: The following attribution is mandatory for *Pram Ramps*:

Element Name	Mandatory (Y/N)
Rotation	N

Positional Accuracy: The minimum accepted horizontal accuracy for *Pram Ramps* is **± 5m**.

5.8.7 Road Edge

Asset Capture: Complex linear feature (polylines including curves but not bézier curves) representing the top (back) of kerb. In case of inverts, edge of concrete furthest from road centreline. Refer to the blue line in **Figure 12** for capture location.

Spatial Relationship: Must be coincident to other polylines representing road edge where there is a common boundary between kerb types / material change i.e. no slivers and/or overlaps.

Mandatory Attribution: The following attribution is mandatory for *Road Edges*:

Element Name	Mandatory (Y/N)
Type	Y
Length_m	Y
PavementExtension_mm	N

Positional Accuracy: The minimum accepted horizontal accuracy for *Road Edge* is **± 5m**.

5.8.8 Road Island

Asset Capture: Multi-patch region/polygon feature representing the area of Island/LATM bounded by the back of Kerb features. Asset capture is based on physicality therefore separate regions/polygons are required if the Type of Island or Infill changes. Refer to **Figure 13** for an example of asset capture.

Spatial Relationship: Must be coincident to other regions representing road islands where there is a common boundary i.e. no slivers and/or overlaps.

Mandatory Attribution: The following attribution is mandatory for *Road Islands*:

Element Name	Mandatory (Y/N)
Type	Y
Area_sqm	Y
InfillType	Y

Positional Accuracy: The minimum accepted horizontal accuracy for *Road Islands* is **± 5m**.

Figure 13

5.8.9 Road Pathway

Asset Capture: Complex linear feature (polylines including curves but not Bezier curves) representing the centre longitudinal axis of a road pathway (on-road cycleway).

Spatial Relationship: Not applicable

Mandatory Attribution: The following attribution is mandatory for *Road Pathways*:

Element Name	Mandatory (Y/N)
Use	Y
Structure	N
SurfaceMaterial	Y
Width_m	Y

Positional Accuracy: The minimum accepted horizontal accuracy for *Road Pathways* is **± 5m**.

5.8.10 Sub Soil Drain

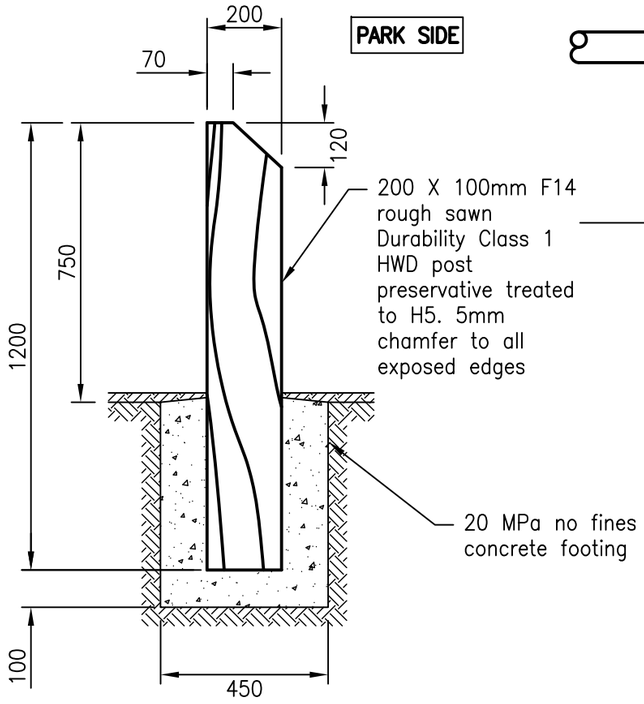
Asset Capture: Simple Linear feature (i.e. straight lines) representing the Invert of a circular sub-soil drain pipe asset. Pipes are typically broken where the Use and/or Type of drain changes.

Spatial Relationship: Must be coincident to Flush Points.

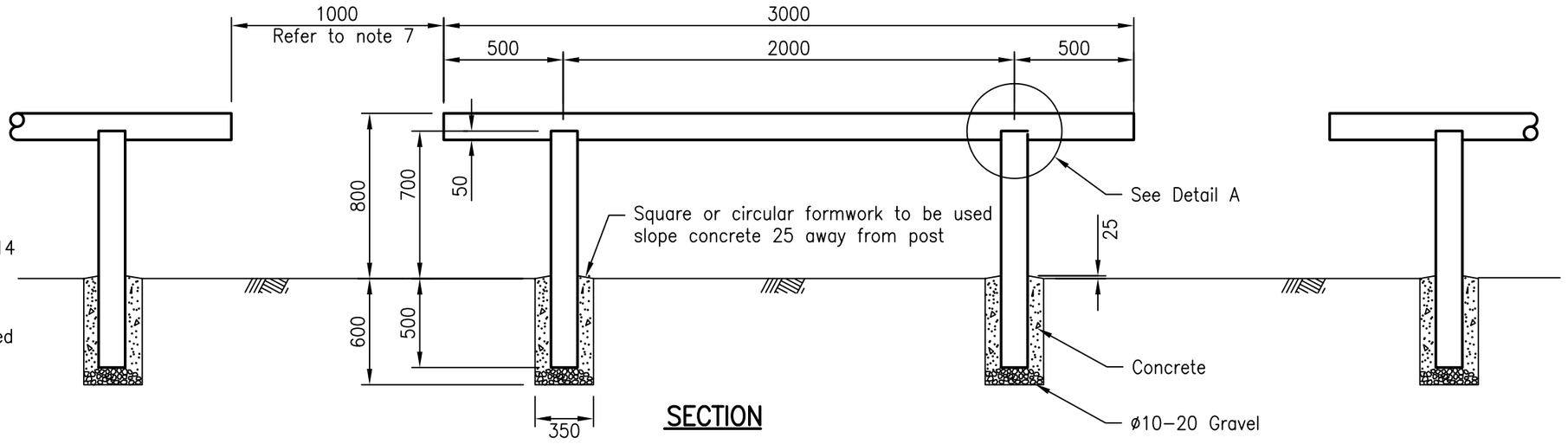
Mandatory Attribution: The following attribution is mandatory for *Sub Soil Drains*:

Element Name	Mandatory (Y/N)
Use	Y
Type	Y
Length_m	Y

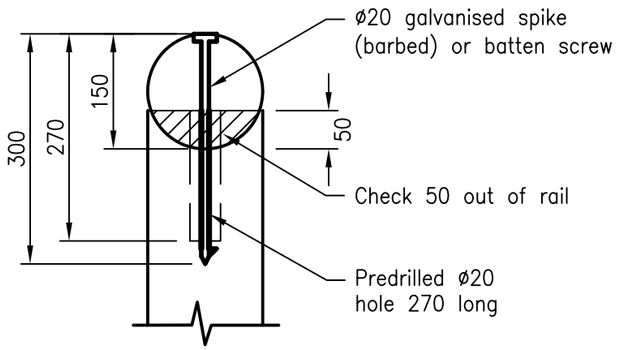
Positional Accuracy: The minimum accepted horizontal accuracy for *Sub Soil Drains* is **± 1m**.



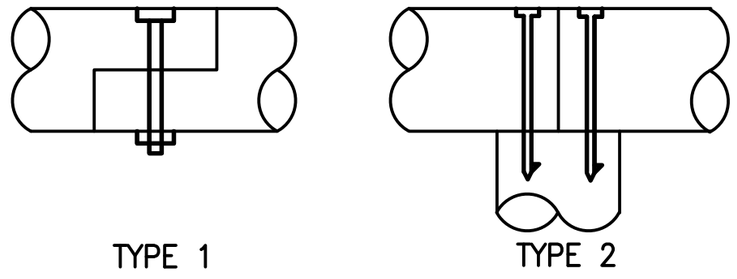
SIDE SECTION



SECTION

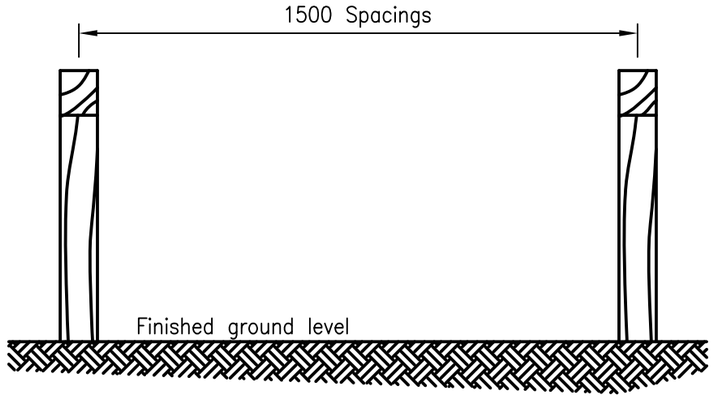


DETAIL A



TYPE 1 TYPE 2

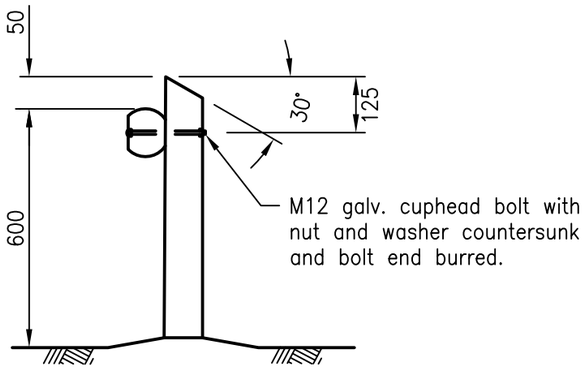
TYPICAL RAIL JOINTS FOR CONTINUOUS FENCING



FRONT ELEVATION

HARDWOOD TIMBER BOLLARD

Refer to relevant Council for Bollard Type



ALTERNATIVE RAIL

NOTES:

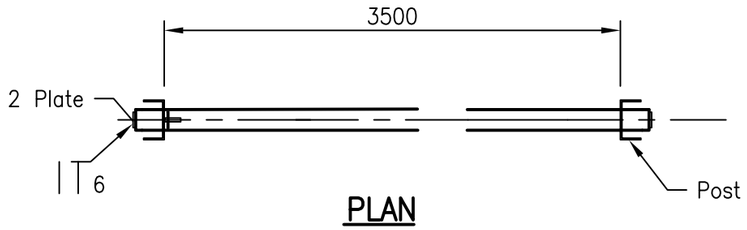
1. Concrete N25 in accordance with AS 1379 and AS 3600. Durability class H5 min to AS 1604.
2. All hardwood timber to be Durability class 1, F14 preservative treated to H5.
3. Log Barriers to be 150 diameter, Grade A treated to AS 1604. Use of CCA treated timber to be approved by relevant Council prior to installation.
4. Paint all cut surfaces with industrial clear water repellant to lock in chemicals used on CCA, in accordance with AS 1607.
5. Material
   Hexagonal head bolts to AS 1111.
   Nuts to AS 1112.
   Washers to AS 1237.
   Galvanising to AS 1214.
6. Check for service locations prior to boring for posts
7. The speed environment of the road should be considered when determining the lateral placement of log barrier fencing adjacent to the road way. Refer Austroad "Guide to Road Design – Part 6".
8. All dimensions are in millimetres unless shown otherwise.

Rv.	DATE	REVISIONS
E	06/14	Review
D	03/13	Amended Drawing Number
C	02/11	Review
B	06/10	Review
A	06/09	ORIGINAL ISSUE

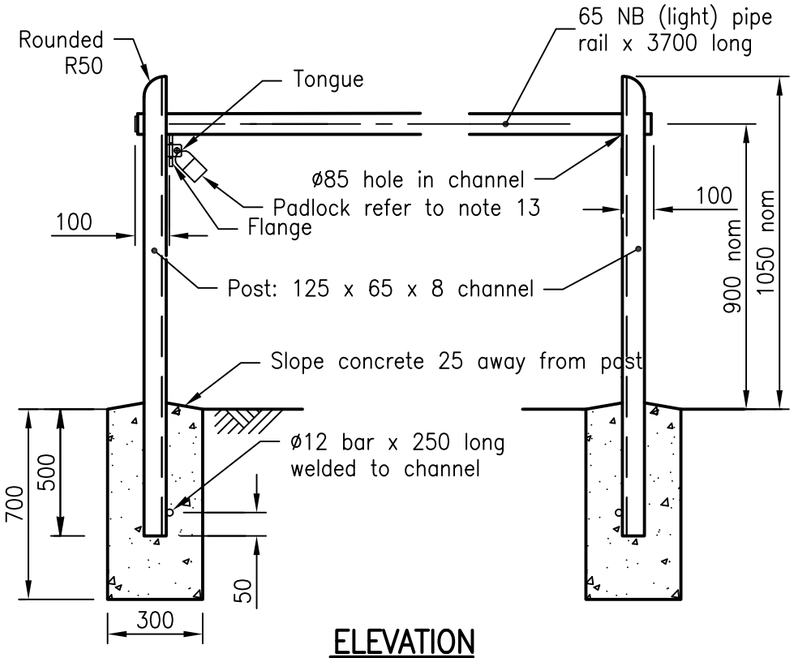
INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

FENCING
LOG BARRIER AND ALTERNATIVE HARDWOOD TIMBER BOLLARD

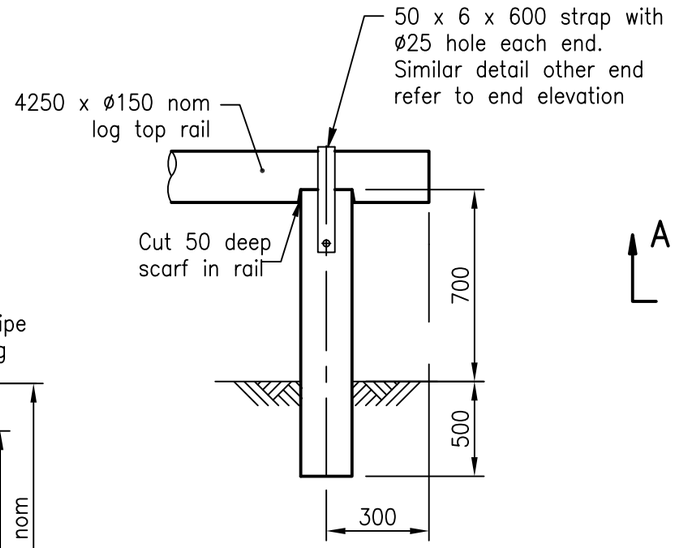
GS–042



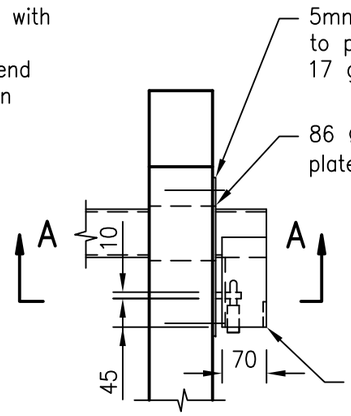
PLAN



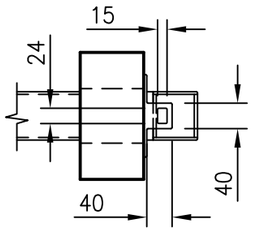
ELEVATION



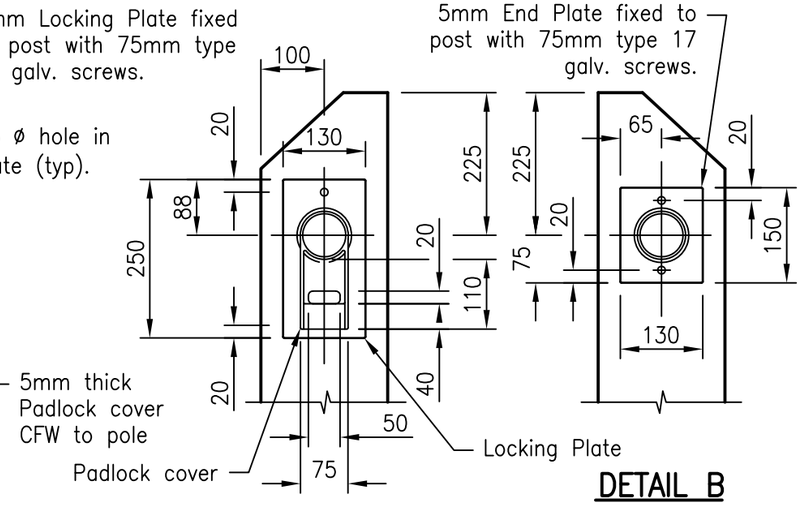
ELEVATION



DETAIL A

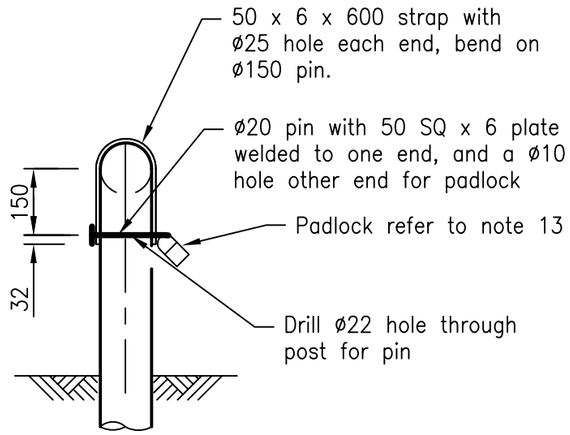


SECTION A–A



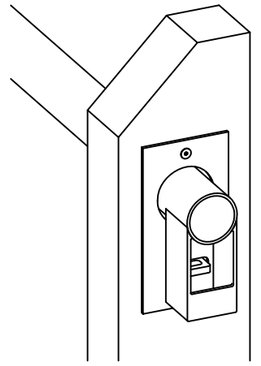
DETAIL B

END ELEVATION

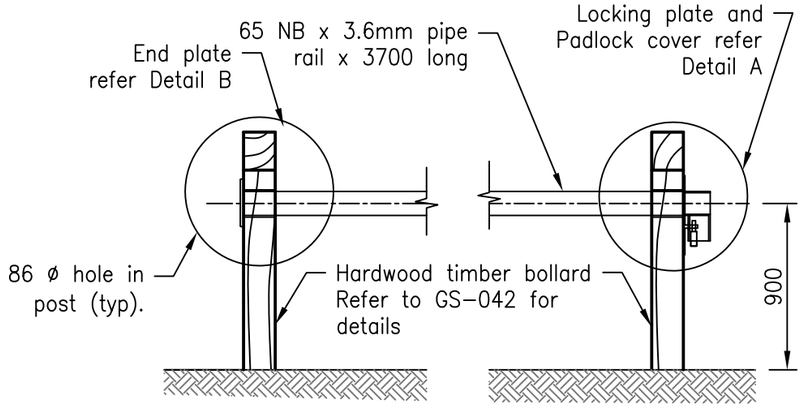


END ELEVATION

LOCKING RAIL TYPE 2

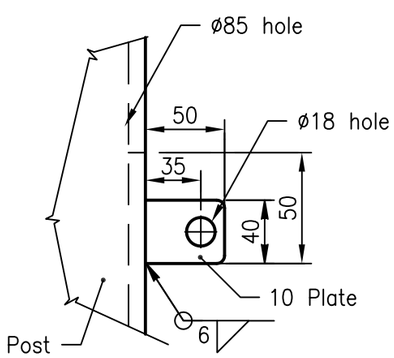


ISOMETRIC VIEW

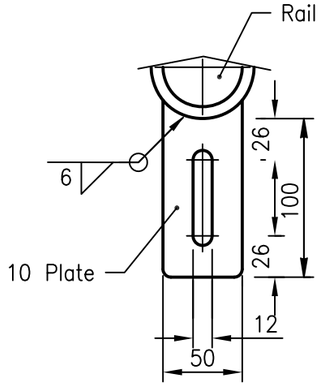


ELEVATION

LOCKING RAIL TYPE 3



TONGUE



FLANGE

LOCKING RAIL TYPE 1

NOTES:

1. All pipes medium black tube to AS 1074.
2. All welds to AS 1554.
3. All welding symbols to AS 1101.3.
4. Steel plates to be Grade 250 to AS 3678.
5. Bar and channels to be Grade 250 to AS 3679.
6. All fabricated work, including plate key, shall have smooth ground edges.
7. All steelwork to be hot dipped galvanised after fabrication to AS 4680.
8. Concrete N25 in accordance with AS 1379 and AS 3600.
9. Log Barriers to be 150 dia. Grade A treated to AS 1604.
10. Use of CCA treated timber to be approved by relevant Council prior to installation.
11. Paint all cut CCA surfaces with industrial clear water repellant to lock chemicals used on CCA, in accordance with AS 1607.
12. All hardwood timber to be Durability Class 1 F14, preservative treated to H5.
13. Refer to relevant Council for supply of approved locking system.
14. Locking rail to be painted yellow (Safety) or as specified.
15. All dimensions are in millimetres unless shown otherwise.

Rv.	DATE	REVISIONS
E	06/14	Review
D	03/13	Amended Drawing Number
D	03/13	Drawing number changed & Type 2 Rail height amended
C	06/11	Review
B	06/10	Review
F	11/15	Isometric View added

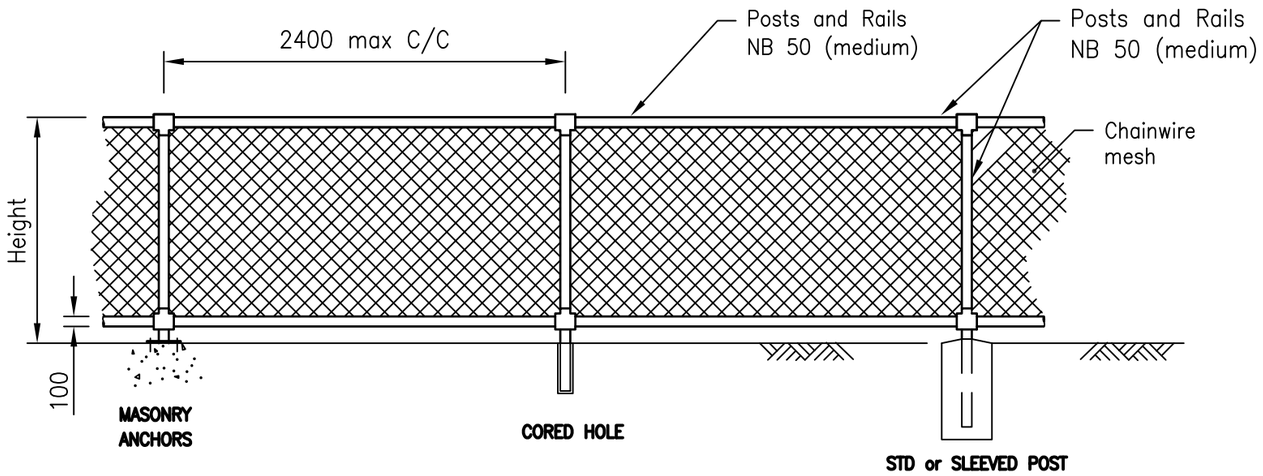
INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA

STANDARD DRAWINGS

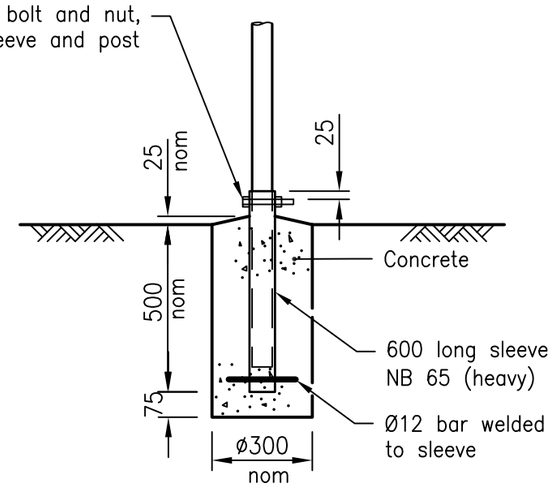
FENCING
LOCKING RAIL
TYPES 1, 2 & 3

GS–043

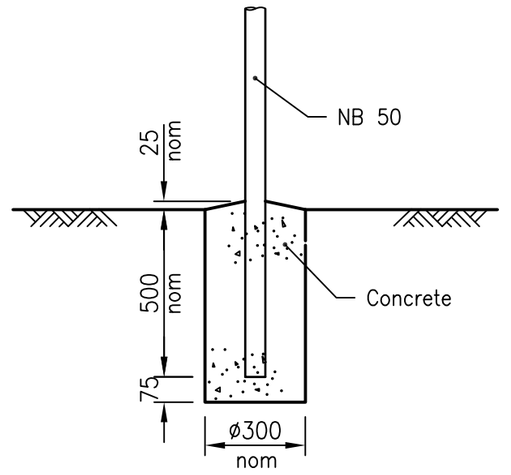
Rv. E D C B A F



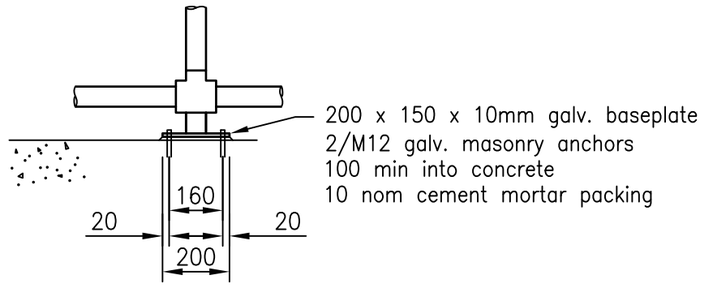
TYPE 1 – A (Height – 1100)
TYPE 1 – B (Height – 1350)



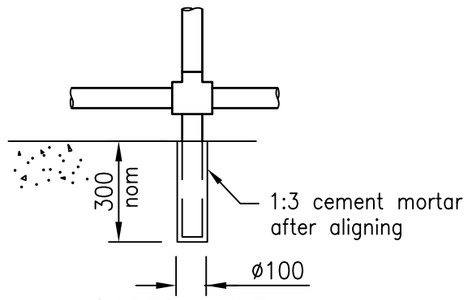
SLEEVED POST



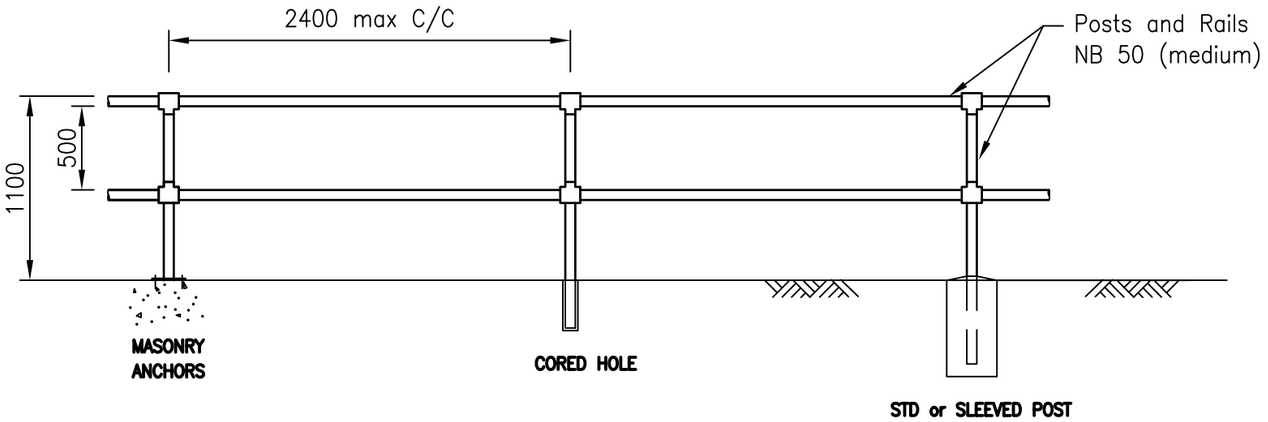
STD. POST



MASONRY ANCHORS



CORED HOLE



TYPE 2

FOOTING DETAILS

NOTES

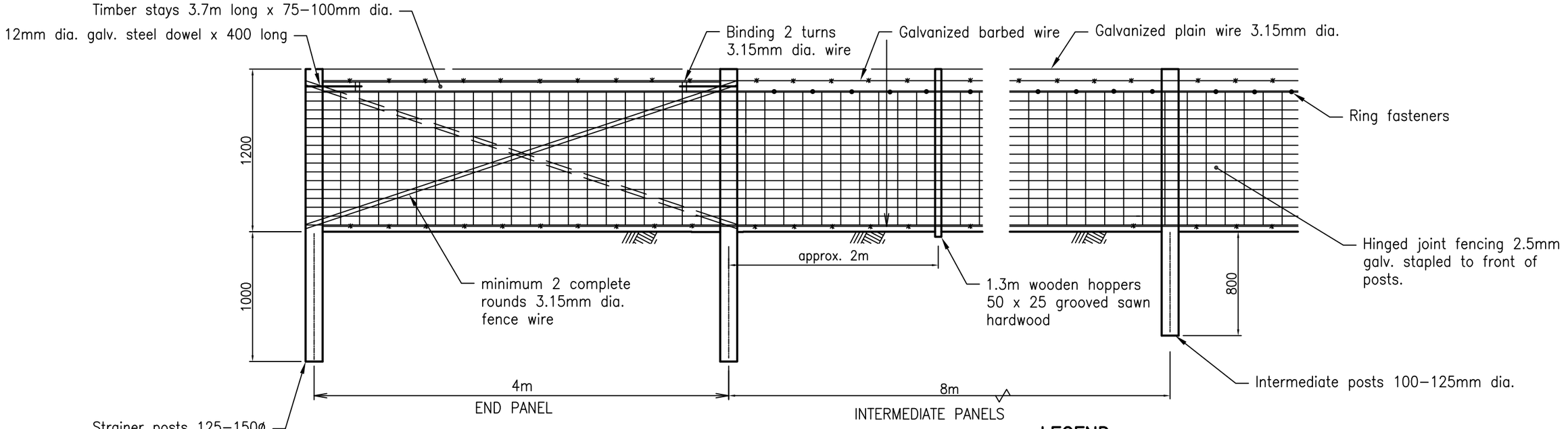
1. Refer project drawings for type of fence to be installed and type of footing to be adopted.
2. Construction of posts & rails shall be done using standard coupling connections only. (no welds).
3. Chainwire to be 50 x 2.5mm galv. to AS 2423 or plastic coated. Chainwire to be fixed using 1.6mm wire ties.
4. ø12 bars, Grade 250 steel to AS 1302
5. Hexagonal head bolts to AS 1111 Nuts to AS 1112 Washers to AS 1237 Galvanizing to AS 4680
6. All rails and posts galvanised steel tube to AS 1074.
7. Concrete N25 in accordance with AS 1379 and AS 3600.
8. All dimensions are in millimetres unless shown otherwise

Rv.	DATE	REVISIONS
D	06/14	Review
C	03/13	Amended Drawing Number
B	12/11	Revised Issue
A	03/08	ORIGINAL ISSUE

INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

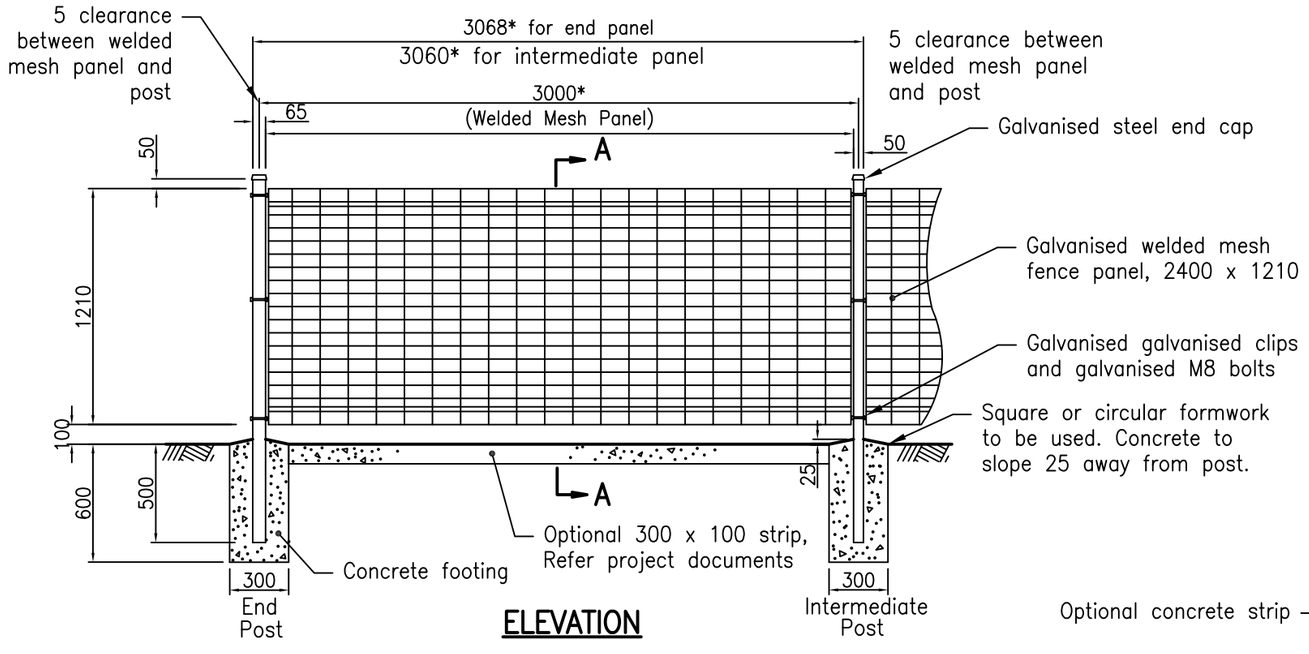
FENCING
TUBULAR STEEL FENCE
WITH & WITHOUT CHAIN WIRE

GS–044



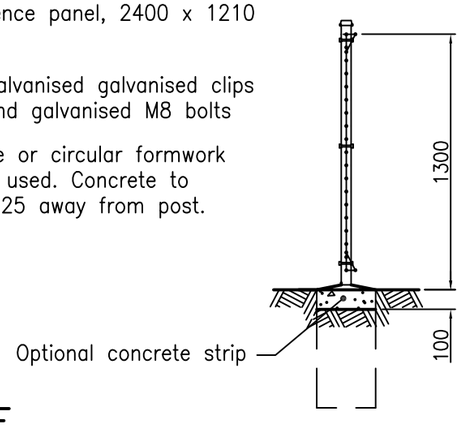
* Welded Mesh panels can be cut to suit reduced post centres in locations requiring additional support. Refer to Project Drawings.

CONTROL FENCE



ELEVATION

WELDED MESH FENCE



SECTION A–A

LEGEND

- Wire fixed to back of posts

NOTES

A – Welded Mesh Fence

1. Gate and end posts to be 65x65x2 galvanized steel section to AS 1163.
2. Intermediate posts to be 50x50x2 galvanized steel section to AS 1163.
3. Panels to be fixed to posts using standard galvanized clips and galvanized M8 bolts.
4. Galvanizing to AS 1214 and AS 1650.
5. Concrete N25 in accordance with AS 1379 and AS 3600.
6. Posts are to be vertical. Raked panels are available for slopes up to 1 in 5.
7. Nuts to be spot welded to bolts as an anti–theft deterent.

B – Control Fence

1. All barbed wire, plain wire, hinged joint fencing, staples and ring fasteners to be galvanized to AS 2423.
2. Provide strainer panels at 100 to 140m spacing. Panels to be as for 'End Panels' with an extra 2/3.15mm wire brace as indicated by broken lines.
3. Posts may be tea–tree, split hardwood or sawn timber.
4. Where fences turn 90° adopt an end panel going away in each direction.
5. Dowels, Grade 250 to AS 3679.

C – General

1. All dimensions are in millimetres unless shown otherwise.

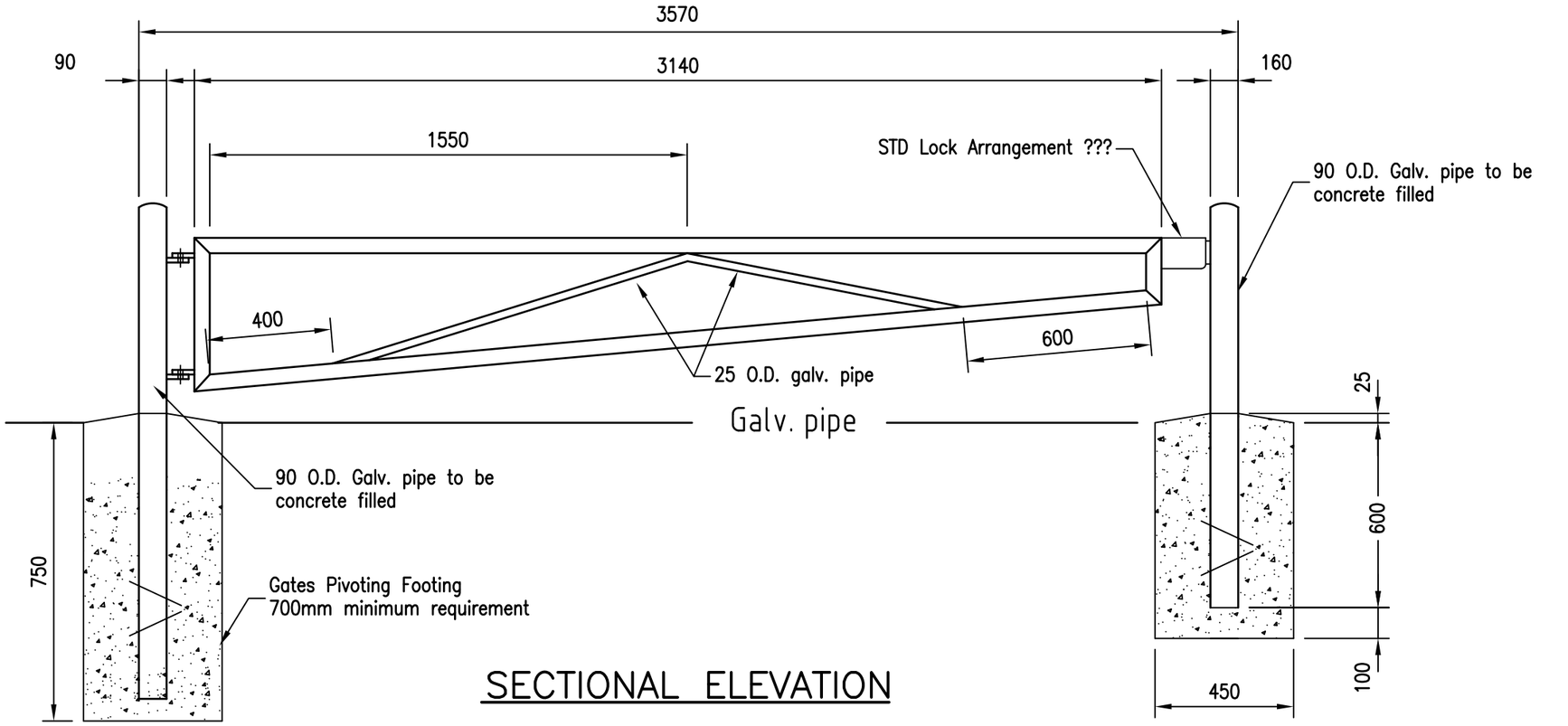
Rv.	DATE	REVISIONS
B	03/14	Amended Drawing Number
A	12/95	ORIGINAL ISSUE

INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

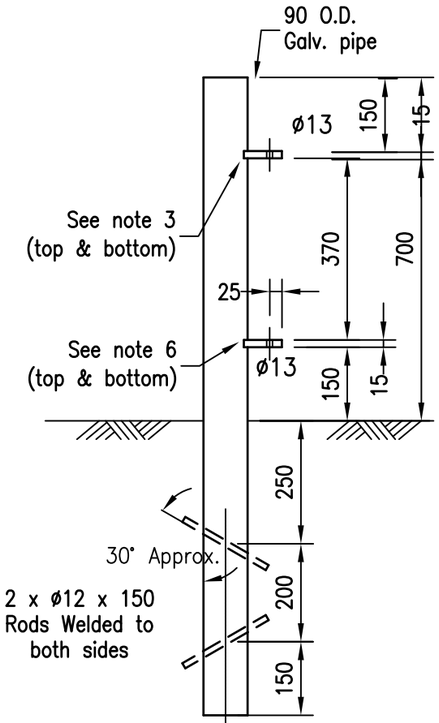
FENCING
WELDED MESH FENCING
AND CONTROL FENCE

GS–045

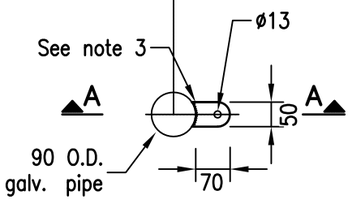
Rv. B A



SECTIONAL ELEVATION



SECTION A–A

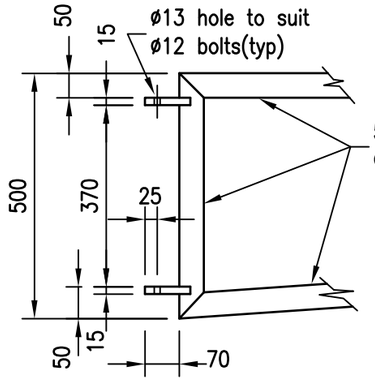


PLAN

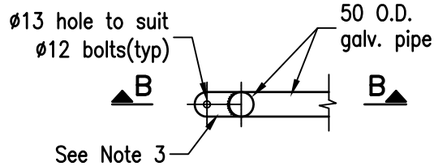
POST HINGE DETAILS

NOTES

1. All concrete to be grade N25
2. Gate to be mounted to post with two M12 galvanised steel bolts 40 long suitably burred after erection.
3. Hinge lugs to be 6 fillet welded to post and gate prior to erection
4. All end and mitre joints to be butt welded all around.
5. All pipes to be medium gauge heavy galvanised finished with two coats of two pack 125 micron minimum total thickness (e.g. Wattly Paracryl or equivalent process). Colour to match colorbond "Caulfield Green".
6. All welds and bare metal to be thoroughly cleaned and painted with cold galvanising primer prior to finish coat.
7. All dimensions are in millimetres unless shown otherwise.



SECTION B–B



PLAN

GATE HINGE DETAILS

These drawings have been developed in consultation between the participating Councils.
BEFORE USE, the user shall confirm that the drawing has been adopted by the appropriate Council.

Rv.	DATE	REVISIONS	
	February	Original Issue	

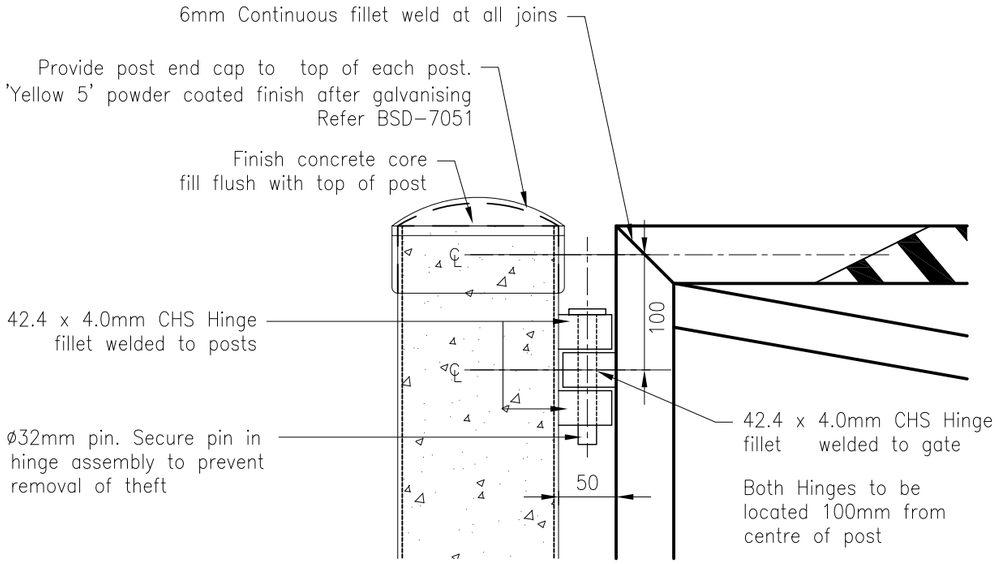
INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA

STANDARD DRAWINGS

FENCING
ENTRANCE BARRIER
SINGLE SWING GATE

GS–047

Rv.

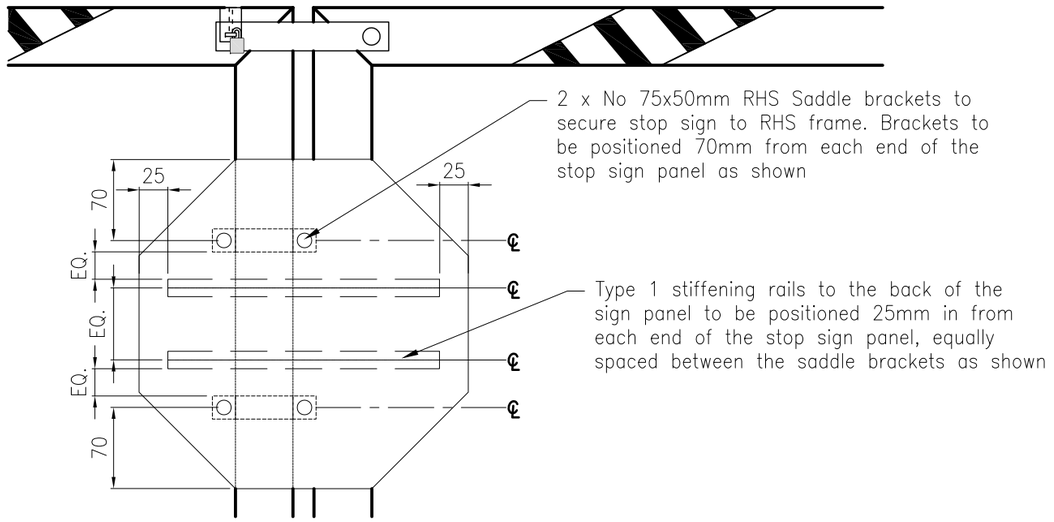


STEEL LOCK GATE HINGE DETAIL

SCALE: 1:5

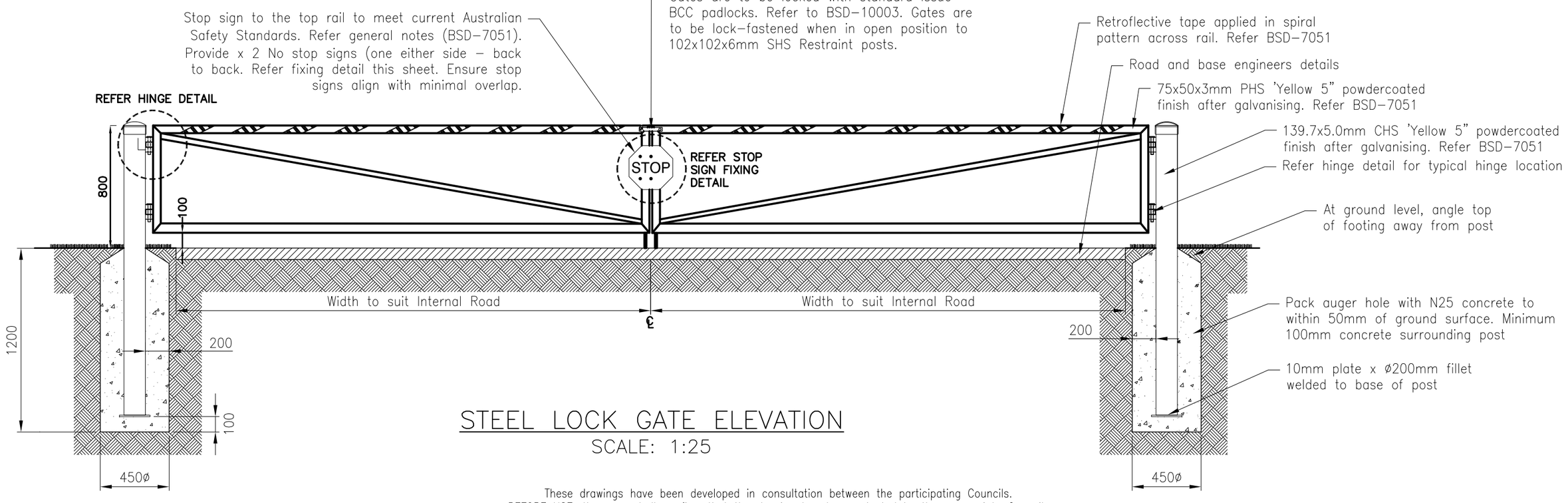
REFER TO BSD-7051 FOR ASSOCIATED SPECIFICATIONS.

NOTE: Provide fixings of a type and material suitable, sufficient and matching in finish and appearance to the components fastened. Provide insulation between dissimilar materials, unless specified otherwise. Where possible all fixings to be tamper/vandal proof to minimise theft or damage. As an example: Only one sign is shown attached to gate frame.



STOP SIGN FIXING DETAIL

SCALE: 1:5



STEEL LOCK GATE ELEVATION

SCALE: 1:25

These drawings have been developed in consultation between the participating Councils.
BEFORE USE, the user shall confirm that the drawing has been adopted by the appropriate Council.

Rv.	DATE	REVISIONS	
	February, 2016	Original Issue	

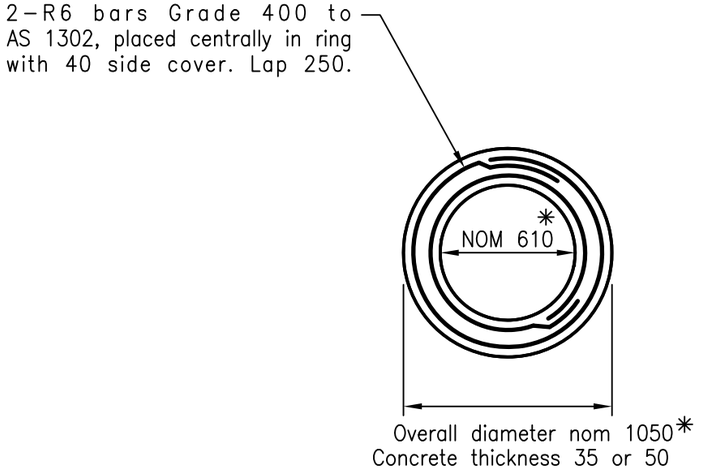
INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA

STANDARD DRAWINGS

FENCING
ENTRANCE BARRIER
DOUBLE SWING GATE

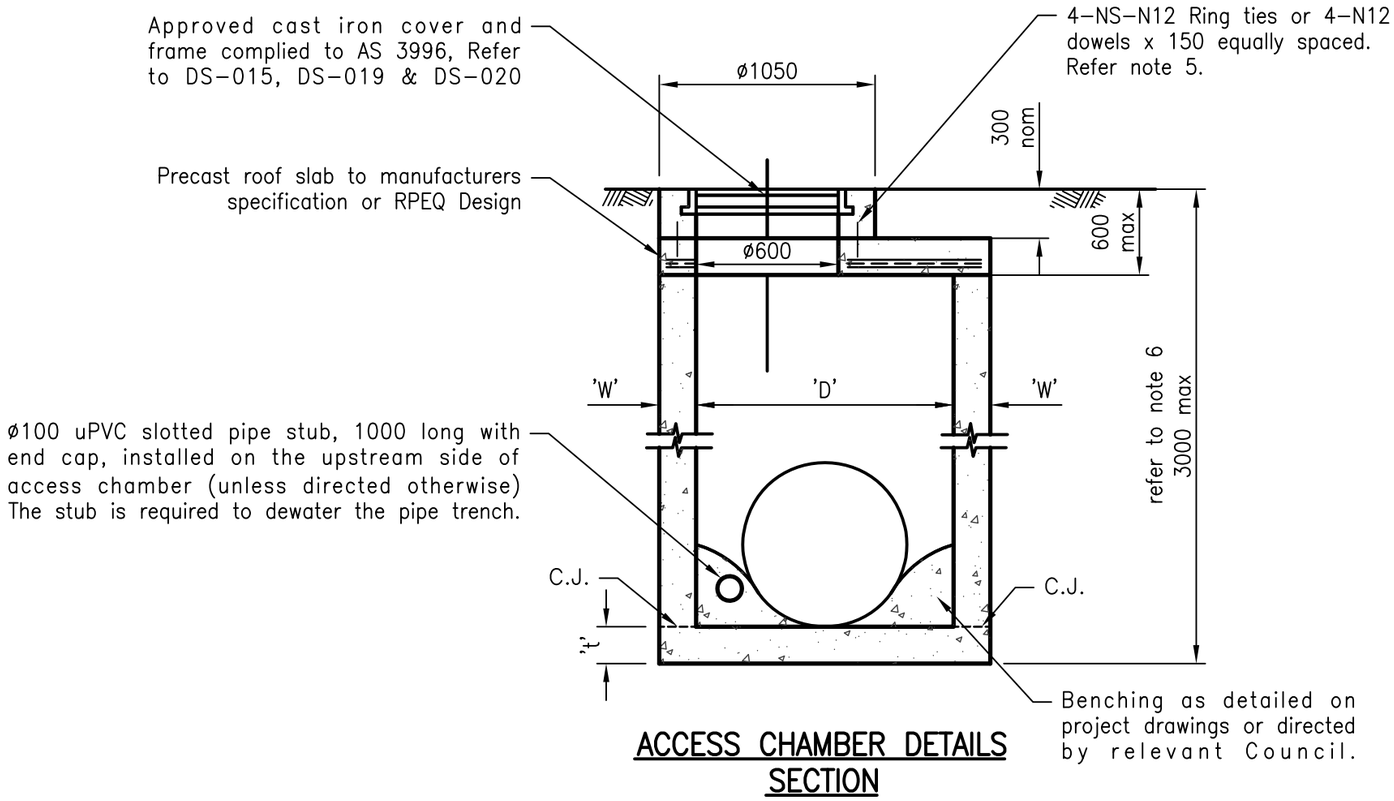
GS-048

Rv.



ROOF RING PLAN

For use in raising covers and frames of existing access chambers
* Size to suit existing access chamber



ACCESS CHAMBER DETAILS SECTION

DIMENSION

Access chamber DIA 'D'	FLOOR THICKNESS 't'		Wall thickness 'W'	Roof/Floor slab DIA
	INLET	OUTLET		
1050	175	150	150	1350
1200	250	225	225	1650
1350	250	225	225	1800
1500	250	225	225	1950
1800	250	225	250	2300
2100	275	250	275	2650

NOTES:

1. Concrete: Benching N25, Structural N40 (precast), N32 (Cast insitu) in accordance with AS1379 and AS 3600.
2. Access chambers which are proprietary items are required to be designed and certified to AS 3996–1992. Access covers subject to road traffic shall be of Class D design, where Minimum Ultimate Limit State Design Load = 210kN. Access covers subject to pedestrian traffic and occasional vehicle load shall be of Class C design, where Minimum Ultimate Limit State Design Load =150kN. (Ref: AS 3996–1992 and Austroads Bridge Design Code 1992).
3. Cover and frame, gray cast iron, Grade > T220 to AS 1830.
4. Refer Project Drawings for size and level of culverts, chamber cover level and setout point details.
5. Precast manhole top slabs are to be supplied with four (4) factory installed ring ties or alternately dowel bars may be accepted, subject to approval from the relevant Council.
6. Manholes deeper than 3000 require individual design and certification.
7. All dimensions are in millimetres unless shown otherwise.

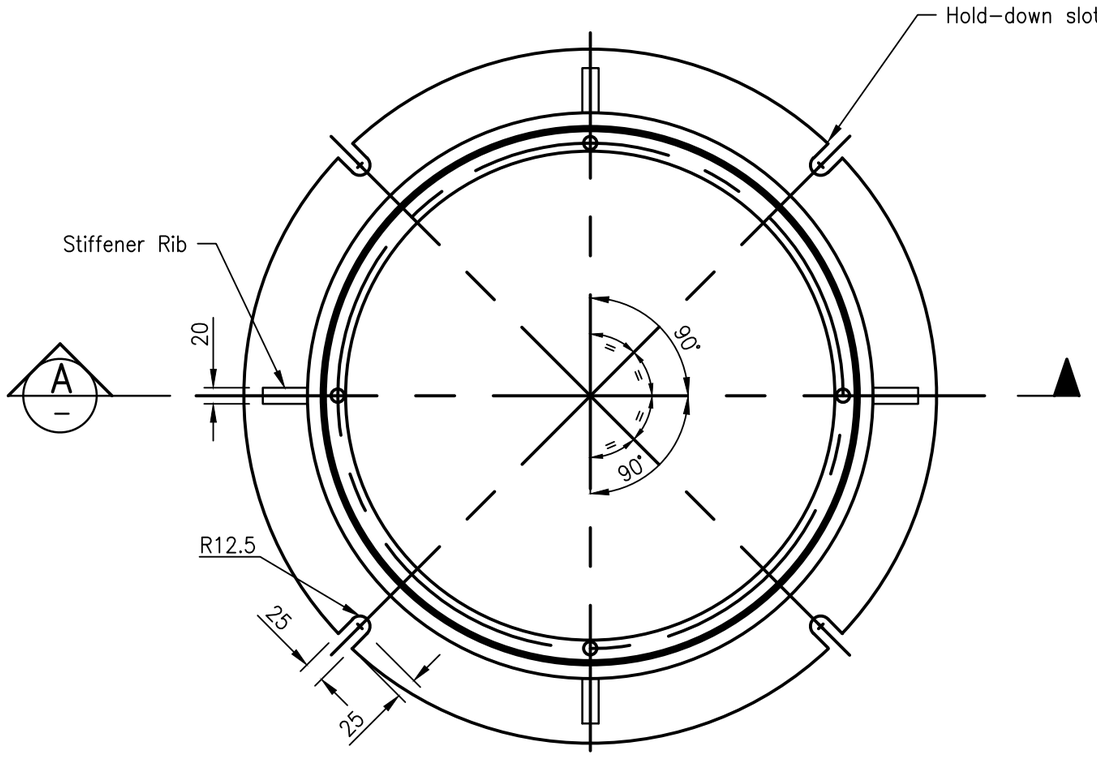
Rv.	DATE	REVISIONS
D	06/14	Review
C	03/14	Amended Drawing Number
B	11/12	Concrete Strength Amended
A	10/12	ORIGINAL ISSUE

INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

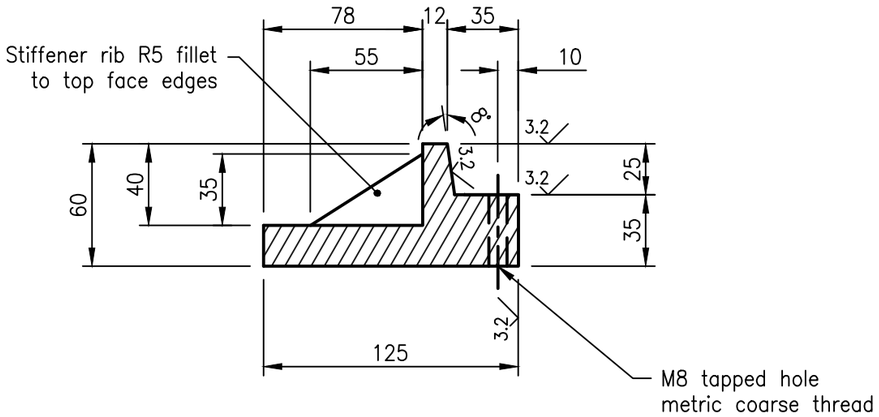
STORMWATER ACCESS CHAMBER DETAIL
1050 TO 2100 DIAMETER

DS–010

Rv. D C B A

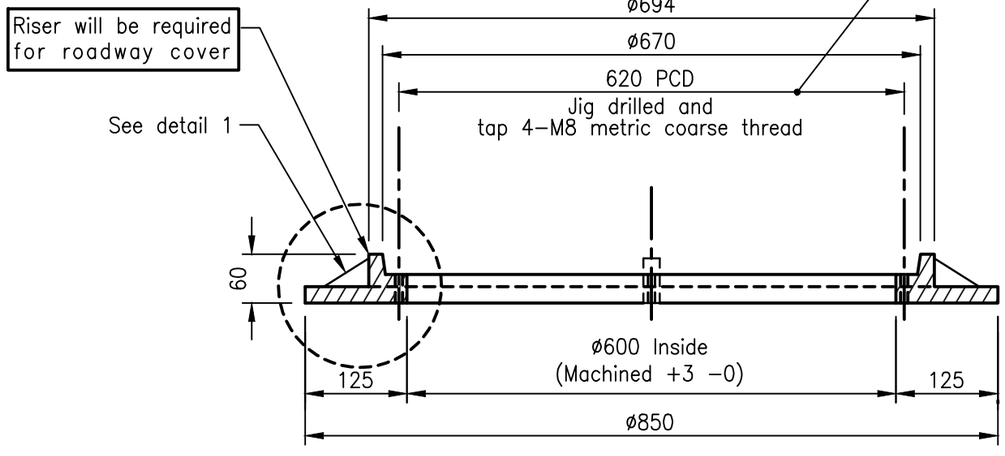


PLAN



DETAIL 1

NOTE:
Gauge shall be used to check PCD and tapped hole position



SECTION A – A

NOTES:

1. All edges to be square.
2. Casting to be free of burrs and pits.
3. Material
   Grey Cast iron (AS 1830)
   Tensile strength : >T220
   Hardness : 145–185 (HB)
   Design Load = 210kN (AS 3996)
   Mass = 59.5Kg
4. Tolerances
   Cast size ± 1.00mm
   Angle Profile ± 0.25°
   Machined size ± 0.125mm
   Overall diameter of cover + 0mm–0.25mm
   DFT of coating 50 µm
5. Machine surface symbol: 3.2
6. All machined surfaces shall have a coating approved as fit for the purpose of providing a rust proof, non–stick and gas/water proof joint.
7. Refer Std Dwg No DS–018 for manhole riser details.
8. Refer Std Dwg No DS–019, DS–020 and DS–021 for manhole cover details.
9. All dimensions are in millimetres unless shown otherwise.

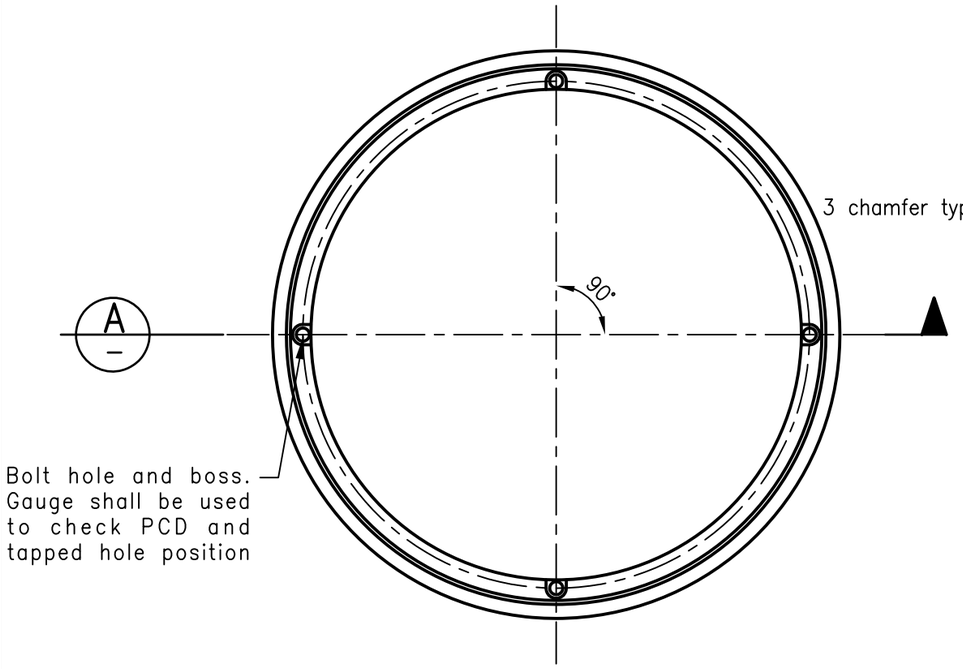
Rv.	DATE	REVISIONS
C	06/14	Review
B	03/14	Amended Drawing Number
A	10/12	ORIGINAL ISSUE

INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

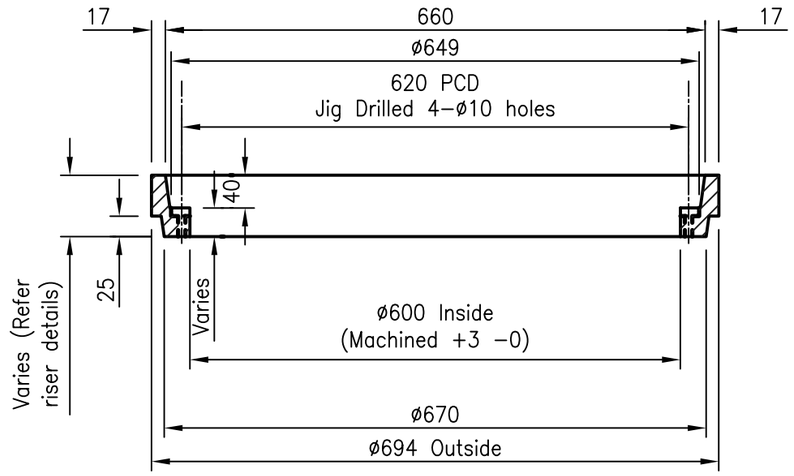
MANHOLE FRAME
(ROADWAY AND NON–ROADWAY)
1050 TO 2100 DIAMETER

DS–015

Rv. C B A



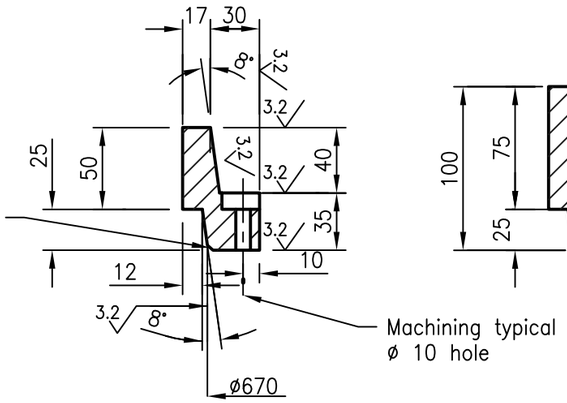
PLAN



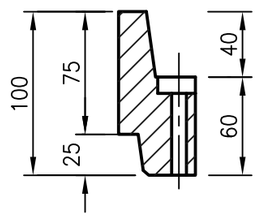
SECTION A

TABLE 1

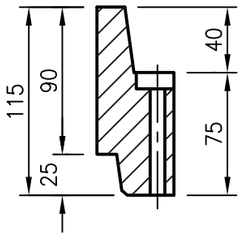
RISER HEIGHT	BOLT LENGTH	
	FOR RISER ONLY	FOR RISER WITH COVER
35	60	100
60	90	130
75	110	150
90	115	160



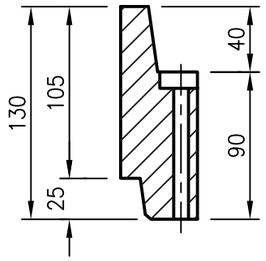
35 RISER
MASS: 27.5kg



60 RISER
MASS: 32kg



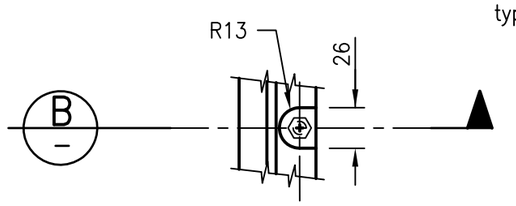
75 RISER
MASS: 38kg



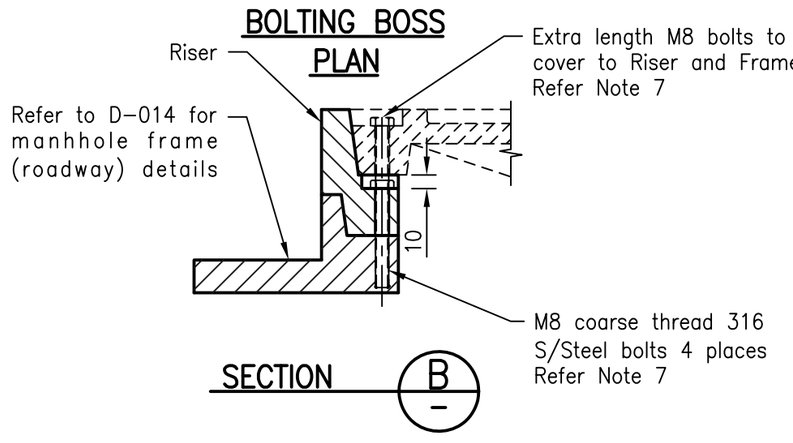
90 RISER
MASS: 44kg

RISER DETAILS

(Refer to 35 riser for typical dimensions for all risers)



BOLTING BOSS PLAN



SECTION B

TYPICAL ASSEMBLY

Bolts: 60 long for 35 riser
90 long for 60 riser
110 long for 75 riser
115 long for 90 riser

NOTES:

1. All edges to be square.
2. Casting to be free of burrs and pits.
3. Material
   Ductile cast iron
   Tensile strength : 600–3 (AS 1831)
   Hardness : 145–185 (HB)
   Design load = 210kN (AS 3996)
   Mass = varies
4. Tolerances
   Cast size ± 1.00mm
   Angle profile ± 0.25°
   Machined size ± 0.125mm
   Overall diameter of cover +0mm–0.25mm
   DFT of coating 50 µm
5. Machine surface symbol: 3.2
6. All machined surfaces shall have a coating approved as fit for the purpose of providing a rust proof, non stick and gas/water proof joint.
7. Four (4) M8 Course Thread Stainless Steel Bolts must be supplied and used to fix riser to frame, where cover is required to be bolted down, min two extra length bolts must be used to secure cover and raiser to frame, with two remaining bolts securing riser to frame. Refer TABLE 1 for bolt Lengths
8. Refer Std Dwg DS–015 for manhole frame details.
9. Refer Std Dwg DS–019, DS–020 and DS–021 for manhole cover details.
10. All dimensions are in millimetres unless shown otherwise.

These drawings have been developed in consultation between the participating Councils.
BEFORE USE, the user shall confirm that the drawing has been adopted by the appropriate Council.

Rv.	DATE	REVISIONS
C	06/14	Review
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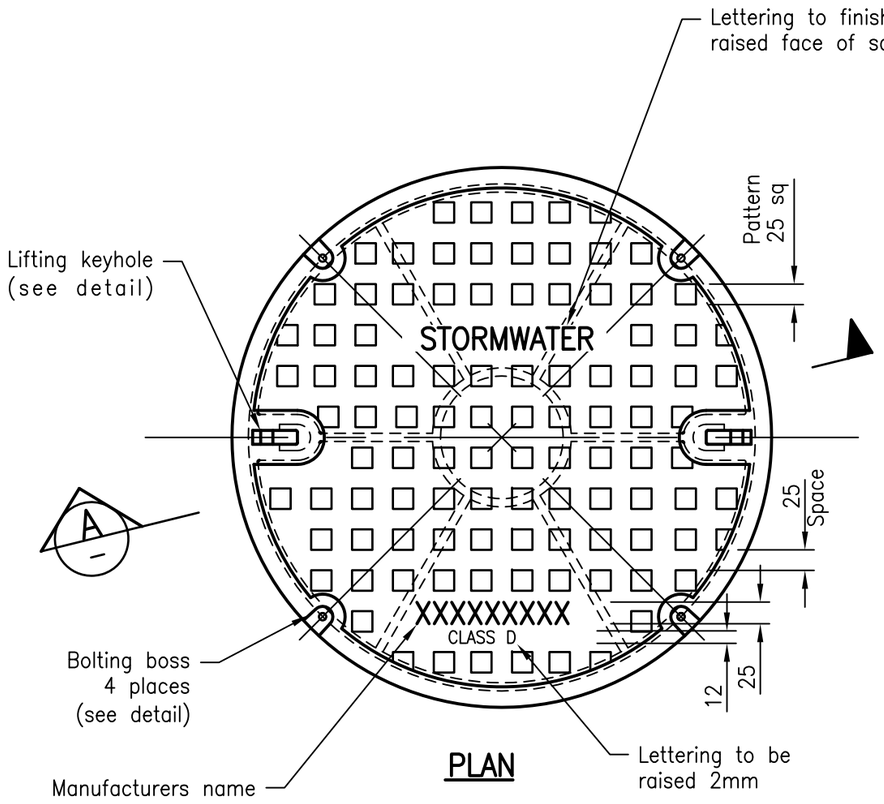
A	10/12	ORIGINAL ISSUE

INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

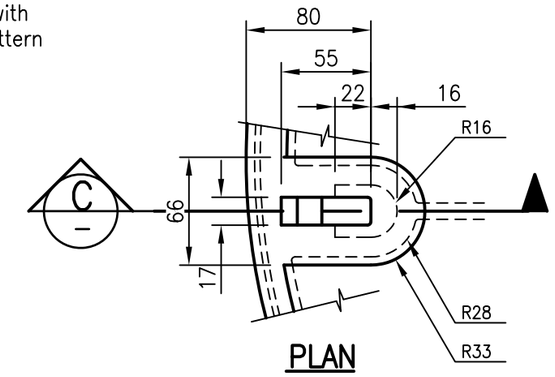
MANHOLE RISER DETAILS
(ROADWAY)

DS–018

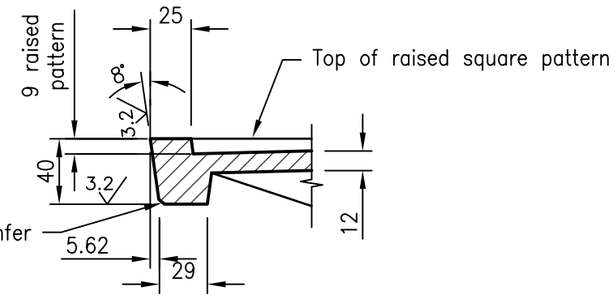
Rv. C B A



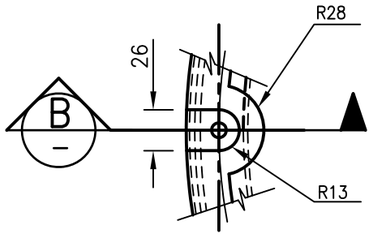
PLAN



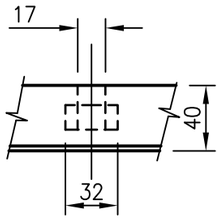
PLAN



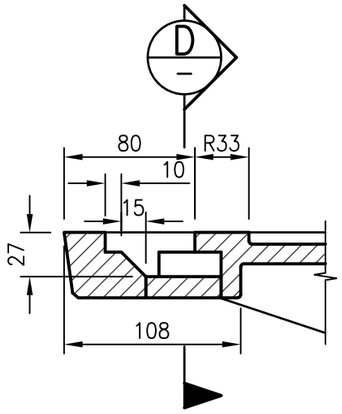
TYPICAL EDGE DETAIL



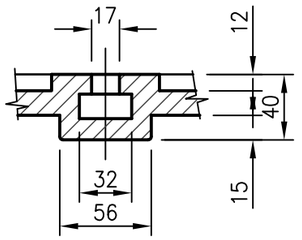
PLAN



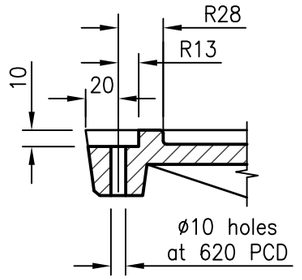
END ELEVATION



SECTION C



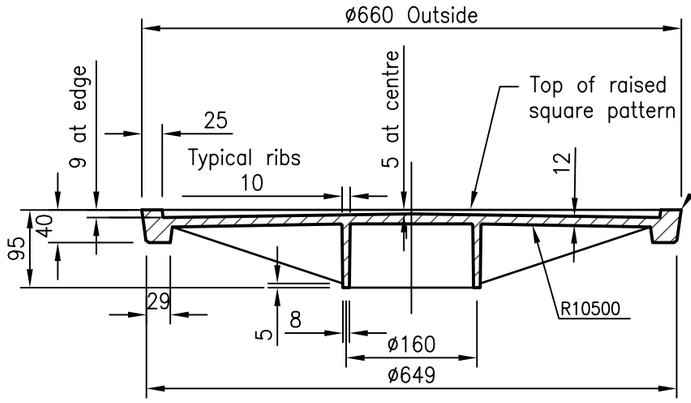
SECTION D



SECTION B

LIFTING KEYHOLE DETAIL

BOLTING BOSS DETAIL



SECTION A

Riser will be required for roadway cover

NOTES:

1. All edges to be square.
2. Casting to be free of burrs and pits.
3. Material
   Ductile cast iron
   Tensile Strength: 600–3 (AS 1831)
   Hardness: 145–185 (HB)
   Design Load = 210kN (AS 3996)
   Mass = 49kg
4. Tolerances
   Cast Size ± 1.00mm
   Angle profile ± 0.25°
   Machined Size ± 0.125mm
   Overall diameter of cover +0mm–0.25mm
   DFT of coating 50 μm
5. Machine surface symbol: 3.2
6. All machine surfaces shall have a coating approved as fit for purpose of providing a rust proof, non–stick and gas/water proof joint.
7. Lids to be bolted down if directed by Designer. min two extra length bolts must be used to secure Cover and Riser to frame. Refer to D–018 for Riser detail and Bolt lengths.
8. Refer Std Dwg DS–015 for manhole frame details.
9. Refer Std Dwg DS–018 for manhole riser details.
10. Refer Std Dwg DS–020 and DS–021 for alternate cover details.
11. All dimensions are in millimetres unless shown otherwise.

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BEFORE USE, the user shall confirm that the drawing has been adopted by the appropriate Council.

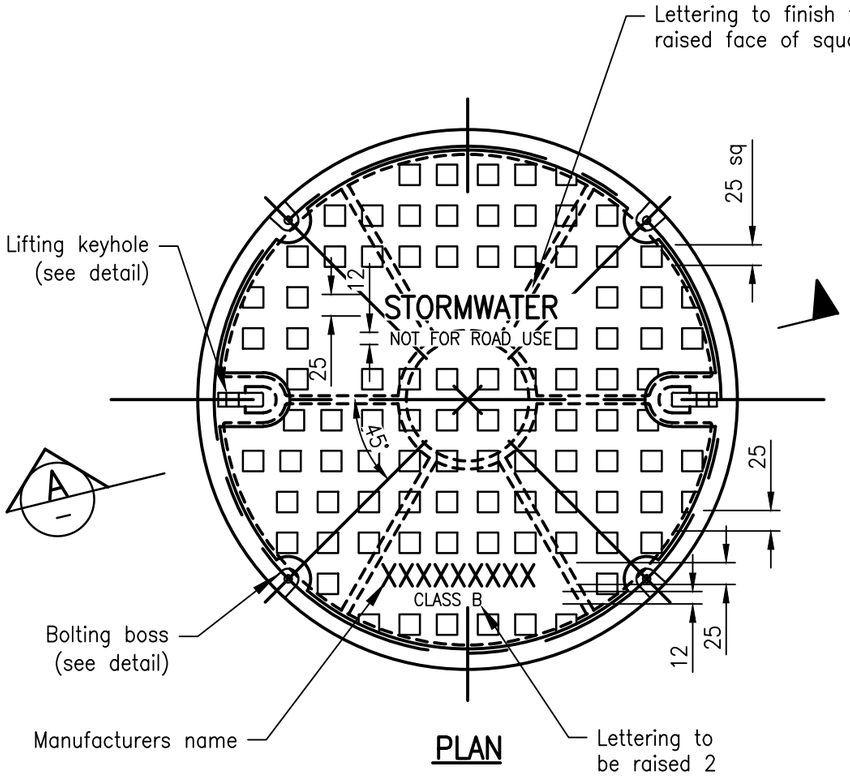
Rv.	DATE	REVISIONS
C	06/14	Review
B	03/14	Amended Drawing Number
A	10/12	ORIGINAL ISSUE

INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

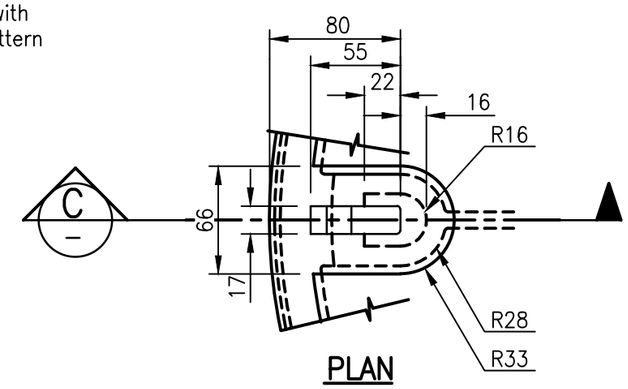
MANHOLE COVER
(ROADWAY)
1050 TO 2100 DIAMETER

DS–019

Rv. C B A



PLAN



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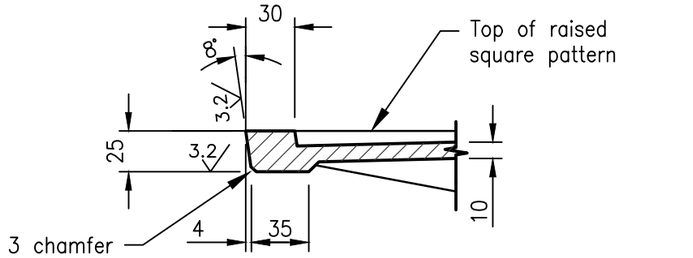
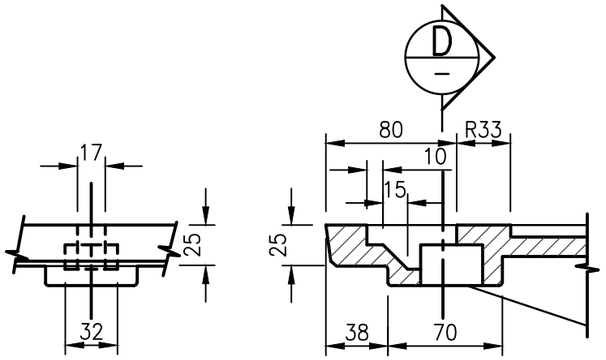
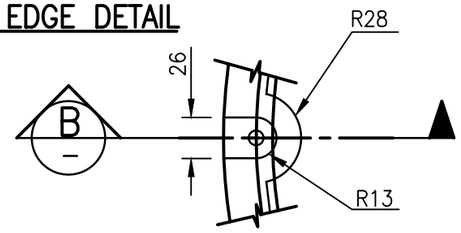


TYPICAL EDGE DETAIL





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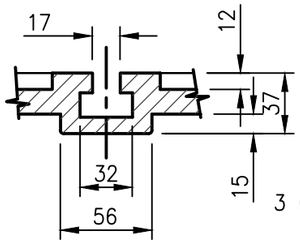
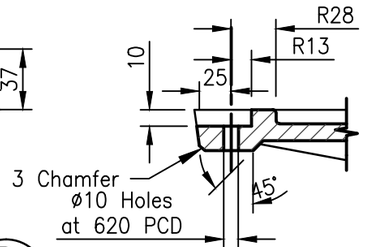
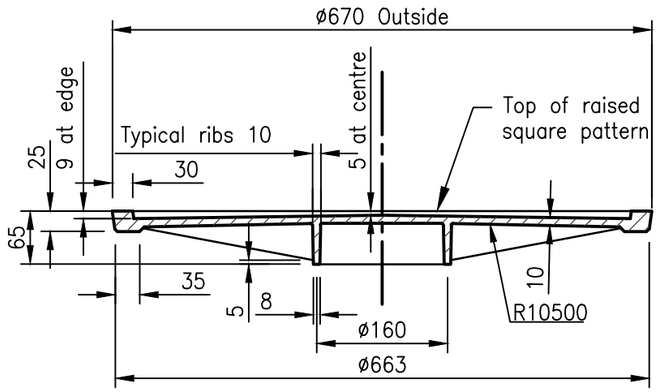


SECTION D



SECTION B



SECTION A

END ELEVATION

SECTION C

LIFTING KEYHOLE DETAIL

BOLTING BOSS DETAIL

NOTES:

1. This drawing is for use in non commercial loading applications where vehicle loads are less than 3.5t.
2. All edges to be square.
3. Casting to be free of burrs and pits.
4. Material
   Ductile cast iron
   Tensile strength : 600–3 (AS 1831)
   Hardness : 145–185 (HB)
   Design load = 80kN (AS 3996)
   Mass = 39kg
5. Tolerances
   Cast size ± 1.00mm
   Angle profile ± 0.25°
   Machined size ± 0.125mm
   Overall diameter of cover +0mm–0.25mm
   DFT of coating 50 μm
6. Machine surface symbol: 3.2
7. All machine surfaces shall have a coating approved as fit for purpose of providing a rust proof, non–stick and gas/water proof joint.
8. Lids to be bolted down if required by Design, using M8 coarse thread 316 stainless steel bolts in four (4) places.
9. Refer Std Dwg DS–015 for manhole frame details.
10. Refer Std Dwg DS–018 for manhole riser details.
11. Refer Std Dwg DS–019 and DS–021 for alternate cover details.
12. All dimensions are in millimetres unless shown otherwise.

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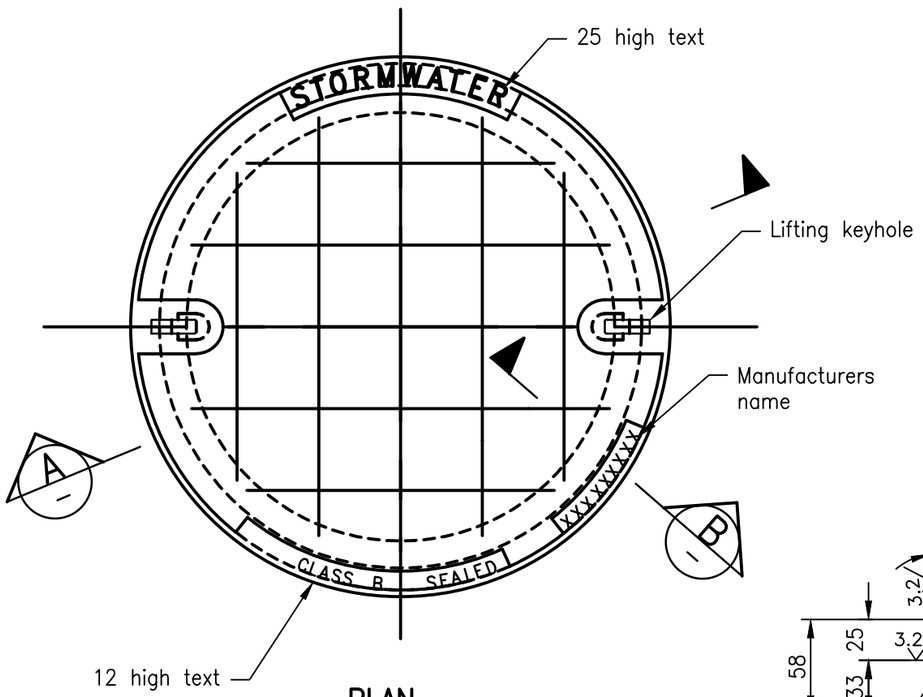
INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

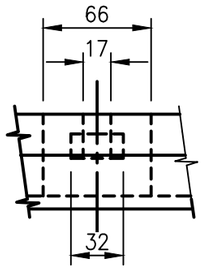
MANHOLE COVER
(NON ROADWAY)
1050 TO 2100 DIAMETER

DS–020

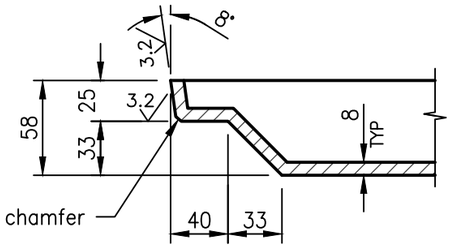
Rv. C B A



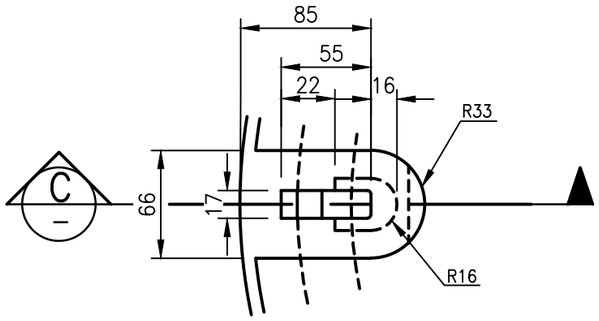
PLAN



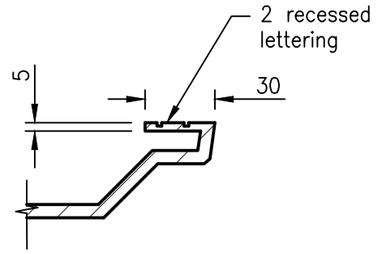
END ELEVATION



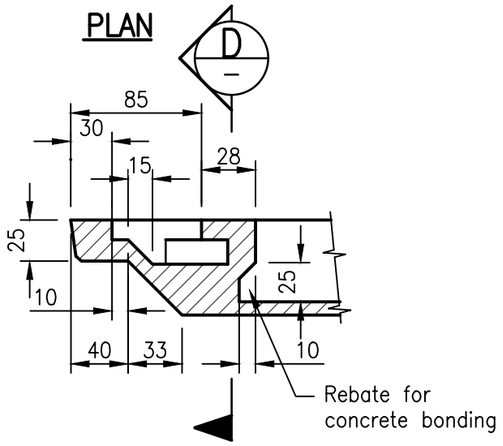
DETAIL 1



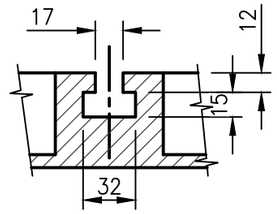
PLAN



SECTION B

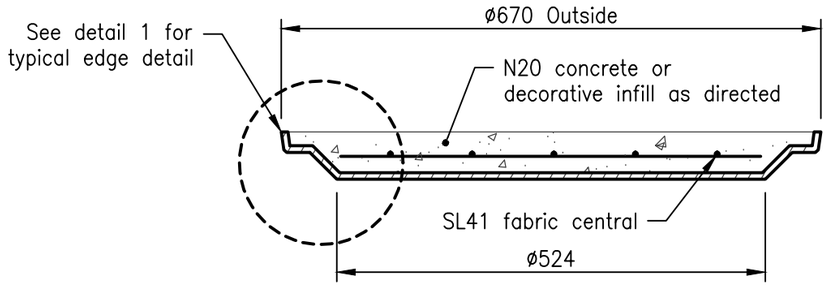


SECTION C



SECTION D

LIFTING KEYHOLE DETAILS



SECTION A

NOTES:

1. This drawing is for use in non roadway application subject to pedestrian loadings only.
2. All edges to be square
3. Casting to be free of burrs and pits.
4. Material
   Ductile cast iron
   Tensile strength : 600–3 (AS 1831)
   Hardness : 145–185 (HB)
   Design Load : 80kN (AS 3996)
   Mass = 59.5kg
5. Tolerances
   Cast size ± 1.00mm
   Angle profile ± 0.25°
   Machined size ± 0.125mm
   Overall diameter of cover +0mm–0.25mm
   DFT of coating 50µm
6. Machine surface symbol: 3.2
7. All machined surfaces shall have a coating approved as fit for the purpose of providing a rust proof non–stick and gas/water proof joint.
8. Refer Std Dwg DS–015 for manhole frame details.
9. Refer Std Dwg DS–018 for manhole riser details.
10. Refer Std Dwg DS–019 and DS–020 for alternate cover details.
11. All dimensions are in millimetres unless shown otherwise.

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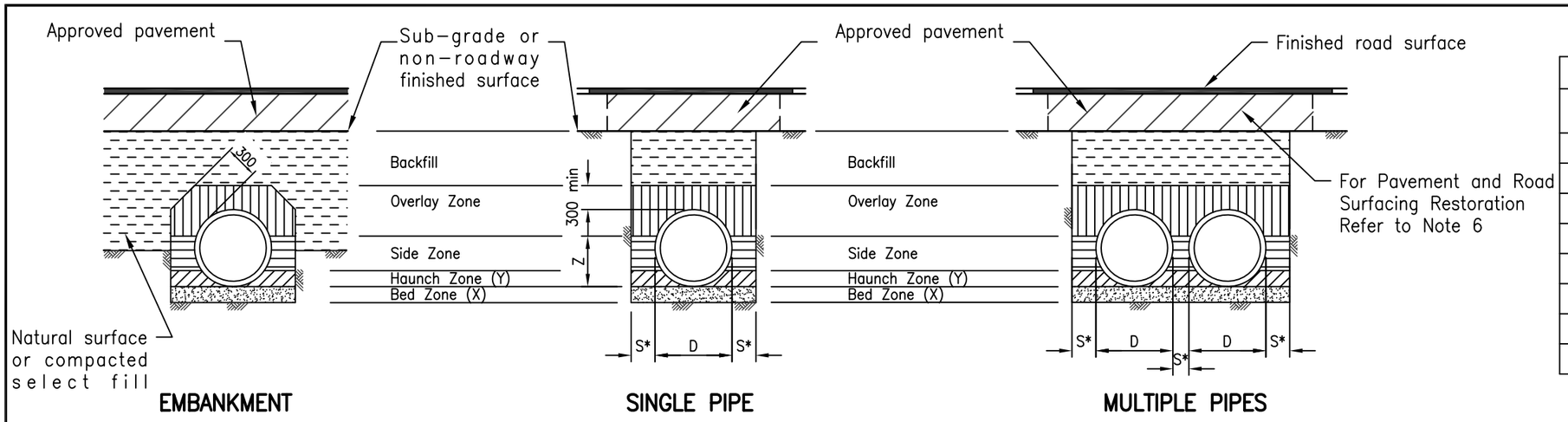
INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

MANHOLE COVER CONCRETE
INFILL (PEDESTRIAN TRAFFIC)
1050 TO 2100 DIAMETER

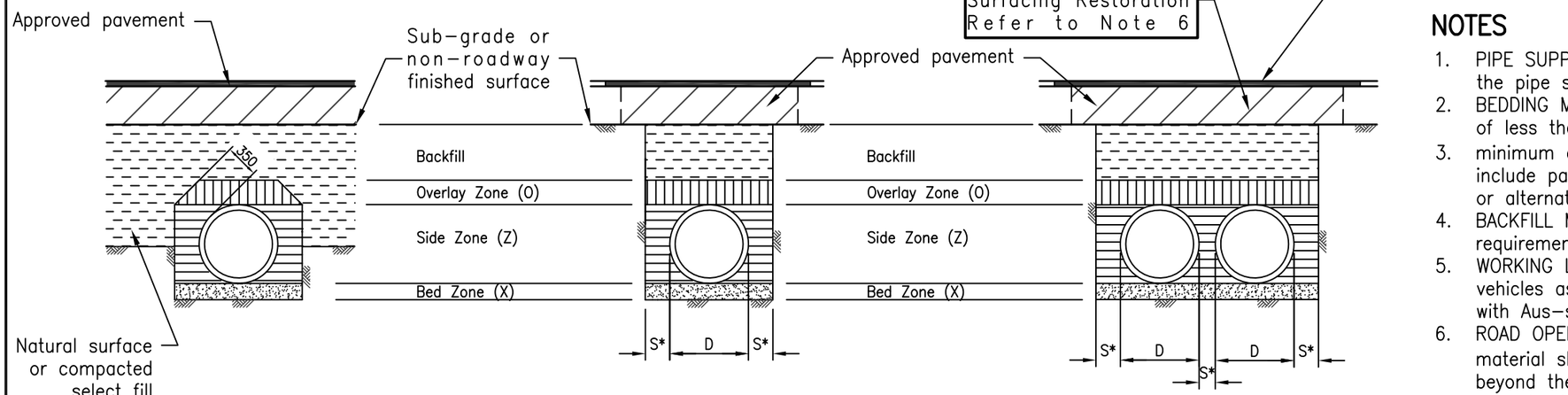
DS–021

C B A Rv.



EMBANKMENT | SINGLE PIPE | MULTIPLE PIPES

RIGID PIPE



EMBANKMENT | SINGLE PIPE | MULTIPLE PIPES

FLEXIBLE PIPE

TABLE 1

BEDDING MATERIAL GRADING (% weight passing)		
Sieve size	**Bed & Haunch zones**	**Side zones**
75.0		100
19.0	100	
9.5		50 – 100
2.36	50 – 100	30 – 100
0.60	20 – 90	15 – 50
0.30	10 – 60	
0.15	0 – 25	
0.075	0 – 10	0 – 25

The use of Controlled Low Strength Material (CLSM) in lieu of the material in Table 1 is to be approved by the relevant Council.

PIPE INSTALLATION DIMENSIONS

RIGID PIPE					FLEXIBLE PIPE			
D (Dia.)	X	Y	Z	S*	X	Z	O	S*
>300 <450	100	0.3 D	–	300	100	Pipe Dia.	150	300
>450 <600	100	0.3 D	–	300	150	Pipe Dia.	150	300
>600 <900	100	0.3 D	–	600	150	Pipe Dia.	200	600
>900 <1200	100	0.3 D	–	600	150	Pipe Dia.	200	600
>1200 <1500	100	0.3 D	–	600	150	Pipe Dia.	200	600
>1500	150	0.3 D	> 0.7 D	900	150	Pipe Dia.	0.25 D	900

S* – Where the use of Controlled Low Strength Material (CLSM) has been approved, the space between multiple pipes and the side of the trench can be reduced in accordance with the requirements of the relevant Australian Standard.

NOTES

1. PIPE SUPPORT TYPE – unless shown otherwise on the project drawings, the pipe support shall be HS3 within road reserve and H2 elsewhere.
2. BEDDING MATERIAL shall comply with Table 1 and have a Plasticity Index of less than 6.
3. minimum depth of OVERLAY ZONE above pipes / culverts as shown may include pavement. Pavement within this area to be compacted by hand or alternatively a lean mix concrete pavement layer may be used.
4. BACKFILL MATERIAL shall be Select Backfill complying with the requirements of Aus–Spec 1352 Pipe drainage.
5. WORKING LOADS are those due to fill material and standard highway vehicles as per AS 3725. Allowance for construction loads shall comply with Aus–spec 1352 Pipe Drainage.
6. ROAD OPENINGS AND RESTORATION – Approved replacement pavement material shall extend a min 300mm (subject to depth of pavement) beyond the perimeter of any trench excavation. The road surfacing shall extend min 100mm beyond the perimeter of any pavement replacement.
7. WINGWALLS fill/backfill material shall be placed 300mm thick behind wingwalls for the length and height of the wings.
8. Increase excavation locally at spigot and socket joints (Rigid pipes) to ensure minimum cover as shown.
9. Unless directed otherwise, provide pipe stub to de–water drainage trench. Stub to be 3m long x 100mm dia. corrugated polyethylene pipe class 400 to AS 2439 (with end cap) installed on the upstream face of manholes.
10. All dimensions are in millimetres unless shown otherwise.

REFERENCED DOCUMENTS
Australian Standards:
AS 3725 Loads on Buried Concrete Pipes
AS 4139 Fibre reinforced concrete pipes and fittings
AS/NZS 2566.1 Buried Flexible Pipelines –Structural Design
AS/NZS 2566.2 Buried Flexible Pipelines – Installation

Specifications:
Nat–Spec 1352 Pipe drainage
Nat–spec 1152 Road Openings and Restorations
Nat–Spec 1112 Earthworks (Roadways)

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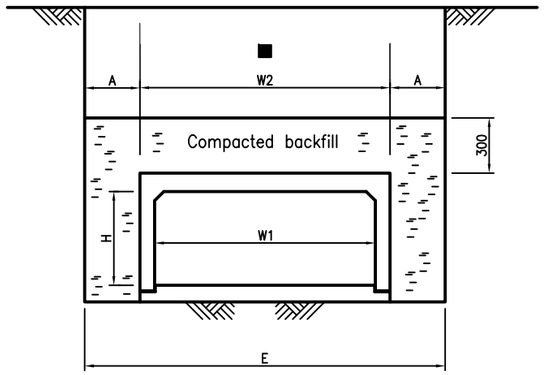
INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

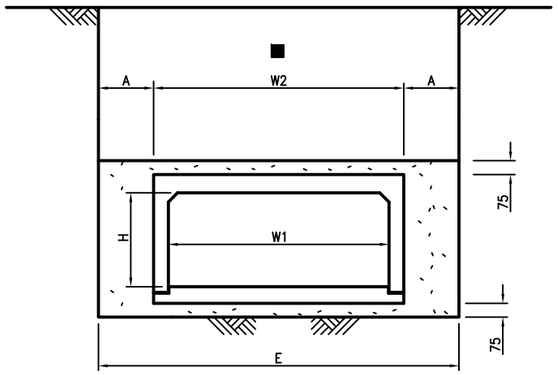
EXCAVATION, BEDDING AND BACKFILLING
RIGID & FLEXIBLE DRAINAGE PIPES

DS–030

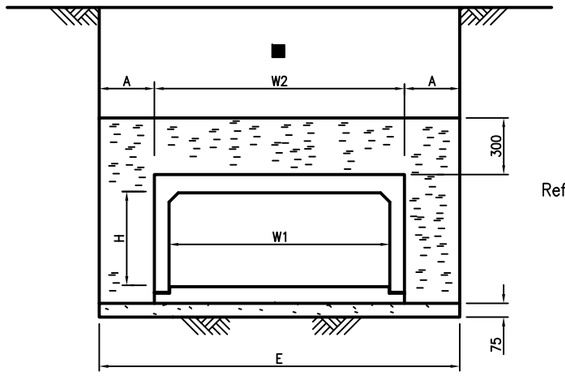
C B A Rv.



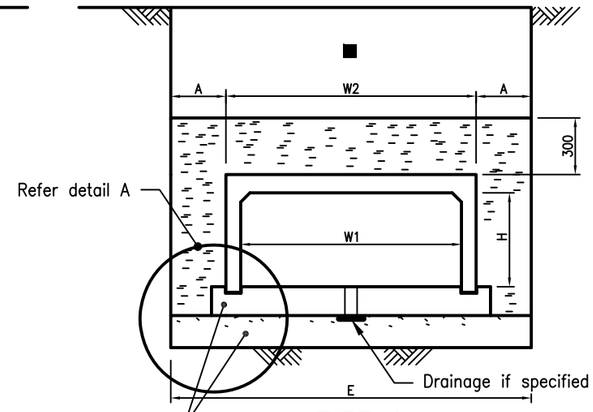
TYPE 1
NATURAL BEDDING



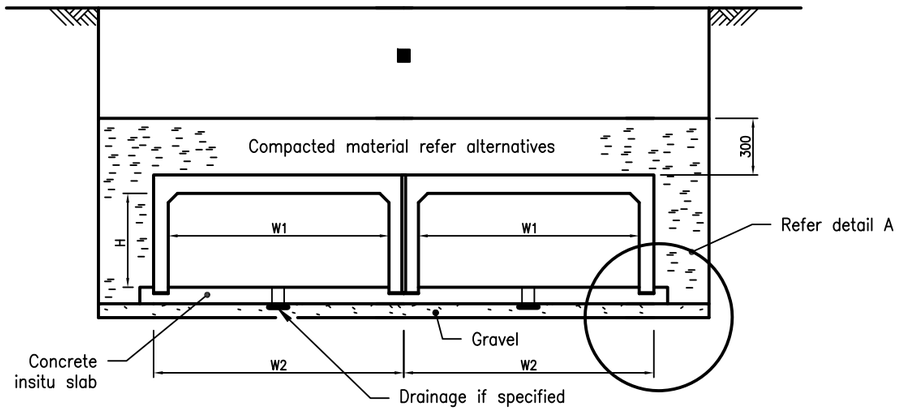
TYPE 2
SAND SURROUND



TYPE 3
SAND BEDDING



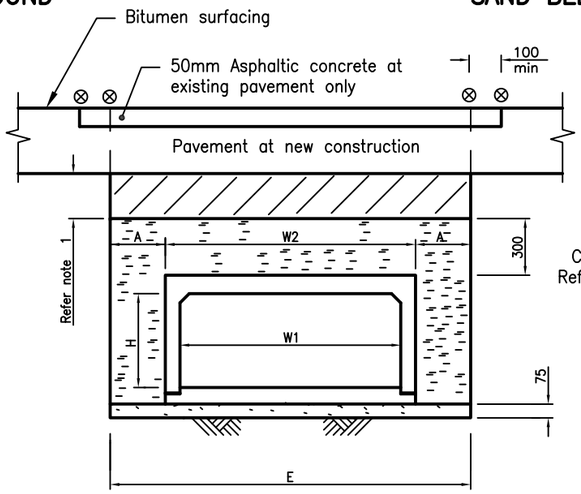
TYPE 4
INSITU BASE SLAB



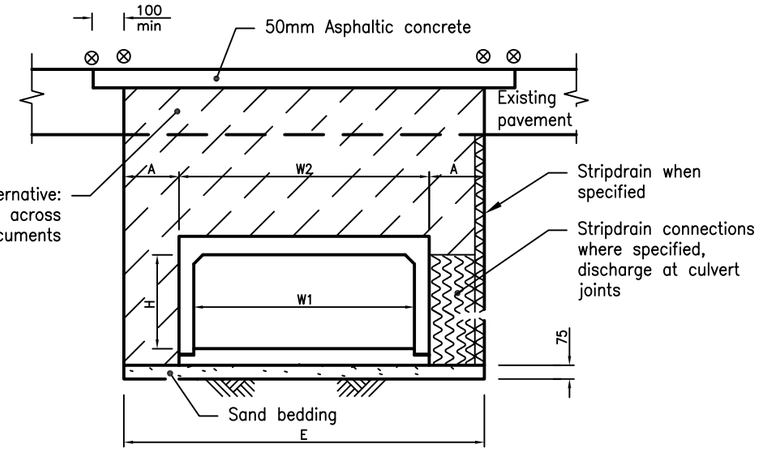
MULTIPLE CULVERTS

W1	W2	E nom
300	420	1000
375	500	1100
450	570	1200
600	730	1300
750	890	1500
900	1050	1700
1200	1360	2000
1520	1700	2300
1820	2010	2600
2130	2340	3000
2440	2670	3300

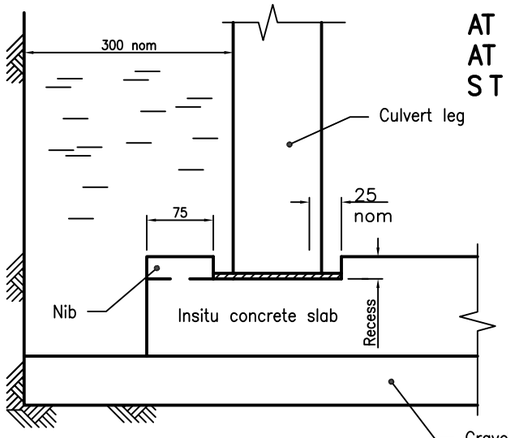
EXCAVATION WIDTH



ALTERNATIVE A
AT EXISTING SURFACED PAVEMENTS OR AT NEW PAVEMENTS ON RESIDENTIAL STREETS & RURAL ROADS



ALTERNATIVE B
AT EXISTING SURFACED PAVEMENTS OR ON INDUSTRIAL, TRUNK COLLECTOR, SUB-ARTERIAL STREETS/ROADS



TYPICAL DETAIL A

LEGEND

A	300mm nom.
■	Refer Alternative A for backfill requirements at new pavement
⊗	Saw cut at existing pavement
	Gravel (min CBR15) or 75mm crusher run backfill
	Lean mix concrete backfill (1:15 mix)
	10mm Cement mortar bed, 1:3 mix

NOTES:

1. Backfill compaction: Approved fill/approved bedding/compacted backfill/CBR15 Gravel 90% Compacted gravel (300 layer) under road pavement 95% Compacted fill – at footpaths/private property 90% max densities determined by Standard Compaction tests to AS 1289.E5.1
2. Refer to DTMR Std. Dwg. 1316 for installation of of precast culverts.
3. Tape all joints with 75 wide Denso (600) Tape or equivalent,
4. All dimensions are in millimetres unless shown otherwise

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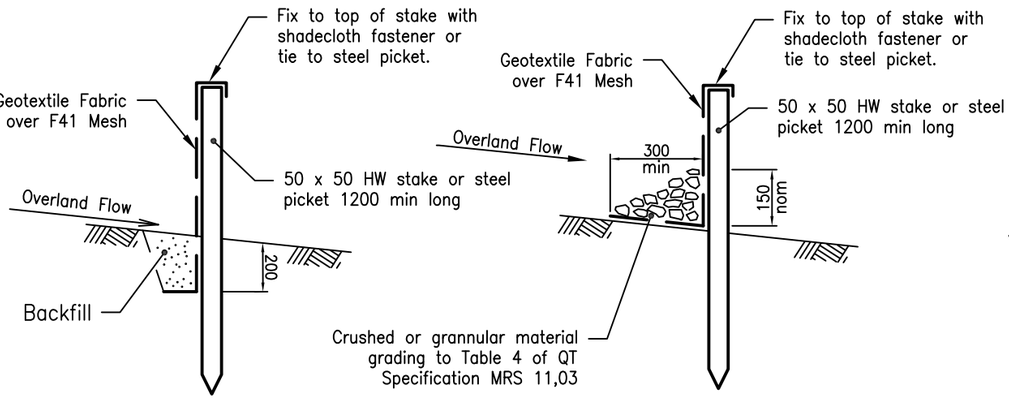
INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

EXCAVATION, BEDDING AND BACKFILLING PRECAST BOX CULVERTS

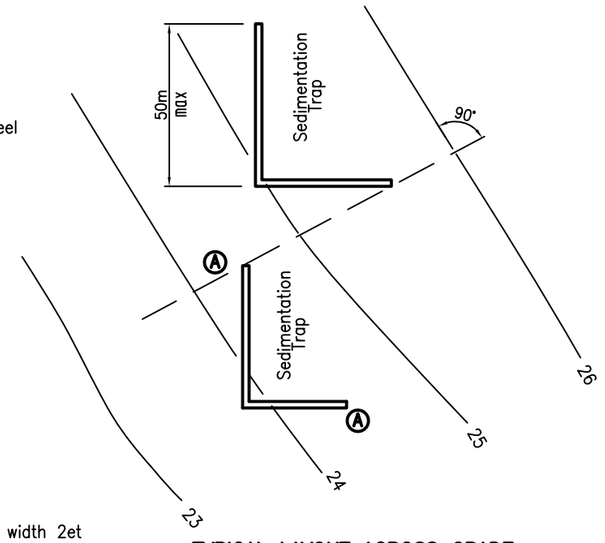
DS-031

Rv. C B A

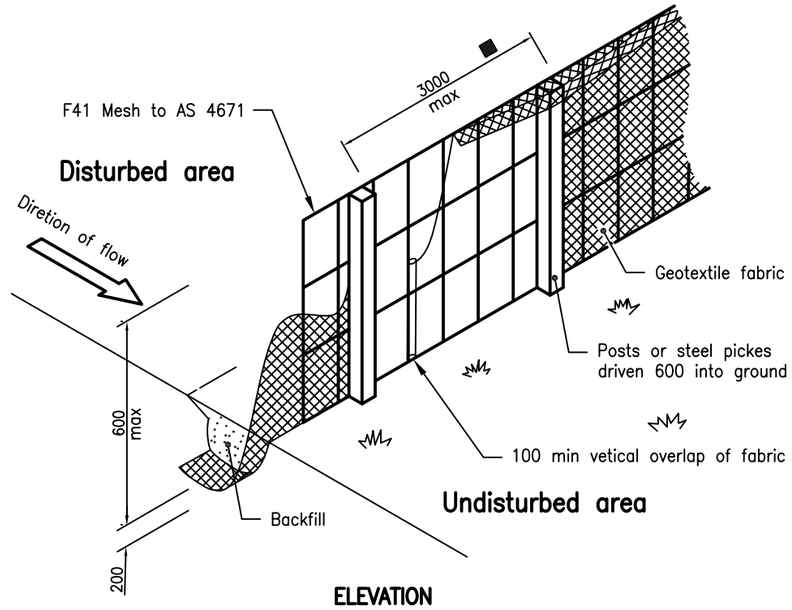


ALTERNATIVE 1

ALTERNATIVE 2

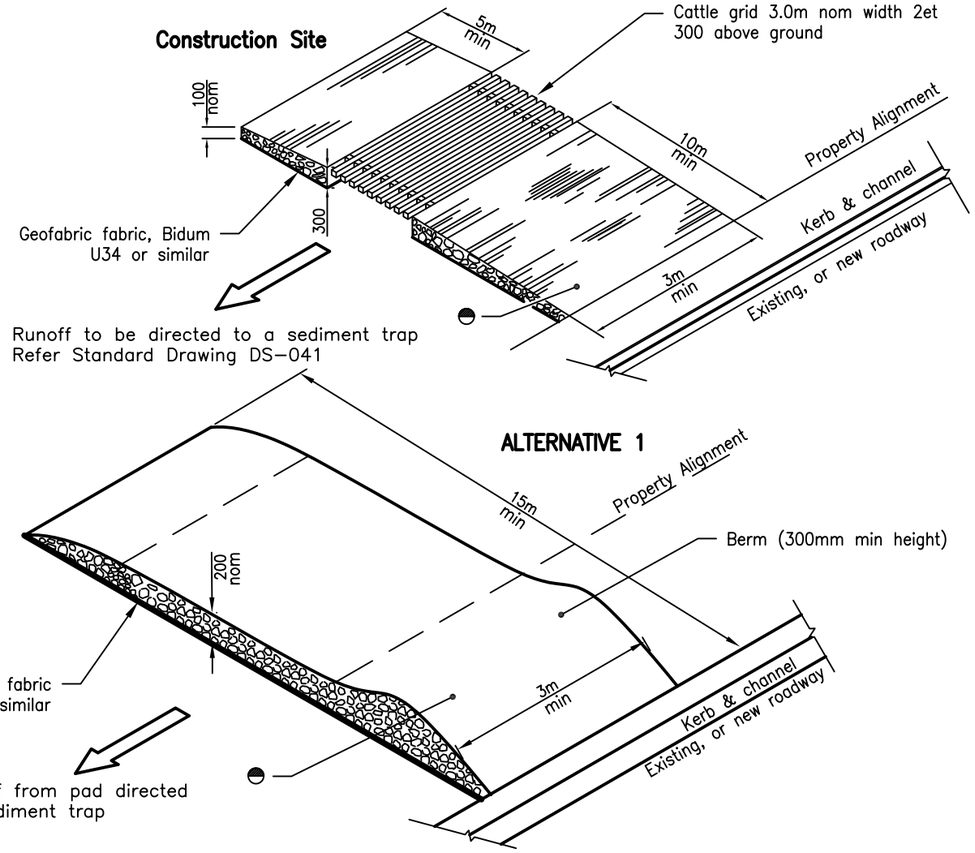


TYPICAL LAYOUT ACROSS GRADE
points A at same elevation



ELEVATION

SEDIMENT FENCE



ALTERNATIVE 1

ALTERNATIVE 2

TEMPORARY CONSTRUCTION ENTRY/EXIT SEDIMENT TRAP

LEGEND

- Unbound pavement material (gravel) to Grading B Table 9 of QT Specification MRS11.05 exclude material finer than AS sieve 2.36
- Without F41 mesh 2000 max C/C

NOTES:

GENERAL

1. All erosion and sediment controls to be in accordance with "Best Practice Erosion and Sediment Control", International Erosion and Sediment Control Association (IECA), Australasia Chapter, 2008 and to the satisfaction of the superintendent,
2. Temporary drainage control. Flow should be diverted around the work site where possible.
3. All drainage, erosion and sediment controls to be installed and be operational before commencing up-slope earthworks.
4. All control measures to be inspected at least weekly and after significant runoff producing storms.
5. Control measures may be removed when on-site erosion is controlled and 70% permanent soil coverage is obtained over all upstream disturbed land.
6. In areas where runoff turbidity is to be controlled, exposed surfaces to be either mulched, covered with erosion control blankets or turfed if earthworks are expected to be delayed for more than 14 days.
7. Straw bale sediment traps are a secondary option which generally should not be used if other options are available.

SEDIMENT FENCE

8. Not to be located in areas of concentrated flow.
9. Normally located along the contour with a maximum catchment area 0.6 ha per 100m length of fence.
10. Woven fabrics are preferred, non-woven fabrics may be used on small work sites, i.e. operational period less than 6 months or on sites where significant sediment runoff is not expected.
11. Where fences need to be located across the contour the layout shall conform to 'Typical Layout Across Grade'.
12. Fences are required 2m min from toe of cut or fill batters, where not practical one fence can be at the toe with a second fence 1m min away. Fence should not be located parallel with toe if concentration of flow will occur behind the fence.
13. Temp Construction Entry/Exit Sediment Trap.
14. Adjacent stormwater runoff to be diverted away from entry/exit.
15. Wheel – wash or spray unit may be required during wet weather.
16. Safety issues must be considered at all times, incorporate traffic control devices to the satisfaction of the superintendent.
17. All dimensions are in millimetres unless indicated otherwise.

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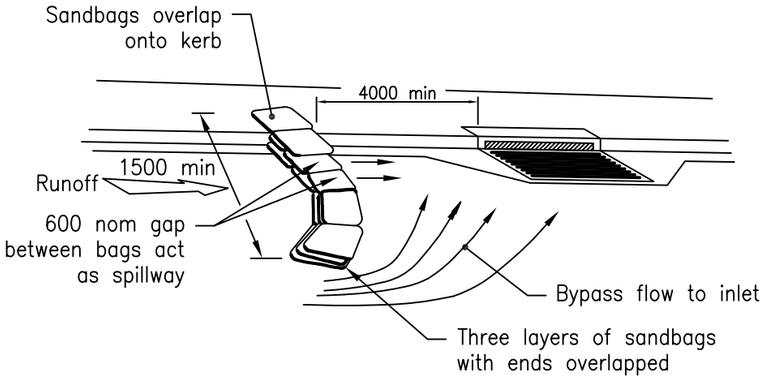
B	11/12	Note 1a Added
A	10/12	ORIGINAL ISSUE

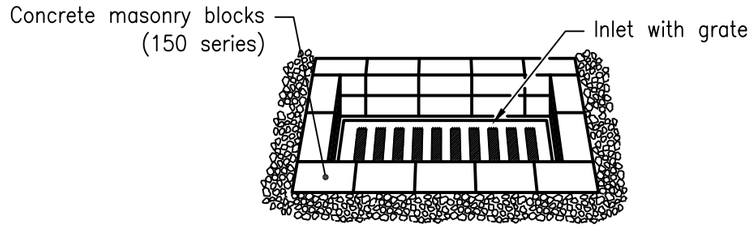
INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

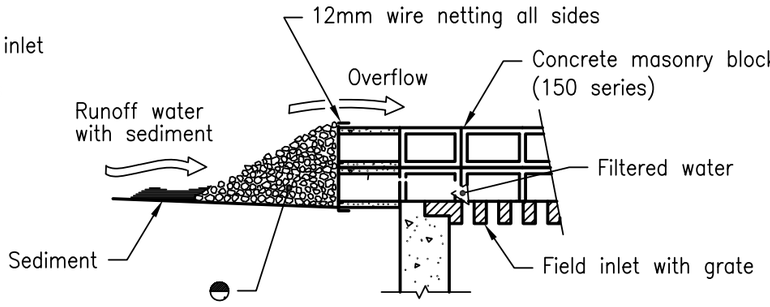
SEDIMENT CONTROL DEVICES
SEDIMENT FENCE, ENTRY/EXIT SEDIMENT TRAP

DS-040

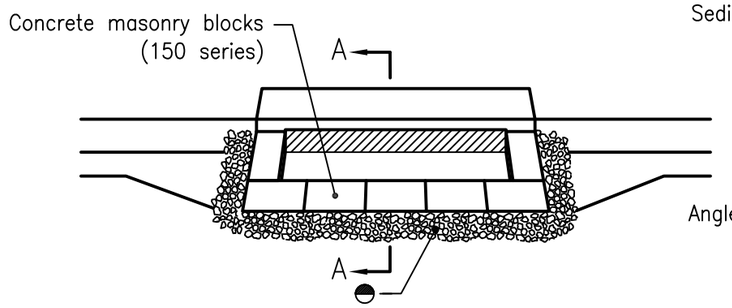


ON GRADE KERB INLET SEDIMENT TRAP





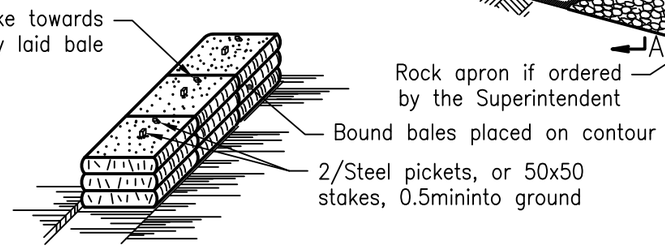
FIELD INLET SEDIMENT TRAP



SECTION A–A

SAG INLET SEDIMENT TRAP

A stabilised bypass 'overland flow path' should exist adjacent to inlet in genuine sags.



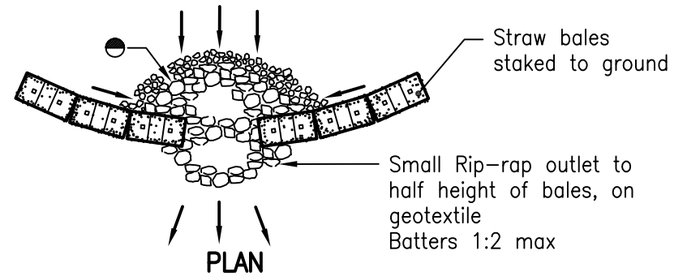
ANCHORING DETAIL

BEDDING DETAIL

STRAW BALE BANK SEDIMENT CONTROL

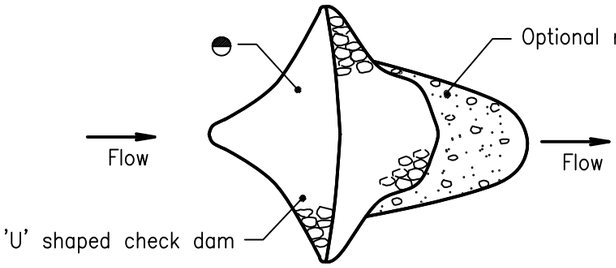
LEGEND

Gravel filter, refer Grading B
Table 9 of QT Specitifation MRS 11.05 excluded material finer then AS sieve 2.36

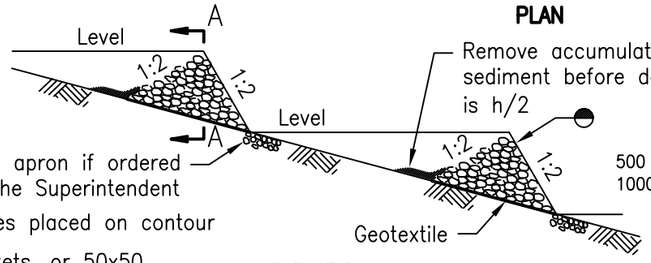


PLAN

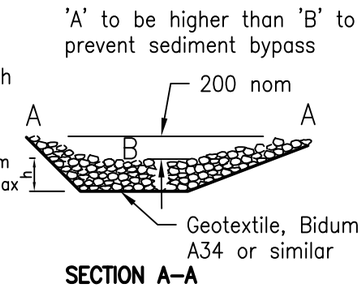
STRAW BALE AND STONE TRAP SEDIMENT CONTROL – CONCENTRATED FLOW



PLAN



ELEVATION



SECTION A–A

CHECK DAMS FLOW CONTROL

NOTES

1. All erosion and sediment controls to be in accordance with "Best Practice Erosion and Sediment Control", International Erosion and Sediment Control Association (IECA), Australasia Chapter, 2008 and to the satisfaction of the superintendent.
2. Field Inlet
   a. A stabilised bypass overland flow path should exist adjacent to the field inlet.
   b. Water level control perimeter banks may be required.
   c. Blocks to be restrained by a horizontal timber rail at block joint height fixed to timber stakes at corners.
3. Check Dams
   a. Catchment area limited to 4 ha.
   b. Use in minor open drains only, (velocity control), sediment collection is a secondary purpose.
4. Straw Bale Banks
   a. Bales shall be placed at the toe of a slope or on the contour, in a row with ends tightly abutting the adjacent bales
   b. Each bale shall be embedded in the soil a minimum of 100mm on the downstream side and placed so the bindings are horizontal.
   c. Bales shall be securely anchored in place with either two stakes or steel pickets driven through the bale. The first stake in each bale shall be driven toward the previously laid bale at an angle to force the bales together.
   d. Inspections shall be frequent and repair or replacement shall be made promptly as needed. Replace at least 3 monthly.
5. Safety issues must be considered at all times, incorporate traffic control devices to the satisfaction of the Superintendent.

These drawings have been developed in consultation between the participating Councils.
BEFORE USE, the user shall confirm that the drawing has been adopted by the appropriate Council.

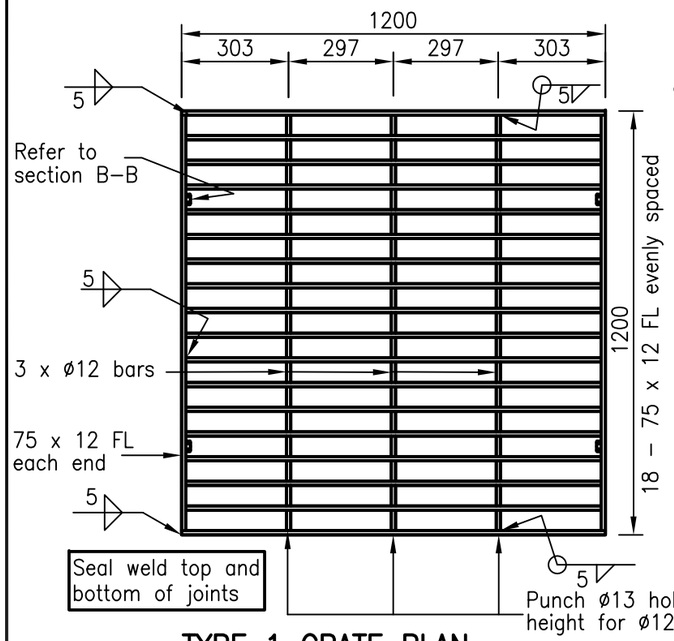
Rv.	DATE	REVISIONS
D	06/14	Review
C	03/14	Amended Drawing Number
B	11/12	Note 1 Added
A	10/12	ORIGINAL ISSUE

INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

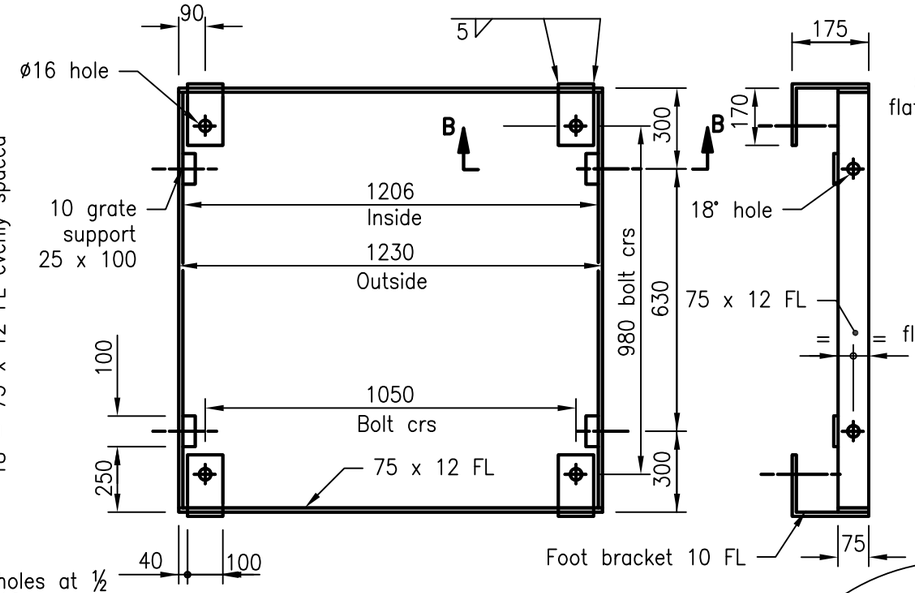
SEDIMENT CONTROL DEVICES
KERB AND FIELD INLET –
CHECK DAMS & STRAW BALES

DS–041

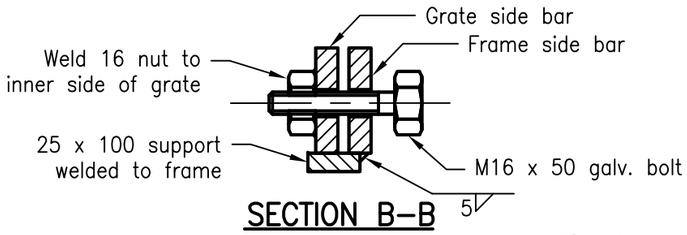
D C B A Rv.



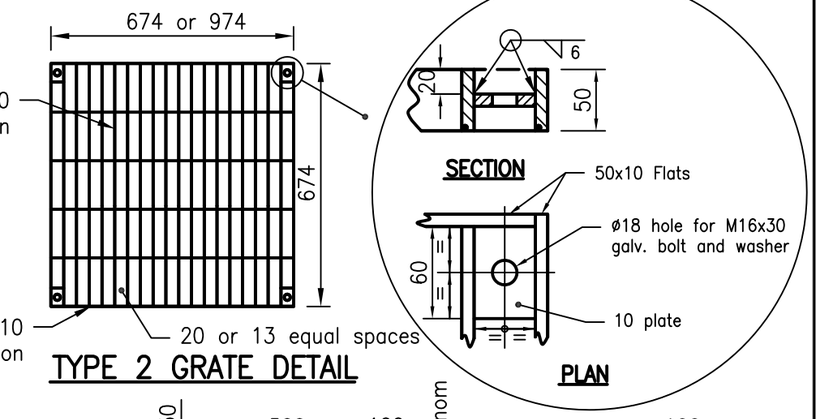
TYPE 1 GRATE PLAN



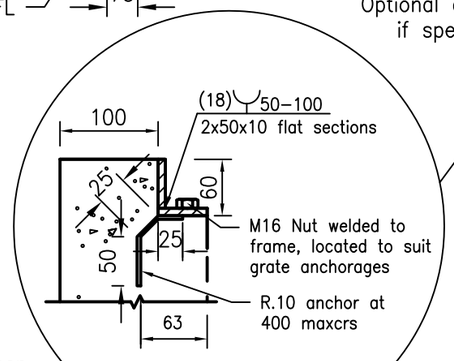
TYPE 1 FRAME PLAN

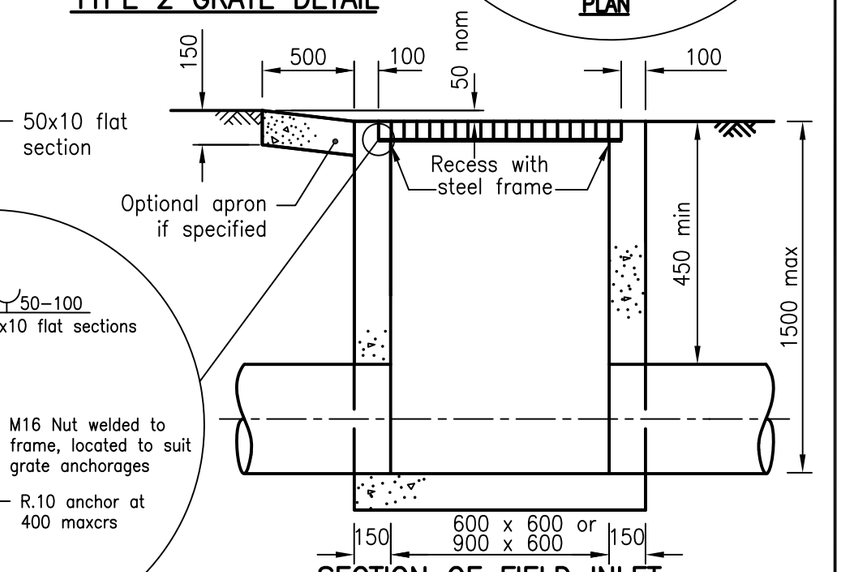


SECTION B–B



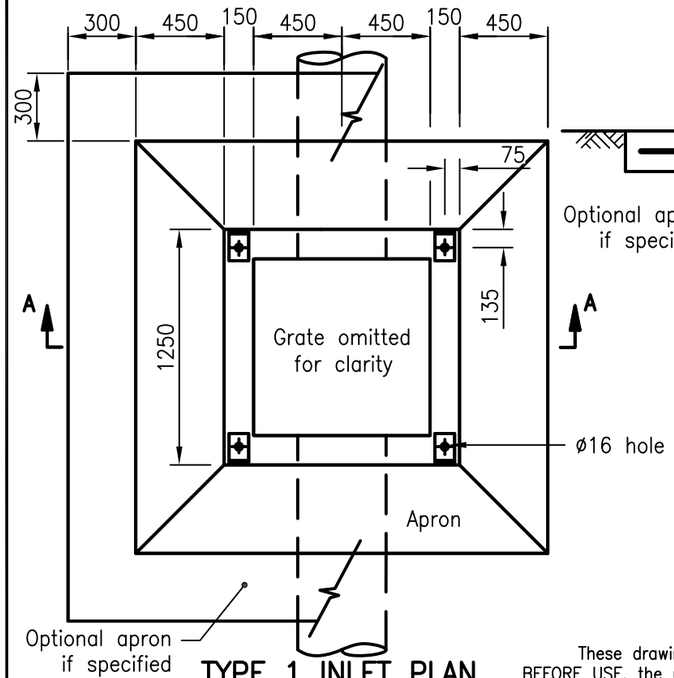
TYPE 2 GRATE DETAIL



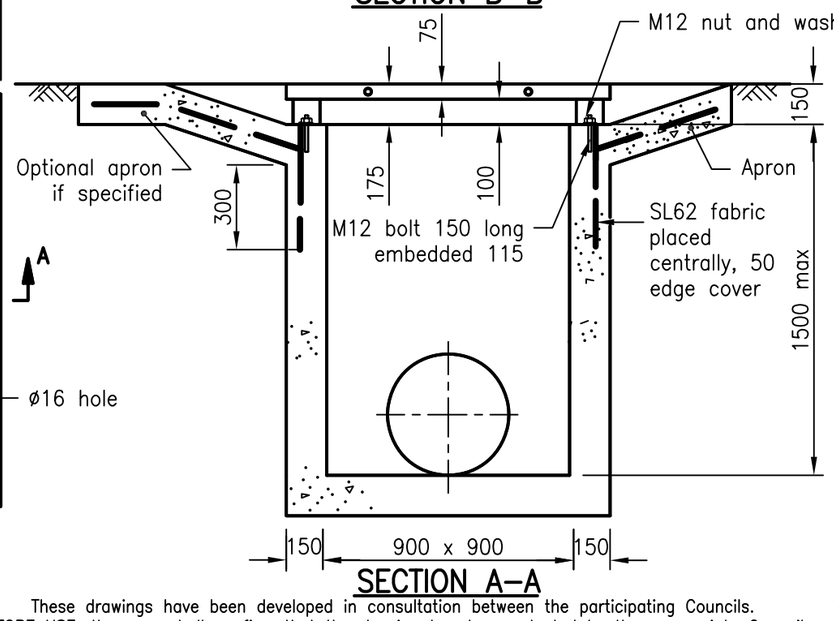


SECTION OF FIELD INLET

TYPE 2A – 600x600 TYPE 2B – 900x600



TYPE 1 INLET PLAN



SECTION A–A

These drawings have been developed in consultation between the participating Councils.
BEFORE USE, the user shall confirm that the drawing has been adopted by the appropriate Council.

NOTES:

1. Concrete N32 precast or N25 cast insitu in accordance with AS 1379 and AS 3600.
2. Live Load Surcharge, earth and ultimate load factors are in accordance with Australian Bridge Design Code.
3. All welds to AS 1554. All welding symbols to AS 1101.3.
4. Grate and frame to be hot dip galvanised after fabrication to AS 1650.
5. Steel reinforcing bars to be Grade 250 to AS 4671.
6. All flats Grade 250 to AS 3678.
7. All angles Grade 250 to AS 3679.1
8. All bolt hexagonal heads to AS 1111, nuts to AS 1112, washers to AS 1237, galv. to AS 1214.
9. Class B grate to AS 3996 – grate in direction nominated, refer Project Drawings.
10. Pits up to a depth of 2.2 metre do not require steel reinforcement. One layer of SL81 mesh is to be placed centrally in the wall for pit depths 2.2 to 3.0 metres.
11. Bicycle safe grates are to be provided in all areas unless approved otherwise.
12. Pit size and depth requirements are:
    - 0–1m depth = 600 x 600 inlet
    - 1–1.5m depth = 900 x 600 inlet
    - 0–2m depth = 900 x 900 inlet
    - 2m or greater = std. manhole with 600 x 600 nom grate set into an approved roof slab.
    - Council may accept 300 x 300 pit for property drainage.
13. All dimensions are in millimetres unless shown otherwise.

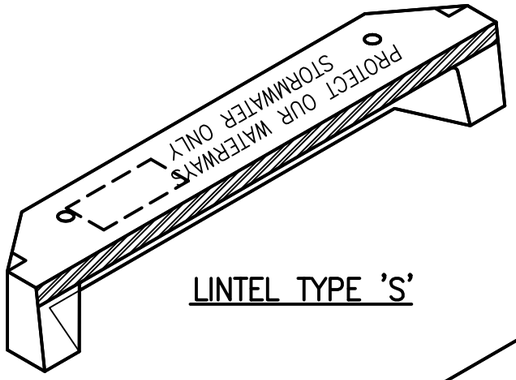
Rv.	DATE	REVISIONS
D	06/14	Review
C	03/14	Amended Drawing Number
B	11/12	Pit max Depth Added
A	10/12	ORIGINAL ISSUE

INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

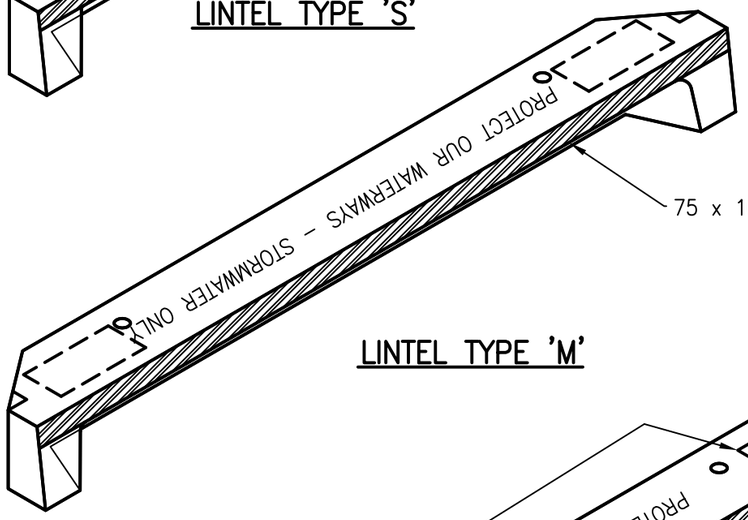
DRAINAGE PITS
FIELD INLET
TYPE 1 AND TYPE 2

DS–050

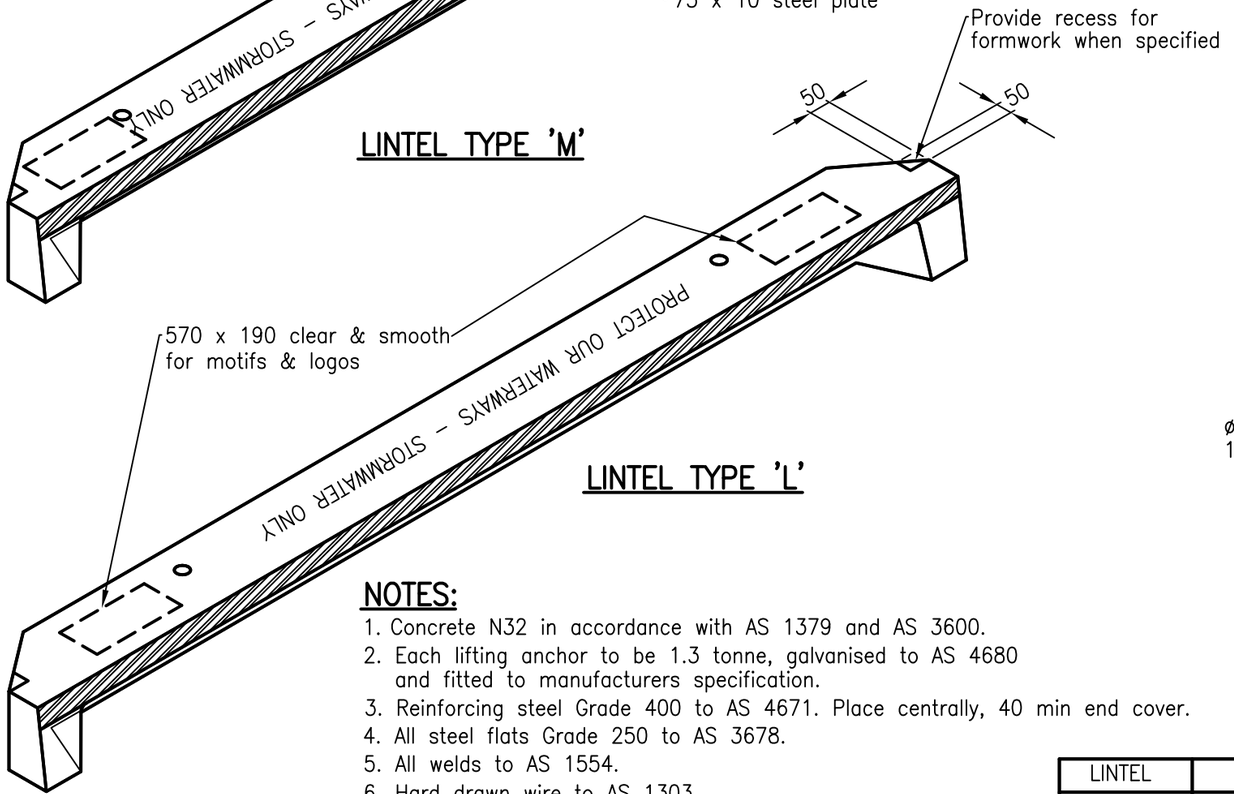
D C B A Rv.



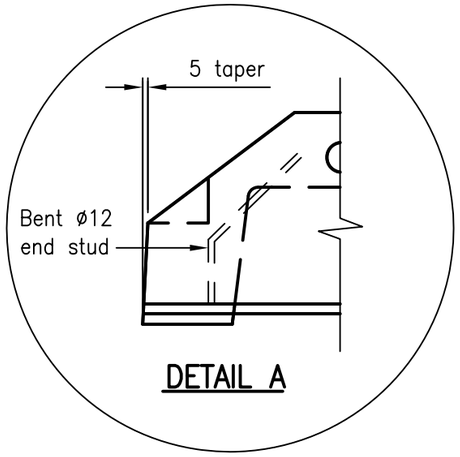
LINTEL TYPE 'S'



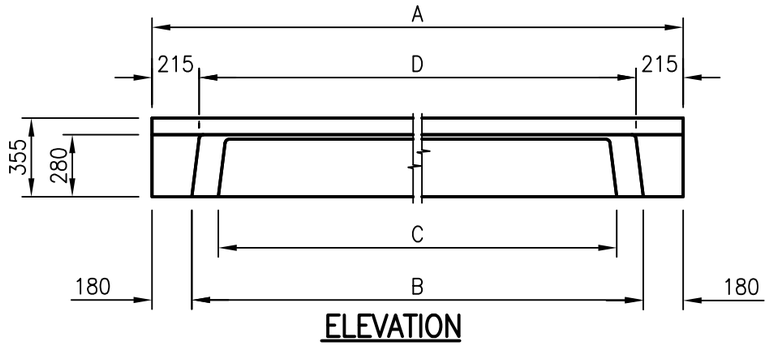
LINTEL TYPE 'M'



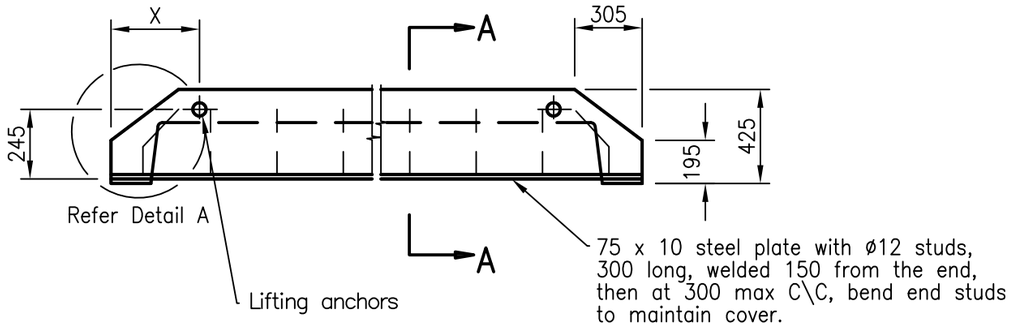
LINTEL TYPE 'L'



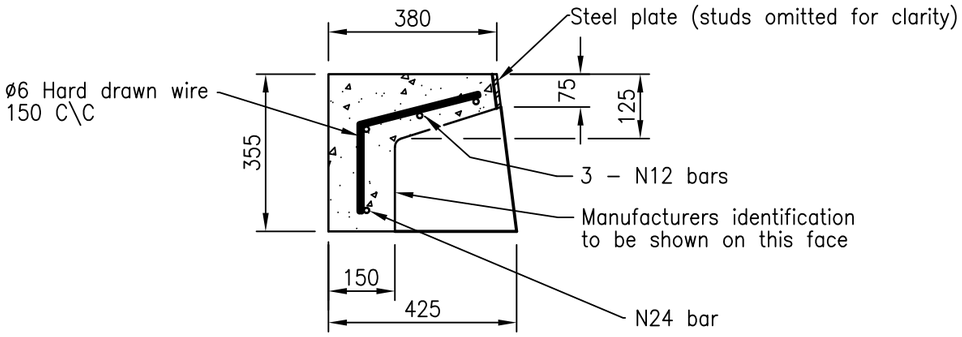
DETAIL A



ELEVATION



PLAN



SECTION A–A

NOTES:

1. Concrete N32 in accordance with AS 1379 and AS 3600.
2. Each lifting anchor to be 1.3 tonne, galvanised to AS 4680 and fitted to manufacturers specification.
3. Reinforcing steel Grade 400 to AS 4671. Place centrally, 40 min end cover.
4. All steel flats Grade 250 to AS 3678.
5. All welds to AS 1554.
6. Hard drawn wire to AS 1303.
7. Steel plate hot dip galvanised after fabrication to AS 4680.
8. Lintel text 40mm high letters imprinted 5mm into concrete. Words face footpath.
9. All dimensions are in millimetres unless shown otherwise.

LINTEL	A	B	C	D	X	MASS (kg)
S	2400	2040	1800	1970	400	445
M	3600	3240	3000	3170	690	550
L	4800	4440	4200	4370	1000	725

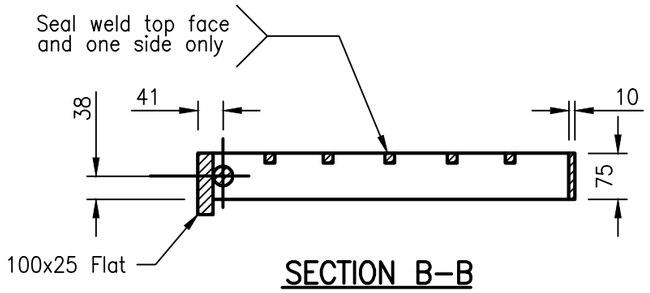
Rv.	DATE	REVISIONS
B	03/14	Amended Drawing Number
A	10/12	ORIGINAL ISSUE

INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALIA
QUEENSLAND DIVISION INC.
STANDARD DRAWINGS

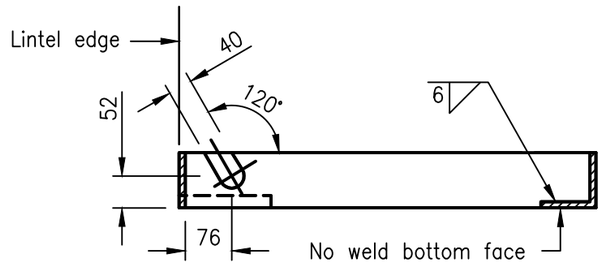
DRAINAGE PITS
KERB INLET
PRECAST LINTEL DETAILS

DS–061

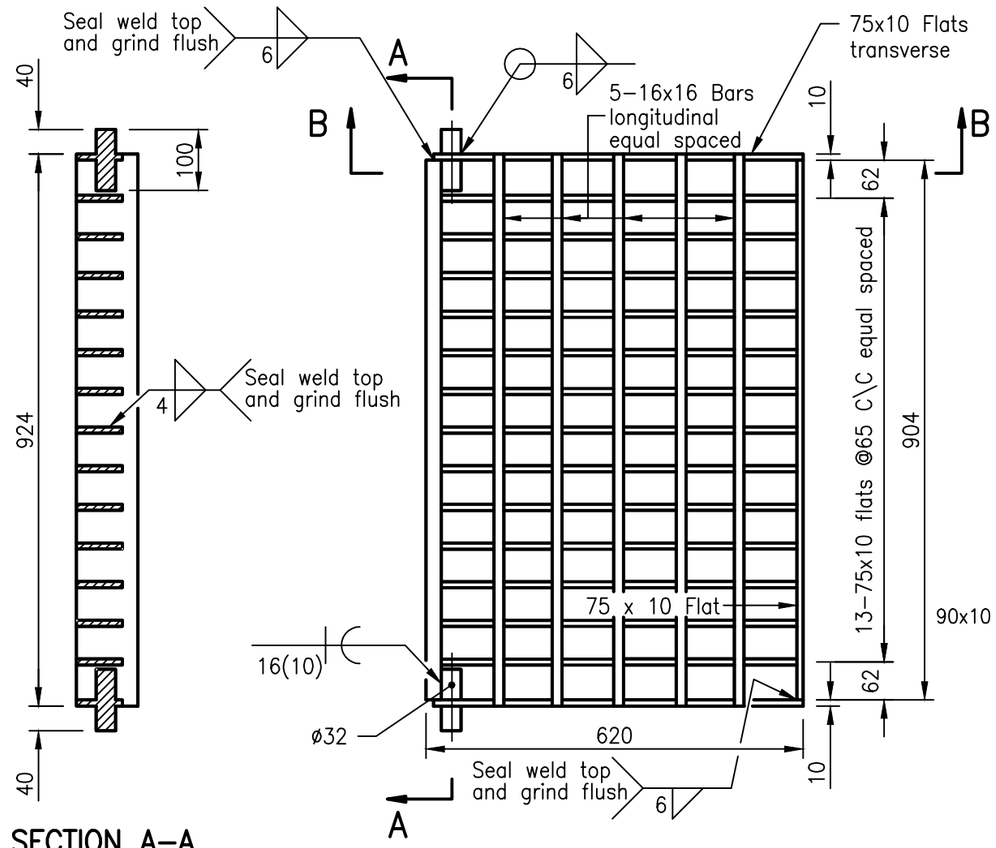
Rv. B A



SECTION B–B

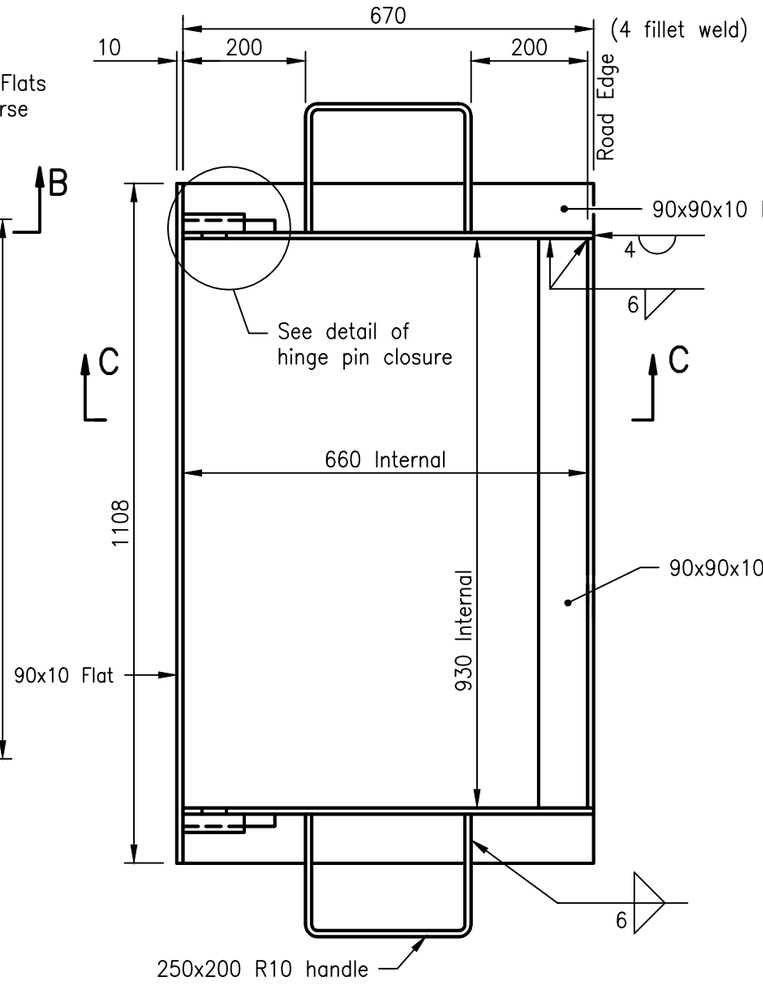


SECTION C–C

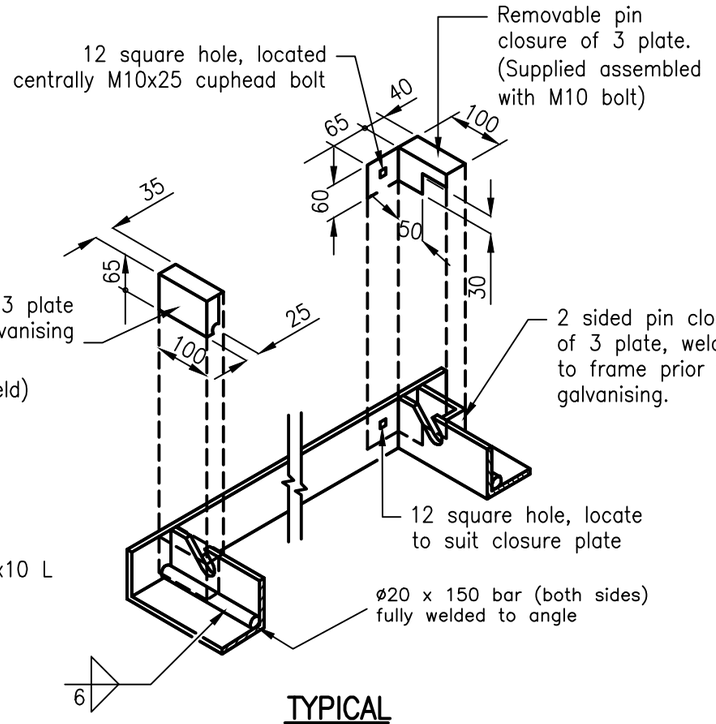


SECTION A–A

PLAN OF GRATE



PLAN OF FRAME



TYPICAL DETAIL OF HINGE PIN CLOSURES

A locking device shall be provided in accordance with clause 3.2.1.4 of AS 3996.

NOTES:

1. Mass of grate = 85 kg.
2. Mass of frame = 39 kg.
3. All steel flats Grade 250 to AS 3678.
4. All steel bars and angles Grade 250 to AS 3679.
5. Grate, Frame and Hinge to be hot dip galvanised after fabrication to AS 1650.
6. All bolt hexagonal heads to AS 1111, Nuts to AS 1112, Washers to AS 1237 and Galv. to AS 1214.
7. All welds to AS 1554. Welding symbols to AS 1101.3.
8. Refer Std Dwg DS–060 and DS–063 for kerb inlet details Refer Std Dwg DS–061 for precast lintel details.
9. Grate and Frame to be Class D bicycle safe to AS 3996.
10. Alternative fabricated steel grate and frame may be used when approved by relevant Council
11. All dimensions are in millimetres unless shown otherwise

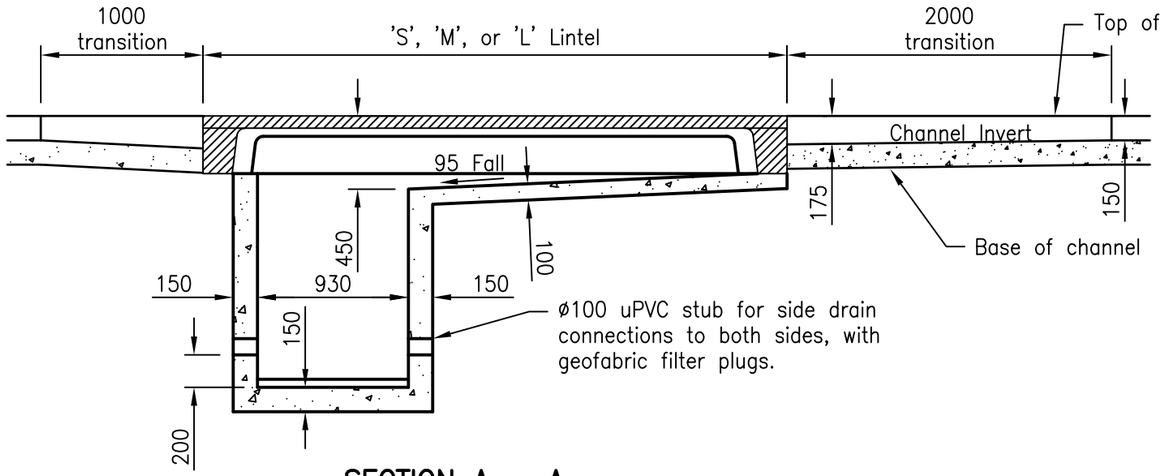
Rv.	DATE	REVISIONS
C	06/14	Review
B	03/14	Amended Drawing Number
A	10/12	ORIGINAL ISSUE

INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

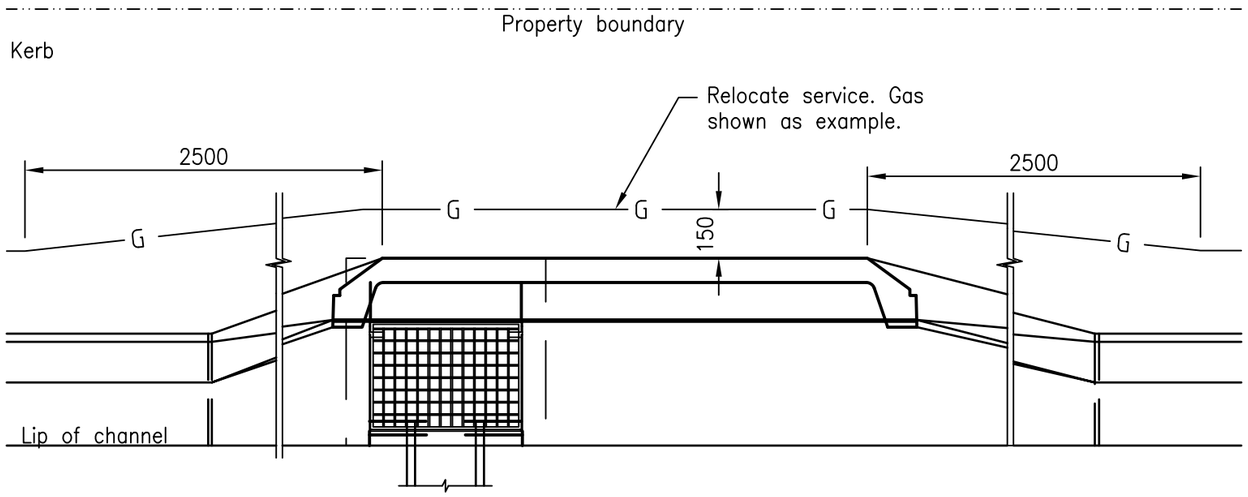
DRAINAGE PITS
KERB INLET
GRATE AND FRAME

DS–062

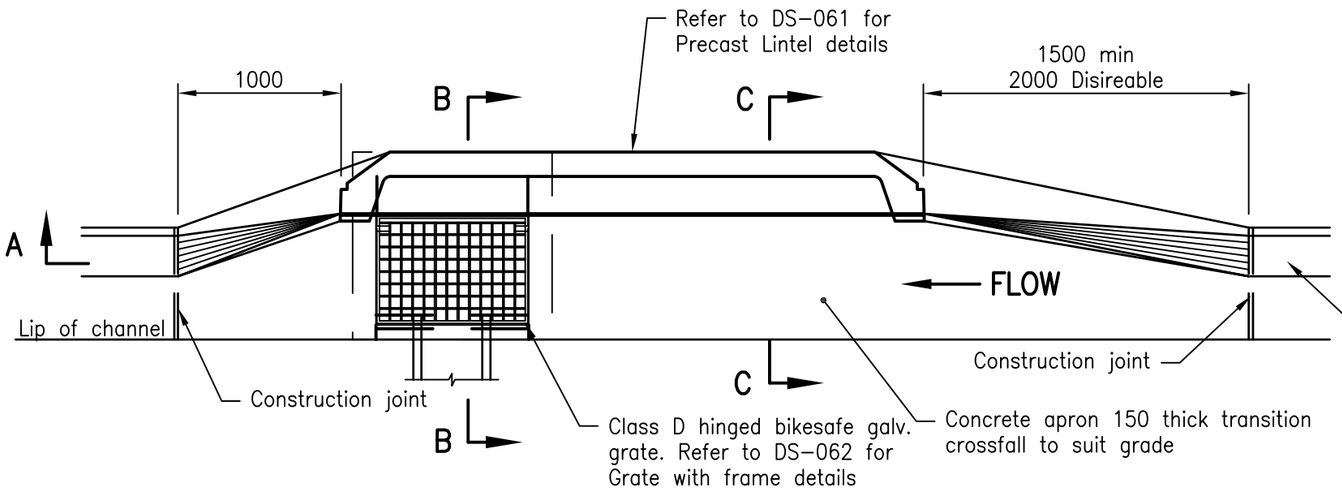
Rv. C B A



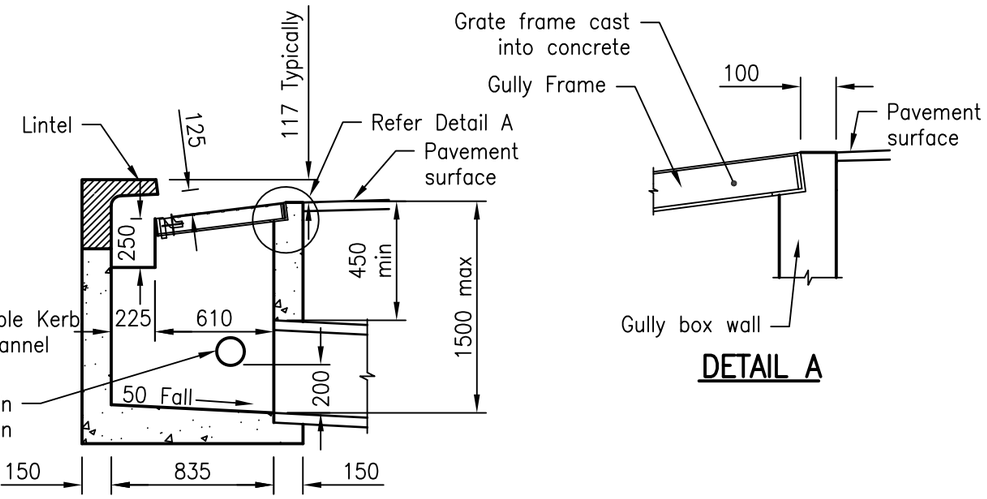
SECTION A – A



SERVICE RE–ALIGNMENT DETAILS

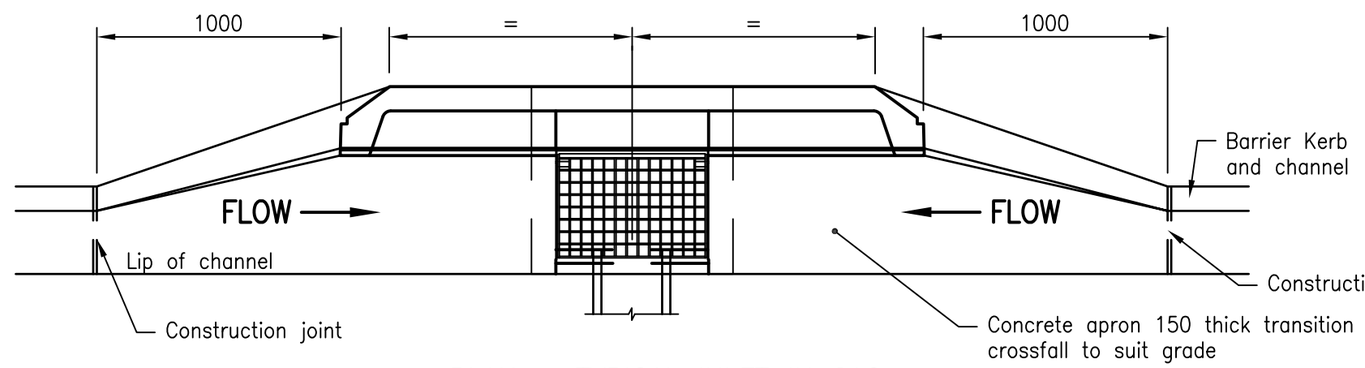


PLAN – TYPICAL INLET ON GRADE

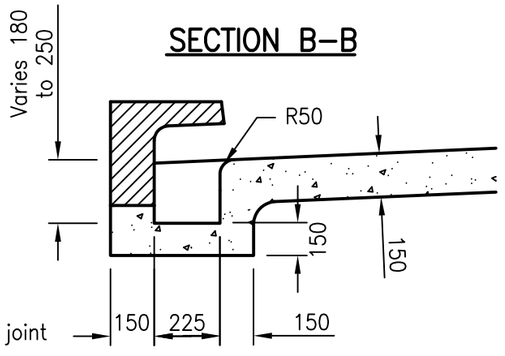


DETAIL A

SECTION B–B



PLAN – TYPICAL INLET IN SAG



SECTION C–C

NOTES

1. The kerb inlet may be cast–in–situ or precast. This drawing indicates a cast–in–situ catchpit with a precast lintel.
2. Precast concrete N32 in accordance with AS 1379 and AS 3600.
3. Cast in–situ concrete N32 in accordance with AS 1379 and AS 3600.
4. Refer to project drawings for set out point detail.
5. All dimensions are in millimetres unless shown otherwise.

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BEFORE USE, the user shall confirm that the drawing has been adopted by the appropriate Council.

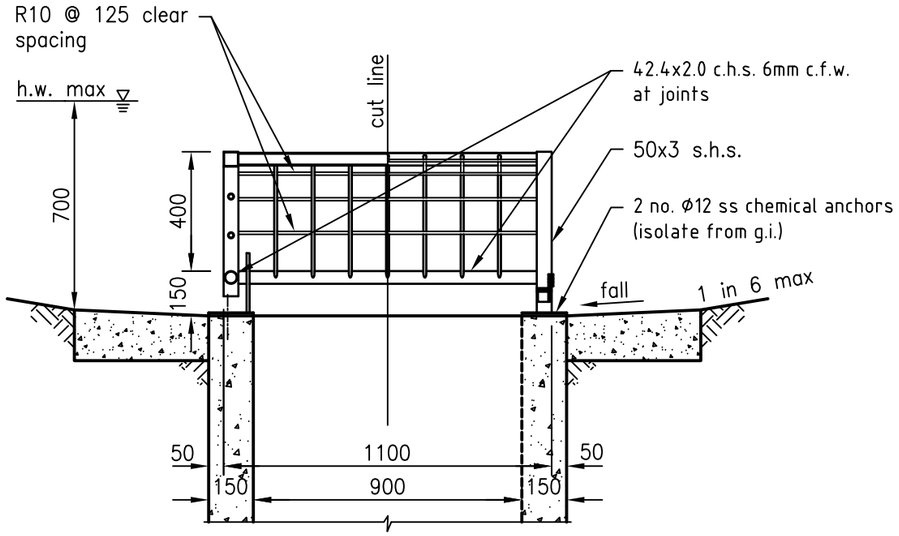
Rv.	DATE	REVISIONS
C	06/14	Review
B	03/14	Amended Drawing Number
A	10/12	ORIGINAL ISSUE

INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

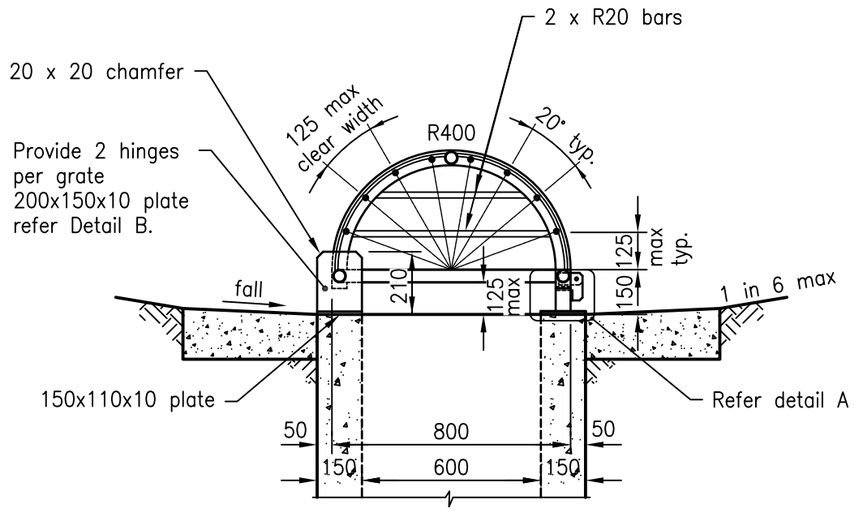
DRAINAGE PITS
KERB INLET – LIP IN LINE
GENERAL ARRANGEMENT

DS–063

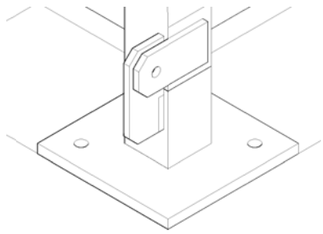
Rv. C B A



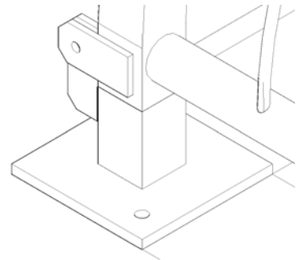
SECTION B–B
TYPE 1 GENERAL USE



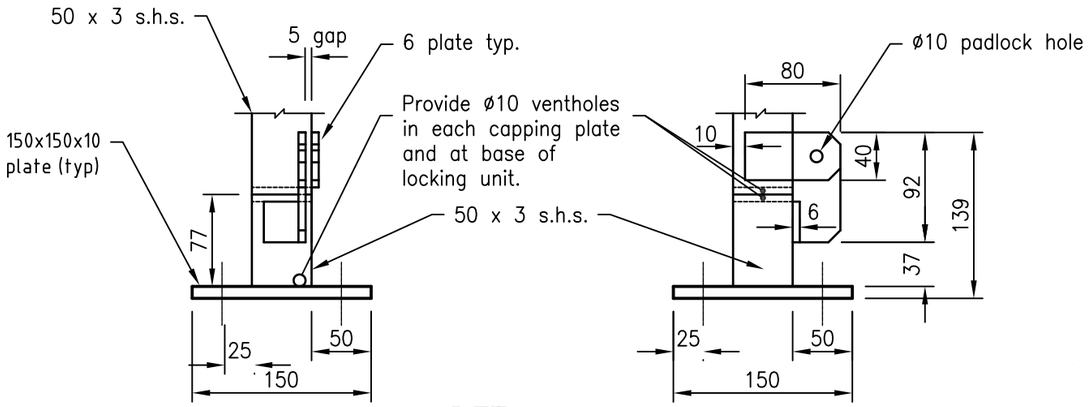
SECTION A–A



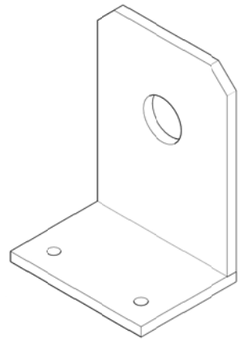
LOCKING UNIT A



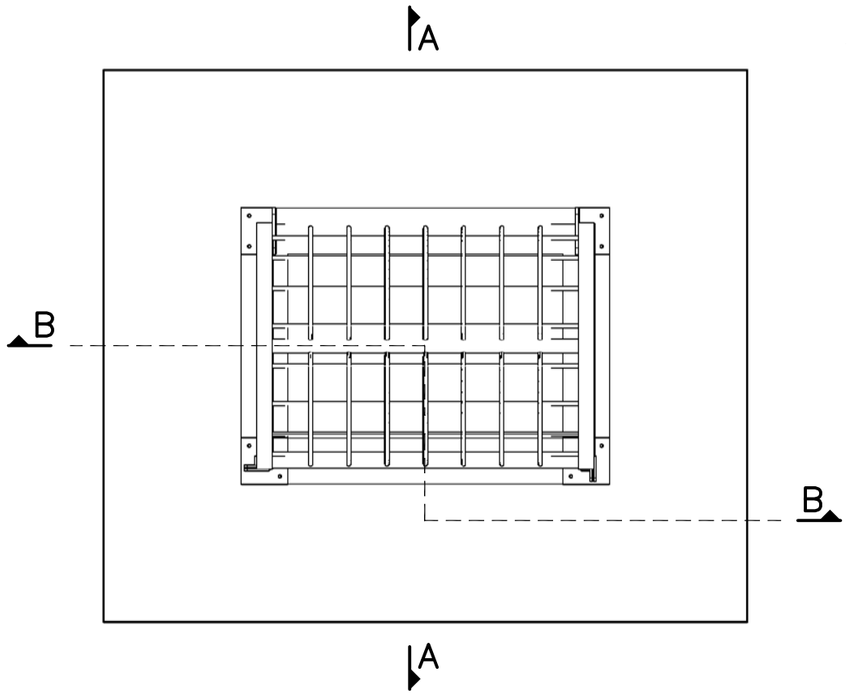
LOCKING UNIT B



DETAIL A



DETAIL B

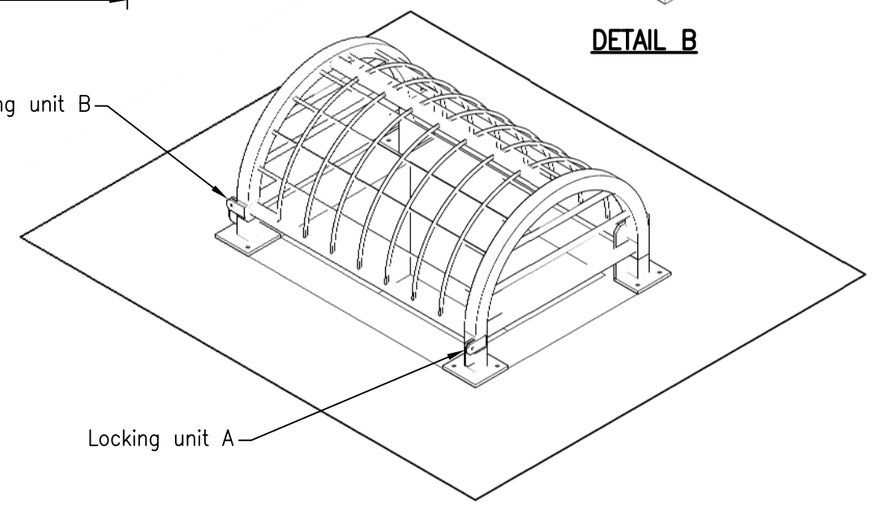


PLAN

NOTES:

1. Concrete to be grade N32.
2. All components to be hot–dipped galvanised to AS/NZS 4680 after fabrication.
3. All welds 6mm c.f.w. all round.
4. All edge distances to chemical anchors to be not less than 25mm.
5. Locking units to be secured with hot dipped galvanised m8 bolts with snug tightened nut upon installation.
6. Ensure clear opening widths of 125 max in fabrication and installation for child proof safety.
7. Dimensions are in millimetres unless shown otherwise.

THIS IS NOT A FRANGIBLE ITEM



ISOMETRIC VIEW

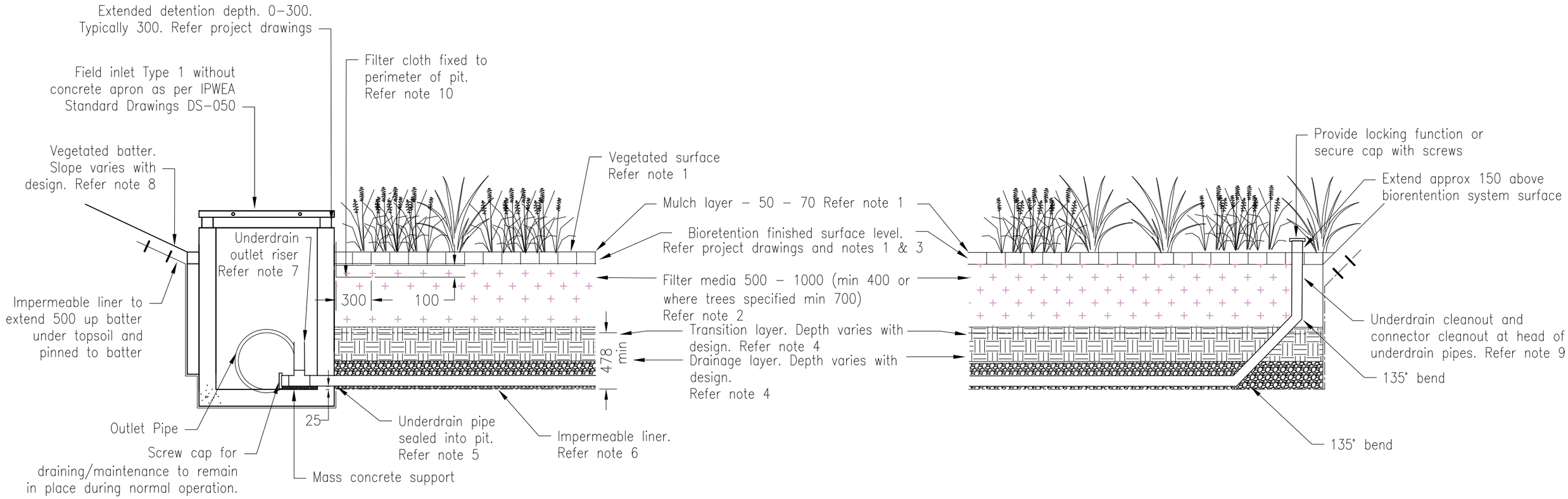
Rv.	DATE	REVISIONS
B	06/14	Review
A	10/13	ORIGINAL ISSUE

INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

DRAINAGE PITS
FIELD INLET PIT
DOME TOP COVER (900x600)

DS–069

Rv. B A



NOTES:

1. Bioretention system surface. Surface level is top of filter media. Surface to be mulched and planted as per project drawings and the 'Bioretention Technical Design Guidelines' (Water by Design).
2. Filter media specification shall be in accordance with the 'Adoption guidelines for Stormwater Biofiltration Systems (CRC for water sensitive cities) and the Bioretention Technical Design Guidelines (Water by Design). Bioretention hydraulic conductivity shall be in accordance with Practice Note 1: in situ Measurement of Hydraulic Conductivity' (FAWB). The number of samples to be tested shall be in accordance with the 'Construction and Establishment Guidelines – Swales, Bioretention Systems and Wetlands' (Water by Design).
3. Construction tolerances shall be in accordance with the 'Construction and Establishment Guidelines –Swales, Bioretention Systems and Wetlands' (Water by Design)
4. Transition layer and drainage layer depths vary with design. Depths and specification to be in accordance with project drawings and the 'Bioretention Technical Design Guidelines' (Water by Design)
5. Underdrain. Slotted rigid pipe laid flat. Refer to project drawings for diameter and pipe invert. Pipe should not be installed with a filter sock surrounding pipe. Underdrain pipes shall be sealed into pits using grout or other approved watertight seal.
6. Impermeable liner. Compacted clay or synthetic liner with permeability of no greater than 1×10^{-9}m/s. Impermeable liner to be sealed around all protrusions. Synthetic liners to be installed and sealed in accordance with manufacturers requirements. Impermeable liner as per project drawings and 'Bioretention Technical Design Guidelines' (Water by Design)
7. Underdrain outlet riser establishes max saturated zone water level. Underdrain outlet riser as per project drawings and 'Bioretention Technical Design Guidelines' (Water by Design)
8. Vegetated batter. Slope and planting to be in accordance with project drawings and 'Bioretention Technical Design Guidelines' (Water by Design).
9. Inspection/cleanout point. Vertical solid pipe section attached to the end of each underdrain in accordance with project drawings and the 'Bioretention Technical Design Guidelines'(Water by Design)
10. Filter cloth to be fixed to perimeter of pit to avoid runnelling of water between pit and soil interface. Begin filter cloth 100 above surface. Extend to 100 below surface. Continue 300 horizontally into filter media.
11. For general design and construction notes refer to DS–078
12. All dimensions in millimetres unless otherwise noted.

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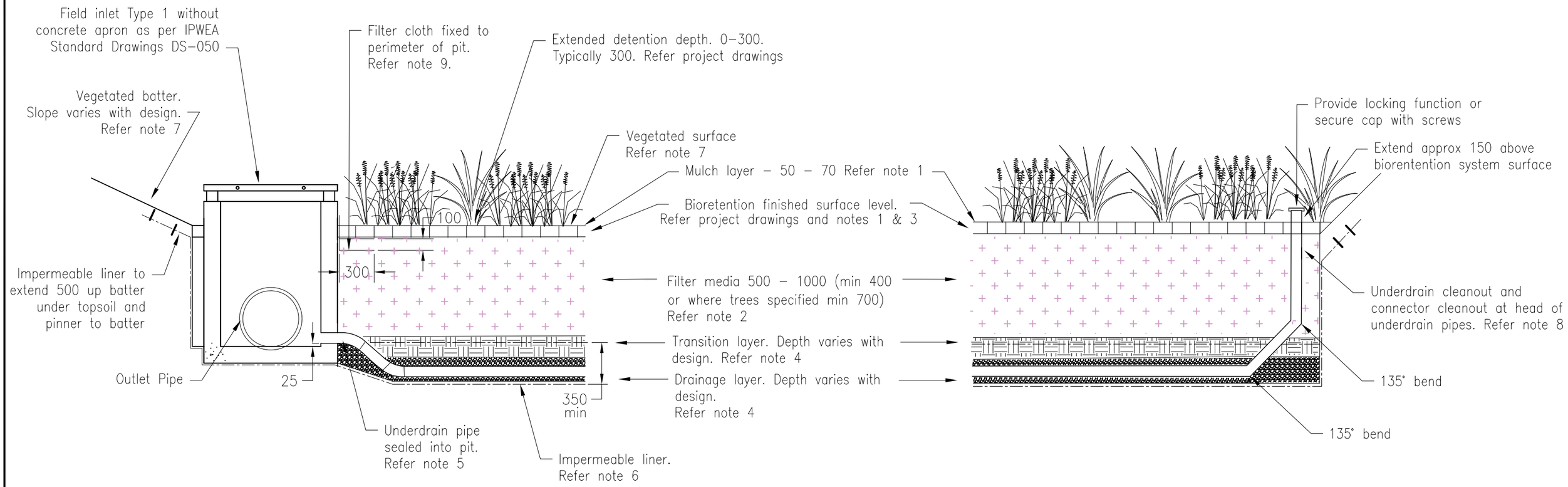
STANDARD DRAWINGS

BIORETENTION DRAINAGE PROFILE – TYPE 1
SATURATED ZONE – UNCONSTRAINED

DS–070

Rv.



NOTES:

1. Bioretention system surface refer note 1 DS-070
2. Filter media specification refer note 2 DS-070
3. Construction tolerances refer note 3 DS-070
4. Transition layer and drainage layer refer note 4 DS-070
5. Underdrain refer note 5 DS-070
6. Impermeable liner refer note 6 DS-070
7. Vegetated batter refer note 8 DS-070
8. Inspection/cleanout point refer note 9 DS-070
9. Filter cloth refer note 10 DS-070
10. For general design and construction notes refer to DS-078
11. All dimensions in millimetres unless otherwise noted.

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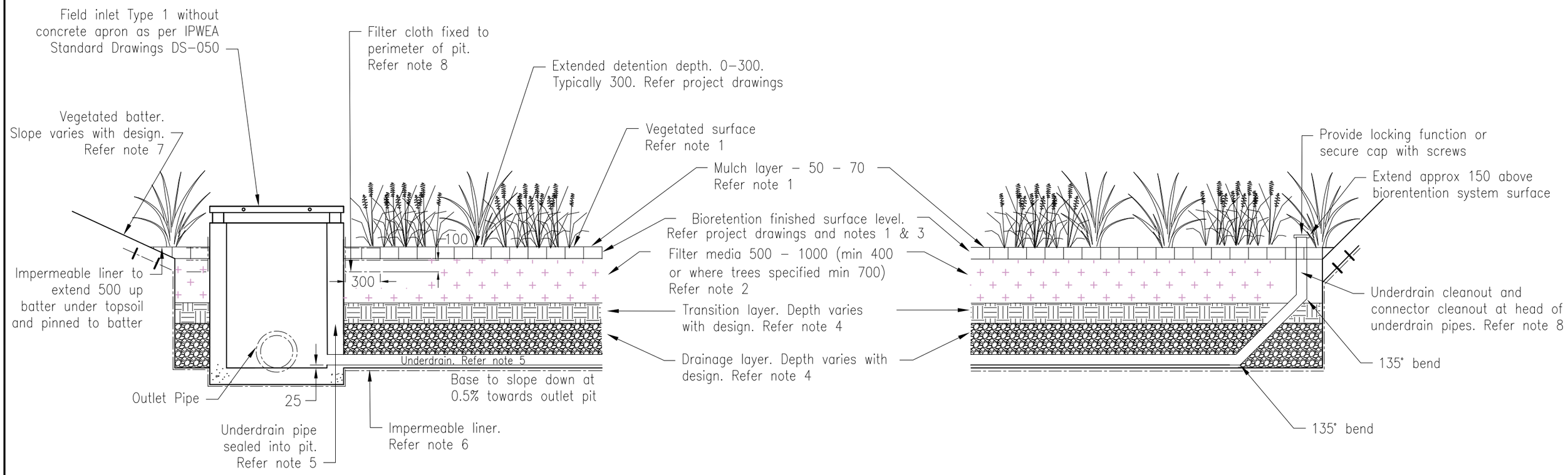
STANDARD DRAWINGS

BIORETENTION DRAINAGE PROFILE - TYPE 1 SATURATED ZONE - CONSTRAINED

DS-071

Rv.



NOTES:

1. Bioretention system surface. Refer note 1 DS-070
2. Filter media specification. Refer not 2 DS-070
3. Construction tolerances. Refer note 3 DS-070
4. Transition layer and drainage layer. Refer note 4 DS-070
5. Underdrain. Refer note 5 DS-070
6. Impermeable liner. Refer note 6 DS-070
7. Vegetated batter. Refer note 8 DS-070
8. Inspection/cleanout point. Refer note 9 DS-070
9. Filter Cloth refer note 10 DS-070
10. For general design and construction notes refer to DS-078
11. All dimensions in millimetres unless otherwise noted.

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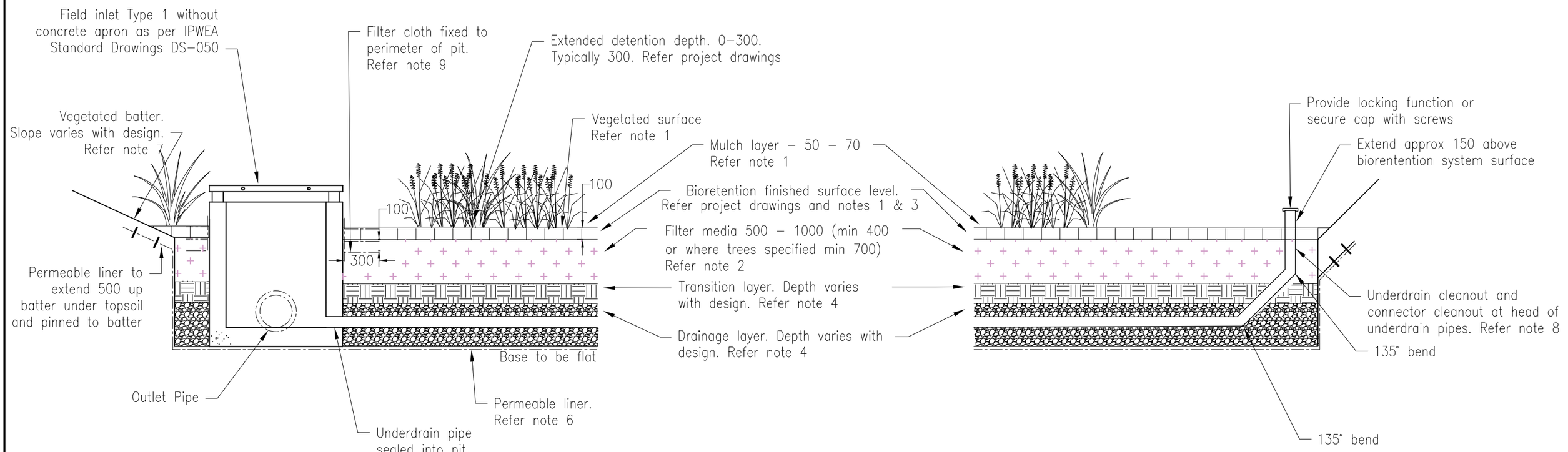
	February, 2016	Original Issue				



NOTES:

1. Bioretention system surface. Refer note 1 DS-070
2. Filter media specification. Refer note 2 DS-070
3. Construction tolerances. Refer note 3 DS-070
4. Transition layer and drainage layer. Refer note 4 DS-070
5. Underdrain. Refer note 5 DS-070
6. Permeable liner. Non-woven geotextile filter cloth to base and sides of bioretention system. Filter cloth not to be placed between any filter layers. Permeable liner as per project drawings and "Bioretention Technical Design Guidelines' (Water by Design).
7. Vegetated batter. Refer note 8 DS-070
8. Inspection/cleanout point. Refer note 9 DS-070
9. Filter cloth refer note 10 DS-070
10. For general design and construction notes refer to DS-078
11. All dimensions in millimetres unless otherwise noted.

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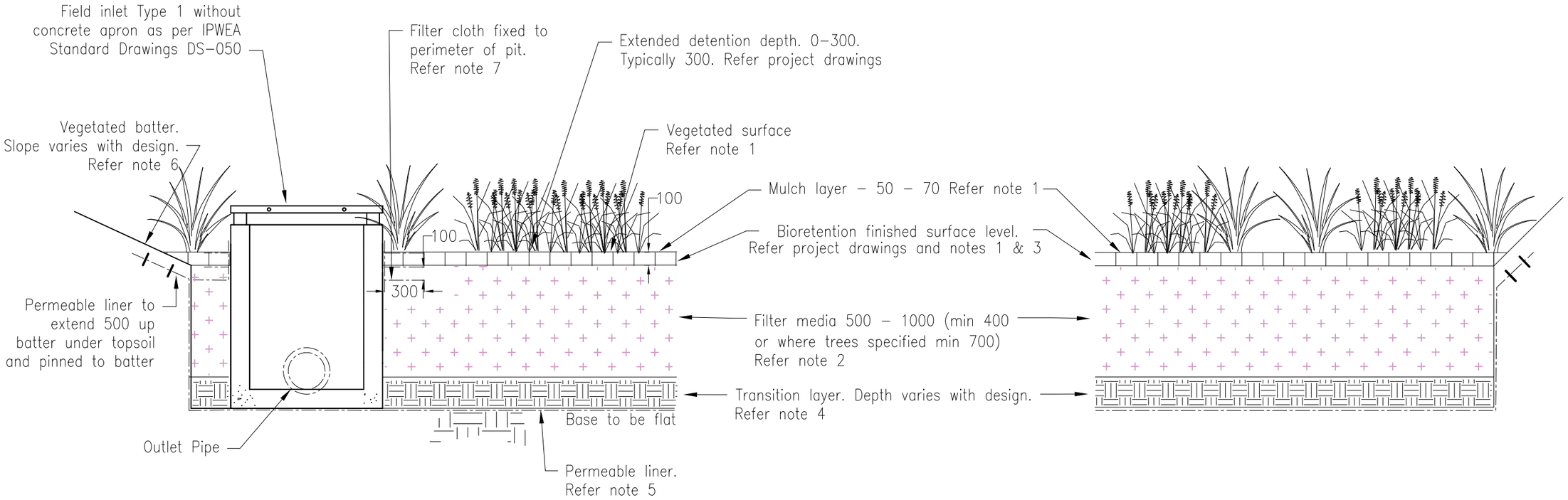
STANDARD DRAWINGS

BIORETENTION DRAINAGE PROFILE - TYPE 3 CONVENTIONAL

DS-073

Rv.



NOTES:

1. Bioretention system surface. Refer note 1 BIO–01
2. Filter media specification. Refer note 2 BIO–01
3. Construction tolerances. Refer note 3 BIO–01
4. Transition layer depth varies with design. Depth and specification to be in accordance with project drawings and the 'Bioretention Technical Design Guidelines' (Water by Design).
5. Permeable liner. Refer Note 6 DS–073
6. Vegetated batter. Refer not 8 DS–078
7. Filter cloth refer note 10 DS–070
8. For general design and construction notes refer to DS–078
9. All dimensions in millimetres unless otherwise noted.

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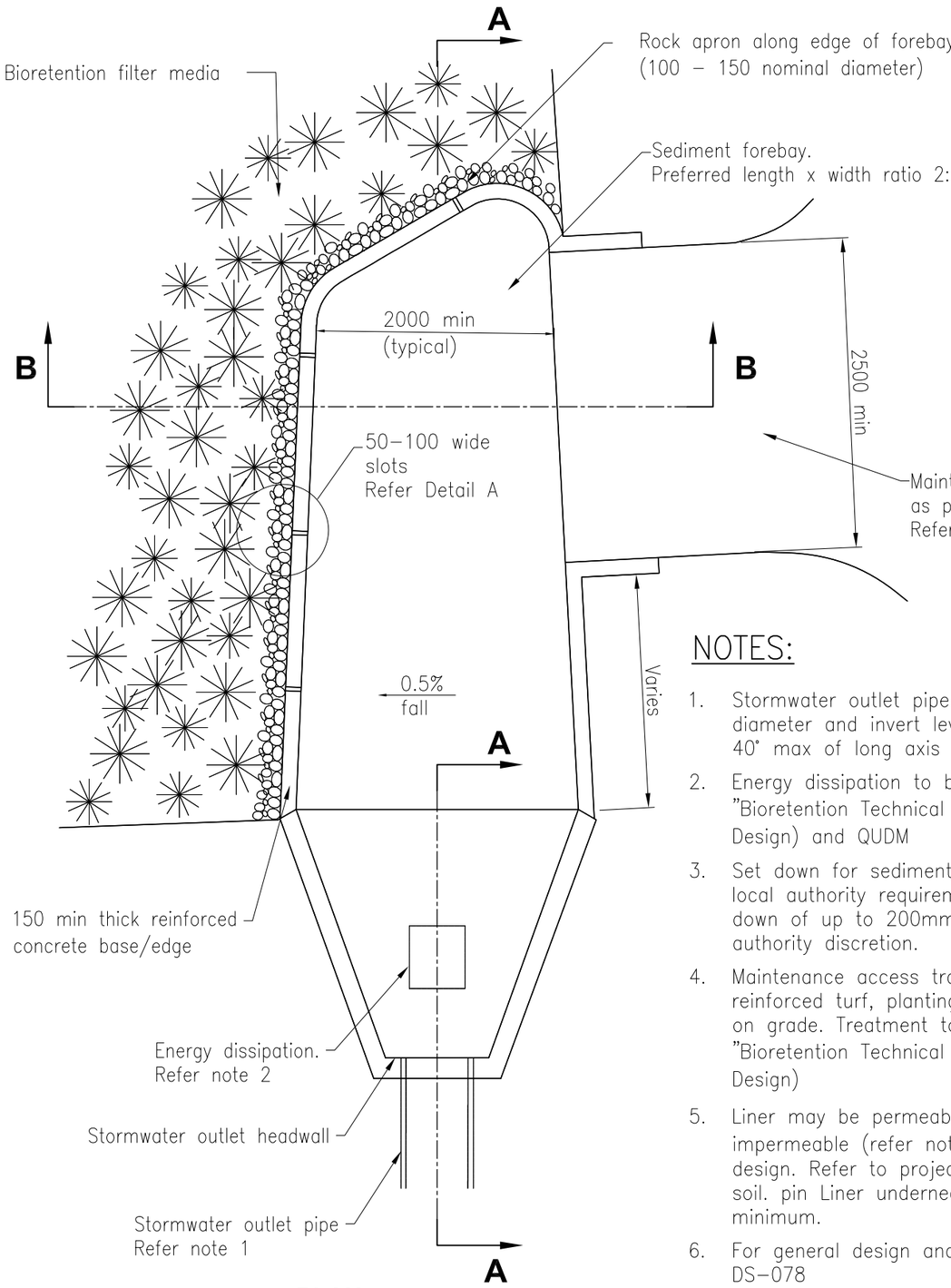
STANDARD DRAWINGS

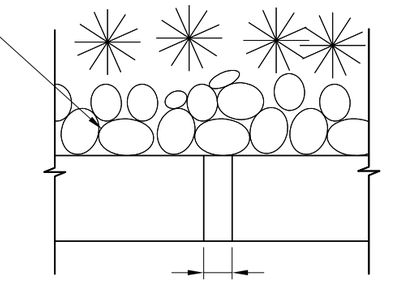
BIORETENTION DRAINAGE PROFILE – TYPE 4 PIPELESS

DS–074

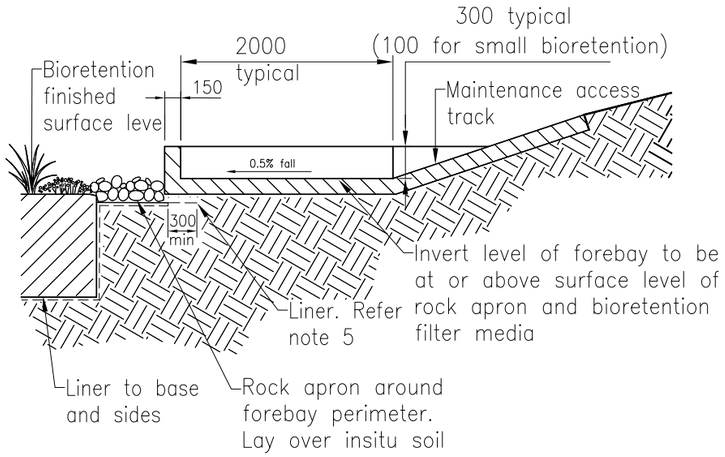
Rv.



PLAN



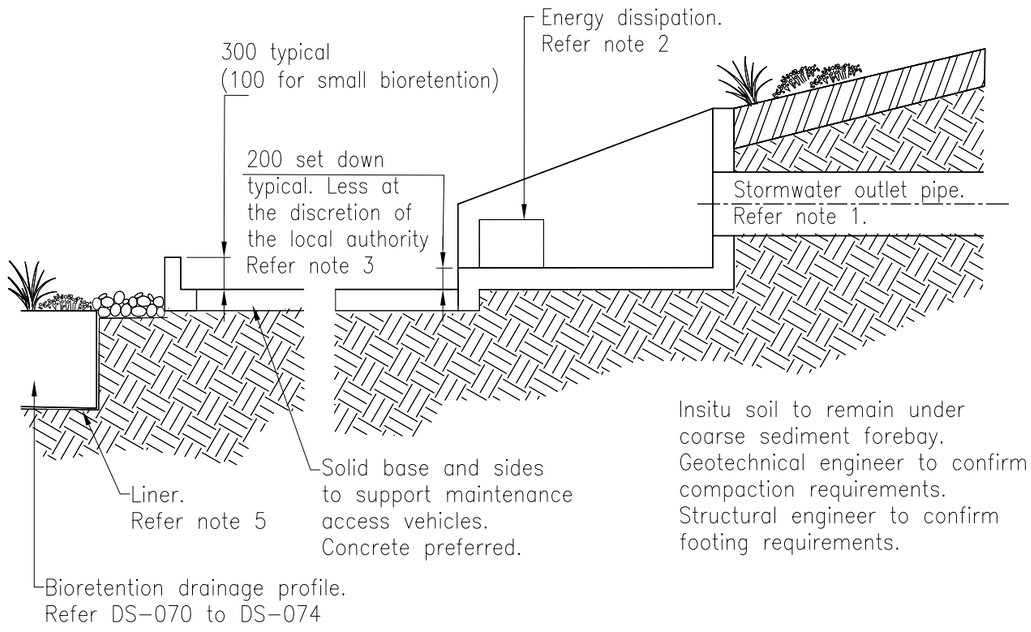
DETAIL A



SECTION B-B

NOTES:

1. Stormwater outlet pipe. Refer project drawings for diameter and invert level. Pipe to be aligned to within 40° max of long axis of the coarse sediment forebay.
2. Energy dissipation to be in accordance with the "Bioretention Technical Design Guidelines" (Water by Design) and QUDM
3. Set down for sediment accumulation required subject to local authority requirements and site constraints. Set down of up to 200mm is typical. Can be flush at local authority discretion.
4. Maintenance access track. Treatment may include reinforced turf, planting, gravel or concrete and depend on grade. Treatment to be in accordance with the "Bioretention Technical Design Guidelines" (Water by Design)
5. Liner may be permeable (refer note 12 on DS–078) or impermeable (refer note 13 on DS–078) depending on design. Refer to project drawings. Lay Liner over insitu soil. pin Liner underneath sediment forebay 300mm minimum.
6. For general design and construction notes refer to DS–078
7. All dimensions in millimetres unless specified otherwise.



SECTION A-A

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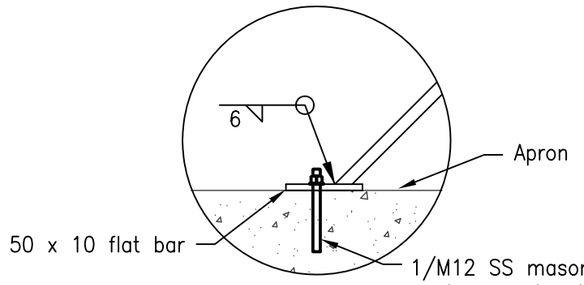
STANDARD DRAWINGS

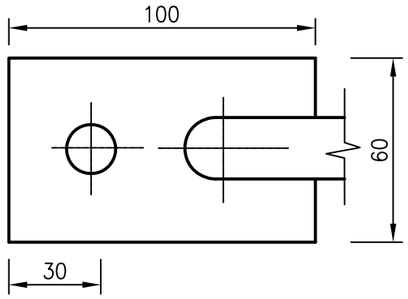
LARGE BIORETENTION SEDIMENT FOREBAY

DS–075

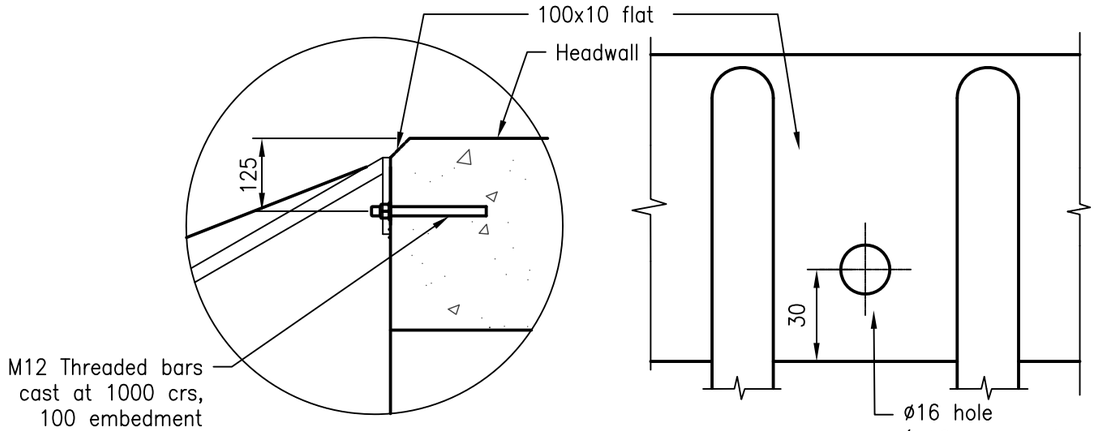
Rv.



DETAIL A

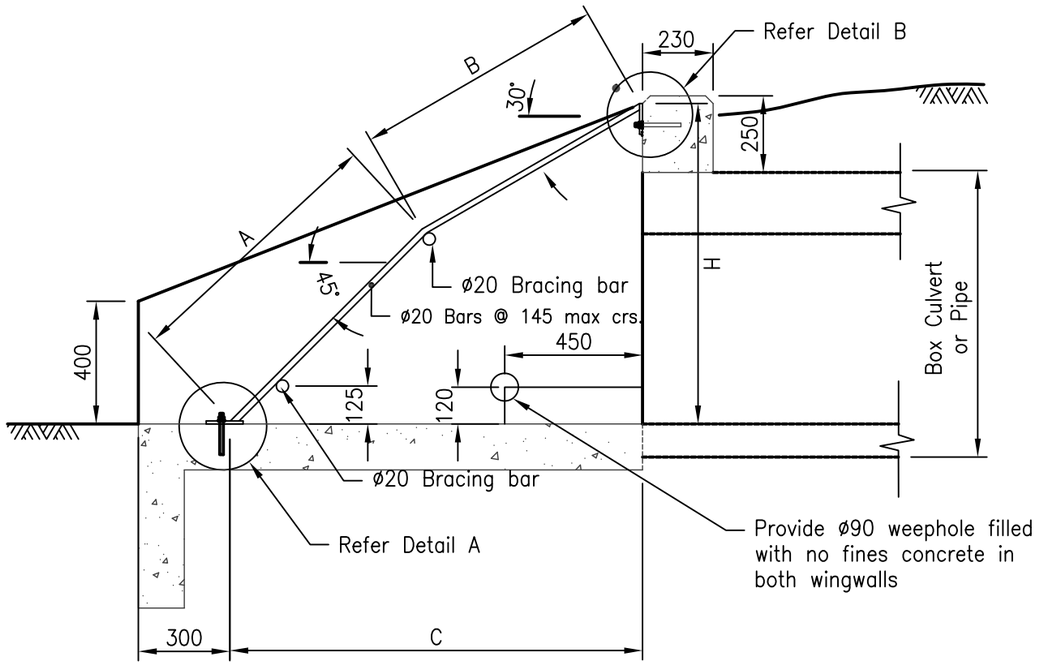


BOTTOM PLATE DETAIL



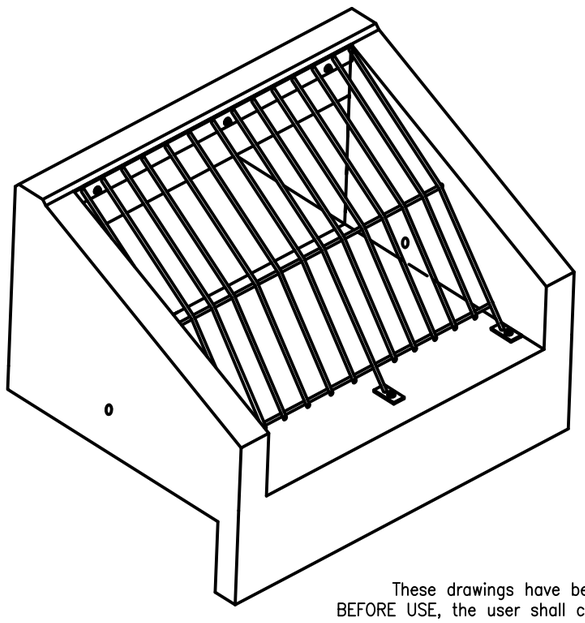
DETAIL B

TOP PLATE DETAIL



SECTION A–A

Reinforcement omitted for clarity

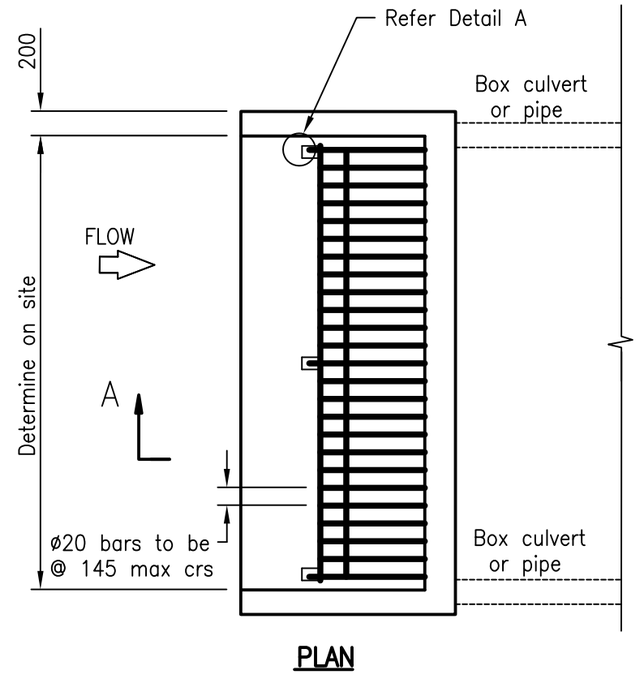


NOTES:

1. For Wingwall and Headwall details and reinforcement, refer TMR Std Dwg 1303
2. For Apron details and reinforcement, refer TMR Std Dwg 1318 (Type 3 Apron)
3. Concrete to be Class N32/20 AS1379–3600.
4. All cover to reinforcement to be 50mm minimum.
5. Cover in aggressive environments refer TMR Std Dwg 1303.
6. All sections to be grade 300 and all bar to be grade 400.
7. All welds to conform to AS1554 and be 6mm continuous fillet welds unless otherwise noted.
8. All steelwork to be hot dip galvanised after fabrication to AS4680.
9. All nuts, bolts and washers to be stainless steel grade 316. with isolation washers.
10. Refer to TMR Standards for safe distances to carriageways.
11. All dimensions are in millimetres unless shown otherwise.

TABLE 1

CULVERT HEIGHT	A	B	C	SCREEN HEIGHT
375	500	613	884	660
450	575	671	988	742
600	675	841	1206	898
750	800	977	1411	1054
900	900	1181	1659	1227
1200	1150	1478	2093	1552



PLAN

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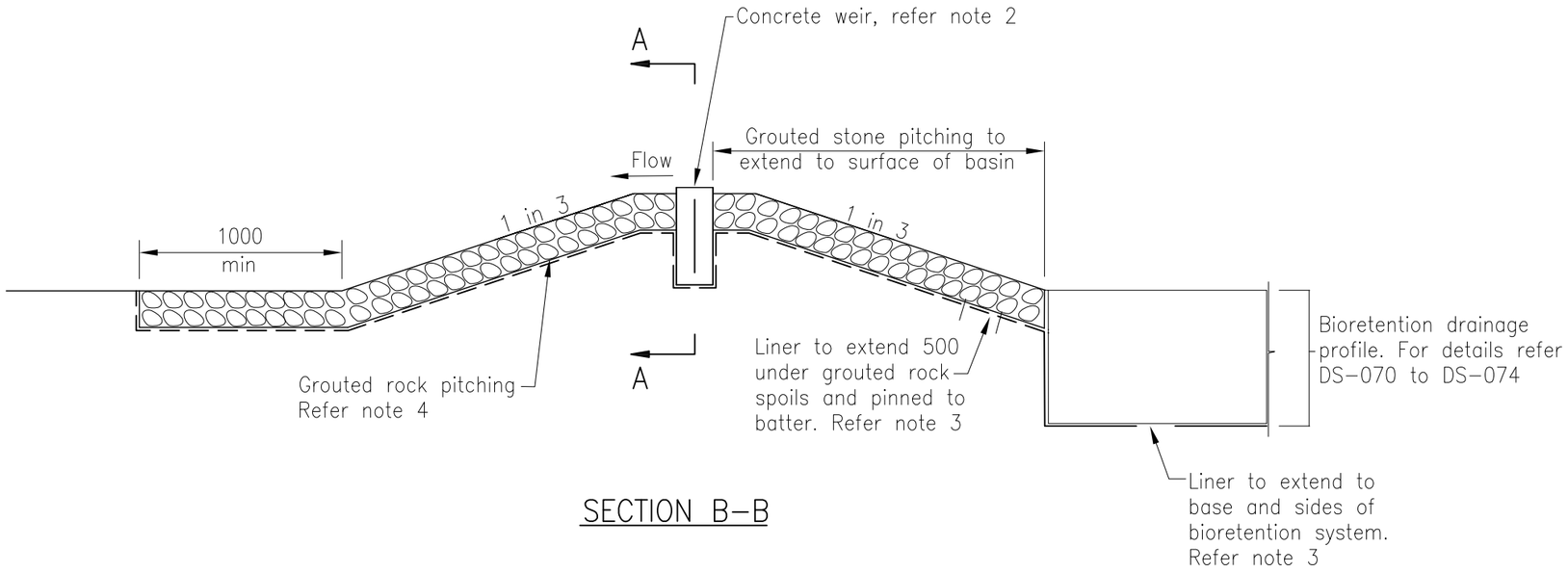
Rv.	DATE	REVISIONS
C	06/14	Review
B	03/14	Amended Drawing Number
A	10/12	ORIGINAL ISSUE

INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

DRAINAGE DETAILS
CULVERT INLET SCREEN

DS–082

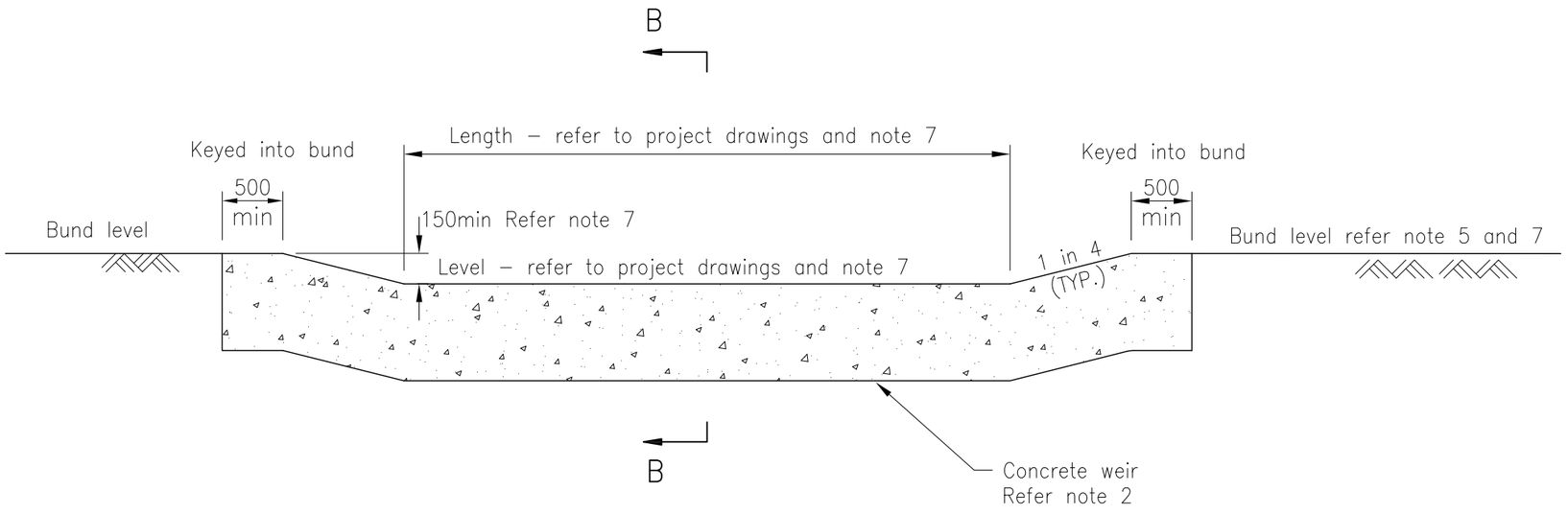
Rv. C B A



SECTION B–B

NOTES:

1. Insitu material to be tested and approved by geotechnical engineer prior to weir construction.
2. Concrete weir – 300 wide x 600 deep concrete (N32) with SL82 mesh placed centrally.
3. Liner. permeable or impermeable depending on design. Refer to DS–070 to DS–074
4. Grouted stone pitching – stones 75–100, 300 thick on filter cloth, refer note 3. Refer landscape drawings and project drawings for plant specification and details. Geotechnical engineer to confirm compaction requirements for bund subsoil.
5. Construction tolerances as documented in the 'Water Sensitive Urban Design Construction and Establishment Guidelines – Swales, Bioretention Systems and Wetlands' (Water by Design) must be achieved. Construction tolerances and bund levels must be noted on project plans.
6. For extent and details of scour protection refer to project drawings.
7. Bund level, refer to project drawings for minimum freeboard requirements. Bund levels must be noted on project drawings.
8. All dimensions are in millimetres unless otherwise noted.



SECTION A–A

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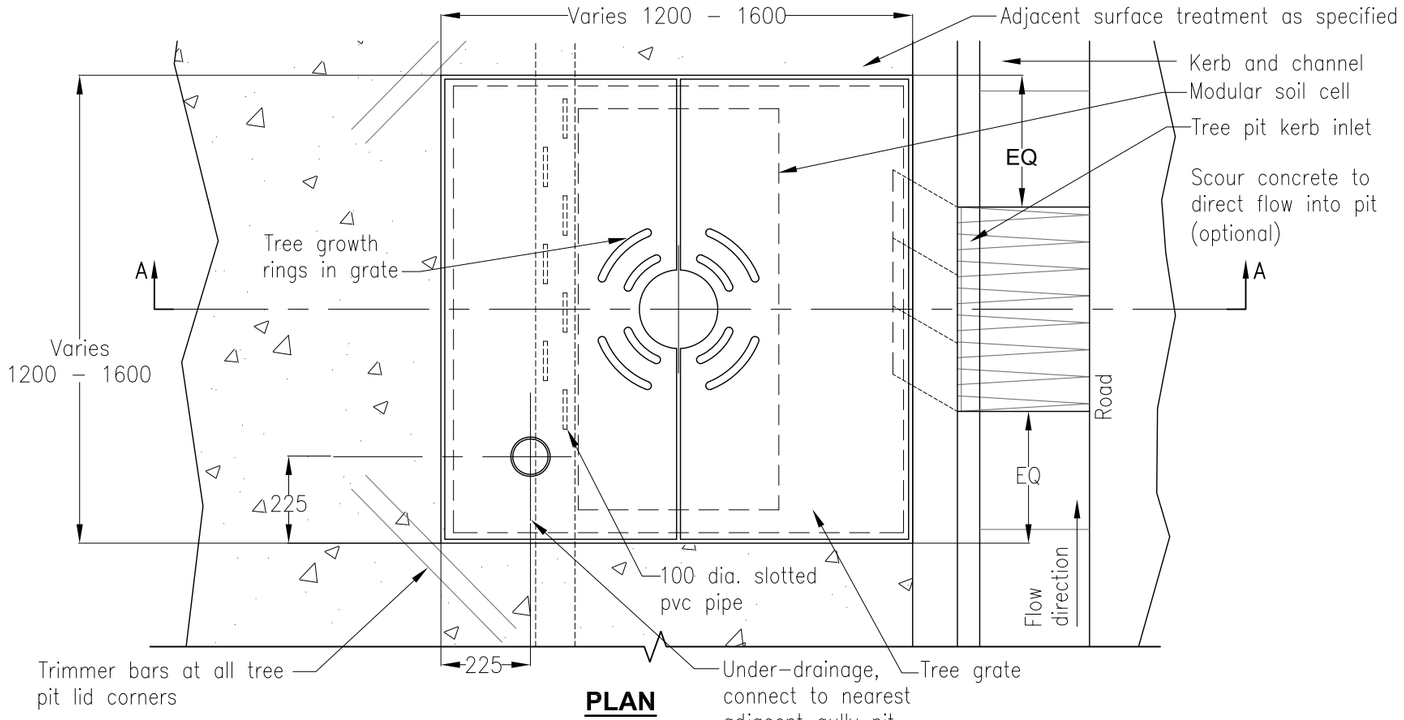
STANDARD DRAWINGS

BIORETENTION WEIR

DS–076

Rv.



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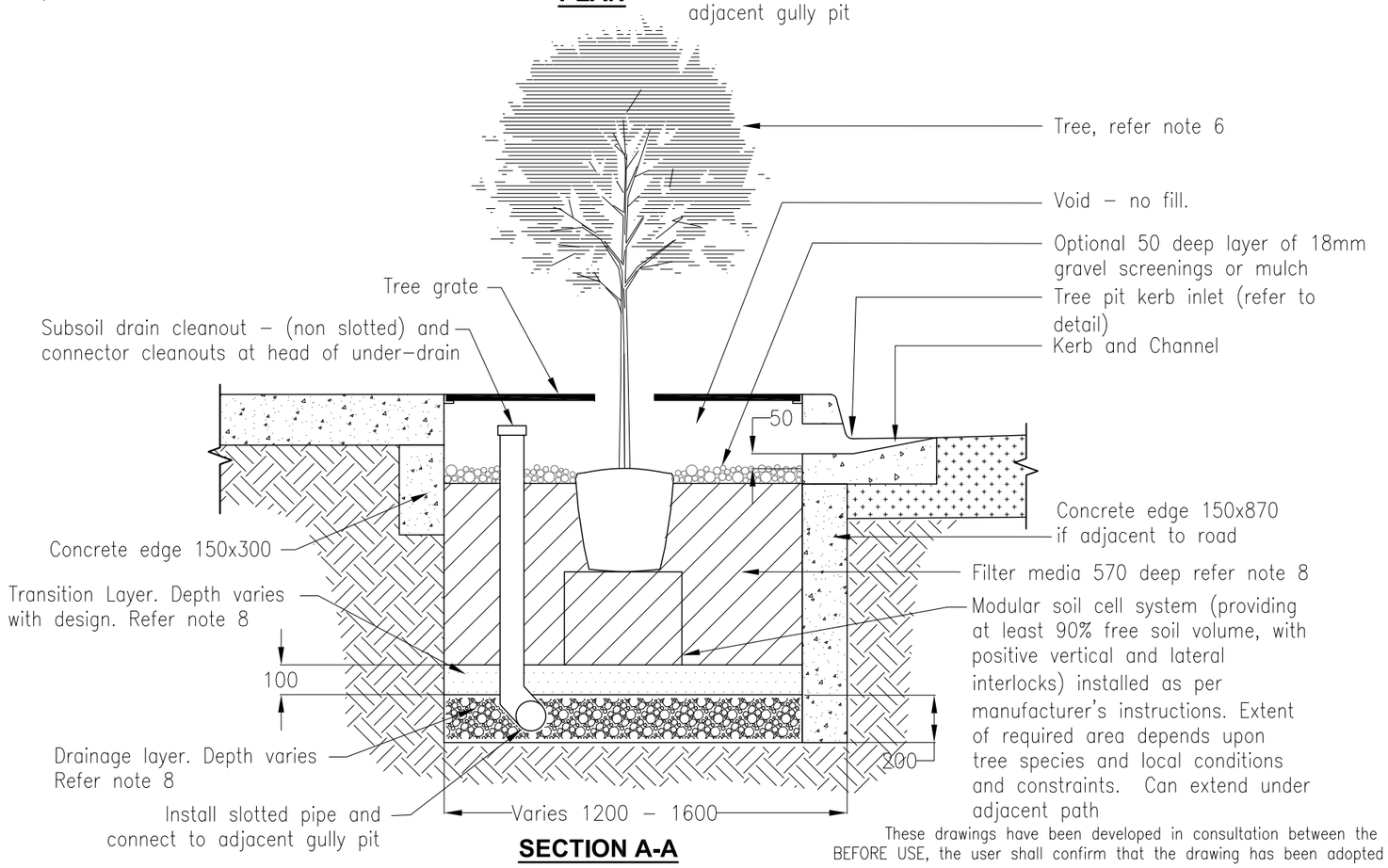
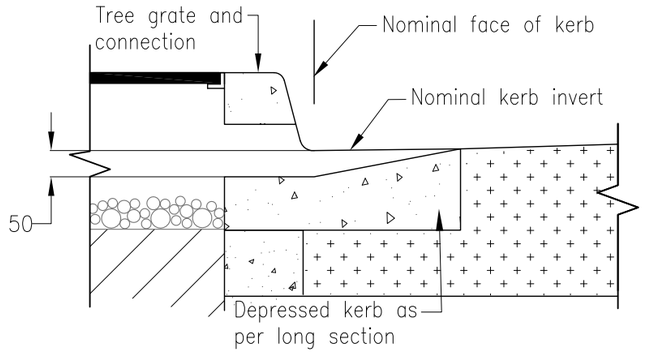


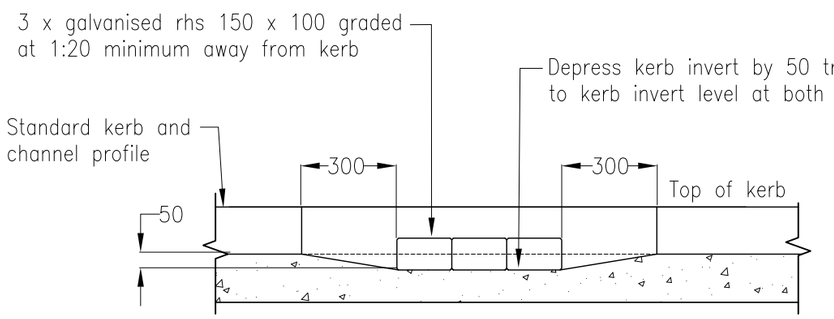
SECTION A-A

NOTES:

1. For general design and construction notes refer to DS–078.
2. WSUD kerb shown is only suitable for street tree pits and small raingardens. Larger systems may need specific inlet design or multiple inlets.
3. Where no parking lane exists, RHS kerb inlet may be replaced by an open kerb cut.
4. Ensure tree pit drainage is connected to stormwater system to avoid flooding the tree.
5. Tree pits are to be located upstream of gully pits.
6. Street tree to be appropriate for traffic sight lines.
7. Filter media specification shall be in accordance with the 'Guidelines for Soil filter Media in Bioretention systems' (FAWB) and the Bioretention Technical Design Guidelines (Water by Design). Bioretention hydraulic conductivity shall be in accordance with 'Practice Note 1: InSitu Measurement of Hydraulic Conductivity' (FAWB). The number of samples to be tested shall be in accordance with the 'Construction and Establishment Guidelines –Swales, Bioretention Systems and Wetlands' (Water by Design).
8. Transition layer and drainage layer specifications to be in accordance with Bioretention Technical Design Guidelines (Water by Design.
9. All dimensions in millimetres unless specified otherwise.



TREE PIT KERB INLET TYPICAL SECTION



TREE PIT KERB INLET ELEVATION

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STANDARD DRAWINGS

BIORETENTION STREET TREE

DS–077

Rv.

Bioretention System Specification

1. Referenced documents.
   The following documents are incorporated into this specification by reference:
   1.1. Standards
      1.1.1. AS 1289 - Methods of Testing Soils for Engineering Purposes
      1.1.2. AS 1289.5.4.1-2007- Soil Compaction and Density Tests--Compaction Control Test--Dry Density Ratio, Moisture Variation and Moisture Ratio
      1.1.3. AS 1289.5.7.1-2006 - Soil Compaction and Density Tests--Compaction Control Test--Hilf Density Ratio and Hilf Moisture Variation (rapid method)
      1.1.4. AS 2758 - Aggregates and Rock for Engineering Purposes
      1.1.5. AS 4419 - Soils for Landscaping and Garden Use
      1.1.6. 1.1.6 AS 4454 - Composts, Soil Conditioners and Mulches
   1.2. Other publications
      1.2.1. Guidelines for Soil Filter Media in Bioretention Systems (FAWB) - the current version of the guideline can be found at http://www.monash.edu.au/FAWB/
      1.2.2. Construction and Establishment Guidelines - Swales, Bioretention systems and Wetlands (Water by Design) http://waterbydesign.com.au/ceguide/
      1.2.3. Transferring Ownership of Vegetated Stormwater Assets (Water by Design) http://waterbydesign.com.au/transferguide/
      1.2.4. Transferring Ownership of Vegetated Stormwater Assets (Water by Design) http://waterbydesign.com.au/transferguide/
      1.2.5. Bioretention Technical Design Guidelines (Water by Design) http://waterbydesign.com.au/techguide/
      1.2.6. Water Sensitive Urban Design Field Guide (Water by Design)
2. Abbreviations and definitions
   2.1. The bioretention system specification consists of the following abbreviations and definitions:
   2.2. Filter: soil layer which acts as a pollutant filter and supports plant growth.
   2.3. Impermeable liners: the liner that prevents water movement between the filter and the surrounding soils and defines the edge of the system.
   2.4. Transition layer: layer to separate filter layer from the drainage layer to avoid migration of soils from the filter to the drainage layer
   2.5. Drainage layer: relatively free draining layer to convey infiltrated water to the underdrainage.
   2.6. Under-drains: slotted drains collect treated stormwater from the drainage layer at the base of the bioretention system.
3. Test methods and standards
   3.1. The following test methods and standards are to be used as specified in the above guidelines when conducting tests associated with this specification:
   3.2. The hydraulic conductivity of potential filter media shall be measured using the ASTM F1815-11 method
   3.3. Particle size distribution: AS1289.3.6.1 - 1995
   3.4. Soils for landscaping and garden use: AS4419 - 2003.
4. Materials
   4.1. Materials shall meet the required specifications detailed in *Section 8 Filter media, Section 9 Transition layer, Section 10 Drainage layer, Section 11 Under drainage, Section 12 Permeable liner, Section 13 Impermeable liner and Section 14 Landscaping* of this document.
   4.2. All materials must be certified by the supplier with certification and delivery supply dockets shall be provided on request to certify the material delivered is the material tested.
5. Timing and erosion and sediment control
   5.1. The timing of civil and landscape works for bioretention systems must be carefully planned to ensure that both the bioretention system and the downstream waterways, are not impacted by stormwater and sediment (e.g. through best practice erosion and sediment control). In particular, the drainage layer, transition layer and filter media must not be placed until the risk of high sediment loading from upstream construction activities has been mitigated. The construction sequence must be approved by the superintendent.
   5.2. Erosion and sediment control during construction must be delivered in accordance with all legislative requirements including, where required, the preparation of site-specific ESC plan/s in accordance with current Best Practice Erosion and Sediment Control (e.g. IECA 2008, or later version).
6. Earthworks and hydraulic structures
   6.1. The construction of hydraulic structures must ensure the design levels are achieved. Bunds/ embankments surrounding the system shall be at correct levels. The below table summarises the construction tolerances for each element of a typical bioretention system.
   6.2. Bioretention systems tolerances

Bioretention element	Tolerance (unless specified otherwise)
Hydraulic structures	+ /- 25 mm (+/- 15 mm for streetscape systems)
Earthworks	+ /-50 mm
Under-drainage	+/- 25 mm
Drainage and transition layers	+ 25 mm
Surface level	+/- 25 mm +/- 40 mm for filter media >300 m² provided the average extended detention requirement is within 25 mm of the design requirement.
Embankments and bunds	-25 mm, + 50 mm

7. Maintenance access.
   Maintenance access is provided in accordance with the design drawings.

8. Filter media
   8.1. Materials
   A fundamental part of bioretention systems is the filter media. The main role of the filter media is to support vegetation and remove pollutants. Filter media should be loamy sand that has high permeability when compacted. It should not contain any rubbish or deleterious material. The loamy sand should contain some organic matter to improve water-holding capacity and plant health, but it should be low in nutrient content. The filter media must be compliant with AS4419 - Soils for Landscaping and Garden Use, and meet the following requirements:

Parameter	Test method in accordance with	Requirement
Saturated hydraulic conductivity	ASTM f1815-11	50 - 500 mm/hr (200 preferred)
pH	AS 4419	5.5 - 7.5
Electrical conductivity	AS 4419	<1.2 dS/m
Nitrogen content	AS 4419	<800 mg/kg
Phosphorus content	AS 4419	<40 mg/kg
Organic content	AS 4419	3% - 10%. Where organic content is below this threshold, the filter media may be ameliorated by adding 50 mm of compost and tining it into the top 150 mm of filter media.
Particle size distribution	AS 1289.3.6.1 - 1995	Clay & silt 3 - 6% (<0.05 mm) Very fine sand 5 - 30% (0.05 - 0.15 mm) Fine sand 10- 30% (0.15 - 0.25 mm) Medium to coarse sand 40- 60% (0.25 - 1.0 mm) Coarse sand 7 - 10% (1.0 - 2.0 mm) Fine gravel <3% (2.0 - 3.4%)

Source: Guidelines for Soil Filter Media in Bioretention Systems (FAWB) and Bioretention Technical Design Guidelines (Water by Design)

Filter media must be free of weeds and propagates. Other characteristics of the filter media required for plant growth should be confirmed with a soil analysis or confirmed with a horticulturist/landscape architect.

   8.2. Testing frequency
   Suitable filter media can be delivered to site or imported sand can be ameliorated to meet the above specification. In either case, the media shall be tested against the above parameters at one sample per 500 m3 of filter media. For soil supplied to site, testing must be undertaken on the actual material to be delivered to the bioretention system. The supplier and contractor will be responsible for ensuring the filter media meets the specification and the correct material is delivered to site prior to installation.
   8.3. Installation and compaction
   When installing, the following specifications shall be applied:
      8.3.1. Filter media shall be installed and compacted in two lifts for depths of over 500 mm. Compaction shall be light and even across the surface.
      8.3.2. The top surface of the drainage layer, transition layer and the filter media layer shall be level and free from localised depressions to ensure even distribution of stormwater flows across the surface and prevent localised ponding.
      8.3.3. Filter fabric must not be used between drainage layer, transition layer and the filter media layers or wrapped around the under-drainage

9. Transition layer
   9.1. Transition layers prevent filter media migrating into the drainage layer.
      9.1.1. Materials
         9.1.1.1. Transition layer shall be minimum thickness of 100 mm coarse sand unless otherwise specified (typically 1mm particle size diameter) with <2% fines.
         9.1.1.2. A particle size distribution for the sand shall be obtained to ensure that it meets the following criteria (VicRoads).
         9.1.1.3. D15 (transition layer) ≤ 5 x D85 (filter media)
      9.2. Testing
      A sample of the proposed transition layer is to be provided to the superintendent for approval prior to installation. The superintendent may require the transition layer to be tested to ensure its particle size.

10. Drainage layer
Drainage layers convey infiltrated water into the slotted under-drainage pipes.
   10.1. Materials
      10.1.1. Drainage layer shall be comprised of fine gravel (nominal 2-5 mm) with <2% fines and a minimum saturated hydraulic conductivity of 400 mm/hr. The depth of the drainage layer shall ensure at least 50 mm of aggregate cover over all perforated under-drainage pipes.
      10.1.2. A particle size distribution for the gravel shall be obtained to ensure that it meets the following bridging criteria (VicRoads): D15 (drainage layer) ≤ 5 x D85 (transition layer)
   10.2. Testing
      A sample of the proposed drainage layer is to be provided to the superintendent for approval prior to installation. The superintendent may require the drainage layer to be tested to ensure its particle size.

11. Under-drainage
   11.1. Materials
      Either slotted rigid pipe (HDPE or similar) or ag-pipe can be used for under-drainage as specified in the construction drawings. When installing, the following specifications shall be considered:
      11.1.1. Typically 100 mm-slotted HDPE pipe is the preferred type of rigid pipe.
      11.1.2. The slots in the pipe shall not allow the drainage layer aggregate to freely enter the pipe (under-drainage with slot width of 2 mm or smaller is preferred).
   11.1.3 Under-drainage pipes must not be surrounded by any geofabric or sock.
   11.2. Installation
      11.2.1. The maximum spacing of under-drains for bio-retention systems <100 m2 is 1.5 m from centre to centre. For bioretention systems >100 m2 the maximum spacing can be increased to 2.0 - 2.5 m if specified in the construction drawings.
      11.2.2. The under-drains shall be sloped towards the outlet pit (min. 0.5% longitudinal grade) and the base of filtration trench shall be free from localised depressions. For bioretention systems with a saturated zone a 0% pipe grade is acceptable.
      11.2.3. All junctions and connections shall be appropriately sealed.
      11.2.4. Under-drainage pipes shall be sealed into the overflow pit.
      11.2.5. All under drainage pipes to have raised clean out points constructed from non-slotted pipes which extend to 150 mm above filter media surface

12. Permeable liner (where specified)
   12.1. A permeable geotextile liner fabric must be used to line the outside of the bioretention system.
   12.2. The liner must extend at least 500 mm beyond the top of the sides and must be keyed into batter and covered by at least 200 mm of topsoil.
   12.3. The liner must be resistant to all soil acids and alkalis, resistant to microorganisms and comply with the requirements of AS3706.12 and AS3706.13.

13. Impermeable liner (where specified)
   13.1. Materials
      Liner options include clay, geosynthetic bentonite clay liners or high-density poly ethylene (HDPE) liners. Refer to the project drawings for liner details.
   13.2. Installation
      Installation must be in accordance with manufacturers specifications and design drawings and achieve the following:
      13.2.1. The liners shall be keyed into the batters and to the embankments.
      13.2.2. Liners must be sealed around protrusions such as outlet pipes.
   13.2.3 Must achieve a maximum permeability of $1x10^{-9}$m/s

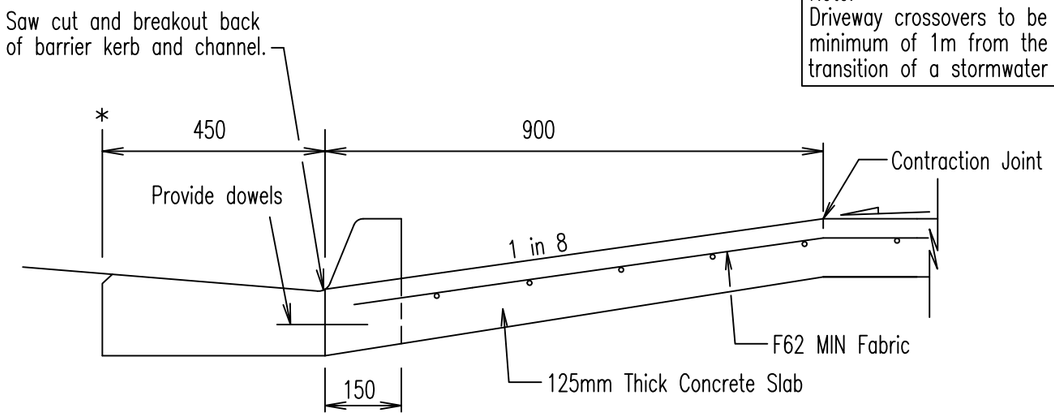
14. Landscaping
   14.0. Refer to landscape design drawings.
   14.1. Batter slopes must have min 200 mm topsoil which must be tested by a NATA-accredited laboratory in accordance with AS 4419.
   14.2. Subsoils to be cultivated to 150 mm prior to placing topsoil on batter slopes.
   14.3. Planting densities and species must be consistent with the landscape design drawings. No substitutions should be made unless approved by the superintendent.
   14.4. Plants supplied to site must:
      14.4.1. be grown in clean, weed- and pest-free conditions;
      14.4.2. be well developed, sun-hardened and contain a fully established root ball that does not crumble when removed from its container.
      14.4.3. be at least 200 mm high.
      14.4.4. show no sign of pest and disease
      14.4.5. show no signs of nutrient deficiency
      14.4.6. be free from weeds
      14.4.7. be clearly labelled
      14.4.8. be supplied in a container that is at least: 90 mm high x 50 mm wide
   14.5. Preparing Filter media: Unless specified otherwise, each plant must receive at least 10 g of slow-release native fertilizer in granular or tablet form. Pre-hydrated water crystals may be applied at 1-2% by weight.
   14.6. Mulch must be applied in accordance with the design drawings, be applied prior to planting, provide coverage of the soil and not exceed 75 mm thickness, and be kept 50 mm clear of plant stems. Unless otherwise specified, mulch should be fine sugar cane mulch secured in place by a loose weave jute net pinned at 500 mm centres.
   14.7. Filter media surface and plant stock are to be watered immediately prior to planting. Unless otherwise specified, plants should be planted in clumps of the same species, and large monocultures avoided.
   14.8. Plant method must minimise soil compaction and ensure that all roots are covered by at least 10 - 20 mm of soil, avoid covering plant crowns.
   14.9. Unless specified otherwise, the following irrigation schedule applies during plant establishment (at 2.5 - 5 L per plant per week)
      - Week 1-5 Five waterings per week
      - Week 6-10 Three waterings per week
      - Week 11-15 Two waterings per week
      - Thereafter As required to sustain plants until successful establishment
   14.10. Replanting must occur during the establishment period if less than 90% of plants survive.
   14.11. Successful plant establishment in bioretention systems is considered when the plants are robust and self-sustaining, and meet the following criteria.
      - Vegetation must cover at least 90% of the bioretention surface with mulch covering the remainder (< 10% mulch visible from above)
      - Average groundcover plant height must be greater than 500 mm.
      - Plants must be healthy and free from disease.
      - No weeds or litter to be present.

15. Certification and chain of custody
   15.1. The following certification and the chain of custody applies to bioretention media:
      15.1.1. The supplier and contractor are responsible for ensuring the bioretention media meets the specifications outlined in these guidelines and that the correct material is delivered to site. The supplier must arrange for testing of the filter media by a soil laboratory certified for the methods in accordance with the requirements listed above. On the basis of the testing, the soil laboratory and supplier must certify the material meets these specifications. The supplier must provide the certification and laboratory test results to the contractor with the supply docket.
      15.1.2. The contractor provides a copy of the supplier's certification, test results and supply docket to the site superintendent or bioretention designer for review.
      15.1.3. Following review of the certification, test results and the supply docket, the site superintendent or bioretention designer approves installation of the bioretention media.
      15.1.4. The relevant sections of the bioretention media sign-off form as per the Construction and Establishment Guidelines (Water by Design) should be completed and signed. This sign-off form is provided as part of the construction certification by the site superintendent or bioretention designer.

16. Hold points
   16.1. The following hold points must be observed in accordance with the most recent Water by Design construction checklists and superintendent approval is required for works to proceed:
      16.1.1. Prestart meeting
      16.1.2. Completion of hydraulic structures and under-drainage
   16.1.3 Prior to placing filter media
      16.1.4. After placement of filter media (prior to applying mulch and planting).

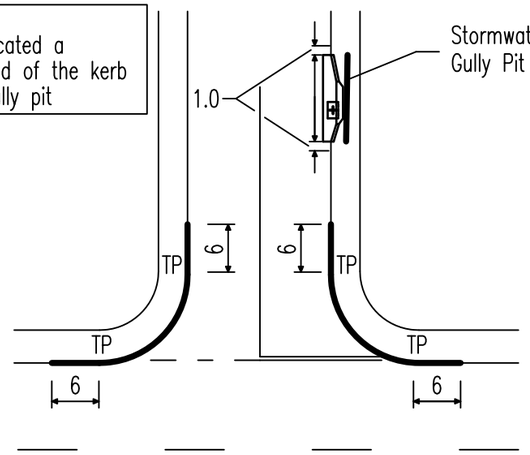
17. Compliance testing (for on-maintenance or off-maintenance)
   17.1. Compliance testing must be in accordance with chapter 5 of Transferring Ownership of Vegetated Stormwater Assets (Water by Design). Checklists must be completed and signed by the superintendent.

Disclaimer: it is the responsibility of the certifying registered professional engineer to ensure these standard notes are adapted to the specific needs of the project. It is expected that additional drawing notes would be required to cover other important project issues (e.g. Workplace Health and Safety, Environmental Protection, Erosion and Sediment Control, etc). Healthy Waterways, IPWEA and all contributors to this document accept no liability for the use, misuse or any omission or inaccuracy in this document.



BARRIER KERB & CHANNEL – TYPE B1

Note:
Driveway crossovers to be located a minimum of 1m from the end of the kerb transition of a stormwater gully pit



Prohibited Locations shown in a heavy line.
All Dimensions are in Metres.

TABLE 1 – DRIVEWAY CROSSOVER WIDTHS

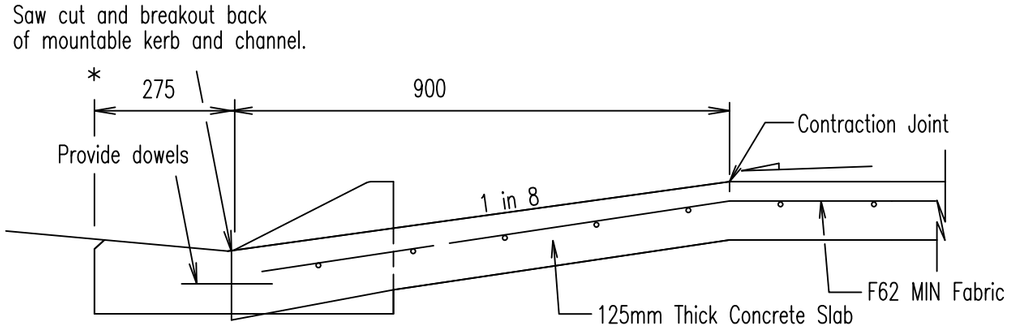
	Description	No. of Crossings Permitted	W1	W2	Special Conditions
Single Dwelling House	Single Garage	1	4.5m	3.5m	1. W1 must not be more than 50% of the total lot frontage width
	Double Garage	1	6.0m	5.0m	
	Double Garage	2	6.0m	5.0m	1. Min. 20m frontage 2. Min 6m between crossovers 3. Max. combined total width 9m
	Double garage or carport on property boundary	1	7.0m	6.0m	
Concrete	Duplex with frontage of less than 20m	1	7.0m	6.0m	
		2	4.0m	3.0m	1. Min. 6m between crossovers
	Duplex with frontage of 20m or more	2	4.0m	5.0m	1. Min. 6m between crossovers
W1 – Maximum allowable width at kerb invert (including splays)					
W2 – Maximum allowable width at property boundary					

LEGEND

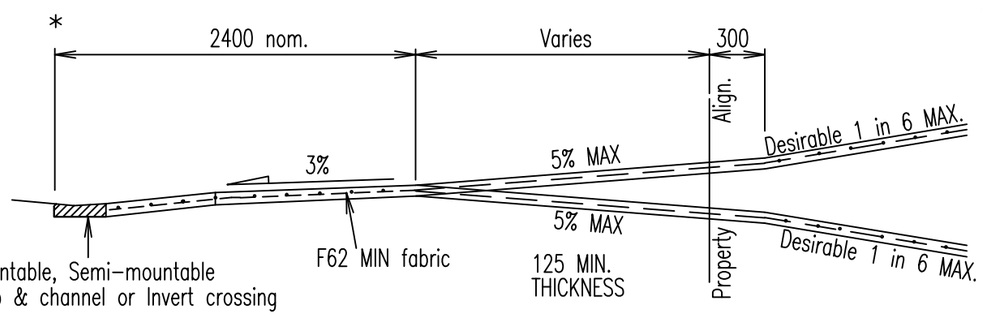
* Lip Line for Setting Out
\# Refer to Table 1

NOTES:

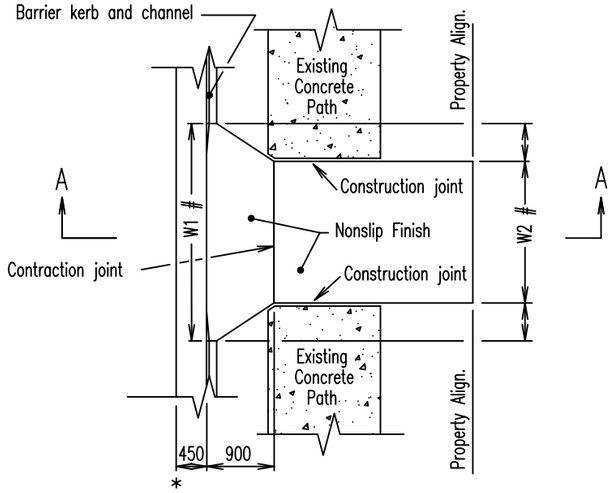
1. Crossings are not designed for commercial vehicles.
2. Reprofile and turf adjacent footpath to finish flush with driveway. Footpath earthworks adjoining concrete must be well compacted.
3. Where concrete paths exist, sawcut and grade smoothly to driveway crossover and join with expansion joint
4. Concrete surface tolerance to be $^{+5mm}_{-0mm}$, over 3 metre sections.
5. Concrete N25 in accordance with AS 1379 and AS 3600.
6. Reinforcement fabric to AS 4671, 50 top and edge cover, lap fabric 250.
7. Expansion joints to be 10 thick, full depth closed cell cross linked polyethylene foam (85 – 150 kg/m)
8. Other kerb and channel types shall have the same construction treatment as shown on this drawing.
9. All reinforcing mesh shall be supported on bar chairs.
10. Driveways are not to be constructed within 1m of a stormwater gully pit.
11. Galvanised steel dowels, 12mm dia, 250mm long and spaced at 500mm centres are used when joining to concrete paths and where the kerb is removed to ensure a flush joint is maintained.
12. Reinforcing mesh to be cut at construction joint
13. All dimensions in millimetres.
14. Removal of mountable kerb is optional on collector street, access streets and access places.
15. All driveway crossovers are to be constructed perpendicular to the road.



MOUNTABLE KERB & CHANNEL – TYPE M1



SECTION A–A



SLAB ABUTTING CHANNEL INVERT BARRIER KERB AND CHANNEL

H	UPDATED	3/17	
G	UPDATED	3/10	
F	AMENDED	12/07	
E	AMENDED	7/05	
D	AMENDED	2/03	
C	AMENDED	1/02	
B	AMENDED	1/99	
A	ORIGINAL ISSUE	1/98	
REVISIONS		DATE	APPROVED

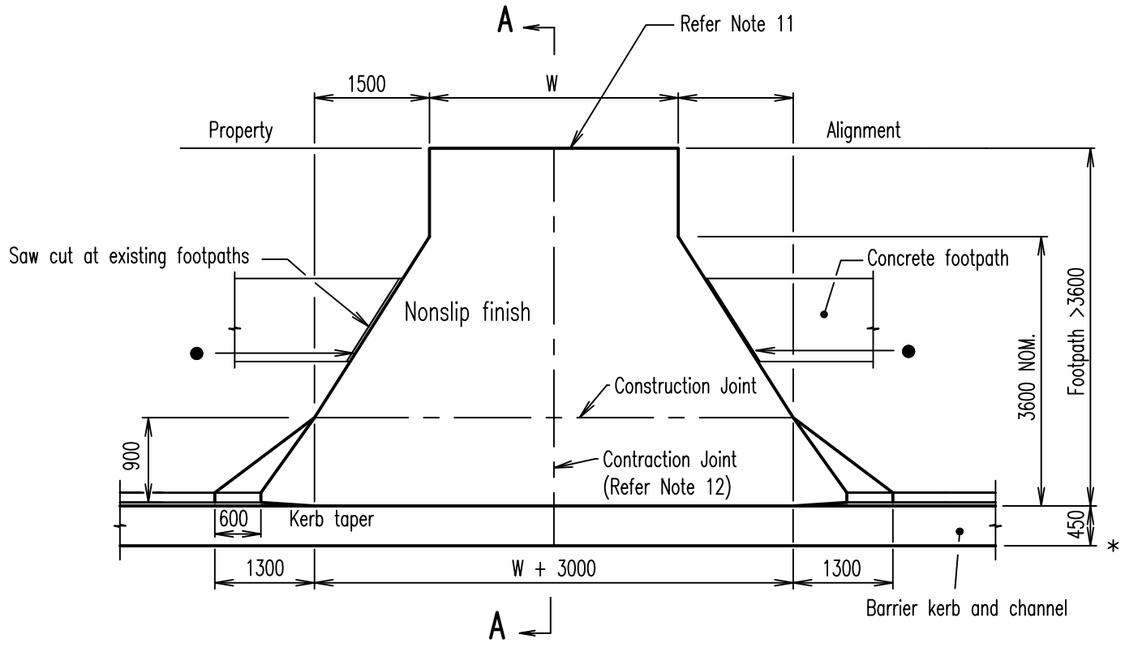
Redland CITY COUNCIL

DOMESTIC DRIVEWAY CROSSOVER FOR KERB AND CHANNEL

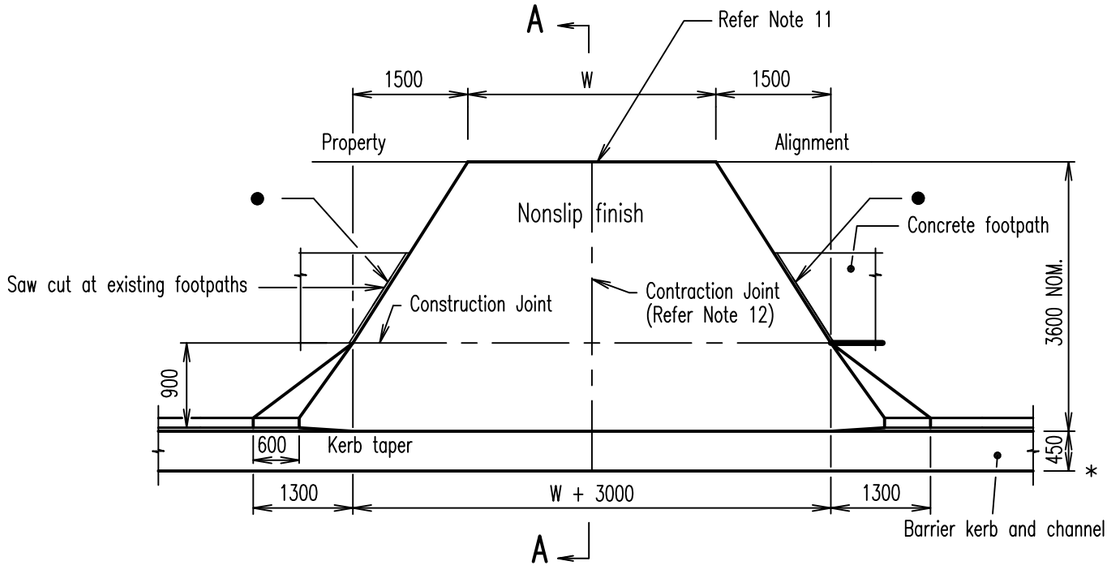
ROAD/STREET
Standard Drawing
R–RCC–1

F G H

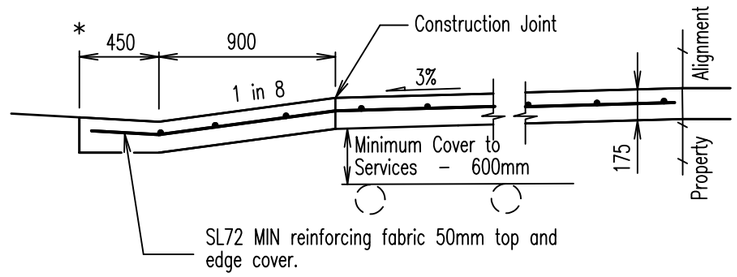
A B C D E



PLAN – WIDE FOOTPATHS



PLAN – 3.6m FOOTPATH



SECTION A – A

LEGEND

* Lip Line

● Expansion joints to be 10 thick, full depth closed cell cross linked polyethylene foam (85 – 150 kg/m³). Also refer Note 12.

NOTES:

1. Concrete N25 in accordance with AS 1379 and AS 3600.
2. Reinforcing fabric to AS 4671. Lap fabric 250mm.
3. Depths of concrete and reinforcing steel shown are the minimum requirements for good foundation conditions, and average traffic loading. Where this does not apply, depths of concrete and reinforcing shall be increased to suit specific conditions.
4. Design of crossings may vary, refer project drawings.
5. Dimension W, 3.0m One way, 5.5m Two way, refer specification or project drawings.
6. Reprofile adjacent footpath to match driveway,as directed by Redland City Council. Footpath earthworks adjoining concrete must be well compacted.
7. Existing footpath profile to be maintained where possible.
8. Compaction for subgrade 95% Standard to AS 1289.5.1.1.
9. Where subgrade is less than CBR 5 excavate and provide imported material to satisfaction of the Superintendent.
10. The driveway shall be concrete unless otherwise approved.
11. Gully pits may be provided on each side inside the property boundary when discharging to street underground drainage. Alternatively, a grated drain may be provided on the side of the property boundary. Refer project Drawings.
12. Galvanised steel slip dowels, 12mm dia, 250mm long and spaced at 500mm are used when joining to concrete paths to ensure a flush joint is maintained.
13. Contraction joints are required at 3 to 4.5m centres.
14. All reinforcing mesh shall be supported on bar chairs.
15. This drawing indicates the minimum standard required unless otherwise specified in the development approval.
16. All dimensions in millimetres.

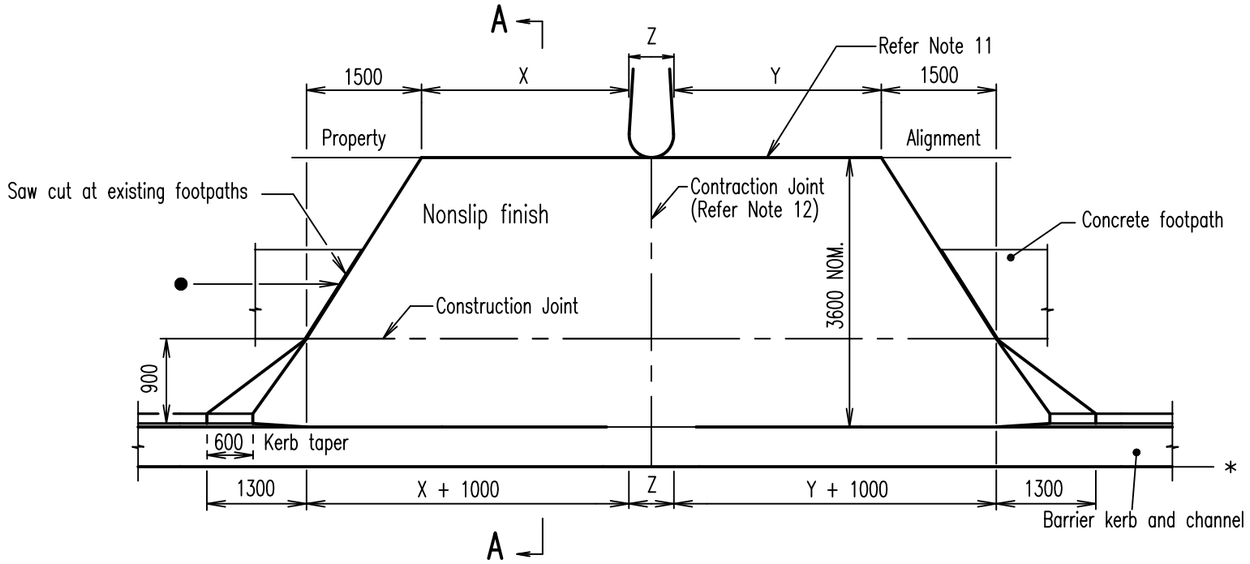
E	UPDATED	3/10	
D	AMENDED	7/05	
C	AMENDED	1/02	
B	AMENDED	1/99	
A	ORIGINAL ISSUE	1/98	
REVISIONS		DATE	APPROVED

Redland CITY COUNCIL

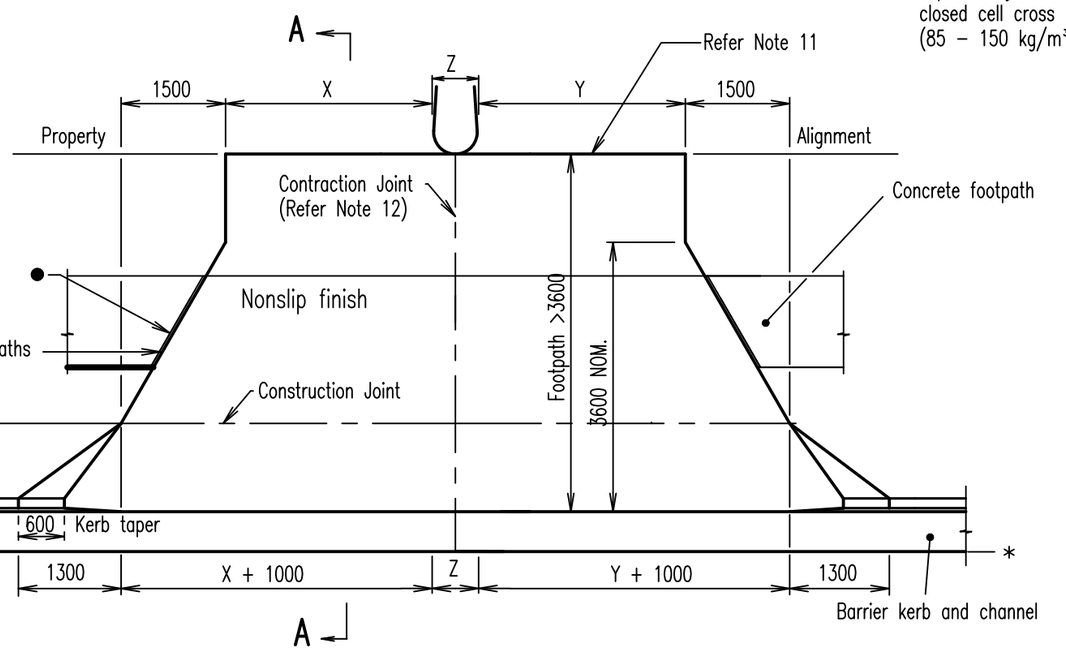
COMMERCIAL / INDUSTRIAL/ MULTIPLE DWELLING / DRIVEWAY CROSSOVER

ROAD/STREET
Standard Drawing
R-RCC-2

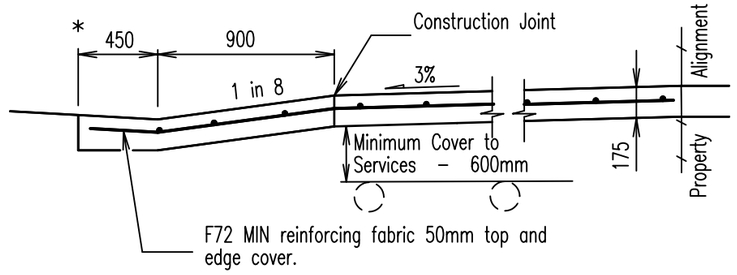
A | B | C | D | E



PLAN – 3.6m FOOTPATH



PLAN – WIDE FOOTPATHS



SECTION A – A

LEGEND

* Lip Line

● Expansion joints to be 10 thick, full depth closed cell cross linked polyethylene foam (85 – 150 kg/m³).

NOTES:

1. Concrete N25 in accordance with AS 1379 amd AS 3600.
2. Reinforcing fabric to AS 4671. Lap fabric 250mm.
3. Depths of concrete and reinforcing steel shown are the minimum requirements for good foundation conditions, and average traffic loading. Where this does not apply, depths of concrete and reinforcing shall be increased to suit specific conditions.
4. Design of crossings may vary, refer project drawings.
5. Dimensions X, Y, & Z , refer specification or project drawings. Unless otherwise specified X = 5500, Y = 4500 and Z = 1200
6. Reprofile adjacent footpath to match driveway, as directed by Redland City Council. Footpath earthworks adjoining concrete must be well compacted.
7. Existing footpath profile to be maintained where possible.
8. Compaction for subgrade 95% Standard to AS 1289.5.1.1.
9. Where subgrade is less than CBR 5 excavate and provide imported material to satisfaction of the Superintendent.
10. The driveway shall be concrete unless otherwise approved.
11. Gully pits may be provided on each side inside the property boundary when discharging to street underground drainage. Alternatively, a grated drain may be provided on the side of the property boundary. Refer project Drawings.
12. Contraction Joints are required in driveway at 3 to 4.5m centres.
13. All reinforcing mesh shall be supported on bar chairs.
14. This drawing indicates the minimum standard required unless otherwise specified in the development approval.
15. All dimensions in millimetres.

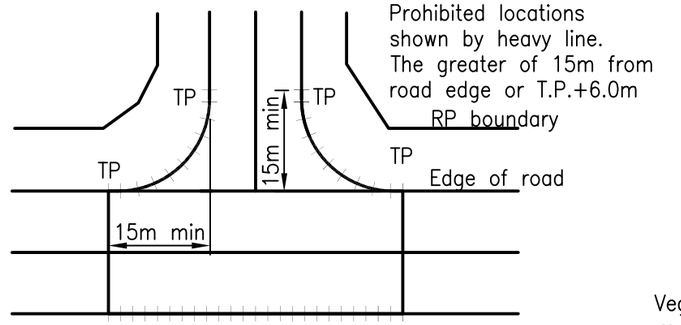
E	UPDATED	3/10	
D	AMENDED	6/04	
C	AMENDED	1/02	
B	AMENDED	1/99	
A	ORIGNIAL ISSUE	1/98	
REVISIONS		DATE	APPROVED

Redland CITY COUNCIL

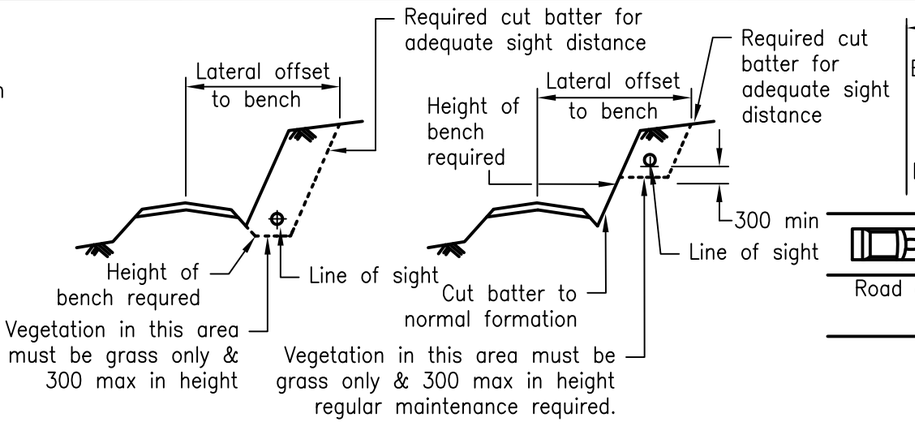
COMMERCIAL/INDUSTRIAL DRIVEWAY CROSSOVER

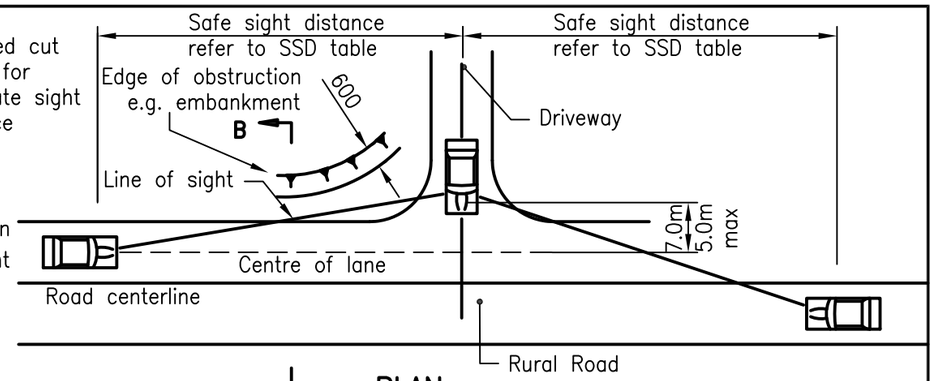
Standard Drawing
R-RCC-3

A B C D E



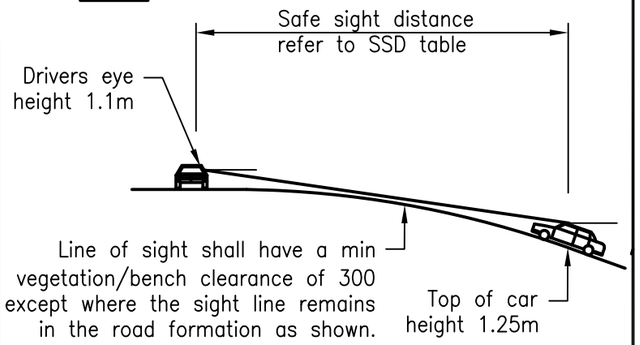
PROHIBITED LOCATIONS AT INTERSECTIONS FOR RURAL DRIVEWAYS





B

PLAN



BENCHING DETAIL

SECTION B–B

PIPE SIZE		
Catchment Area	ARI 2	ARI 10
<0.5Ha	375	450
<1.0Ha	450	525
<1.5Ha	525	600
<2.5Ha	600	2/450
<3.0Ha	2/450	2/525
<4.0Ha	2/525	2/600
<5.0Ha	2/600	(2)

For average daily traffic <= 2000, ARI 2
For average daily traffic > 2000, ARI 10

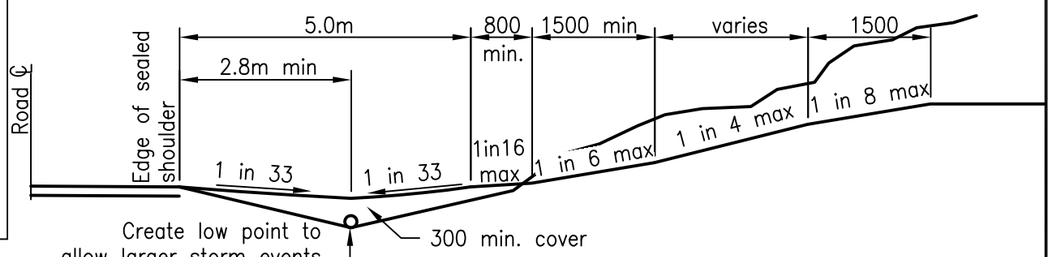
(1) Alternatives may be approved if supported with calculations in accordance with the provisions of the Queensland Urban Drainage Manual or under the provisions of Council's Planning Scheme.

(2) Seek consulting engineer advice.

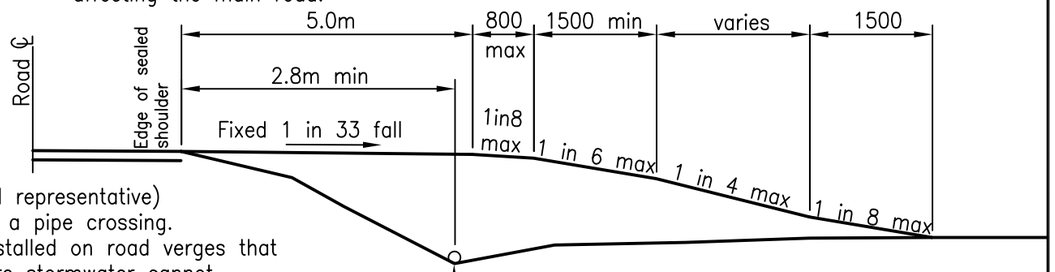
Safe Sight Distance	
Speed Limit (km/h)	Safe Sight Distance (m)
40	73
50	97
60	123
70	151
80	181
90	214
100	248

Based on Austroads Part 4A – 2009, Table 3.2

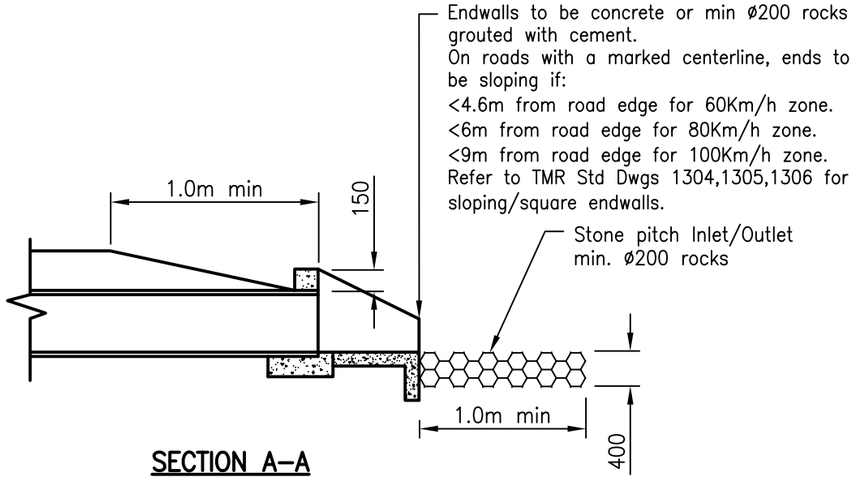
LONGITUDINAL SECTION SSD – EXITING FROM DRIVEWAY



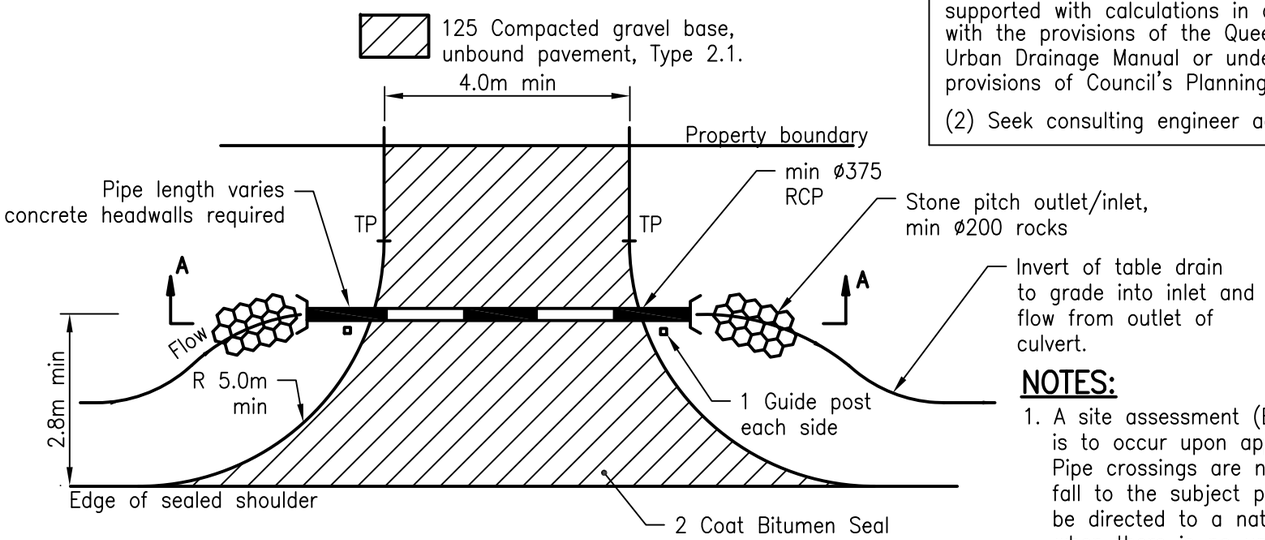
TYPICAL DRIVEWAY SECTION – ROAD IN CUT



TYPICAL DRIVEWAY SECTION – ROAD IN FILL



SECTION A–A



DRIVEWAY PLAN

NOTES:

1. A site assessment (By a Council representative) is to occur upon application for a pipe crossing. Pipe crossings are not to be installed on road verges that fall to the subject property where stormwater cannot be directed to a natural water course or drainage easement or when there is no upstream stormwater catchment or V–Drain.
2. All dimensions are in millimetres unless shown otherwise.

Rv.	DATE	REVISIONS
F	06/14	Review
E	03/14	Amended Drawing Number
D	12/11	Drawing number changed from SEQ R–056 to RS–056
C	06/10	Review
B	06/09	Review
A	03/08	ORIGINAL ISSUE

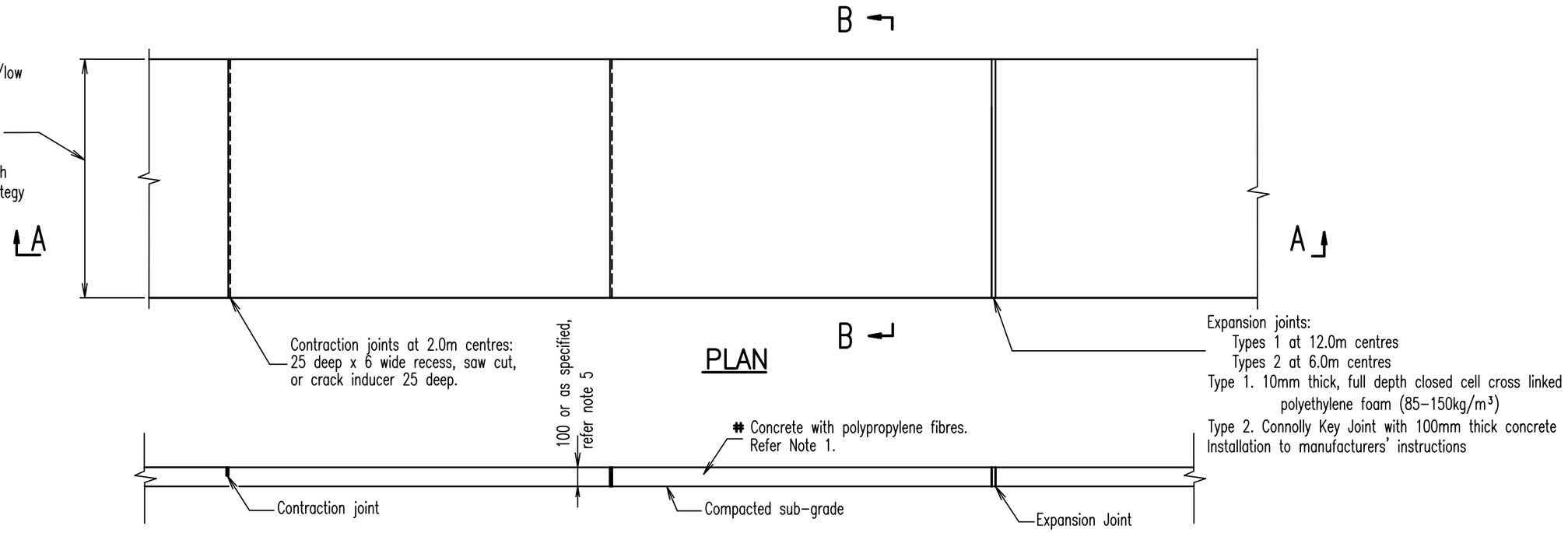
INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

DRIVEWAYS
RURAL DRIVEWAY

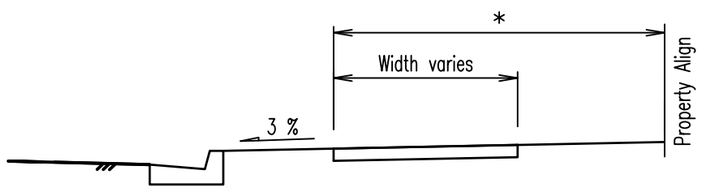
RS–056

F E D C B A Rv.

Width varies:
– Footpaths 1500 minimum width
– Shared use paths 2500 minimum, 2000 absolute minimum in restrcted/low use situations
– Commuter and recreational paths 2500 minimum width for lower order paths or 3000 maximum width for higher order paths in accordance with Redlands Cycling and Pedestrian Strategy Technical Report.



SECTION A – A



SECTION B–B

(Where kerb & channel exists)

FIBRE REINFORCED CONCRETE SPECIFICATION

The concrete shall be reinforced with a mixed dose of high performance polymer fibres and discreet graded fibrillated filament fibres. These fibres shall be provided as a coarse filament in an engineered contoured sinusoildal profile, of not less than 600 denier and discreet graded fibrillated filament fibres, of not greater than 6 denier. These fibres are to be manufactured from virgin polypropylene and added to the concrete, at the rate of 4.6kg per cubic metre. The 4.6kg shall consist of 3.8kg of HPP and 0.8kg of discrete graded fibrillated filament fibres.

LEGEND

*** 2700 width for 4000 verge**
Distance varies to provide adequate clearance to street light poles, trees and fixed objects on wider verges.

 # Alternative treatment without fibres, where specified by Council is SL62 reinforcing fabric, 50mm top edge cover, supported on bar chairs. Also refer Note 5.

NOTES

1. **Concrete N25 in accordance with AS 1379 and AS 3600. with polypropylene fibres incorporated into the concrete mix Refer Fibre Reinforced Concrete Specification**
2. **All concrete to be broom finished.**
3. **Contraction/expansion joints, 2m MAX spacing.**
4. **Finished surface tolerance to be maximum +6mm relative to kerb level and crossfall specified. –0mm**
5. **Thickness to be increased to 125mm at residential vehicular crossovers and through parks and reserves. Provide a contraction joint at both ends of crossover**
6. **Concrete footpaths, adjoining existing driveways are to be transitioned over a minimum 5.0m length.**
7. **Galvanised steel slip dowels, 12mm dia, 250mm long and spaced at 500mm are used wehn joining to existing concrete paths to ensure a flush joint is maintained.**
8. **A street opening permit must be obtained from Council, seek approval of location and levels prior to excavation.**
9. **All dimensions in millimetres.**

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C	AMENDED	1/02	
B	AMENDED	1/99	
A	ORIGINAL ISSUE	1/98	
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Redland CITY COUNCIL

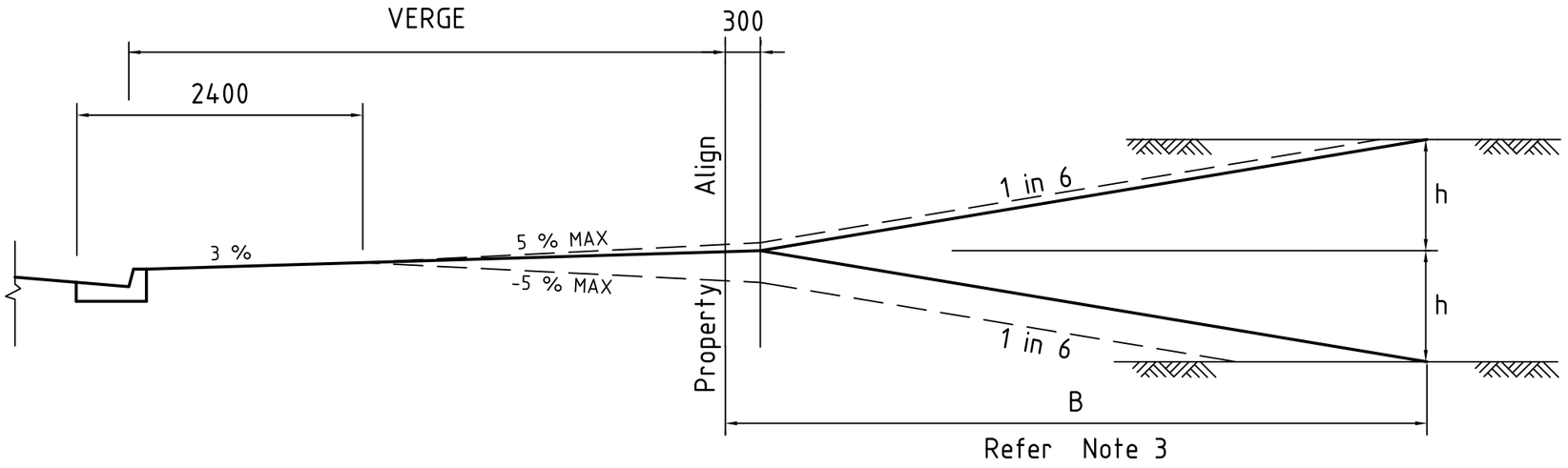
CONCRETE FOOTPATHS AND SHARED USE PATHS

ROAD/STREET

Standard Drawing

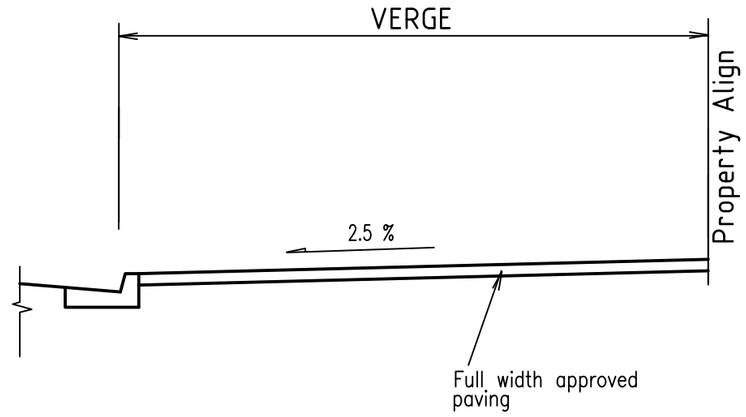
R–RCC–4

A | B | C | D | E



RESIDENTIAL FOOTPATH PROFILE & ADJOINING BATTER

Scale 1:50



COMMERCIAL FOOTPATH PROFILE

NTS

NOTES

1. Where h < 750, a standard 3% footpath with 1 in 6 batter shall be adopted.
2. Where h > 750, a combination of 3% and + 5% Max. may be adopted for the footpath profile with 1 in 6 slopes in private property.
3. Where B > 6000 when adopting 1 in 6 batters they may be increased to 1 in 4 Max. with B constant at 6000.
4. Where h > 1500, 1 in 2 batters may be provided with access points to each property graded at 1 in 4. (Not to be adopted unless approved by the Manager Infrastructure Development.
5. Provide Topsoil and Turfing as specicfied.
6. All grades are to conform with regard to accessability to all members of the community.
7. Variations may be approved at the descretion of the Manager Infrastructure Develpment.
8. Paving type and pattern to be approved by Redland Shire Council.

C	UPDATED	3/10	
B	AMENDED	1/99	
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REVISIONS		DATE	APPROVED

Redland CITY COUNCIL

FOOTPATH PROFILE POLICY

ROAD/STREET

Standard Drawing

R-RCC-5

A | B | C

CORRIDOR WIDTHS

Refer Note 3

Electricity & Communications	900
Gas	300
Water See Note 13	600
Communications See Note 13	900
Poles/trees	500

1200 to 2000

Sewerage Reticulation located on high side of major roads (See Note 13)

Property Alignment

Communications Service (See Note 3)

Electricity consumer mains

1000

Electricity service pillar

Road Reserve Alignment

HIGH SIDE

500 500

B

Road Reserve

Alignment

5500 Nom

2000

Sewerage Reticulation See Note 13

Lip of Channel

Possible Street Light (See Note 4)

Indicator discs

Indicator disc

Possible Street Light (See Note 4)

Indicator disc

Lip of Channel

1000

Stormwater (See Note 11)

A

MAIN

Electricity conduit Communications conduit See Note 7

STREET

Gas service in conduit

Water conduit

Electricity conduits

W C

A

STREET

THOMAS

Major Water Main or Sewerage Trunk Mains or Rising Main (See Note 6)

CORRIDOR WIDTHS

Poles/trees	500
Communications	900
Water	600
Gas	300
Electricity & Communications	900

(See Note 2 & 3)

1000

5500 Nom

Varies

2950

2250

1500

1050

300

Refer Note 6 & 9

Road Reserve Alignment

Indicator discs

Possible street light (See Note 4)

Indicator disc

See Note 3

Indicator disc

Possible street light (See Note 4)

Lip of Channel

C C

G W G W

E E

900

Communications pit

Communications service

1000

Electricity service pillar

Electricity consumer mains

LOW SIDE

B

500 500

Property Alignment

Property Alignment

Property Reserve Alignment

Gas service(20mm) location varies, not necessarily connected to all properties.

NOTES

1. The alignment and depths of existing services shall be proven on site by consultation with the relevant service authorities prior to any excavation and shall not be inferred from this drawing.
2. Electricity distribution may be located alternatively on high side of street in lieu of low side, provided it remains within the 900 wide joint share Elec/Communications corridor.
3. Refer Energex standard drawings for alignment and for details of joint use trench with communications.
4. Street light poles shall generally be located 1400 behind the lip of channel on verges exceeding 4m in width.
5. Refer Appropriate Standard Drawing for sectional views.
6. Major water mains or trunk sewer or rising mains are to be located on the low side of the street
7. Alternative location for water conduit subject to RSC approval.
8. Conduits to extend 600 beyond back of kerb or 300 beyond Concrete path where applicable.
9. Water mains are located on the low side of the street unless otherwise approved.
10. Trees not to be planted closer than 7000 from street lights.
11. Stormwater mains are located on the high side of the street under the kerb & channel where side inlet chambers are used.
12. Conduits to have a minimum 1000 separation.
13. Sewerage reticulation instead of Communications and Water is located on the verge on the high side of type A and B streets. (Road reserve widths of 18 metres or less). The location is 1200 to 2000 in private property on all higher order roads.
14. All dimensions in millimetres.

LEGEND

Road crossing conduits	
Gas –	G
Water –	W
Sewerage –	S
Communications –	C
Electricity –	E
Street light –	X

F	UPDATED	3/10	
E	AMENDED	7/05	
D	AMENDED	11/03	
C	AMENDED	1/02	
B	AMENDED	1/99	
A	ORIGINAL ISSUE	1/98	
REVISIONS		DATE	APPROVED

Redland CITY COUNCIL

PUBLIC UTILITIES IN ROAD RESERVES

TYPICAL SERVICE CORRIDORS AND ALIGNMENTS

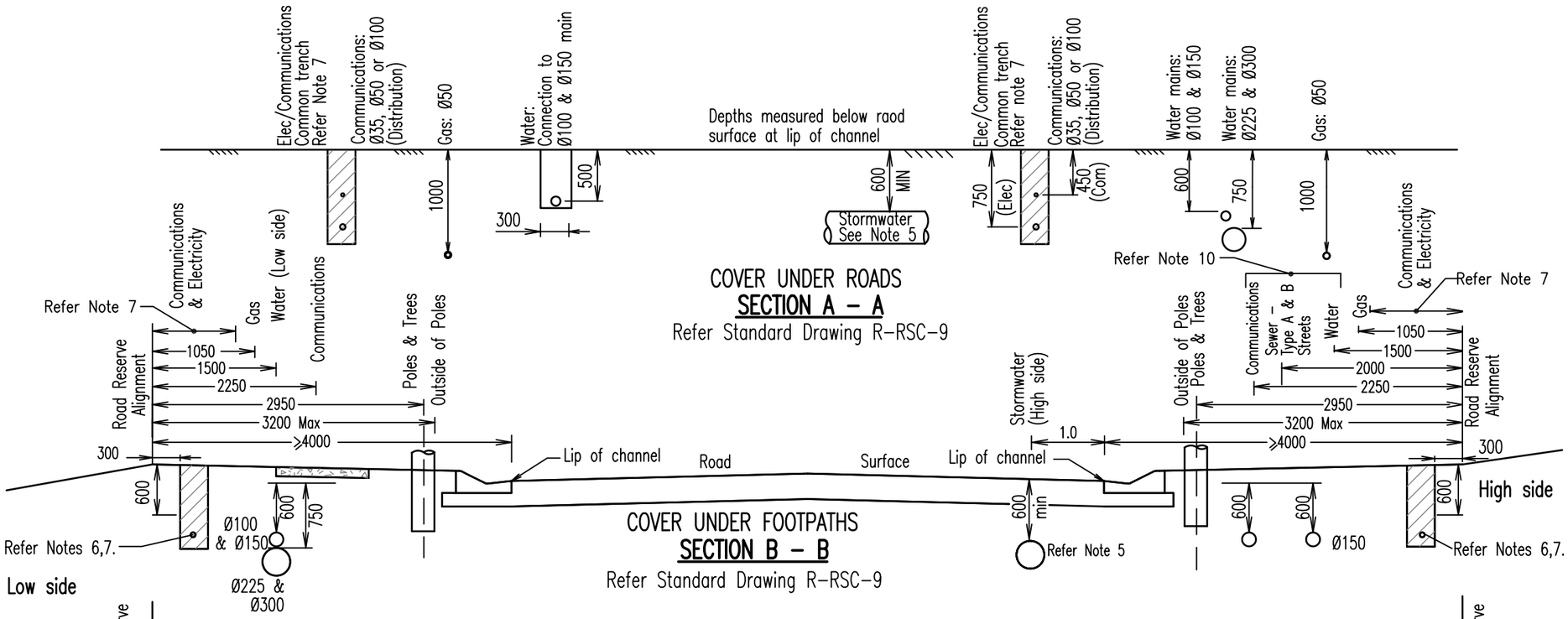
F

ROAD/STREET

Standard Drawing

R–RCC–6

A B C D E



NOTES

1. Electricity conduits adopted are Typically:
   Ø40 for street lighting
   Ø80 for LV, Ø100, 11kV
   Ø100/125 for HV, 33kV
2. Water conduit to be encased in lean mix concrete if less than 150mm cover below the bottom of box.
3. Non–corrosive metal indicator discs to be placed in kerb over all conduits.
4. All depths are from Lip of Channel
5. Stormwater main to be at sufficient depth to have a min. 150 clearance from other services. Stormwater main may also be located under Kerb & Channel when Catch Pits are used as Access Chambers.
6. Electricity distribution may be located alternatively on high side of street in lieu of low side,provided it remains within the 900 wide joint share Elec/Communications corridor.
7. Refer Energex standard drawings for alignment and for details of joint use trench with communications.
8. Alignment is subject to design. Street Lights, Poles shall generally be located 1400 behind lip of channel on verges exceeding 4m in width.
9. For Communication conduits,the following depths apply: Distribution Lines
   – 450mm on verge
   – 600mm under roads
   Main Lines
   – 600mm for verges & under roads
10. Sewer reticulation instead of Communications and Water is located on the verge on the high side of Type A and B streets (Road Reserve width 18 metres or less). The location is 1200 to 2000 in private property on all higher order roads.
11. All dimensions are in millimetres

F	UPDATED	3/10	
E	AMENDED	7/05	
D	AMENDED	11/03	
C	AMENDED	1/02	
B	AMENDED	1/99	
A	ORIGINAL ISSUE	1/98	
REVISIONS		DATE	APPROVED

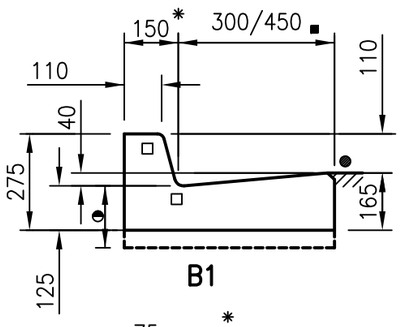
Redland CITY COUNCIL

PUBLIC UTILITIES IN ROAD RESERVES
TYPICAL SERVICE CONDUIT SECTIONS

F

ROAD/STREET
Standard Drawing
R–RCC–7

A | B | C | D | E



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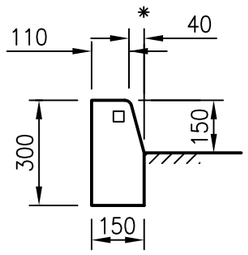
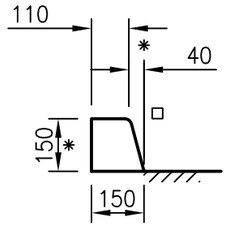


B2

*For Carparks where overhang is required can reduce to 100.



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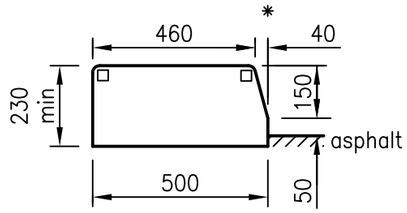

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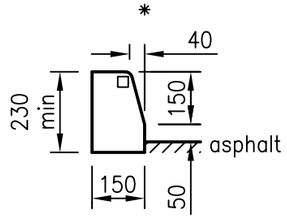
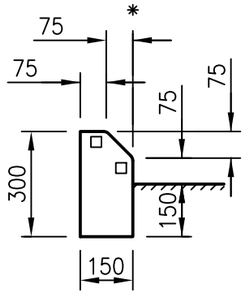


B7

BARRIER TYPE



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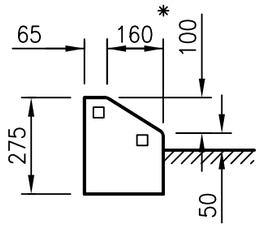
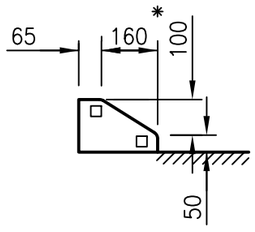


SM3



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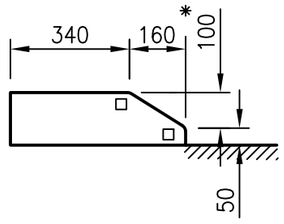
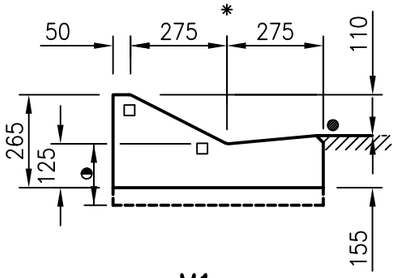


SM5

REFER TO PROJECT DRAWINGS FOR KERB SETOUT

SEMI – MOUNTABLE TYPE



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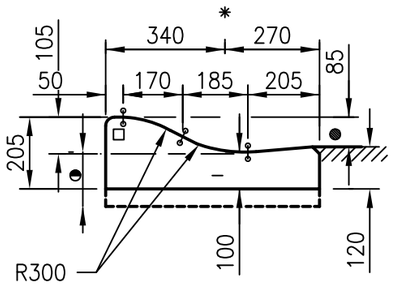

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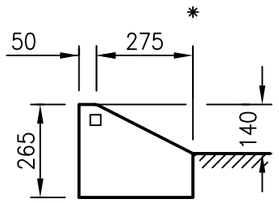
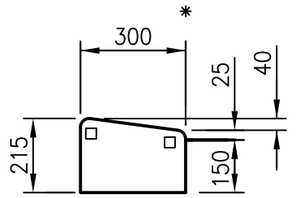
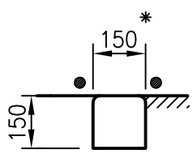


M4



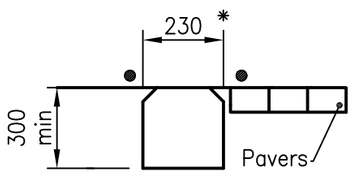
M6

MOUNTABLE TYPE



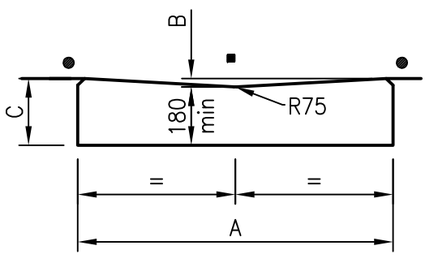
No vehicle loading

ER1



With vehicle loading

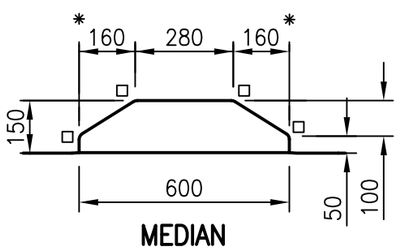
ER2



DIMENSION		
A	B	C
600	25	200 min
900	40	220 min

For wider channel's refer to project drawings

CHANNEL



MEDIAN

EDGE RESTRAINT

NOTES:

1. All materials and construction shall comply with AS 2876 except for dimensions on this drawing.
2. All concrete N32 min (refer project documentation) in accordance with AS 1379 and AS 3600 unless approved otherwise by relevant Council.
3. Control joints shall be 3 metre centres unless otherwise directed by relevant Council.
4. Expansion joints at 12 metre centres unless otherwise directed by relevant Council. Expansion joints, preformed jointing material of bituminous fibreboard or equivalent approved by relevant Council.
5. All dimensions are in millimetres unless shown otherwise.

LEGEND

- ✱ nominal kerb line.
- ■ Channel invert width, refer project drawings.
- ● R10 Radius.
- □ R20 Radius.
- ◓ 175 where specified for commercial and industrial applications, refer project drawings.

These drawings have been developed in consultation between the participating Councils.
BEFORE USE, the user shall confirm that the drawing has been adopted by the appropriate Council.

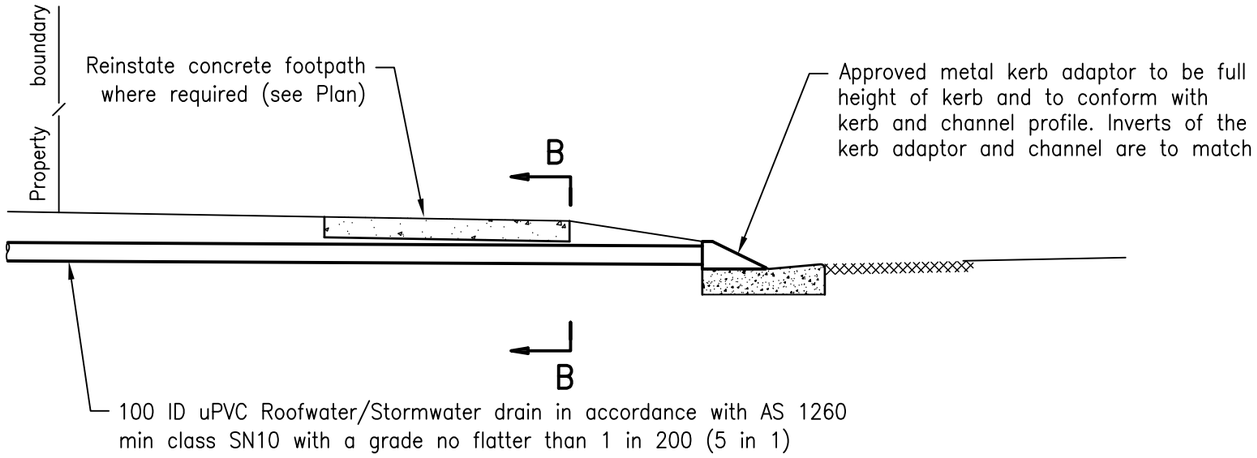
Rv.	DATE	REVISIONS
E	06/14	Review
D	06/11	Review
C	06/10	Review
B	06/09	Review
A	03/08	ORIGINAL ISSUE

INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

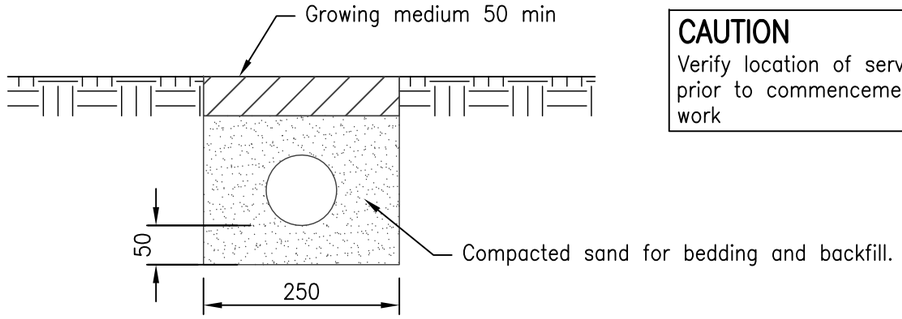
KERB AND CHANNEL
PROFILES AND DIMENSIONS
INCLUDING EDGE RESTRAINTS, MEDIAN & CHANNEL

RS–080

E D C B A Rv.

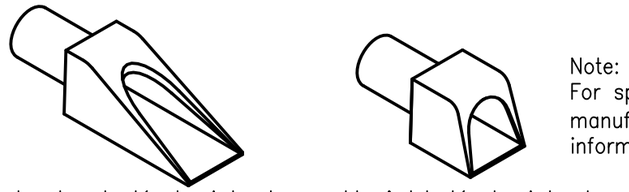


SECTION A–A



SECTION B–B

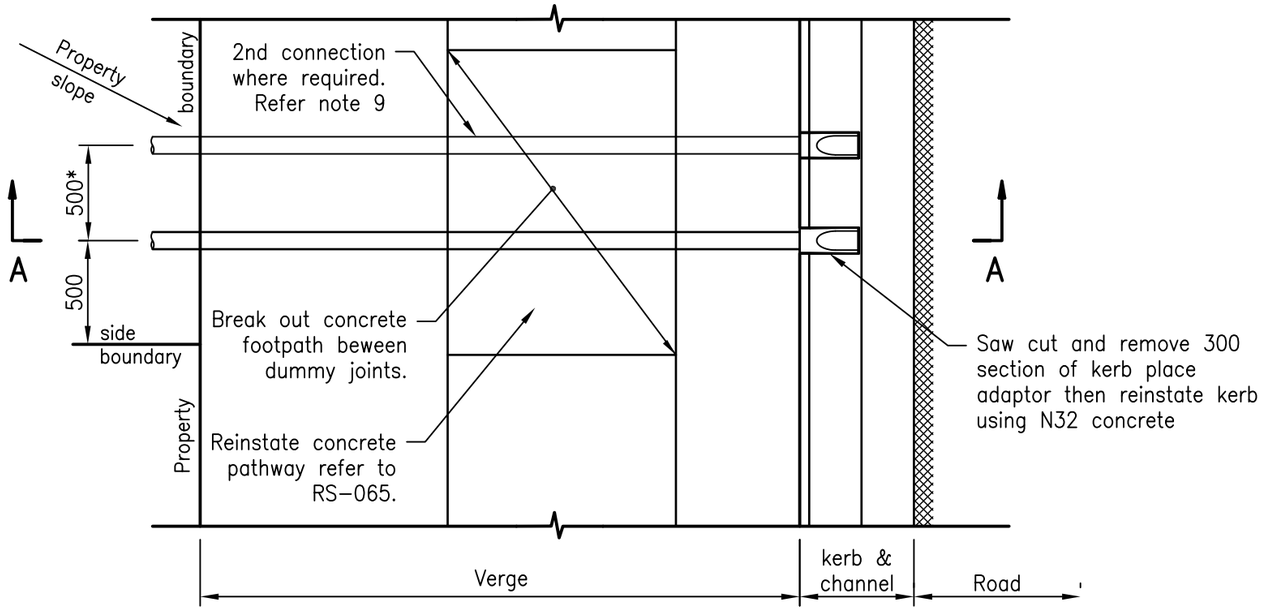
CAUTION
Verify location of services prior to commencement of work



Layback Kerb Adaptor Upright Kerb Adaptor

Note:
For specifications refer to manufacturer's product information.

TYPICAL FULL HEIGHT KERB ADAPTORS



*** Spacing may be reduced if approved by relevant Council**

PLAN

NOTES:

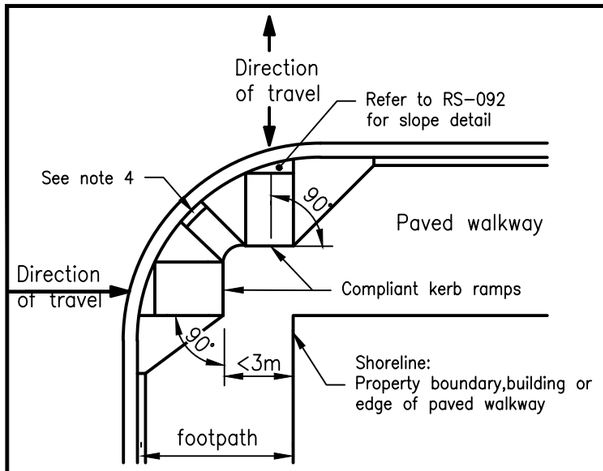
1. Kerb adaptors and other ancillary components within the verge are to be designed to cater for residential vehicle loadings and be approved by the relevant Council.
2. Roofwater/Stormwater drains are to transport only clean stormwater runoff from roofed or otherwise uncontaminated areas.
3. The requirements of AS 3500.3.1 Stormwater drainage – Performance requirements and the Queensland Building Code Regulations are to be met.
4. Roofwater/Stormwater drain outlets are not to be positioned within 5 metres of the upstream side of a catchpit (measured from the nearest catchpit component). Thus providing uncompromised capture efficiency of the catchpit. Outlets in this area are to discharge into the catchpit. The maximum discharge of stormwater drainage allowable to Council's kerb & channel street drainage system at any one location is 25 litres/second.
5. Council approval is required to connect to stormwater infrastructure such as manholes, catchpits and the like.
6. An alternative Roofwataer/Stormwater drain within the verge is two continual lengths of 125x75x3 hot dipped galvanised RHS at a grade no flatter than 1 in 200 and cut to finish flush with the kerb profile. All cut ends are to be cold galvanised and the kerb reinstated. Concrete cover to relevant Council approval.
7. Council's policy is that provision and maintenance of private Roofwater/Stormwater drains are the responsibility of the property owner. The property owner is also responsible for verge restoration to original conditions after construction.
8. Appropriate measures are to be taken to ensure work site safety during construction.
9. The minimum requirement for new allotments is the provision of two kerb adaptors plus piped drainage to the far edge of the concrete footpath where applicable.
10. All dimensions are in millimetres unless shown otherwise.

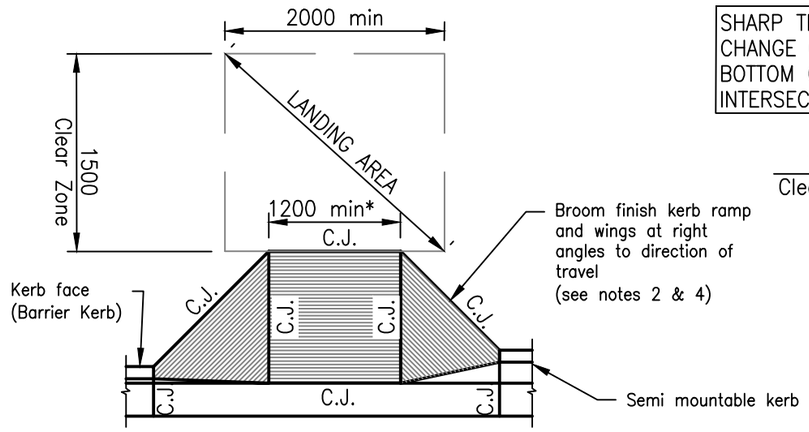
Rv.	DATE	REVISIONS
F	03/14	Amended Standard Drawings
E	12/11	Drawing number changed from SEQ R–081 to R–081
D	06/11	Review
C	06/10	Review
B	06/09	Review
G	06/14	Review
	03/08	ORIGINAL ISSUE

INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

KERB AND CHANNEL
RESIDENTIAL DRAINAGE CONNECTIONS

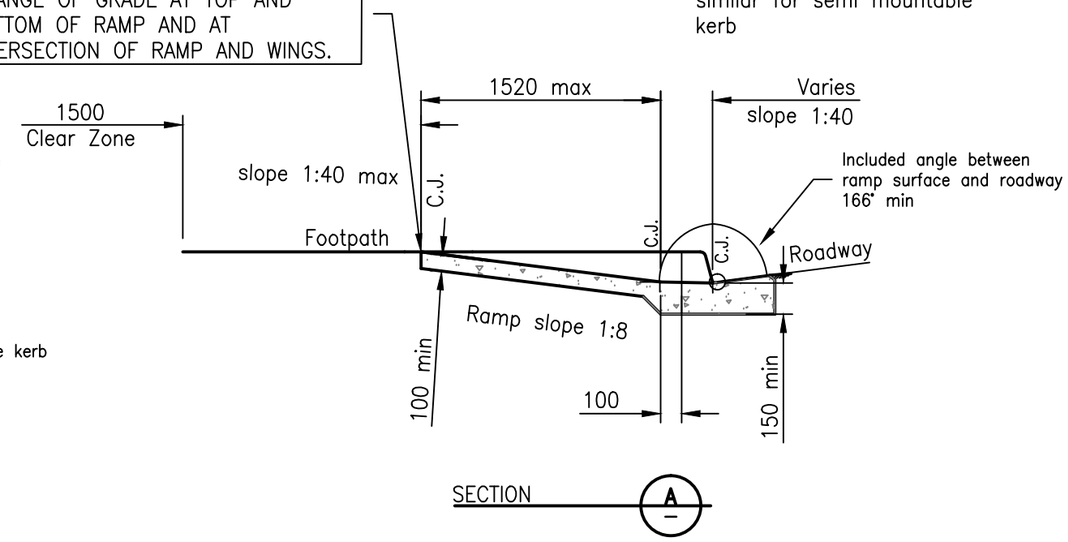
RS–081





SHARP TRANSITION (NO ROUNDING) AT CHANGE OF GRADE AT TOP AND BOTTOM OF RAMP AND AT INTERSECTION OF RAMP AND WINGS.

Barrier kerb shown. Details similar for semi mountable kerb

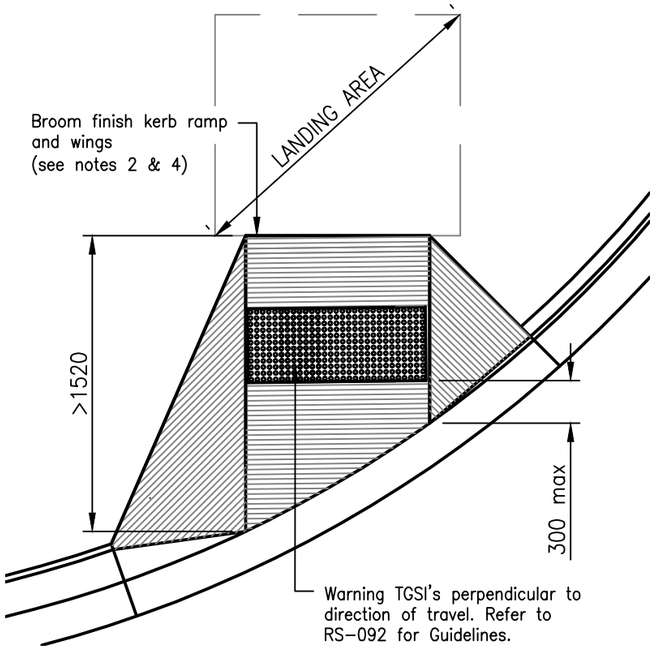


SECTION A

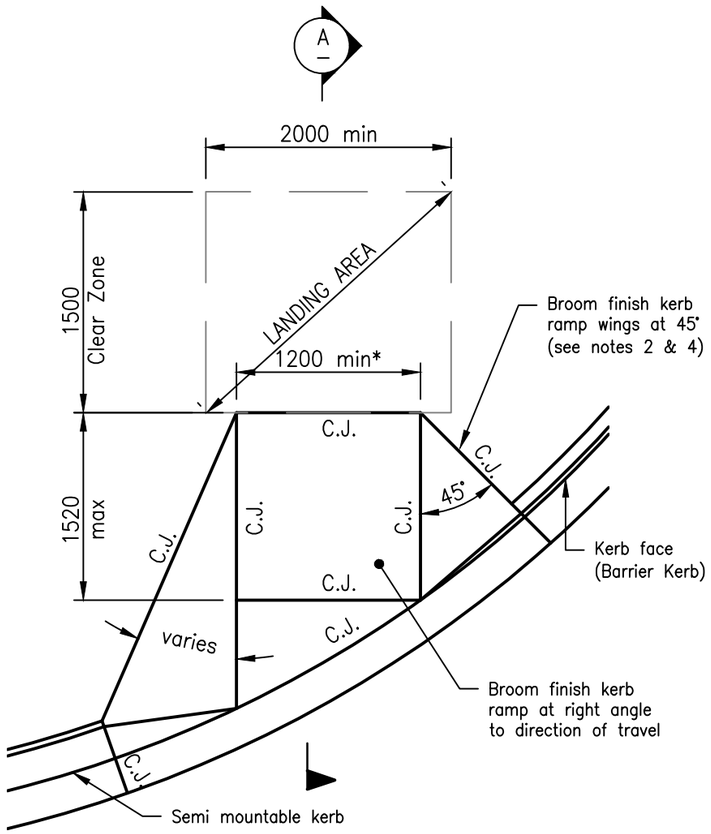
COMPLIANT KERB RAMP ALIGNMENT

COMPLIANT KERB RAMP ALIGNMENT

Refer drawing RS-092 for criteria where TGSI's are required.



NON-COMPLIANT KERB RAMP PLAN VIEW



COMPLIANT KERB RAMP PLAN VIEW

*Kerb ramp to be 1200 min wide or as specified on construction drawings.

NOTES:

A compliant kerb ramp exists where all the following are satisfied:

1. TOP OF RAMP: There shall be a minimum obstruction free wheelchair turnaround distance of 1500 beyond the top of the ramp. The sharp transition at the top and bottom of the ramp shall be perpendicular to the direction of travel. The top of ramp landing area shall have a minimum of 2000 long by 1500 wide clear zone.
2. RAMP: maximum ramp slope for wheelchair access shall be 1:8. A sharp transition (no rounding) is to be maintained at the intersection of graded plane surfaces (top & bottom of ramp and intersection of ramp and wings). The intersection of the ramp and wings should be a tooled joint.
3. RAMP ALIGNMENT: Ramps shall be aligned parallel to the pedestrian direction of travel. Ramps on both sides of a carriageway shall be aligned with one another and the direction of travel.
4. KERB RAMP WINGS: The required wing angle is 45°. Subject to the approval of the superintendent, wings may be angled at less than 45° if the wing is required to be clear of traffic signals hardware, other wings or utility pits/manholes. Wing angle may also be reduced at obtuse angled intersections. Wing widths shall be between 600 and 1500. A maximum slope of 1 on 4 is to be maintained on the wings at the kerb face (ie min 600 wide wing for a 150 kerb). At least a 1 metre kerb upstand is desirable between adjacent kerb ramps wings on an intersection corner.
5. SURFACE OF RAMP and sloping sides shall be slip resistant as specified in AS/NZS 1428.1.

General:

6. CONCRETE to be Class N32/10. All concrete to be broom finished. Ramp to be cast monolithically with the channel or tray.
7. All dimensions are in millimetres unless shown otherwise.

Australian Standards:

AS 2876 Concrete kerbs and channels (gutters) – Manually or Machine Placed
AS 1428.1 Design for access and mobility – Part 1 General requirements for access – New building work
AS/NZS 1428.4.1 Design for access and mobility – Part 4.1 Means to assist the orientation of people with vision impairment – Tactile Ground Surface Indicators

These drawings have been developed in consultation between the participating Councils.
BEFORE USE, the user shall confirm that the drawing has been adopted by the appropriate Council.

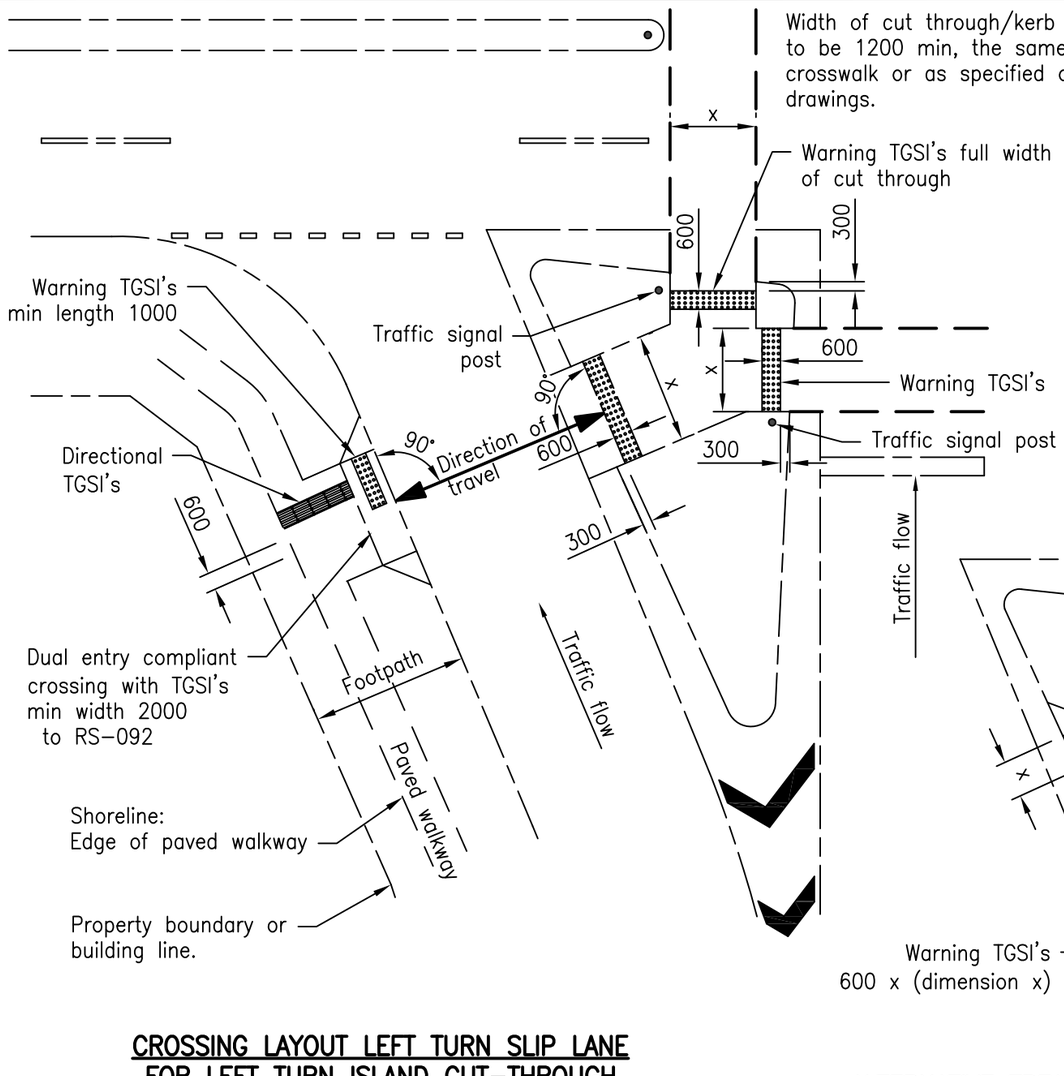
Rv.	DATE	REVISIONS
F	03/14	Amended Standard Drawings
E	12/11	Drawing number changed from SEQ R-090 to RS-090
D	06/11	Review
C	06/10	Review
B	06/09	Review
G	06/14	Review
	03/08	ORIGINAL ISSUE

INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

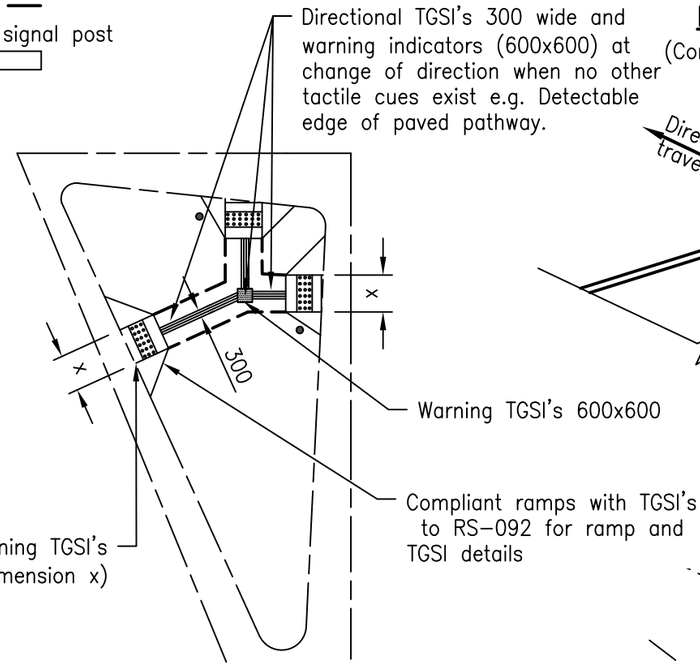
KERB RAMPS
RAMPED PEDESTRIAN CROSSINGS

RS-090

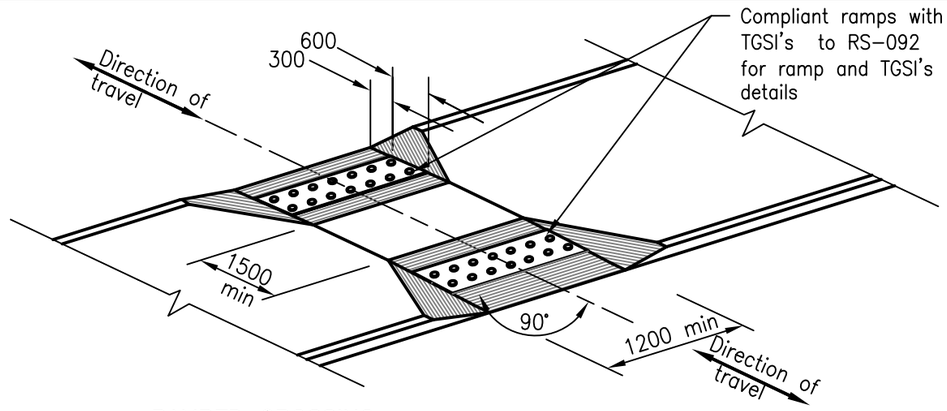
F E D C B G Rv.



CROSSING LAYOUT LEFT TURN SLIP LANE FOR LEFT TURN ISLAND CUT-THROUGH

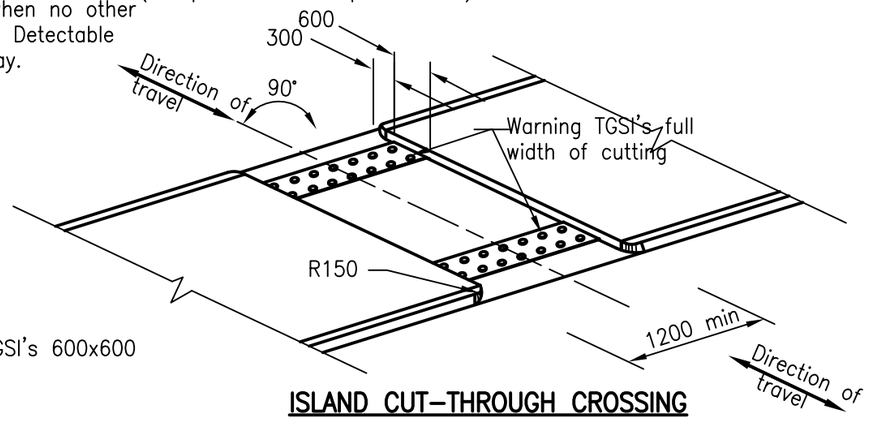


ALTERNATIVE TREATMENT ACROSS LEFT TURN ISLAND KERB RAMPS WITH DIRECTIONAL TGSI OR WALKWAY EDGE

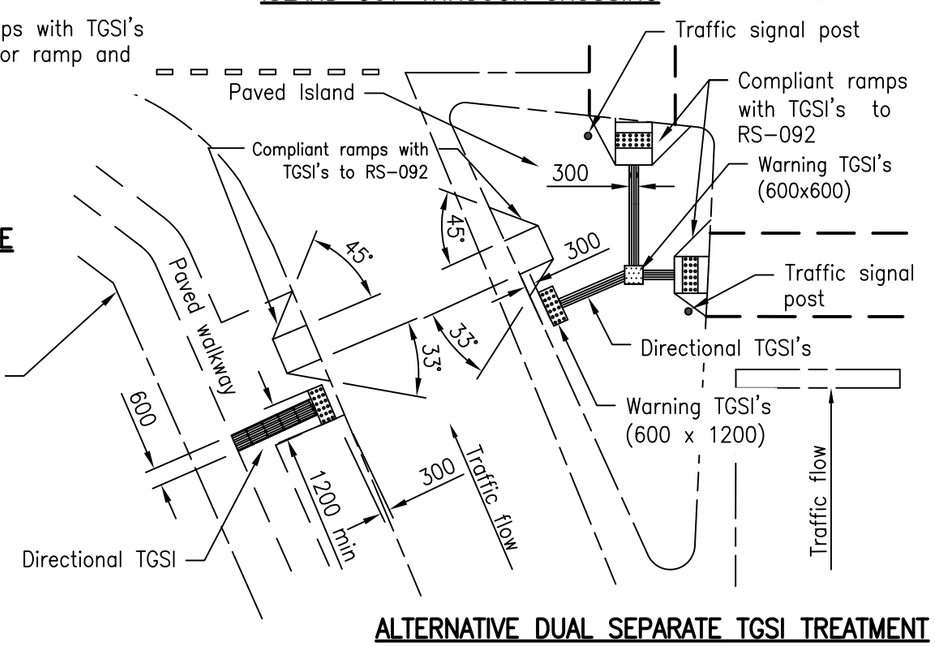


RAMPED CROSSING

(Compliant kerb ramps installed)



ISLAND CUT-THROUGH CROSSING



ALTERNATIVE DUAL SEPARATE TGSI TREATMENT ACROSS LEFT TURN SLIP LANE

NOTES:

1. Ramp details and notes as for Kerb Ramps to RS-090.
2. Tactile ground surface indicators (TGSI's) shall be in accordance with AS 1428.4.1.
3. Directional TGSI's to continue to the top of kerb ramp, unless edge of paved walkway provides consistent detectable cue for pedestrians with vision impairment.
4. Cut-through islands are to be constructed parallel to the direction of travel.
5. Installation of TGSI's on ramped kerb crossings to RS-092 & RS-093.
6. TGSI's to be provided at designated crossing points when new designs or modifications are being carried out to island or median cut throughs.
7. All dimensions are in millimetres unless shown otherwise.

REFERENCED DOCUMENTS:
Australian Standards:

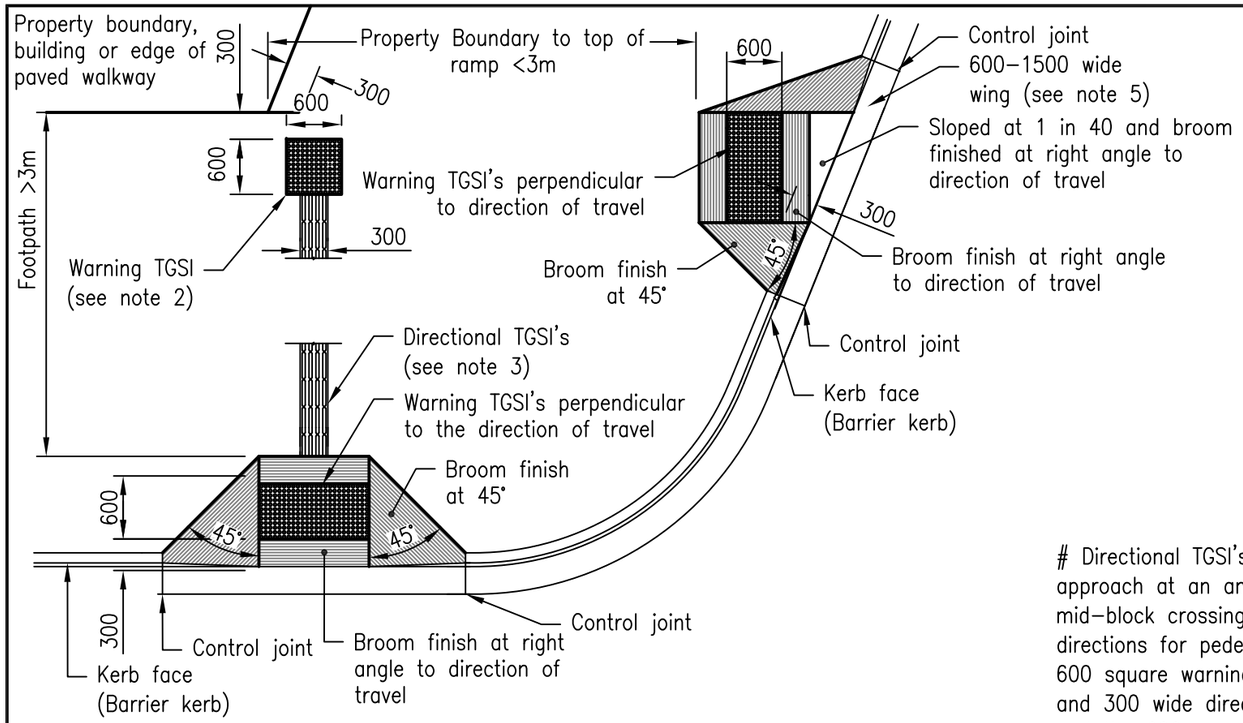
AS 2876 Concrete kerbs and channels (gutters) – Manually or Machine Placed
AS 1428.1 Design for access and mobility – Part 1 General requirements for access – New building work
AS/NZS 1428.4.1 Design for access and mobility – Part 4.1 Means to assist the orientation of people with vision impairment – Tactile Ground Surface Indicators

Rv.	DATE	REVISIONS
F	06/14	Review
E	12/11	Drawing number changed from SEQ R-091 to RS-091
D	06/11	Review
C	06/10	Review
B	06/09	Review
A	03/08	ORIGINAL ISSUE

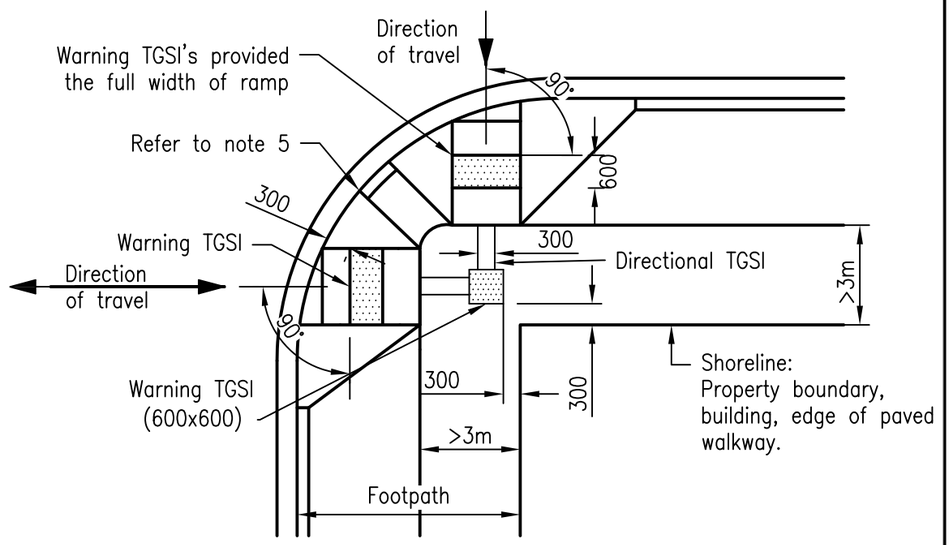
INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

KERB RAMPS
RAMPED AND CUT THROUGH TREATMENTS FOR PEDESTRIAN CROSSINGS SLIP LANES AND MEDIANS

RS-091



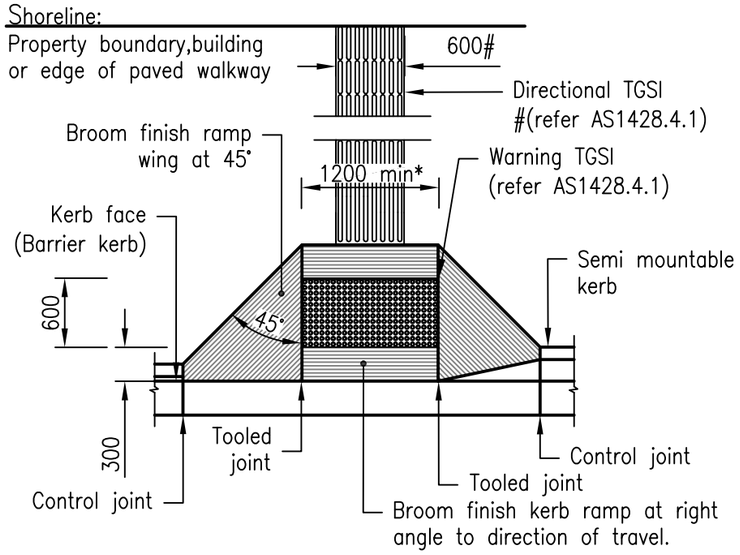
COMPLIANT KERB RAMPS AND TGSI's APPLICATION EXAMPLE PLAN VIEW



COMPLIANT KERB RAMP ALIGNMENT – incl. TGSI's

Directional TGSI's are 600 wide where pedestrians approach at an angle to the path of travel (eg at a mid–block crossing point). If there is a choice of directions for pedestrians (eg on intersection corner) install 600 square warning TGSI's pad 300 from the shore line/s and 300 wide directional TGSI's between top of kerb ramp and the 600 square warning TGSI's pad.

*Kerb ramp to be 1200 min wide or as specified on construction drawings.



COMPLIANT MID BLOCK KERB RAMP incl. TGSI's

GUIDELINES

For the installation of Tactile Ground Surface Indicators (TGSI) for pedestrians with a vision impairment at ramped kerb crossings (kerb ramps):

A. Warning and directional TGSI's shall conform with AS/NZS 1428.4.1 Design for Access and Mobility – Part 4: Tactile Indicators.

B. Tactile indicators shall have luminance contrast in all conditions (eg wet/dry, day/night). Tactile indicators and their base shall be slip resistant. Refer AS/NZS 1428.4.1 for luminance contrast and slip resistance requirements.

C. Warning TGSI's shall be installed (dimensions in brackets are warning TGSI dimensions):
   a) to warn pedestrians with a vision impairment of hazards.
   b) 300 from any hazard e.g. roadway (600 deep x full width of kerb ramp, path of travel or cut through median/island)
   c) perpendicular to the direction of travel.
   d) at the intersection of 2 (or more) directional indicator strips to indicate a change of direction (600 x 600).
   e) When kerb ramp gradient is shallower than 1:8.5.

D. Directional TGSI's shall be installed (dimensions in brackets are directional TGSI dimensions):
   a) to give directional guidance to pedestrians with a vision impairment in the absence of normally available cues.
   b) along the centreline of the direction of travel.
   d) at mid–block kerb ramps or street crossings to direct pedestrians with a vision impairment to the crossing point (600 x property boundary to top of kerb ramp).
   e) between a warning indicator pad indicating a choice of directions and the top of kerb ramps where 2 pedestrian crossings exist on a corner of an intersection.

E. The installation of TGSI should be prioritised as follows:
   a) NO TGSI's REQUIRED when all criteria at Note G are satisfied;
   b) Multiple entry kerb ramp treatment installed (Dual entry or Dual separate). Multiple entry kerb ramps must only be installed when there is sufficient space on both sides of the crossing (see AS/NZS 1428.4.1 for details of multiple entry treatments);
   c) Warning TGSI on the face of a compliant kerb ramp.

F. If a warning TGSI treatment is installed, a warning TGSI treatment must be installed on the other side of the crossing.

G. TGSI's are not required at a crossing point if:
   a) a compliant kerb ramp is installed refer to RS–090.
   b) the top of ramp is within 3 metres of the end of the shore line (property boundary, building line or edge of paved walkway), and
   c) the ramp is in direct continuous accessible path of travel from the shore line (property line, building line or paved walkway) orientated in terms of normally available cues.
   In these situations, a colour treatment of the full width and length of the face of the ramp may assist pedestrians with a vision impairment.

H. Examples of normally available cues that aid people with a vision impairment are:
   a) sharp transitions in grade between surfaces eg top and bottom of a 1 on 8 kerb ramp; change in grade between ramp and ramp wings.
   b) audio tactile push buttons, refer MUTCD Parts 10 and 14 for location and orientation of pedestrian push buttons. Note, an audio tactile push button alone is an insufficient cue for a pedestrian with a vision impairment to find the crossing point.
   c) a detectable edge of a paved walkway or cut through island.

NOTES:

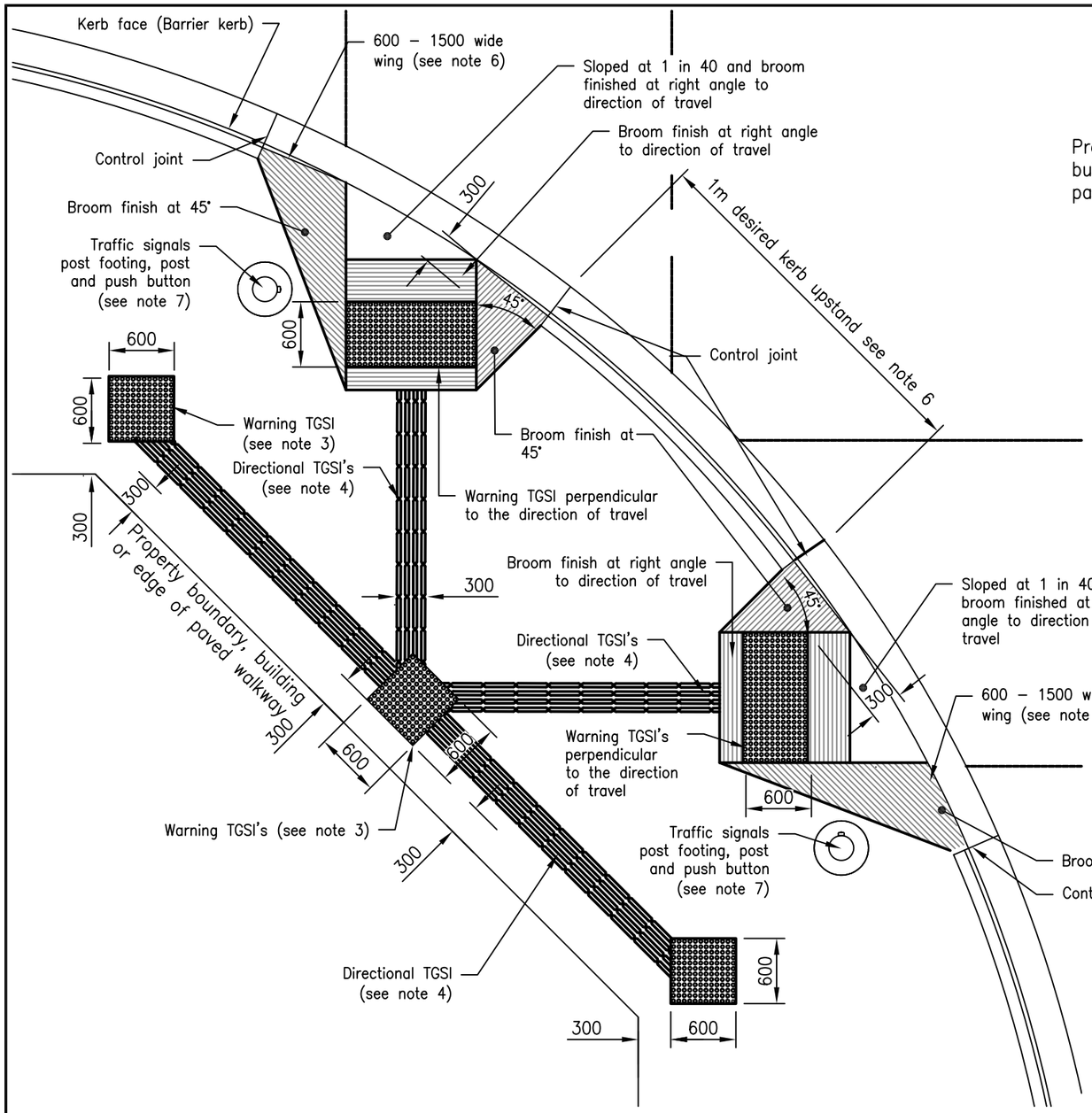
1. For details of compliant kerb ramps refer to RS–090 and RS–091.
2. Warning indicators required adjacent to shoreline (property boundary) to indicate change/choice of direction.
3. Directional indicators are required from the warning indicator pad to the top of the kerb ramps.
4. Warning indicators are required on the kerb ramp to warn of the hazard (the road/traffic). Can be omitted if kerb ramp is in accordance with AS 1428.1 & < 3 metres from the building line.
5. Kerb ramp wings may be angled at less than 45° if required to be clear of signals hardware, other kerb ramps or utility pits/manholes. Kerb ramp wings may also be reduced at obtuse angled intersections, wings shall have a width between 600mm and 1500mm. A maximum of 1:4 slope on kerb ramp wings should be maintained (600mm wide wing for a 150mm kerb). A 1m kerb upstand is desirable between adjacent ramp wings (which may necessitate reduced wing angles).
6. All Dimensions are in millimetres unless shown otherwise

Rv.	DATE	REVISIONS
F	06/14	Review
E	03/14	Amended Drawing Number
D	12/11	Drawing number changed from SEQ R–092 to RS–092.
C	06/11	Review
B	06/10	Review
G	02/16	Amendment to Guideline B

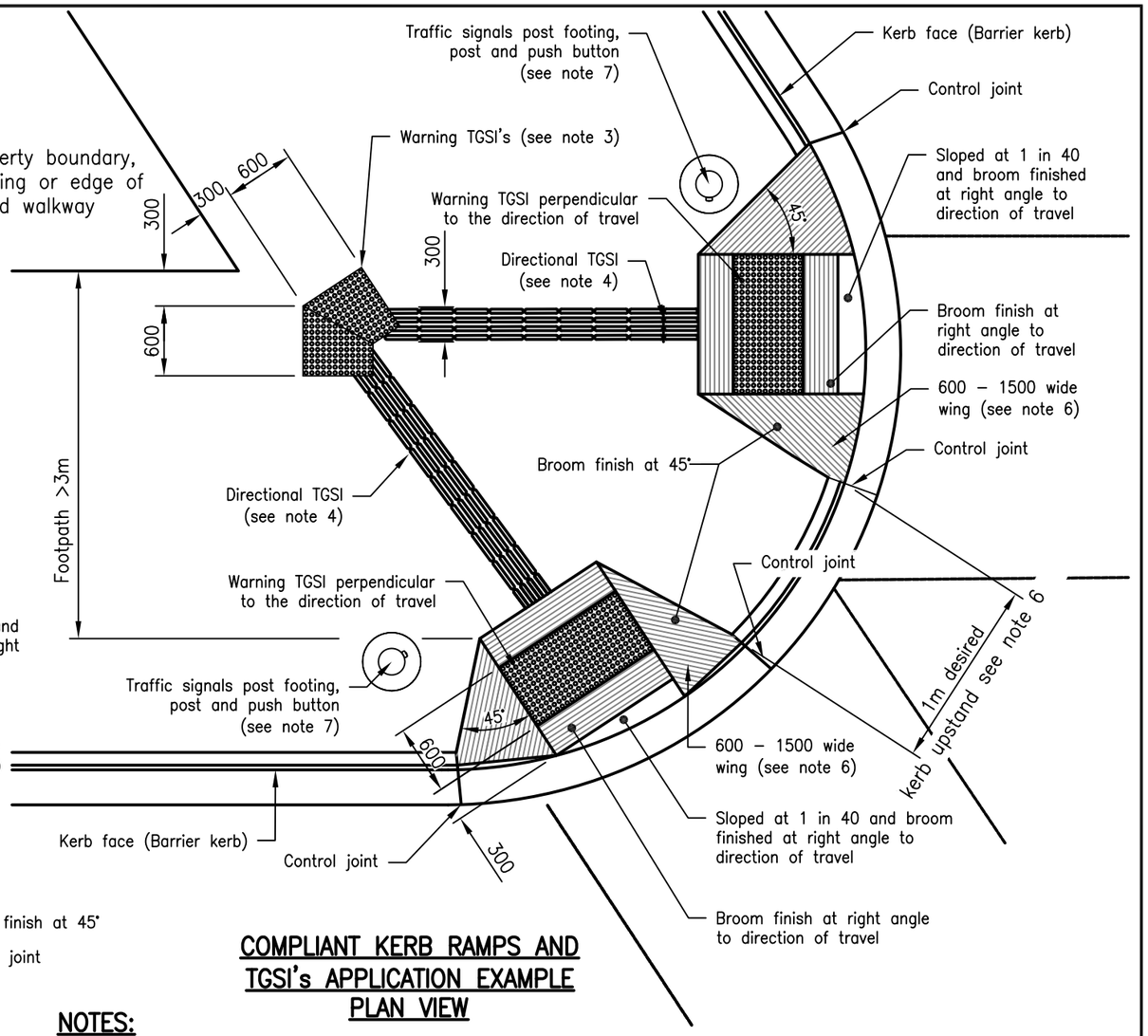
INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

KERB RAMPS
INSTALLATION OF TGSI's
ON RAMPED KERB CROSSINGS

RS–092



COMPLIANT KERB RAMPS AND TGSI's APPLICATION EXAMPLE PLAN VIEW



COMPLIANT KERB RAMPS AND TGSI's APPLICATION EXAMPLE PLAN VIEW

NOTES:

1. For details of compliant kerb ramps refer to RS–090.
2. For details of warning and directional TGSI's, refer to AS 1428.4.1
3. Warning indicators required adjacent to property boundary to indicate change of direction.
4. Directional indicators are required from the warning indicator pad to the top of the kerb ramps.
5. Warning indicators are required on the kerb ramp to warn of the hazard (the road/traffic)
6. Kerb ramp wings may be angled at less than 45° if required to be clear of signals hardware, other kerb ramps or utility pits/manholes. Kerb ramp wings may also be reduced at obtuse angled intersections, wings shall have a width between 600mm and 1500mm. A maximum of 1:4 slope on kerb ramp wings should be maintained (600mm wide wing for a 150mm kerb). A 1m kerb upstand is desirable between adjacent ramp wings (which may necessitate reduced wing angles).
7. For location of traffic signal posts and location and orientation of pedestrian push button assemblies refer to MUTCD Part 14. The push button post should be located on a level surface and the push button assembly located within the zone of common reach. Refer to AS 1428.2 i.e. button to be no more than 400mm outside the edge of a pathway or kerb ramp.
8. All dimensions are in millimetres unless shown otherwise.

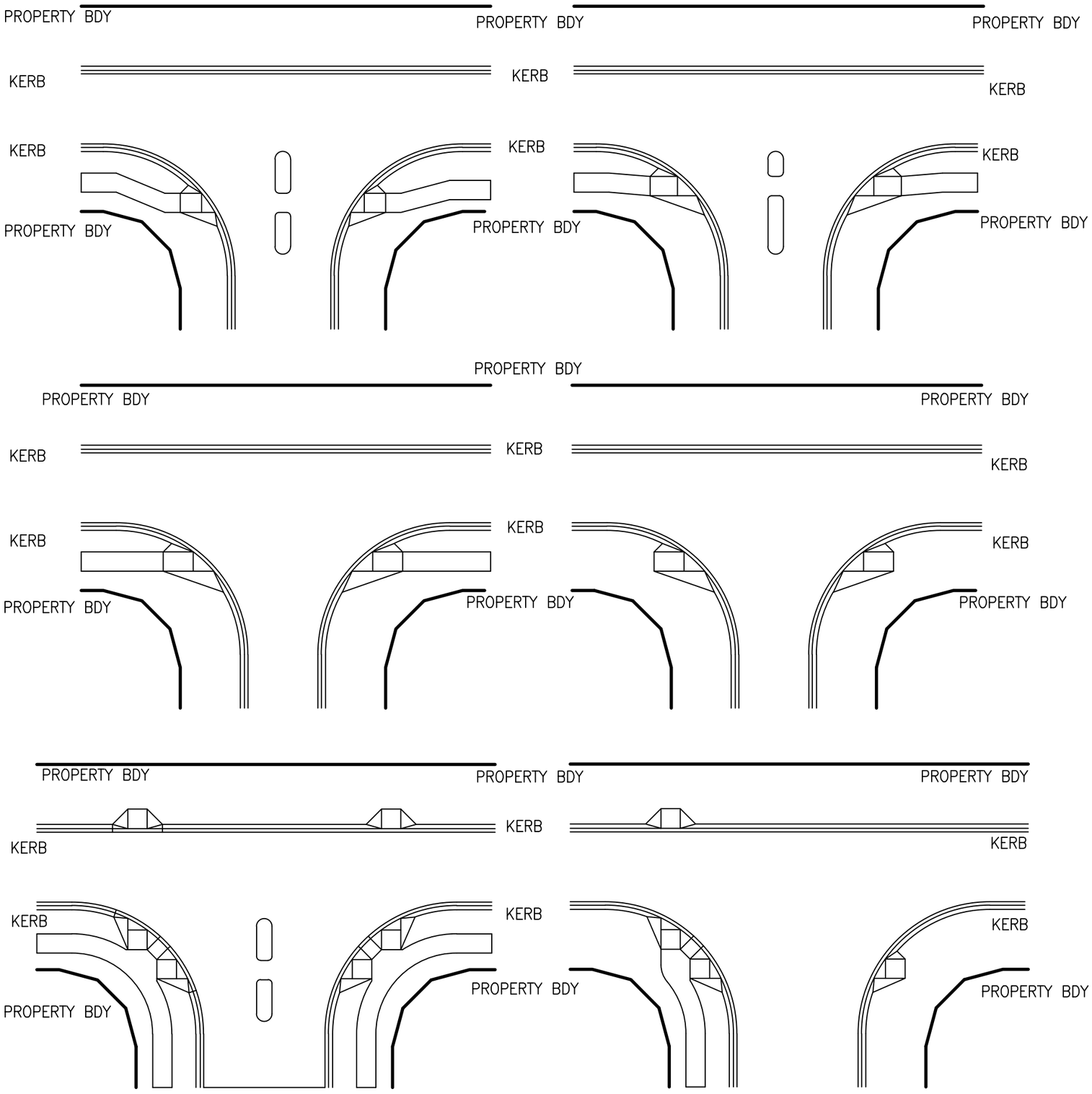
Rv.	DATE	REVISIONS
E	06/14	Review
D	03/14	Amended Drawing Number
C	12/11	Drawing number changed from SEQ R–093 to R–093.
B	06/10	Review
A	06/09	ORIGINAL ISSUE

INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

KERB RAMPS
INSTALLATION OF TGSI's ON RAMPED KERB CROSSINGS
APPLICATION EXAMPLES

RS–093

Rv. E D C B A



KERB RAMPS MUST ALWAYS ALIGN WITH THE OPPOSITE KERB RAMP & MEDIAN/ISLAND CUT THROUGHS

NOTES:

1. For details of compliant kerb ramps refer to RS–090.
2. For details of warning and directional TGSI's, refer to AS1428.4.1.
3. All dimensions are in millimetres unless shown otherwise.

These drawings have been developed in consultation between the participating Councils.
BEFORE USE, the user shall confirm that the drawing has been adopted by the appropriate Council.

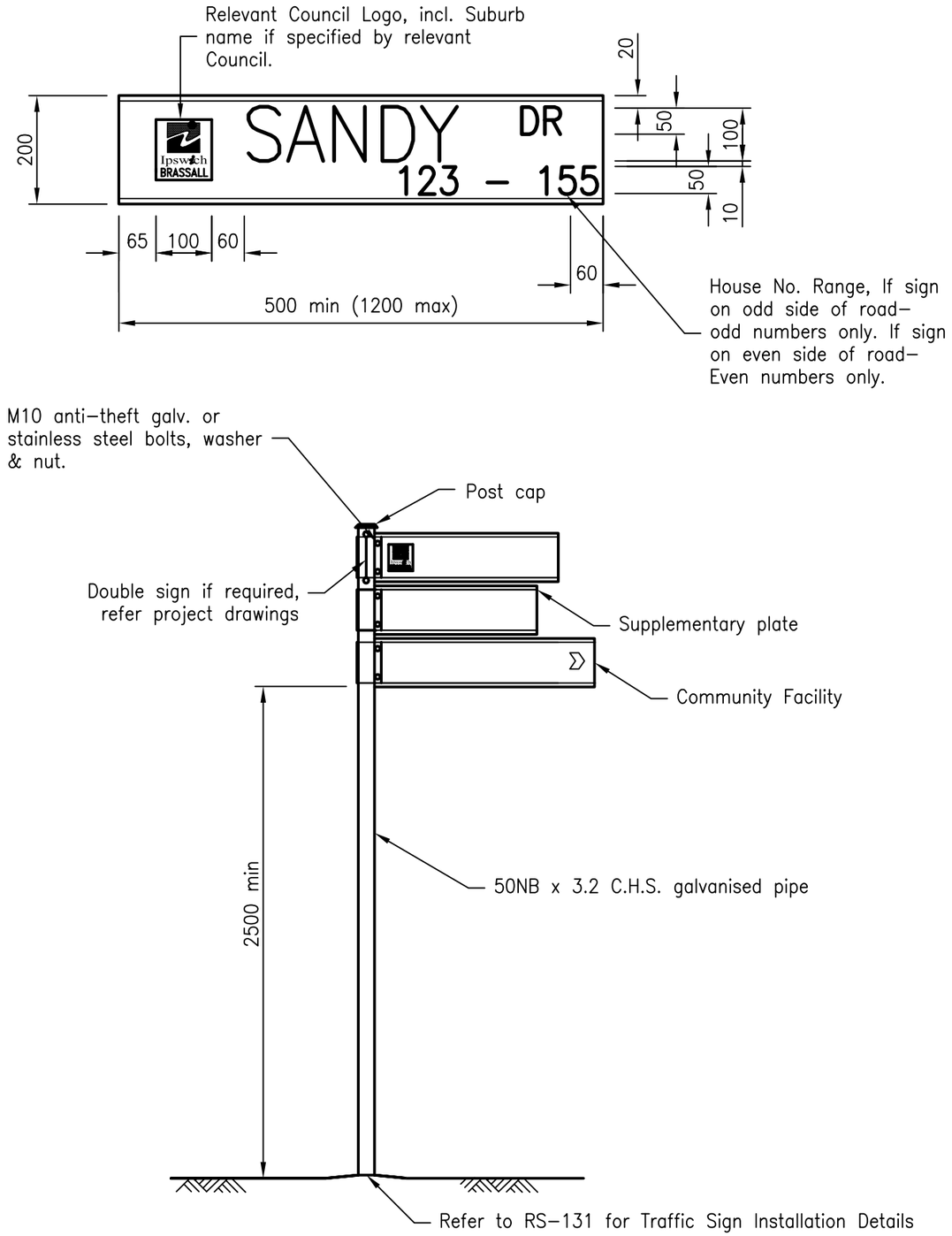
Rv.	DATE	REVISIONS
F	06/14	Review
E	05/14	Amended Drawing Layers & Text Style
D	03/14	Amended Drawing Number
C	12/11	Drawing number changed from SEQ R–094 to R–094
B	06/10	Review
A	06/09	ORIGINAL ISSUE

INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

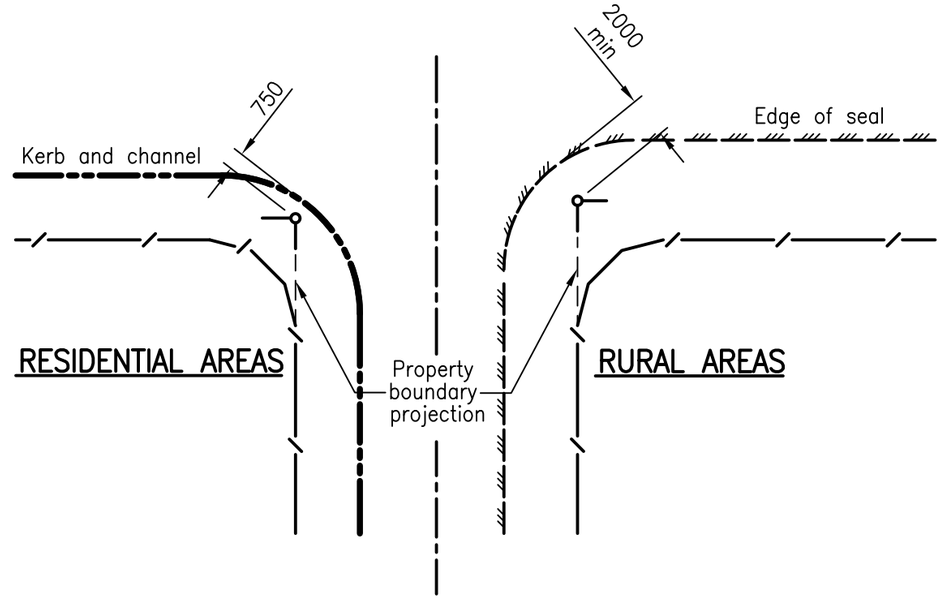
KERB RAMPS
LOCATIONS AND CONFIGURATIONS

RS–094

Rv. F E D C B A



ELEVATION



STREET NAME SIGN LOCATIONS

NOTES:

1. Street names must be approved by relevant Council.
2. Name plates: 200 mm wide x 3 mm thick extruded aluminium or polypropylene section with top and bottom edge thickening.
3. Colour: The recommended colour for street name signs is a black legend on a Class 1 retro–reflective white background in accordance with AS 1742.5.
4. Bracket: Proprietary bracket to suit standard name plate (including 2 x M10 x 25mm anti–theft cadmium or stainless steel bolts nuts and washers). Locking nut to be utilised if specified by relevant Council.
5. Lettering & Numerals : Letters: 100 mm high, Series D, (narrower lettering is permissible in accordance with the MUTCD). Numerals: 50 mm high, Series D. All text to AS 1744.
6. Supplementary Plates to be in accordance with the MUTCD.
7. Community Facility Plates: A desirable maximum of two and an absolute maximum of three facilities to be signposted at any one location in accordance with the MUTCD.
8. All signs are to be approved by relevant Council prior to erection.
9. Refer to RS–131 for Traffic Sign Installation Detail.
10. All dimensions are in millimetres unless shown otherwise.

Rv.	DATE	REVISIONS
E	06/14	Review
D	03/14	Amended Drawing Number
C	12/11	Amended to MUTCD and number changed SEQ R–130 to RS–130
B	06/11	Review
A	11/09	ORIGINAL ISSUE

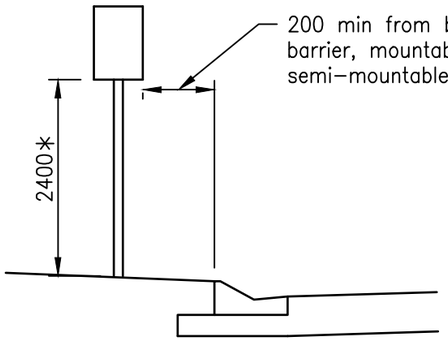
INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

ROAD FURNITURE
STREET NAME SIGN AND LOCATION (FINGER BOARD)

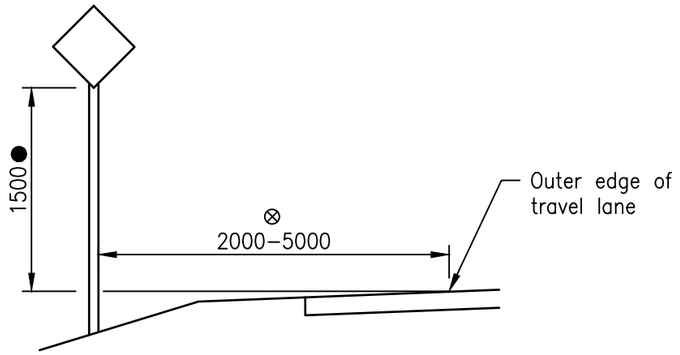
RS–130

E D C B A Rv.

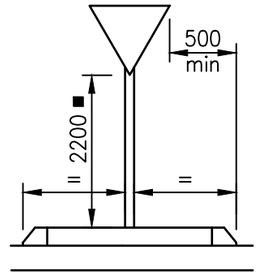
CAUTION
Confirm existence of services prior to installation of sign



RESIDENTIAL AREAS

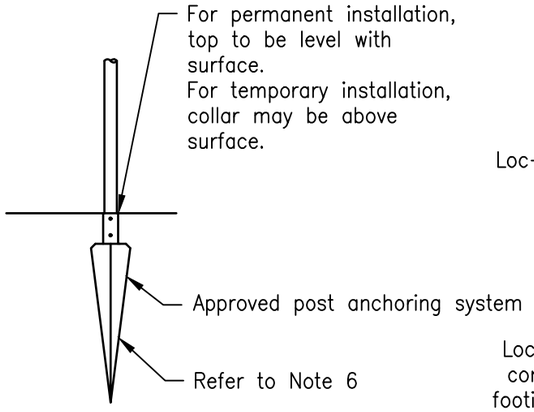


RURAL ROADS

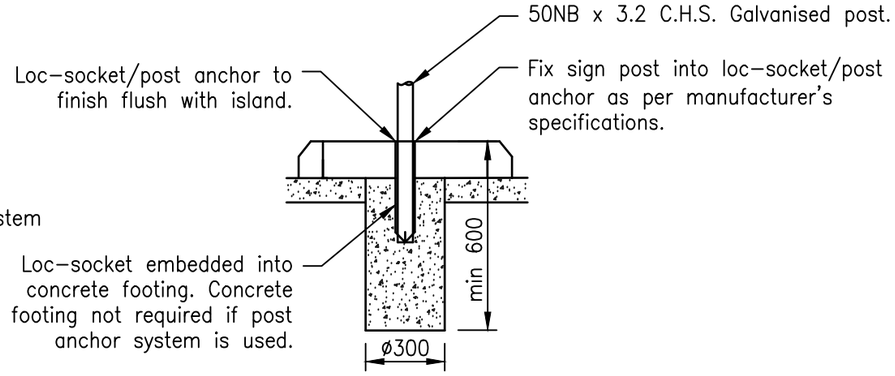


MEDIANS

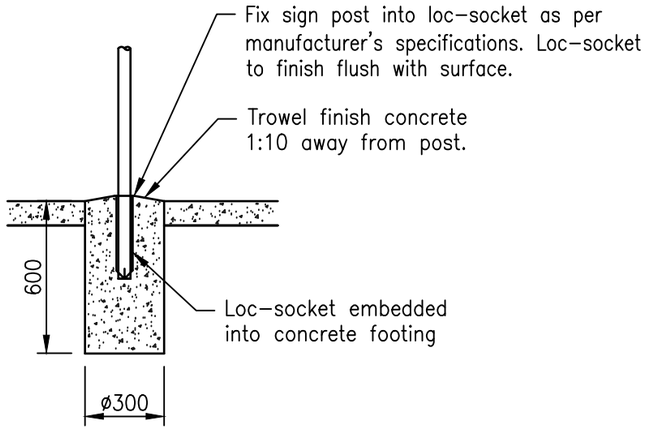
LOCATION OF SIGNS



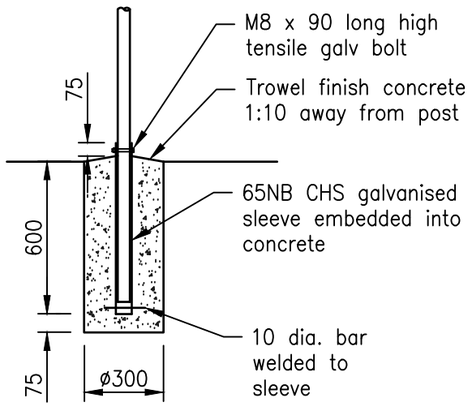
TYPICAL POST ANCHOR



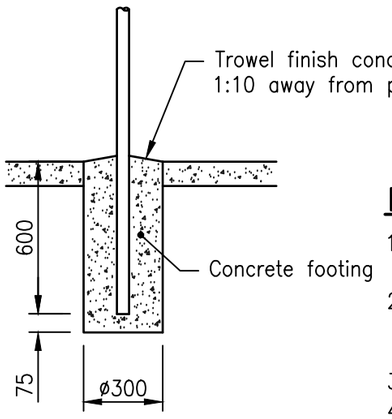
MEDIANS



LOC–SOCKET (OR SIMILAR)



TYPICAL SLEEVE



CONCRETE FOOTING

These drawings have been developed in consultation between the participating Councils.
BEFORE USE, the user shall confirm that the drawing has been adopted by the appropriate Council.

LEGEND

✳ When sign overhangs a pathway, dimension to be 2500.

● Parking and Guide signs to be 2200 above road surface.

■ Some signs (Keep Left, No–U Turn, D4 Hazard series) to be mounted at 525. Height can be adjusted if there is a visibility problem.

⊗ At least 600 clearance to be provided to outer edge of shoulder, line of guide posts or guardrail.

NOTES:

1. All signs are to be approved by relevant Council prior to erection.
2. Signs to be positioned on the side of street/road that provides best visibility. Underground services are to be located prior to installation.
3. Concrete N20 in accordance with AS 1379 and AS 3600.
4. Bars ø10, Grade 250 to AS 1302.
5. Refer to MUTCD for sign locations.
6. Relevant Council approved post anchoring system to be installed to comply with manufacturer's specifications. Other post mounting systems may be used if approved by relevant Council.
7. All dimensions are in millimetres unless shown otherwise.

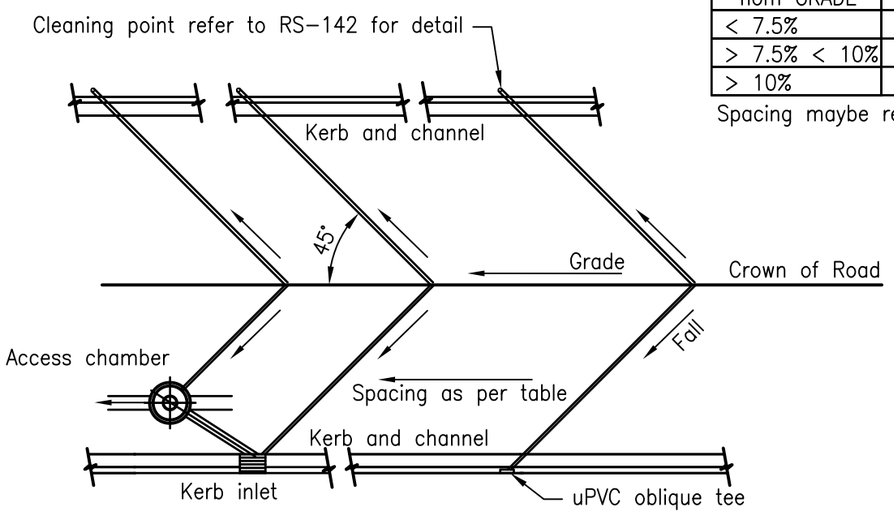
Rv.	DATE	REVISIONS
E	06/16	Review
D	06/14	Review
D	03/14	Amended Drawing Number
C	12/11	Drawing number changed from SEQ R–131 to RS–131
B	06/11	Review Issue
A	11/09	ORIGINAL ISSUE

INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

ROAD FURNITURE
TRAFFIC SIGN INSTALLATION DETAILS

RS–131

E D C B A Rv.

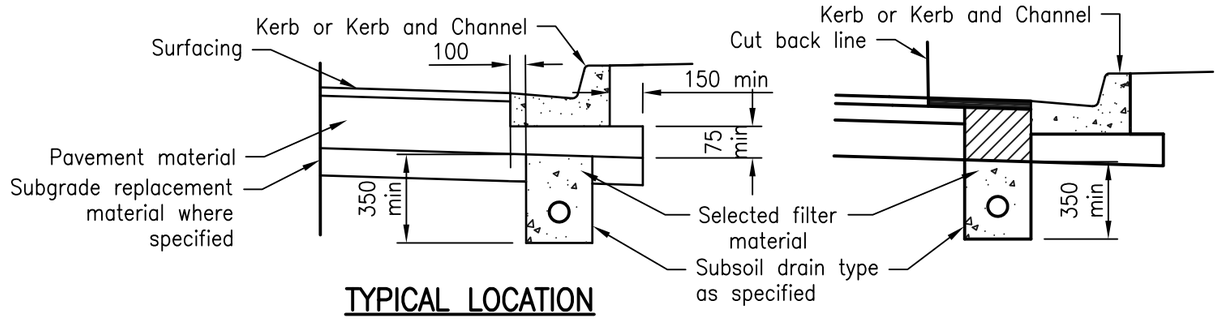


MITRE DRAIN SPACING

nom GRADE	SPACING
< 7.5%	40m centres
> 7.5% < 10%	30m centres
> 10%	20m centres

Spacing maybe reduced if required

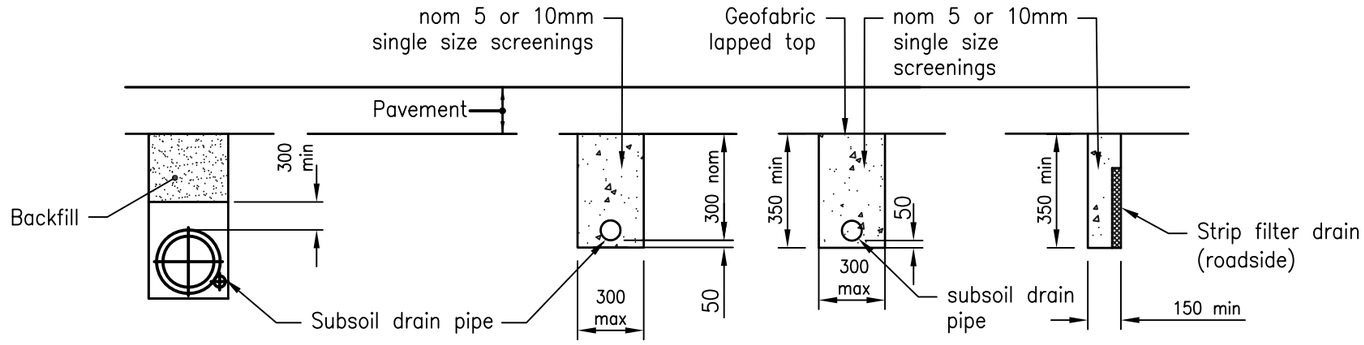
TYPICAL MITRE DRAIN LOCATIONS



TYPICAL LOCATION NEW CONSTRUCTION

ALTERNATIVE LOCATION TO BE APPROVED BY RELEVANT COUNCIL

TYPICAL LOCATION WITH EXISTING K&C



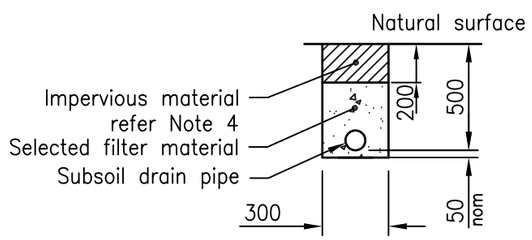
STORMWATER DRAINAGE TRENCHES WITH SUBSOIL DRAINAGE

TYPE A/B TYPE B/C TYPE B/D

A.S. SIEVE SIZE	5mm nom size % BY WT. PASSING	10mm nom size % BY WT. PASSING
13.20 mm	–	100
9.50 mm	–	85 – 100
6.70 mm	100	–
4.75 mm	85 – 100	0 – 20
2.36 mm	0 – 40	0 – 5
75 μm	0 – 2	0 – 2

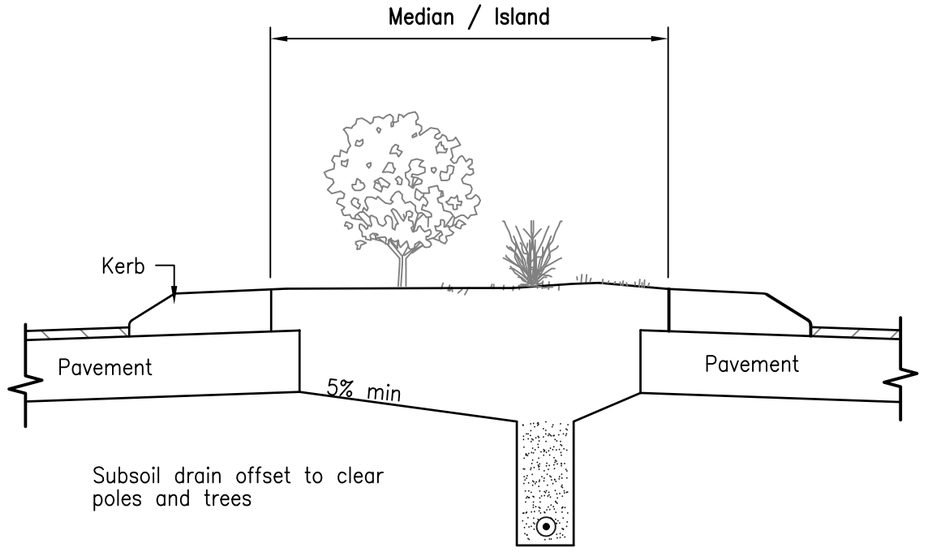
FILTER MATERIAL GRADING

Unless otherwise specified



TYPE E

STANDARD SUBSOIL DRAIN



ALTERNATIVE LOCATION LANDSCAPE MEDIAN

NOTES:

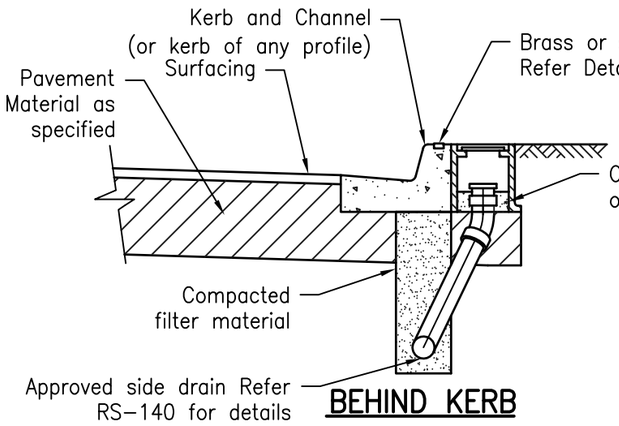
1. All subsoil drains to be Class 1000 polyethylene corrugated slotted pipe to AS 2439.1. Drains shall outlet at drainage pit, preferably or stormwater pipe 200 above invert min grade 0.5%, unless approved otherwise. Other pipes and fittings to be uPVC to AS 1254.
2. Filter materials not complying with the specified grading requirements may be used when approved by the relevant Council. A geofabric may be used to line trenches where approved by the relevant Council.
3. Refer to RS–142 for subsoil drainage access point details.
4. Impervious material to be provided where subsoil drainage is not under a pavement. When impervious material is omitted the backfill/selected filter material shall extend to underside of pavement.
5. All dimensions are in millimetres unless shown otherwise.

Rv.	DATE	REVISIONS
F	03/14	Amended Drawing Number
E	12/11	Drawing number changed from SEQ R–140 to RS–140
D	06/11	Review
C	06/10	Review
B	06/09	Review
G	06/14	Review

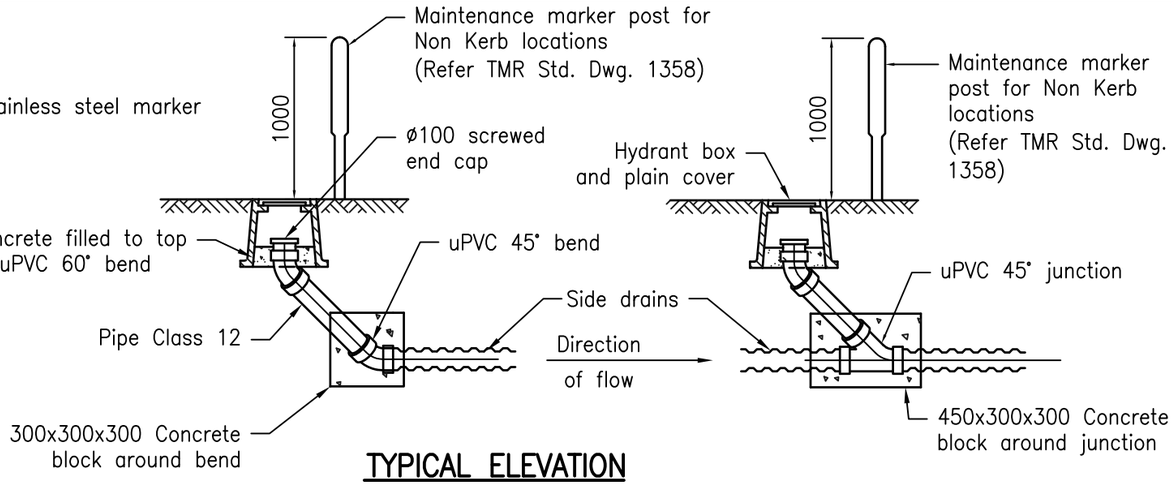
INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

SUBSOIL DRAINS DETAILS AND LOCATIONS

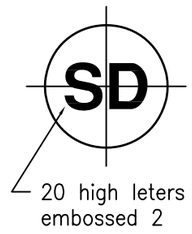
RS–140



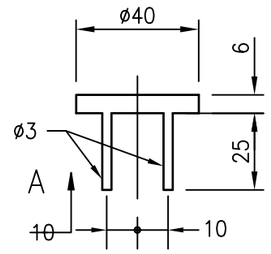
BEHIND KERB



TYPICAL ELEVATION



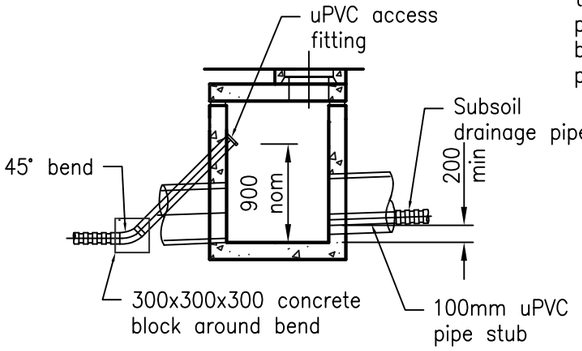
PLAN



SECTION

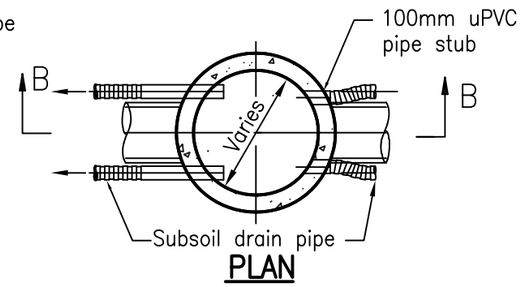
Approved propriety stainless steel markers also permitted

BRASS MARKER DETAIL



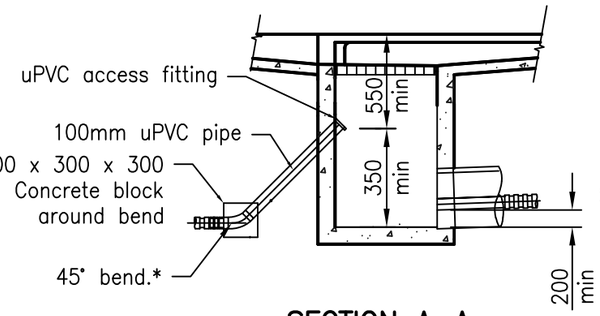
SECTION B–B

* Bend may be omitted where there is insufficient depth to the side drain trench. A min fall of 100mm is to be provided in the connection pipe between the cap and the side drain pipe

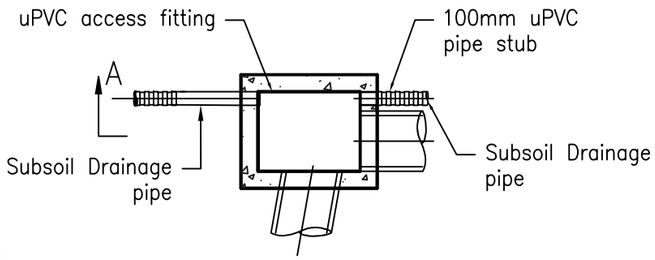


PLAN

CONNECTION DETAIL – ACCESS CHAMBER

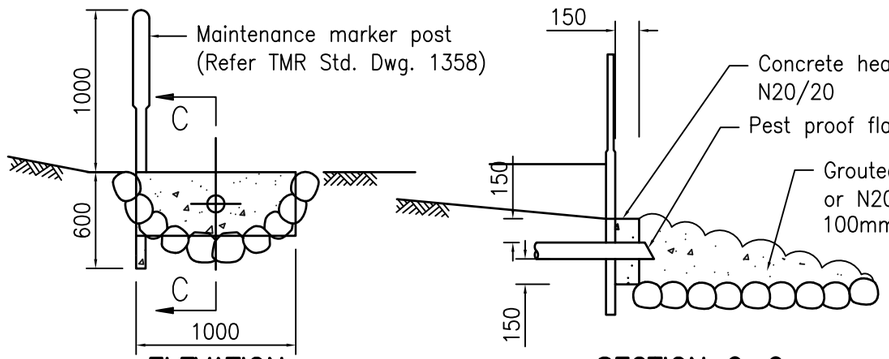


SECTION A–A



PLAN

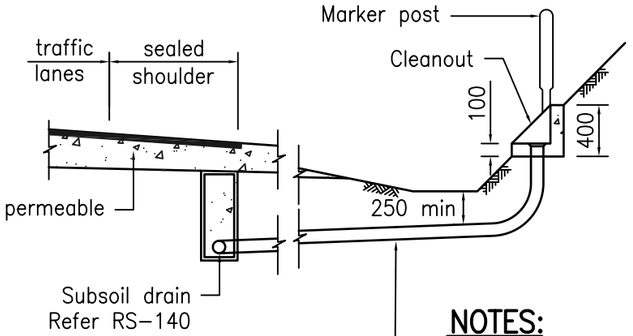
CONNECTION DETAIL – KERB INLET



ELEVATION

SECTION C–C

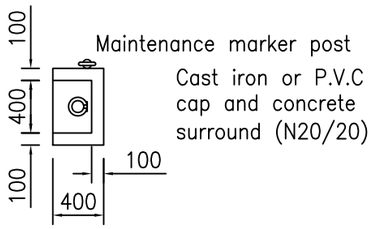
OUTLET TO NATURAL SURFACE



Subsoil drain cleanout – 100 dia upvc SH pipe
Cleanouts at head of pipe and at 60m maximum spacings(50m spacing for strip filter drains)

CUTTING CROSS SECTION

SUBSOIL DRAIN AND CLEANOUT



CLEANOUT

NOTES:

1. Refer to RS–140 for subsoil drain details and locations.
2. All pipes and fittings other than subsoil drains to be 100 dia Class 12 pipe.
3. All subsoil drains shall be in accordance with TMR specification MRTS03.
4. Concrete anchors to be N20 in accordance with AS 1379 and AS 3600.
5. All dimensions are in millimetres unless shown otherwise.

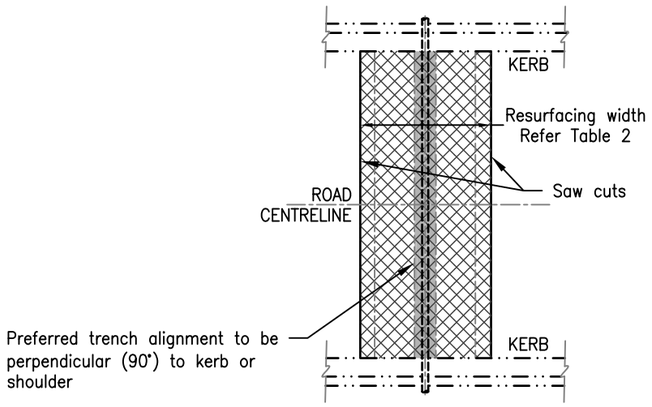
Rv.	DATE	REVISIONS
E	06/14	Review
E	03/14	Amended Drawing number
D	12/11	Drawing number changed from SEQ R–142 to RS–142
C	06/11	Review
B	06/09	Review
A	03/08	ORIGINAL ISSUE

INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

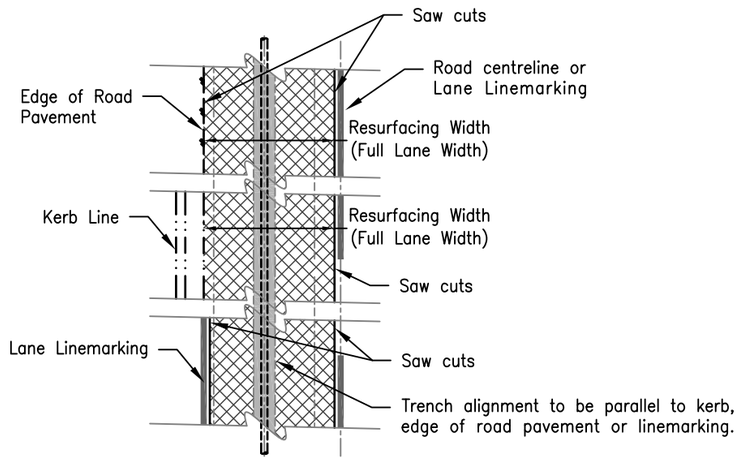
SUBSOIL DRAINS
ACCESS POINTS

RS–142

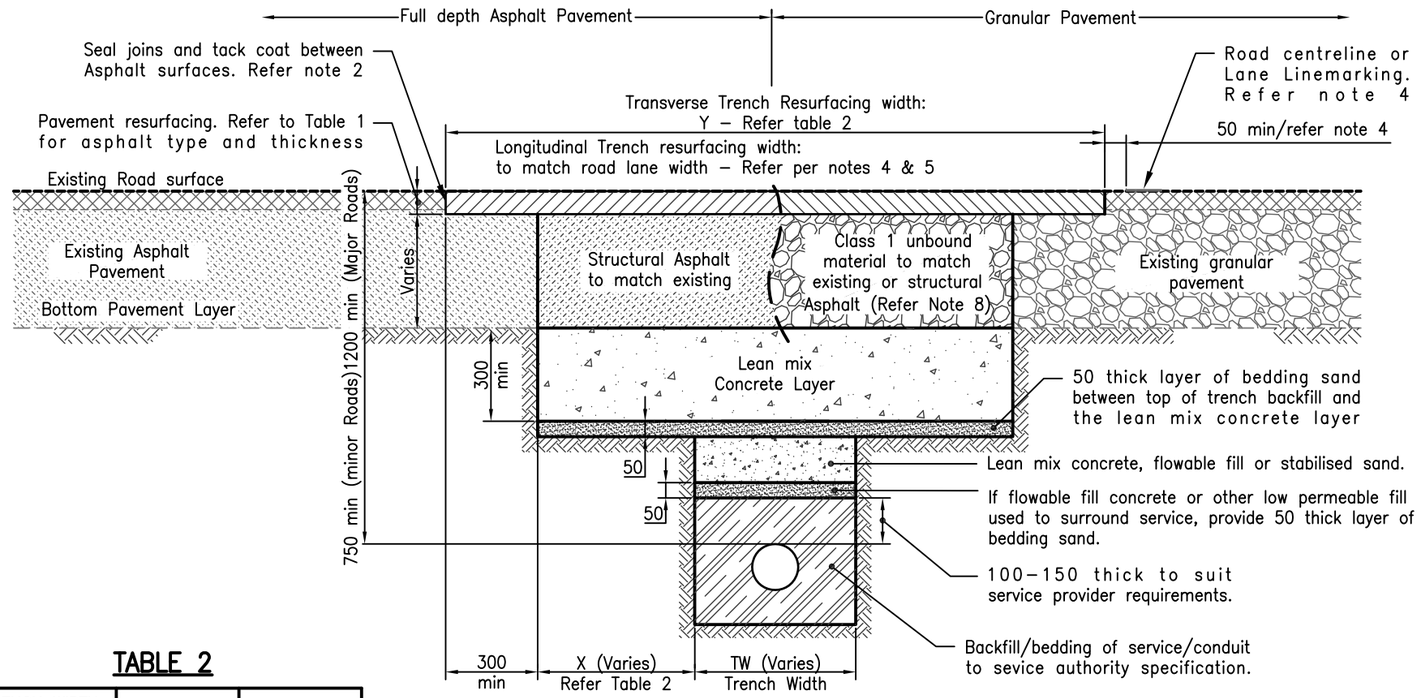
Rv. E D C B A



TYPICAL PLAN VIEW – TRANSVERSE TRENCH



TYPICAL PLAN VIEW – LONGITUDINAL TRENCH
(REFER NOTE 4)



TYPICAL TRENCH REINSTATEMENT CROSS–SECTION

TABLE 1 – SURFACE LAYER

	ASPHALT MIX		SURFACE THICKNESS (EXCLUDING PAVEMENT)	
LOCATION	BCC	TMR	EACH LAYER	TOTAL SURFACE THICKNESS
minor Road	Type 2	DG10	25–40	min 50mm or adjacent Asphalt thickness, whichever is greater
Major Road	Type 3	DG14	50–60	min 100mm or adjacent Asphalt thickness, whichever is greater

TABLE 2

TRENCH WIDTH (TW)	X	Y
<600	TW/2 (150 min)	1500 min
>600	300 min	2200 min

NOTES:

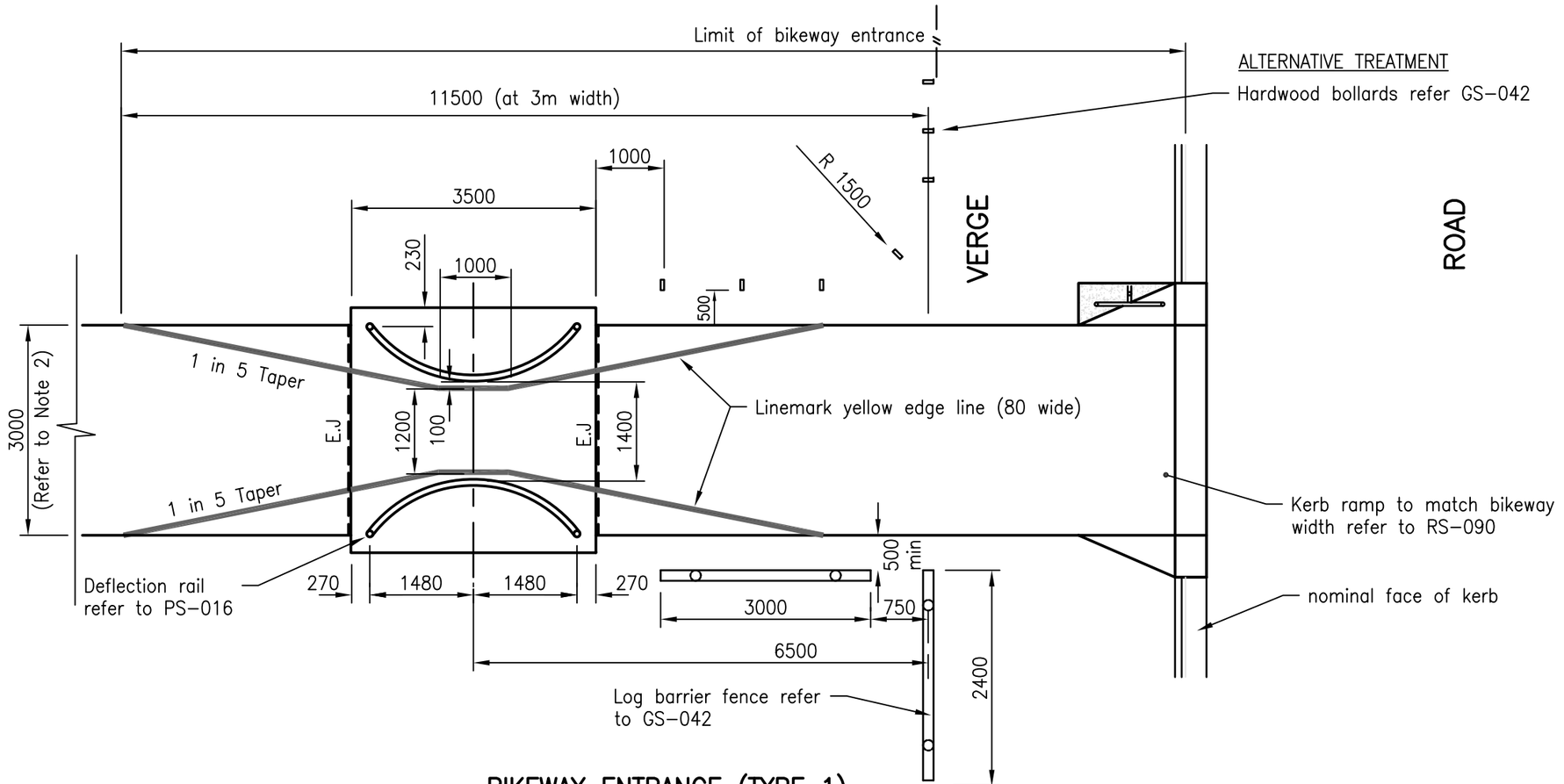
1. Trenchless Technology Techniques are the preferred method for road crossing services conduits in existing Roadways.
2. Asphalt to Asphalt joint – saw cut existing AC where shown or as agreed with Council Representative on site to provide clean cut and seal with bitumen emulsion crack sealant. Apply bitumen emulsion tack coat to all other newly exposed asphalt surfaces prior to placement of reinstated asphalt pavement or surface.
3. All exposed faces of gravel pavement to be primed during sealing operations.
4. Where the trench has been constructed longitudinally in the road, then the final surface repair width is to match the existing lane width and terminate 50mm clear of the road centreline or lane line linemarking to allow for the bitumen emulsion joint seal. Reinstatement of surface adjacent to the kerb or road pavement edge to extend fully to the kerb line or edge of pavement.
5. A part lane resurfacing may be approved where the full reinstatement is able to be completed between the inner and/or outer edge and centre of the lane.
6. The vertical deviation from a 3m straight edge parallel to the centre line of the existing road is not to exceed 5mm.
7. Asphalt surface repairs are to be undertaken within 24 hours unless approved otherwise by council. Final asphalt layers to be placed by paving machine.
8. Where structural asphalt is used to reinstate existing granular pavement, subsoil drainage is to be installed on the uphill side of the trench unless approved otherwise by council.
9. Standard drawings to be read in conjunction with the following reference specifications for civil engineering works:
   - S140 : Earthworks
   - S145 : Installation and maintenance of utility services
   - S300 : Quarry products
   - S310 : Supply of dense graded asphalt
   - S320 : Laying of asphalt
10. For backfill requirements for stormwater drainage pipes refer to DS–030.
11. All dimensions are in millimetres unless shown otherwise

Rv.	DATE	REVISIONS
F	06/14	Review
E	03/14	Amended Drawing number
D	12/11	Drawing number changed and reviewed
C	06/11	Review
B	06/09	Review
A	05/08	ORIGINAL ISSUE

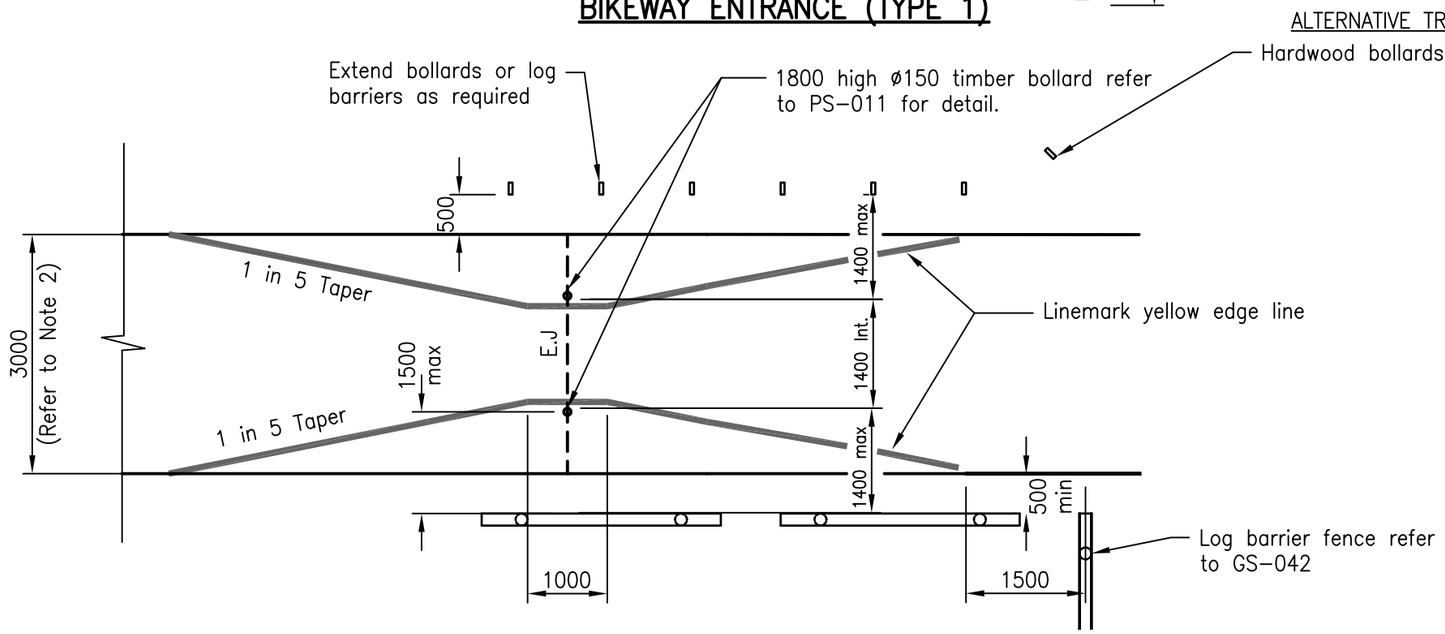
INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

PAVEMENT EXTENSION
TRENCHING AND WIDENING

RS–170



BIKEWAY ENTRANCE (TYPE 1)



BIKEWAY ENTRANCE (TYPE 1– ALTERNATIVE TREATMENT)

LEGEND

Expansion joint (E.J) – – – – – – –

NOTES:

1. Concrete N25 in accordance with AS 1379 & AS 3600.
2. Bikeway to have preferred width of 3000, width may vary.
3. Deflection rails not to be installed on curves.
4. Pavement markings to be installed in waterborne paint or other suitable material. Material to have Anti–Slip/Skid material applied to surface. Thermoplastic materials are not to be used.
5. Refer to RS–065 for concrete construction details.
6. Refer to PS–011 for Type 2 high volume.
7. Refer to PS–013 for bikeway slowdown control reverse curve
8. Refer PS–016 for bikeway furniture details.
9. Refer to MUTCD and Austroads Guide to Road Design Part 6A for Bikeway design and signage.
10. All dimensions are in millimetres unless shown otherwise.

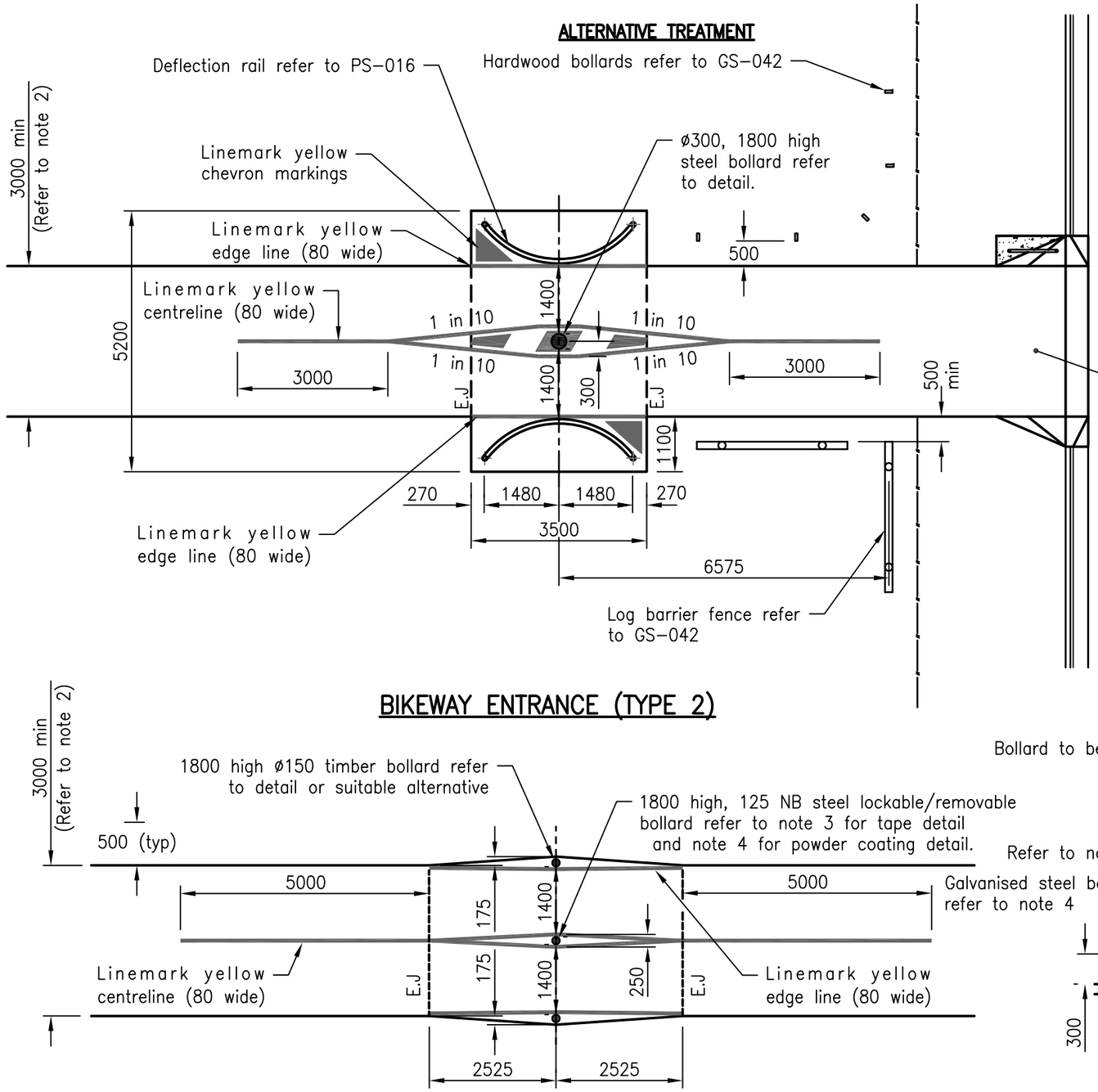
Rv.	DATE	REVISIONS
F	06/14	Review
E	03/14	Amended Drawing Number
D	12/11	Drawing number changed from SEQ P–010 to PS–010
C	06/11	Review
B	06/10	Review
A	11/09	ORIGINAL ISSUE

INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

BIKEWAY ENTRANCE CONTROL
TYPE 1 – LOW VOLUME

PS–010

Rv. F E D C B A

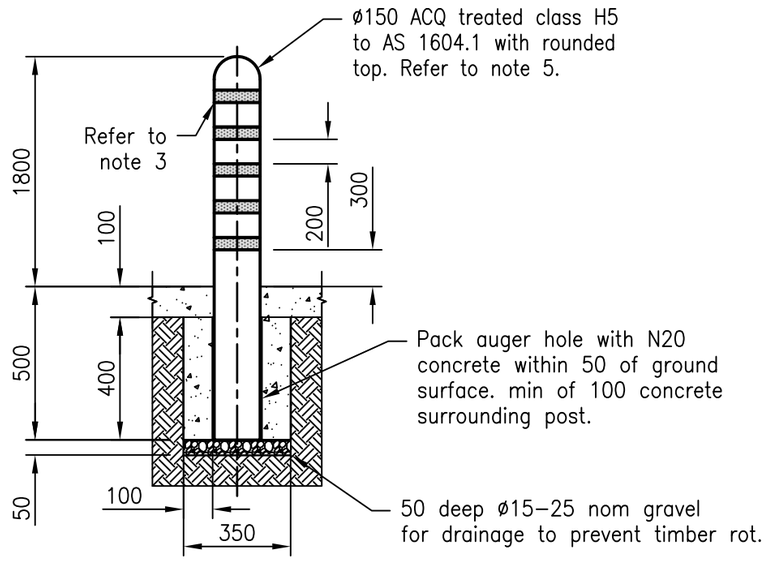


BIKEWAY ENTRANCE (TYPE 2)

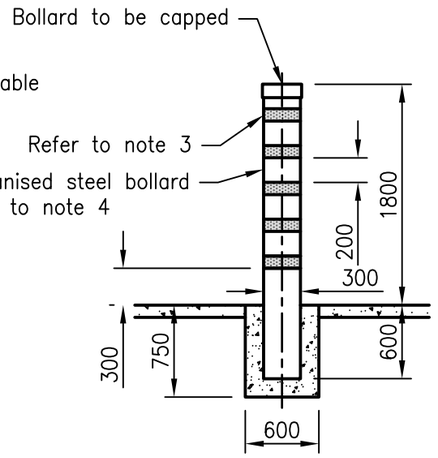
BIKEWAY ENTRANCE (TYPE 2 – ALTERNATIVE)

LEGEND

Expansion joint (E.J) – – – – – – – –



TIMBER BOLLARD DETAIL



STEEL BOLLARD DETAIL

NOTES:

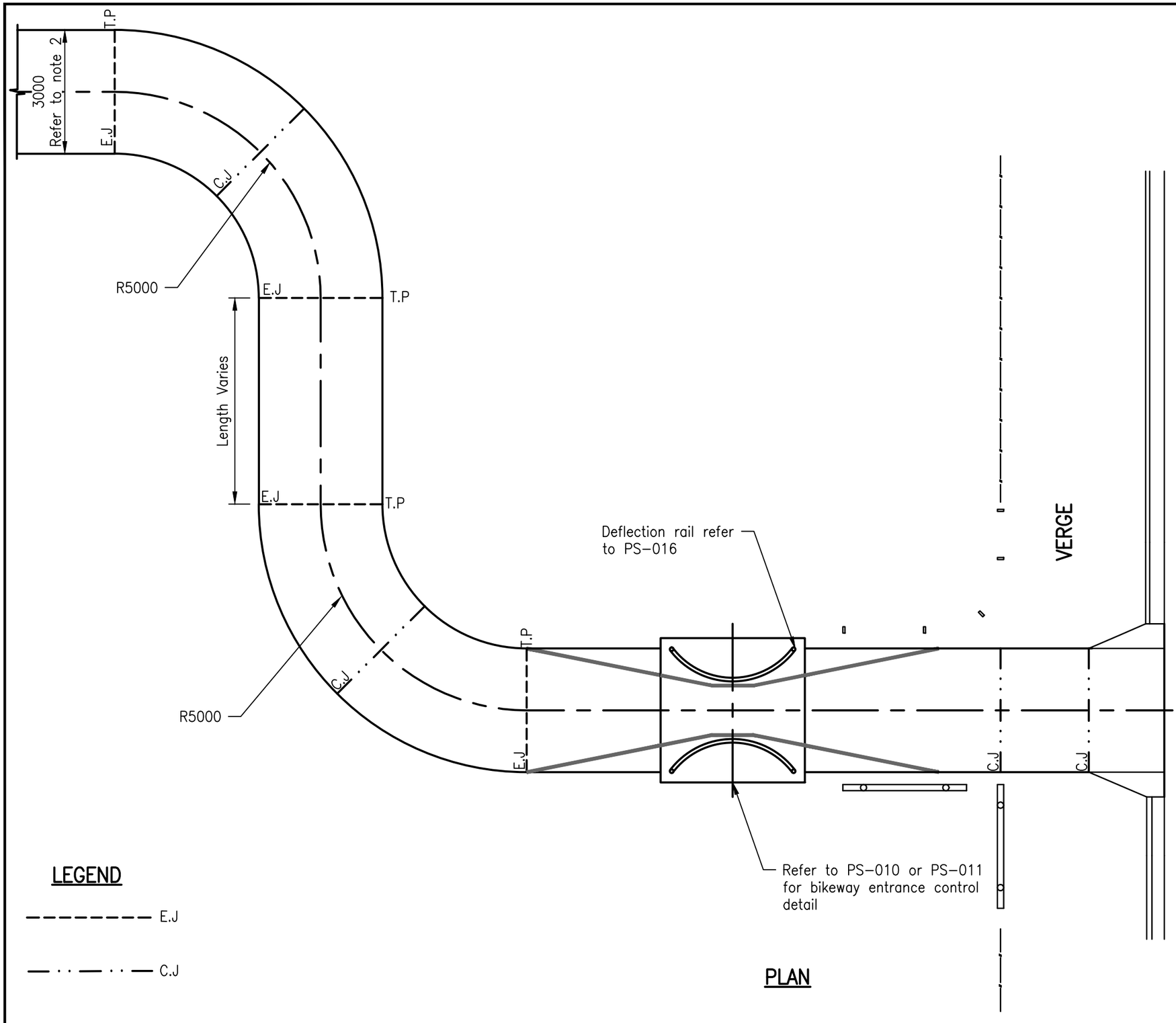
1. Concrete N25 in accordance with AS 1379 & AS 3600.
2. Bikeway to have minimum width of 3000. Width may be increased.
3. Reflective tape to be 100mm wide red class 1A retro–reflective sheeting.
4. Galvanised steel bollard to be powder coated Y11 canary yellow in accordance with AS 2700.
5. Paint timber bollard with two coats of lacquer acrylic Y11 canary yellow in accordance with AS 2700.
6. Refer to RS–065 for concrete construction details.
7. Prior to installation of timber bollards all edges, joints, cuts to receive coating with an approved timber preservative.
8. Pavement markings to be installed in waterborne paint or other suitable material. Material to have anti–slip/skid material applied to surface. Thermoplastic materials are not to be used.
9. Refer to MUTCD and Austroads Guide to Road Design Part 6A for Bikeway design and signage.
10. All dimensions are in millimetres unless shown otherwise.

Rv.	DATE	REVISIONS
F	06/14	Review
E	03/14	Amended Drawing Number
D	12/11	Drawing number changed from SEQ P–011 to PS–011
C	06/11	Review
B	06/10	Review
A	01/10	ORIGINAL ISSUE

INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

BIKEWAY ENTRANCE CONTROL
TYPE 2 – HIGH VOLUME

PS–011



PLAN

LEGEND

E.J

C.J

NOTES:

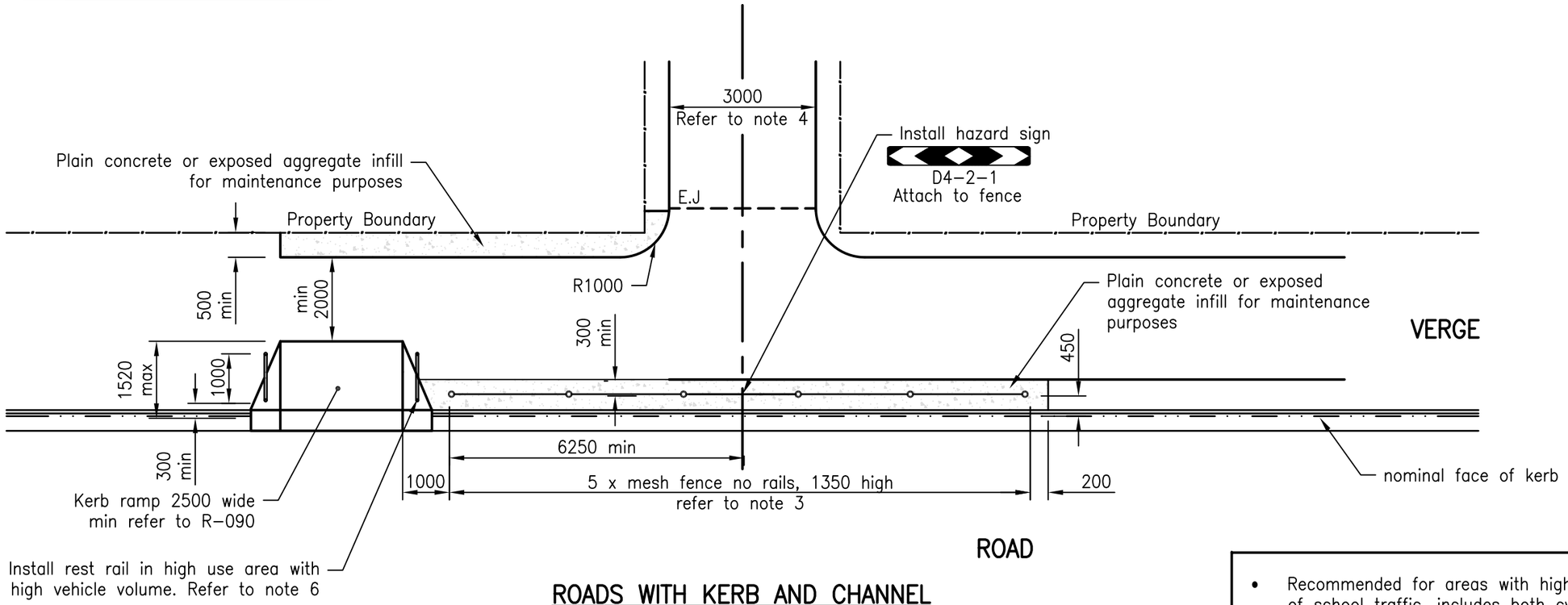
1. Concrete N32 in accordance with AS 1379 and AS 3600.
2. Bikeway to have preferred width of 3000. Width may vary.
3. Bikeway reverse curve installed to slow and control bicycle speed.
4. Deflection rails and log barrier fencing installed to restrict vehicles access.
5. Refer to RS-065 for concrete construction details
6. Refer to PS-015 where reverse curve is not appropriate.
7. Refer to Austroads Guide to Road Design Part A: Pedestrian and Cyclist Paths for clear zones, sight distance requirements and crossfalls.
8. All dimensions are in millimetres unless shown otherwise.

Rv.	DATE	REVISIONS
F	06/14	Review
E	03/14	Amended Drawing Number
D	12/11	Drawing number changed from SEQ P-013 to PS-013.
C	06/11	Review
B	06/10	Review
A	11/09	ORIGINAL ISSUE

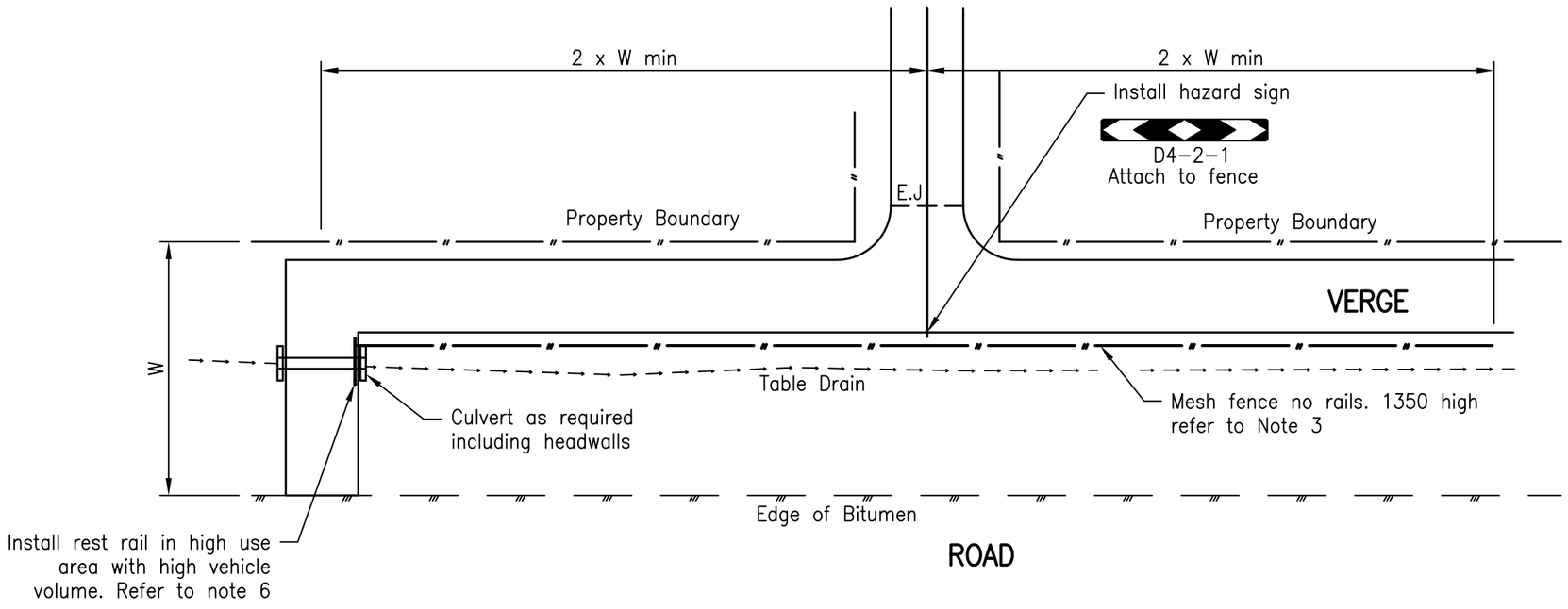
INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

BIKEWAY SLOWDOWN CONTROL
REVERSE CURVE

PS-013



ROADS WITH KERB AND CHANNEL



ROADS WITHOUT KERB AND CHANNEL

- Recommended for areas with high volumes of school traffic, includes both cyclists and pedestrians.
- Ramp position to face oncoming traffic where possible.

NOTES:

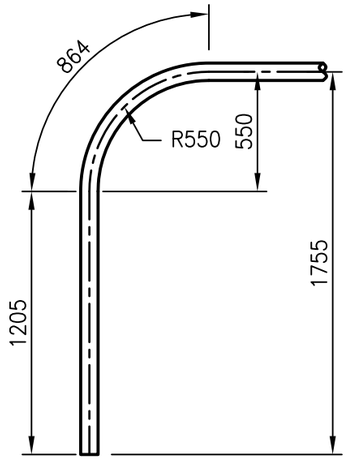
1. Concrete N32 in accordance with AS 1379 and AS 3600.
2. Refer to RS–065 for concrete construction details.
3. Mesh fence no rails details refer to GS–045.
4. Bikeway to have preferred width of 3000. Width may vary.
5. Kerb ramp details refer to RS–090.
6. Rest rail details refer to PS–016 and PS–010.
7. Installation of TGSI's refer to RS–092 and RS–093. TGSI's are required on a bikeway where a need for vision impaired pedestrian has been identified. TGSI's shall comply with AS 1428.4.1.
9. All dimensions are in millimetres unless shown otherwise.

Rv.	DATE	REVISIONS
F	06/14	Review
E	03/14	Amended Drawing Number
D	12/11	Drawing number changed from SEQ P–015 to PS–015
C	06/11	Review
B	06/10	Review
A	08/09	ORIGINAL ISSUE

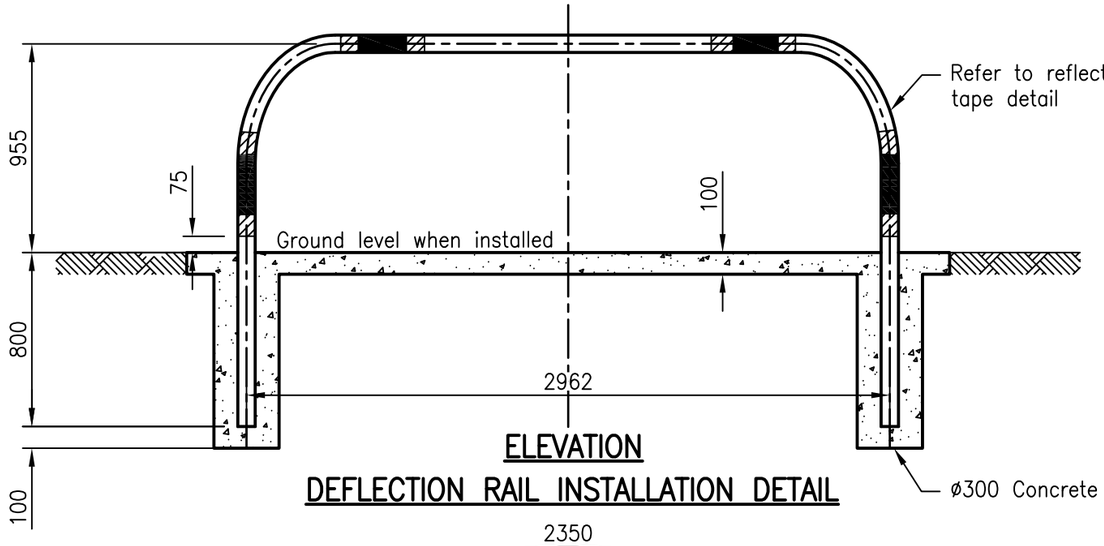
INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

BIKEWAY ENTRANCE CONTROL
OFFSET CHICANE

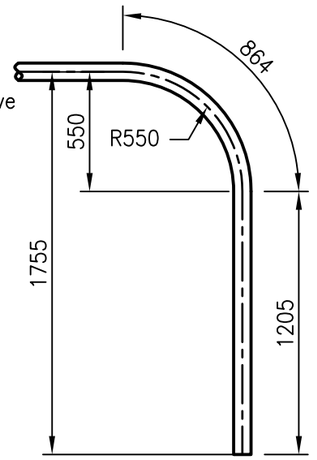
PS–015



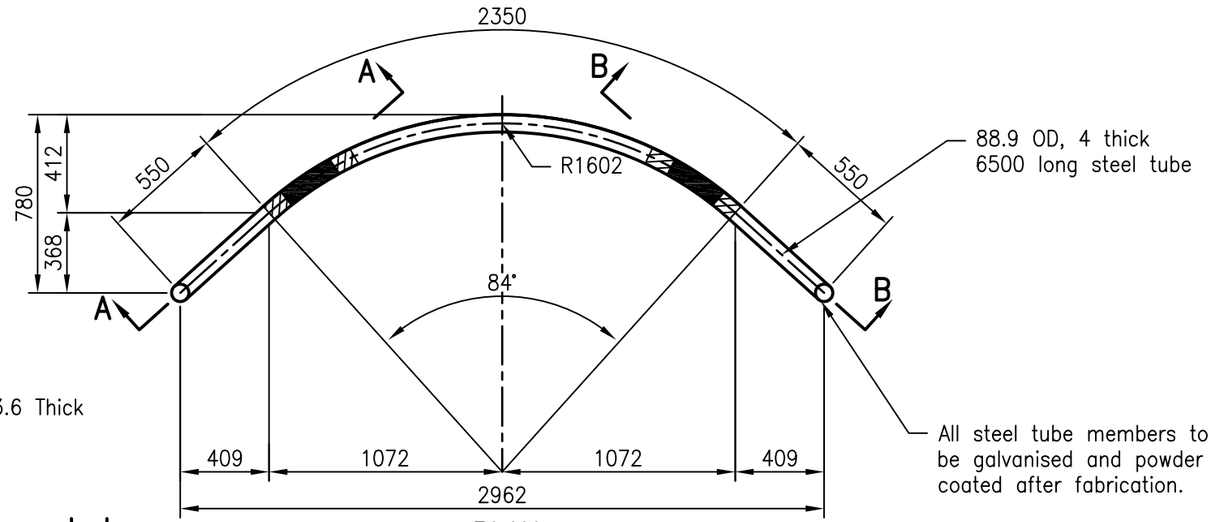
SECTION A–A



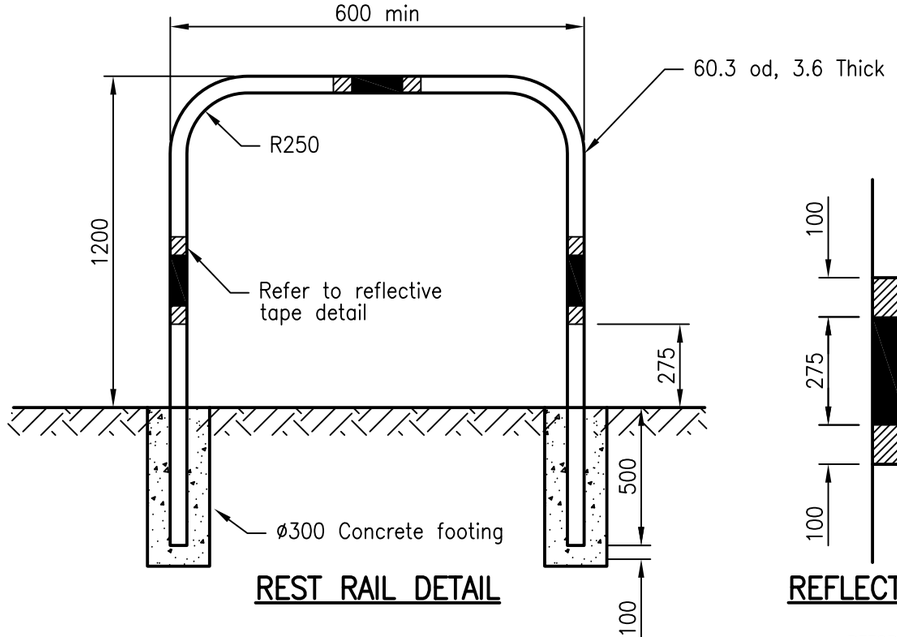
ELEVATION
DEFLECTION RAIL INSTALLATION DETAIL



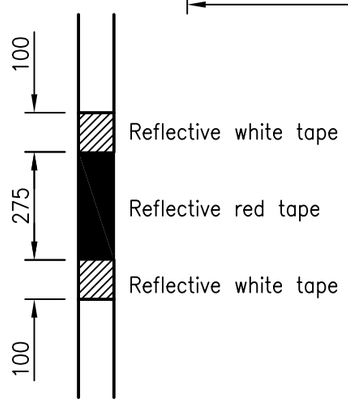
SECTION B–B



PLAN
DEFLECTION RAIL



REST RAIL DETAIL



REFLECTIVE TAPE DETAIL

NOTES:

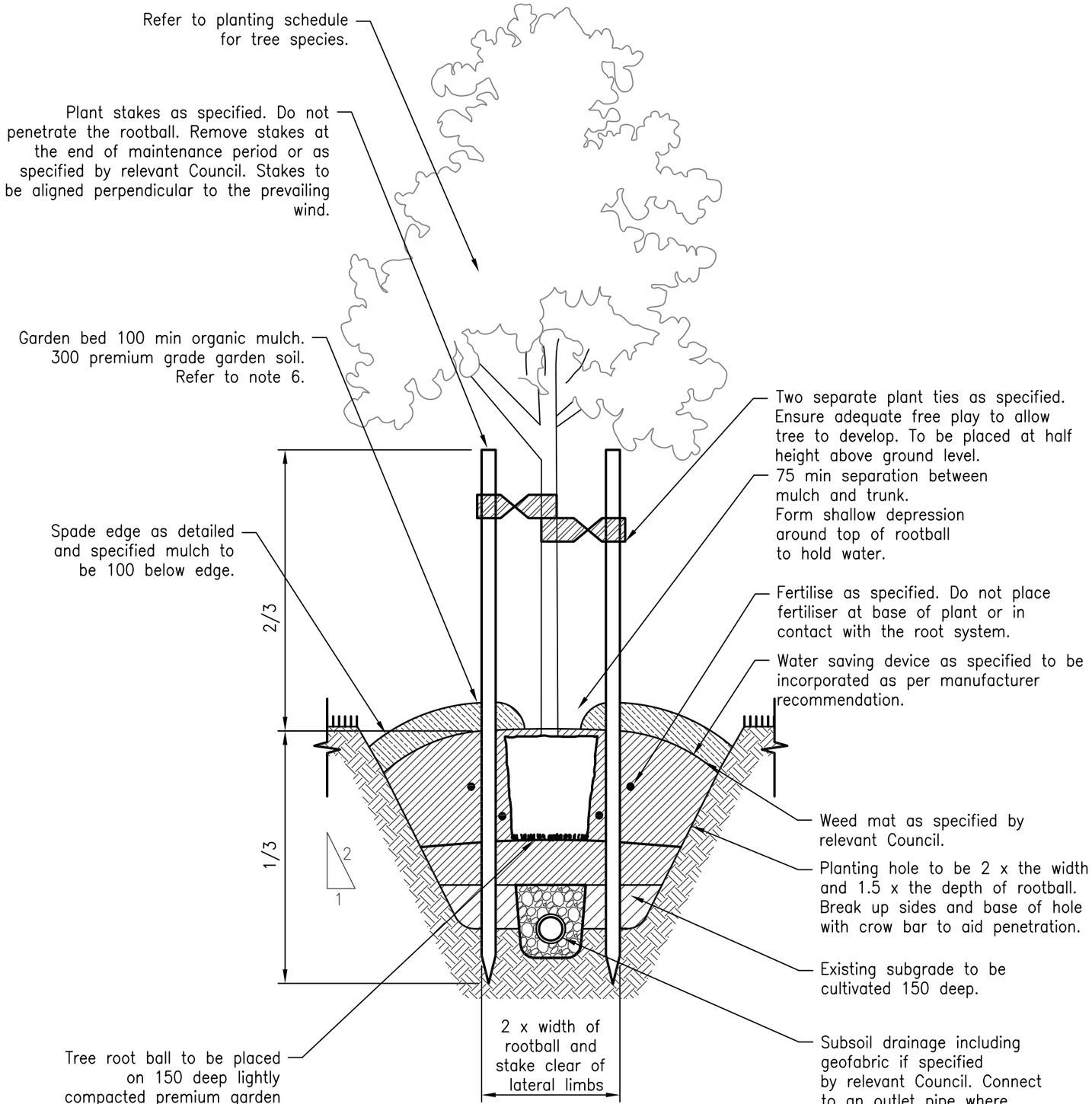
1. Concrete footing to be grade N25 in accordance with AS 3600.
2. Refer to RS–065 for concrete construction details.
3. Galvanised steel tube in accordance with AS 1163.
4. Rollform deflection rail from a single piece 6500 long tube.
5. Reflective tape to be white and red class 1 in accordance with AS 1906.1
6. Galvanised steel to be powder coated in Y11 Canary Yellow to AS 2700–1996.
7. Refer to PS–010 & PS–011 for deflection & rest rail installation details on bikeways.
8. All dimensions are in millimetres unless shown otherwise.

Rv.	DATE	REVISIONS
F	06/14	Review
E	03/14	Amended Drawing Number
D	12/11	Drawing number changed from SEQ P–016 to PS–016
C	06/11	Review
B	06/10	Review
A	08/09	ORIGINAL ISSUE

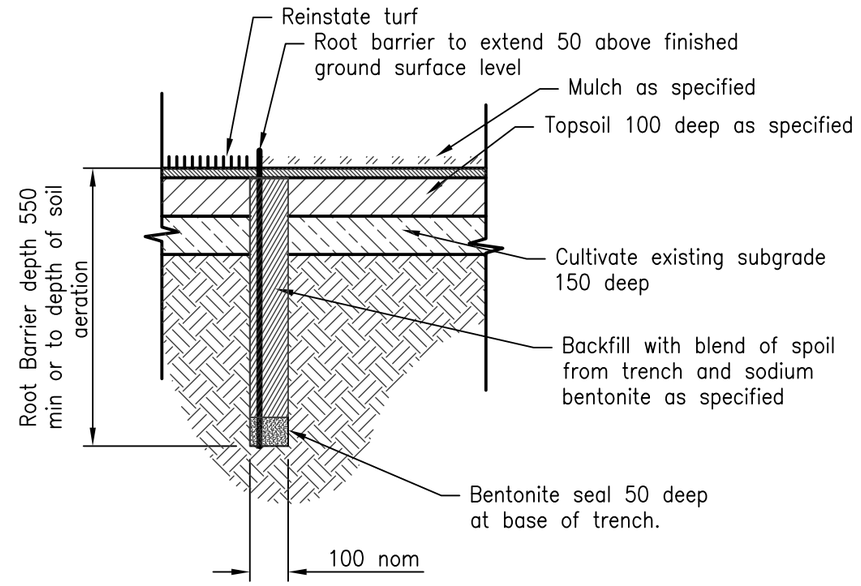
INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

BIKEWAY FURNITURE DETAILS
DEFLECTION AND REST RAIL DETAIL

PS–016



ELEVATION
PLANTING AND STAKING



ROOT BARRIER

Refer to manufacturers specification, location of Root barrier as directed.

CAUTION
Verify location of services prior to commencement of work

NOTES:

1. Plant types as specified, refer project documentation. Prior to planting pre water hole and allow to soak away.
2. Form a saucer shaped depression around base of tree and water immediately.
3. Planting shall be a minimum of 650 from the back of kerb.
4. Provide gravel filter and connect to an outlet pipe where directed. Refer to grading requirements on RS–140.
5. For planting in medians refer to GS–011 and GS–012.
6. Garden bed organic mulch to conform to AS 4419 unless otherwise specified.
7. All dimensions are in millimetres unless shown otherwise.

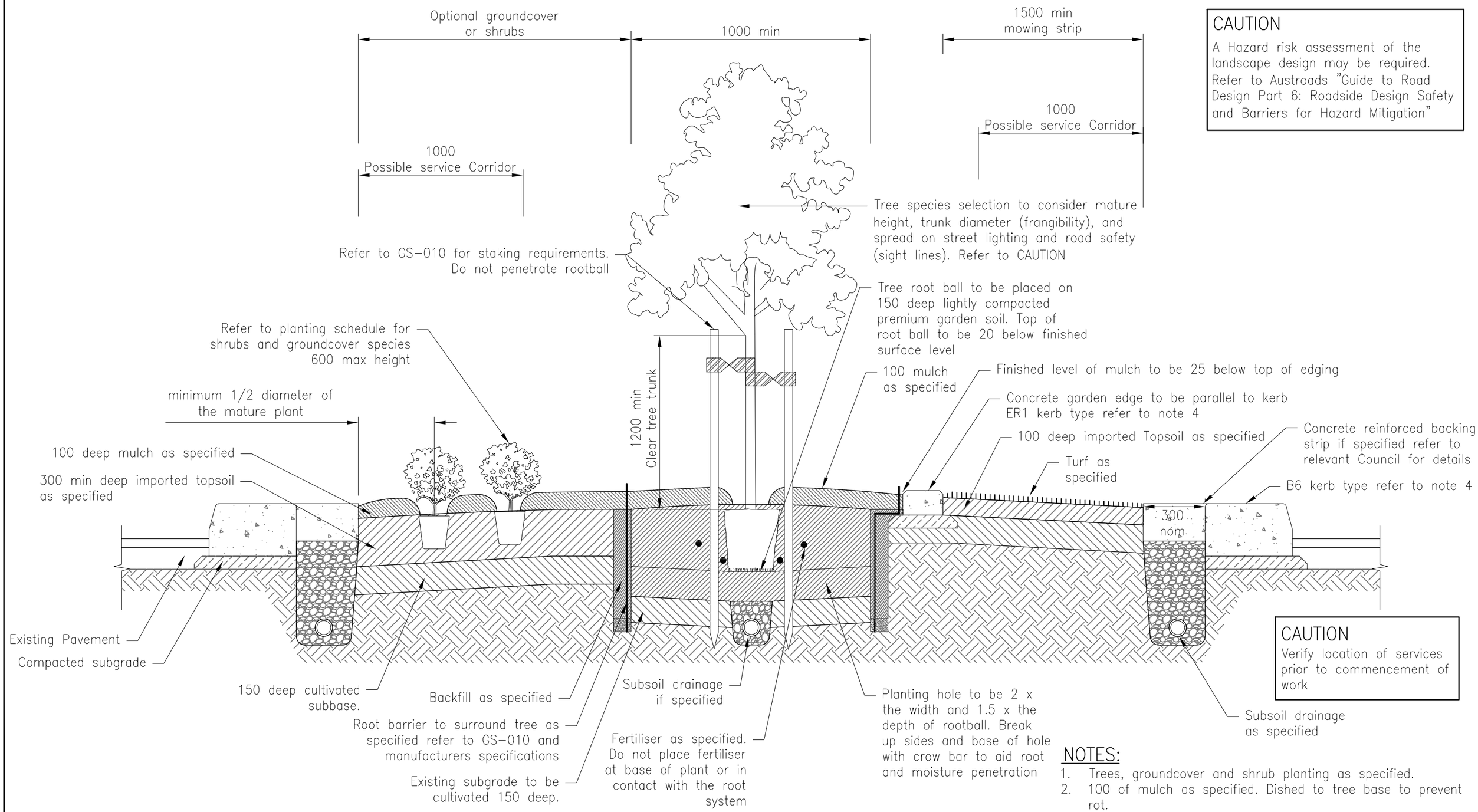
Rv.	DATE	REVISIONS
D	06/14	Review
C	03/14	Amended Drawing Number
B	03/13	Drawing number changed from SEQ G–010 to GS–010
A	01/10	ORIGINAL ISSUE

INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

LANDSCAPING
STREET TREE PLANTING DETAILS
INCLUDING ROOT BARRIERS

GS–010

D C B A Rv.



CAUTION

A Hazard risk assessment of the landscape design may be required. Refer to Austroads "Guide to Road Design Part 6: Roadside Design Safety and Barriers for Hazard Mitigation"

CAUTION

Verify location of services prior to commencement of work

TYPICAL MEDIAN PLANTING SECTION TREES, SHRUBS AND GROUNDCOVERS

These drawings have been developed in consultation between the participating Councils.
BEFORE USE, the user shall confirm that the drawing has been adopted by the appropriate Council

NOTES:

1. Trees, groundcover and shrub planting as specified.
2. 100 of mulch as specified. Dished to tree base to prevent rot.
3. Height of clear tree trunk is dependant upon road safety sight distance requirements. Refer to Austroads "Guide to Road Design Part 3 – Geometric Design"
4. Refer to RS–080 for kerb type unless otherwise specified by relevant Council.
5. All dimensions are in millimetres unless shown otherwise.

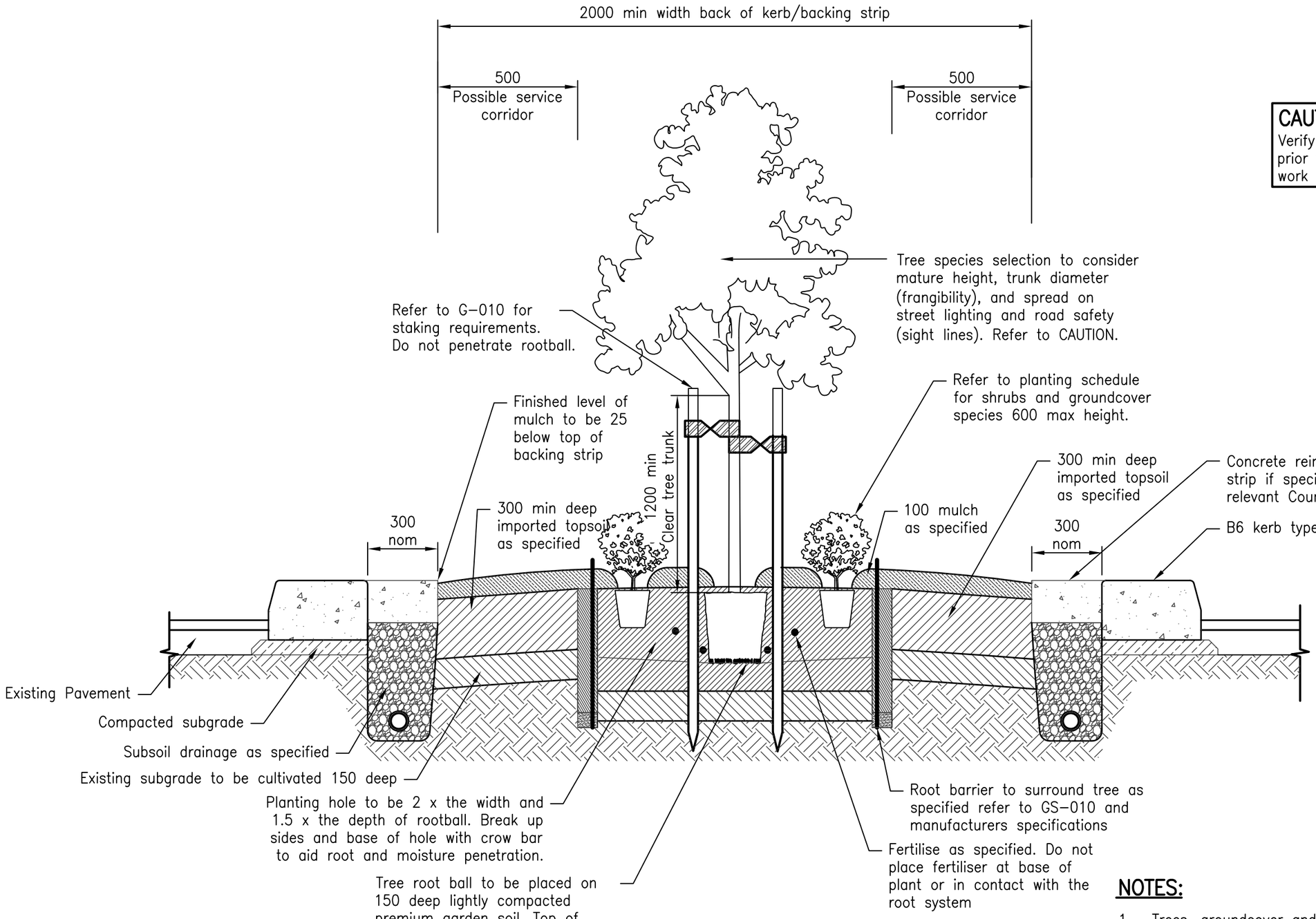
Rv.	DATE	REVISIONS
E	06/14	Review
D	03/14	Amended Drawing Number
C	03/13	Drawing number changed from SEQ G–011 to G–011.
B	06/11	Review
A	01/10	ORIGINAL ISSUE

INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

STREET TREE PLANTING DETAILS
WIDE MEDIAN

GS–011

Rv. E D C B A



CAUTION
Verify location of services prior to commencement of work

TYPICAL MEDIAN PLANTING SECTION TREES, SHRUBS AND GROUNDCOVERS

NOTES:

1. Trees, groundcover and shrub planting as specified.
2. Mulch dished at tree base to prevent rot.
3. Height of clear tree trunk is dependant upon road safety sight distance requirements. Refer to Austroads "Guide to Road Design Part 3 – Geometric Design"
4. Refer to RS–080 for kerb type
5. All dimensions are in millimetres unless shown otherwise

Rv.	DATE	REVISIONS
E	06/14	Review
D	03/14	Amended Drawing Number
C	03/13	Drawing number changed form SEQ G–012 to GS–012
B	02/11	Review
A	01/10	ORIGINAL ISSUE

INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA
STANDARD DRAWINGS

STREET TREE PLANTING DETAILS
NARROW MEDIAN

GS–012

E D C B A Rv.

3.0 PLANNING SCHEME POLICY 3 – FLOOD, STORM TIDE AND DRAINAGE CONSTRAINED LAND

3.1 RELATIONSHIP WITH THE PLANNING SCHEME

(1) This planning scheme policy sets out:

(i) information council may request for the preparation and submission of technical reports for proposed development affected by the flood prone, storm tide and drainage constrained land hazard overlays. These are contained in the following subsections:
3.2.1.1 Flood assessments
3.2.1.2 Storm tide assessments
3.3.1.1 Drainage constrained land assessments

(ii) general guidance for applicants which is contained in the following sections:
3.2.2.1 Hydrological analysis
3.2.2.2 Hydraulic analysis
3.2.2.3 Channel design
3.2.2.4 Trafficable access

3.2 FLOOD AND STORM TIDE ASSESSMENTS

The following information may be required to inform PO4 and PO6 of the Flood and Storm Tide Hazard Overlay Code.

3.2.1 Information that Council may request

3.2.1.1 Flood assessments

(1) A development application involving land that is within the flood hazard overlay may require the submission of a flood report detailing the impacts of the proposed development.

(2) A flood report must be certified by a suitably qualified Registered Professional Engineer of Queensland (RPEQ) and must contain:

(a) a site plan showing the location of existing and proposed structures;
(b) the location of existing and proposed drainage structures and overland flow paths;
(c) an assessment of the contributing catchment for the 50, 10, 5, 2 and 1% AEP design flood events including:
  (i) where in the storm tide area, the provision made for storm tide events;
  (ii) the extent, depth and velocity of the flood waters for each event;
  (iii) a contour plan with levels to AHD at 0.25m contours and details of any structures which may act as a hydraulic controls;
(d) scaled drawings for each design storm event showing a comparison between the existing and proposed scenario;
(e) the impact of the proposed development on surrounding properties;
(f) the extent and impact of any proposed earthworks or changes to the flow path;
(g) for overland flow, any potential blockages in the system from debris;
(h) where within the storm tide hazard area, the impact in terms of foreshore or bank stability and type of protection proposed; and,
(i) all relevant computer data files that are compatible with council's software.

3.2.1.2 Storm tide assessments

(1) A development application involving land that is within the storm tide hazard overlay may require the submission of a storm tide assessment which includes:

(a) a contour plan with levels to AHD at 0.25 metre contours which shows:
  (i) the extent of the storm tide inundation;
  (ii) the location of any existing and proposed structures on the lot;
  (iii) the extent of any proposed excavation and fill;
(b) any impacts on neighbouring properties; and,
(c) any impacts in terms of foreshore bank stability and the type of protection proposed.

3.2.2 Guidance for applicants

3.2.2.1 Hydrological Analysis

(1) Stream flow is to be simulated in accordance with the methods recommended in the Queensland Urban Drainage Manual (QUDM) and Australian Rainfall and Runoff (AR&R).

(2) Hydrological models are to account for all existing and future stream and catchment development.

(3) Model parameters are to be determined by calibration against past flood events and by recognised AR&R regional relationships.

(4) Calibration includes all major flooding events with recorded flood level information.

(5) Calibration models accurately reflect the existing development during the event.

(6) Flood analysis by accepted flood modelling techniques is carried out to determine the worst flooding scenario for the particular flood frequency in concern.

3.2.2.2 Hydraulic Analysis

(1) Flood levels are simulated in accordance with the methods recommended in QUDM and AR&R.

(2) Cross section information used in hydraulic calculations is based on a recent survey of the waterway or foreshore at sufficient detail to accurately model the terrain.

(3) Survey is to Australian Height Datum (AHD).

(4) Roughness coefficients are determined from calibration and published upper bound guidance values and accurately reflect terrain conditions.

(5) Hydraulic gradients are determined from surveyed flood levels or cross-sections up and downstream of the subject site.

(6) Flood levels for a particular annual exceedance probability (AEP) are determined from the design storm that yields the highest water level prediction.

3.2.2.3 Channel design

(1) Maximum average flow velocity in consolidated bare earth and vegetated channels is to comply with the lower of the tabulated values for easily erodible soils in QUDM and/or poor grass cover in AR&R.

(2) The maximum Froude number is less than 0.9 and supercritical flow is not acceptable.

(3) Manning's 'n' values are determined from the sources recommended in QUDM and published upper bound guidance values are adopted.

(4) Velocity and Froude number calculations are to include several stream flow events from a 50 percent AEP (2 year ARI) to 1 percent AEP (100 year ARI) storm event.

(5) Channel design is to minimise erosion potential.

(6) The minimum centreline radius of bends in channels is not less than four times the width of flow of a 1 percent AEP (100 year ARI) flow at that location.

(7) The maximum angle of deflection of the channel between the straight reaches upstream and downstream of the curve is not to exceed 60°.

(8) The channel is straight both upstream and downstream of all curves for a distance in each case equivalent to at least the radius of the curve.

(9) Access to channels is provided for maintenance equipment.

3.2.2.4 Trafficable access

(1) Trafficable access to the site during a flood or storm tide event is to consider emergency service access, the time of the road closure, the number of properties affected, the land use, and the flows depths and width limitations in accordance with section 7.3.15 of QUDM.

(2) Car parking should also be considered in accordance with section 7.3.10 of QUDM..

3.3 DRAINAGE CONSTRAINED LAND ASSESSMENT

3.3.1 Information that Council may request

The following may be required to inform PO7 in the Flood and Storm Tide Hazard Overlay Code.

3.3.1.1 Drainage constrained land assessments

(1) Where an application involves land on the Southern Moreton Bay Islands shown as drainage constrained an assessment that confirms the extent and effects of the drainage issues may be required. Depending on the type of drainage problem, the assessment may need to include:

(a) a contour plan with levels to AHD at 0.25 metre contours which shows the location of any existing and proposed structures on the site;
(b) existing contributing stormwater catchment and future catchment;
(c) the location, depth, width and velocity of calculated stormwater overland flow;
(d) the location of any easements (existing and proposed);
(e) a description of soil layers to a depth of 1.2 metres; and,
(f) the proposed remedial works to address the drainage problem (where possible).

3.3.2 Guidance for applicants

(1) Drainage constrained land on the Southern Moreton Bay Islands is primarily associated with:

(a) existing stormwater overland flow paths;
(b) access constraints due to stormwater overland flow;
(c) high water table; and,
(d) seepage (stormwater and wastewater).

4.0 PLANNING SCHEME POLICY 4 – LANDSLIDE HAZARD

4.1 Relationship with the planning scheme

(1) This part sets out:

(i) information that may be request by Council where development of is proposed on land within the landslide hazard overlay; and

(ii) guidance for applicants on good engineering practices for hillside development to assist applicants, engineers and planners in the design and application of appropriate type and form of developments that best reflects the capability of the land.

(2) Hazard ratings depicted in the Landslide Hazard Overlay use a classification system consistent with the procedures detailed in the paper entitled "A Method of Zoning Landslide Hazards", prepared by McGregor and Taylor and are listed in the table below. They have been mapped based on a grid system of 25m squares for the mainland, and 5m squares for the islands. Each square is defined by a point at its centroid, and data related to the average slope instability.

Table 1 – Hazard Ratings

Hazard Rating	Description
Very High	The event is expected to occur
High	The event will probably occur under adverse conditions
Medium	The event could occur under adverse conditions
Low	The event might occur under very adverse conditions

4.2 Information that Council may request

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(1) A landslide assessment may be required to address PO1 of the Landslide Hazard Overlay Code. This must be undertaken by a suitably qualified Registered Professional Engineer Queensland (RPEQ).

4.2.1 Development within a very high or high landslide hazard area

(1) At minimum a geotechnical report must include:
(i) an extensive site investigation including subsurface investigation with groundwater measurements over at least one wet season;
(ii) the frequency of investigation locations should be no less than 1 location per 30m x 30m grid with an assessment of material strength by appropriate in-situ or laboratory testing. Investigations should establish a comprehensive geotechnical model over the whole site;
(iii) installation of groundwater monitoring points with measurements over at least one typical wet season and comparison of groundwater levels to rainfall events should be made;
(iv) a review of potential hazards; and
(v) an analysis of slope stability using a suitable model appropriate for the conditions.

(2) Where the analysis of slope stability indicates an unfavourable factor of safety, it is necessary to assess the risks to the community with regards to loss of life, injury and damage to infrastructure.

(3) The design of any proposed development must be reviewed and recommendations made by a suitably qualified RPEQ.

(4) Planning and implementation of a program of regular maintenance of slopes, cleaning of drainage course and monitoring of slope for signs of distress may also be required.

4.2.2 Development within a medium or low landslide hazard area

(1) At minimum a geotechnical report must contain:
- (i) a site walkover survey with investigations as required establishing a geotechnical model over the whole site. This may require moderate subsurface investigation or testing to provide subsoil material properties;
- (ii) a review of potential hazards; and
- (iii) an assessment of slope stability using a suitable model appropriate for the site conditions.

(2) Where the analysis of slope stability indicates an unfavourable factor of safety, it is necessary to assess the risks to the community with regards to loss of life, injury and damage to infrastructure.

(3) The design of any proposed development may need to be reviewed and recommendations made by a suitably qualified RPEQ.

4.3 Guidance for applicants

4.3.1 Road Design

(1) Roads on side slopes are usually formed by a combination of cut and fill operations. The design must incorporate effective drainage, and should incorporate good practices including:

- (i) the adoption of batter slopes appropriate to the engineering properties of the different materials exposed in the cut face. As a general rule batters in soil should be 2H:1V, in poor rock 1H:1V and in good rock 0.5H to 1V;
- (ii) where cuttings in rock are proposed, road alignments should be planned as not to coincide with major jointing orientations of the rock;
- (iii) the higher cut faces should include the provision of benches at vertical intervals of not greater than 10m. These benches are required to catch fallen material, to control drainage and to provide access for maintenance of the cut face;
- (iv) the provision of formed surface drains at the top of the cut slope, on the benches and at the toe of the cut slope;
- (v) the provision of slope protection, slope treatment or slope support in areas of potential concern. Slope protection against erosion may utilise a cover of topsoil and grass. On steeper slops treatment of erodible and closely joined rock is commonly by a cover mesh and shotcrete with rock bolts providing treatment of areas with adversely oriented joining. In areas of greater concern slope support can be provided by an engineered retaining wall. The design of the wall depends on the site conditions and cut dimensions but could include gabion crib, masonry and reinforced concrete wall designs.

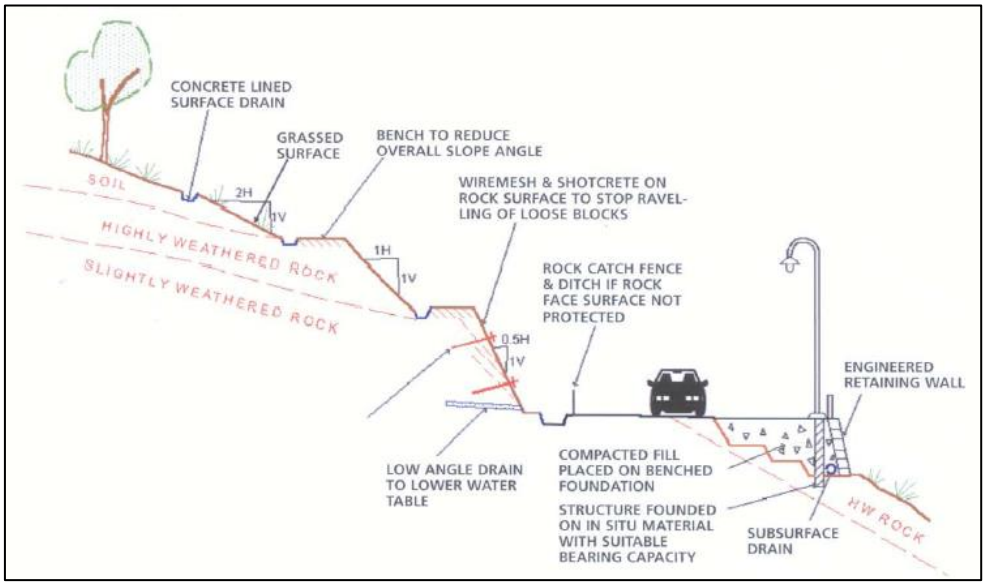
(2) The road fill embankment design should incorporate:
- (vi) the removal of all unsuitable material including trees, vegetation and topsoil from embankment foundation;
- (vii) the preparation of the embankment foundation by the formation of terraces across the slope. These terraces should be at least 2m wide with a maximum height of 0.6m;
- (viii) the installation of drainage, if required, in the foundation. This drainage may involve trench drains in areas of local seepage or a drainage blanket in an area that is generally wet;
- (ix) the embankment fill should be placed in an engineered manner. Placement of earth fill should be in layers – each not thicker than 300mm and compacted by roller to not less than 95% relative to Standard Compaction;

(x) the design of compacted earth fill slopes in soil should be no steeper than 1.5H:1V, and may often be lower subject to retained height, soil strength and maintenance considerations. Surface protection should be by grass or rock;

(xi) the provision of drainage at the crest and toe of the embankment as formed drains leading to an identified disposal area.

Examples of how to maintain slope stability for road design is illustrated in Figure 1.

Figure 1 – Possible methods of maintaining stability in road design



4.3.2 Examples of good hillside practices

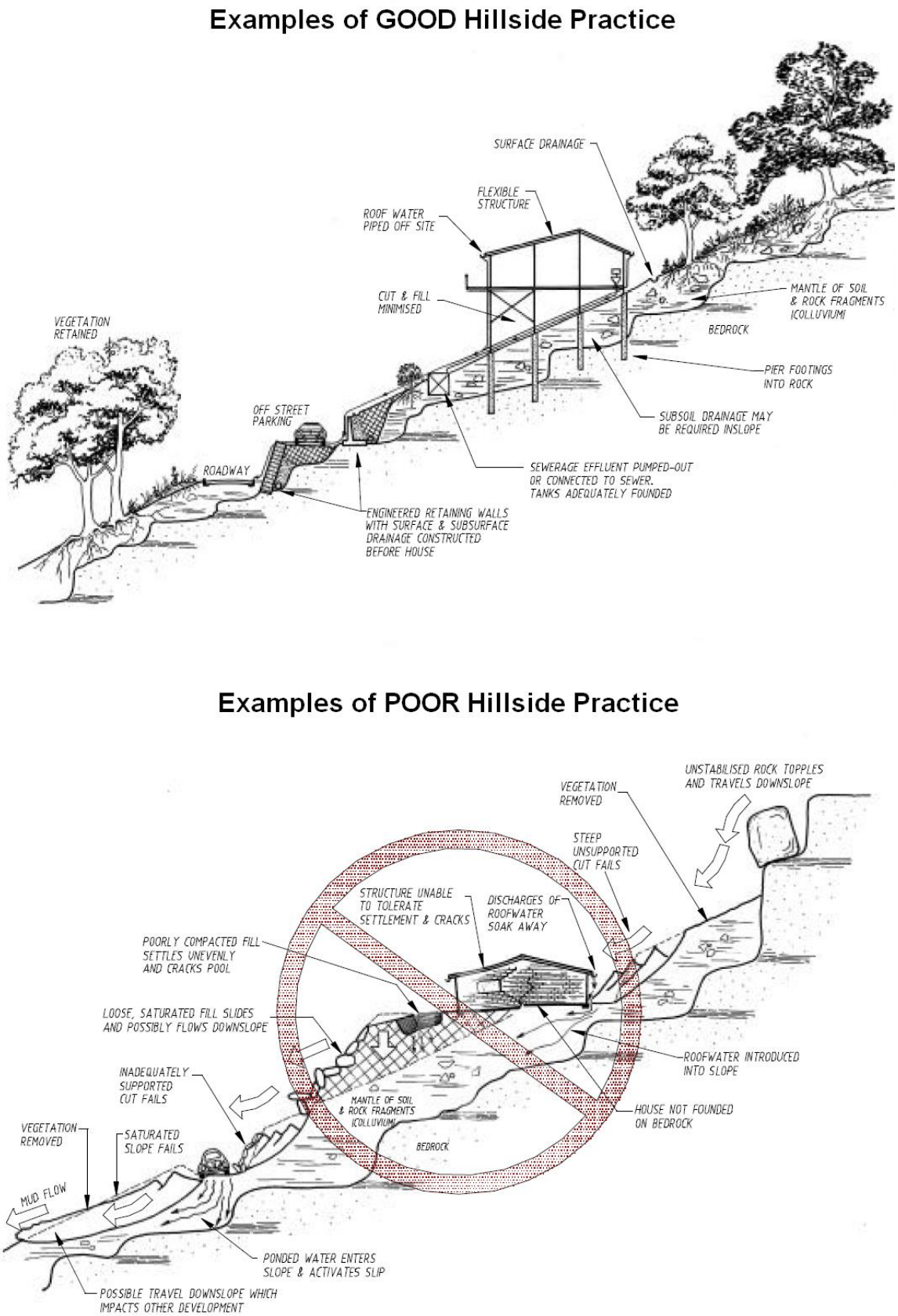
Examples of good and poor hillside engineering practice are given in Table 1 and Figure 2 below.

Table 1 – Guidelines for hillside construction practice

	GOOD ENGINEERING PRACTICE	*POOR ENGINEERING PRACTICE*
ADVICE		
GEOTECHNICAL ASSESSMENT	Obtain advice from a qualified, experienced geotechnical consultant at early stage of planning and before site works.	Prepare detailed plan and start site works before geotechnical advice.
PLANNING		
SITE PLANNING	Having obtained geotechnical advice, plan the development with the risk arising from the identified hazards and consequences in mind.	Plan development without regard for the Risk.
DESIGN AND CONSTRUCTION		
HOUSE DESIGN	Use flexible structures which incorporate properly designed brickwork, timber or steel frames, timber or panel cladding. Consider use of split levels. Use decks for recreational areas where appropriate.	Floor plans which require extensive cutting and filling. Movement intolerant structures.
SITE CLEARING	Retain natural vegetation wherever practicable.	Indiscriminately clear the site.
ACCESS & DRIVEWAYS	Satisfy requirements below for cuts, fills, retaining walls and drainage. Council specifications for grades may need to be modified. Driveways and parking areas may need to be fully supported on piers.	Excavate and fill for site access before geotechnical advice.
EARTHWORKS	Retain natural contours wherever possible.	Indiscriminant bulk earthworks.
CUTS	Minimise depth. Support with engineered retaining walls or batter to appropriate slope. Provide drainage measures and erosion control.	Large scale cuts and benching. Unsupported cuts. Ignore drainage requirements
FILLS	Minimise height. Strip vegetation and topsoil and key into natural slopes prior to filling. Use clean fill materials and compact to engineering standards. Batter to appropriate slope or support with engineered retaining wall. Provide surface drainage and appropriate subsurface drainage.	Loose or poorly compacted fill, which if it fails, may flow a considerable distance including onto property below. Block natural drainage lines. Fill over existing vegetation and topsoil. Include stumps, trees, vegetation, topsoil, boulders, building rubble etc in fill.
ROCK OUTCROPS & BOULDERS	Remove or stabilise boulders which may have unacceptable risk. Support rock faces where necessary.	Disturb or undercut detached blocks or boulders.
RETAINING WALLS	Engineer design to resist applied soil and water forces. Found on rock where practicable. Provide subsurface drainage within wall backfill and surface drainage on slope above. Construct wall as soon as possible after cut/fill operation.	Construct a structurally inadequate wall such as sandstone flagging, brick or unreinforced blockwork. Lack of subsurface drains and weepholes.
FOOTINGS	Found within rock where practicable. Use rows of piers or strip footings oriented up and down slope. Design for lateral creep pressures if necessary. Backfill footing excavations to exclude ingress of surface water.	Found on topsoil, loose fill, detached boulders or undercut cliffs.
SWIMMING POOLS	Engineer designed. Support on piers to rock where practicable. Provide with under-drainage and gravity drain outlet where practicable. Design for high soil pressures which may develop on uphill side whilst there may be little or no lateral support on downhill side.	
DRAINAGE		
SURFACE	Provide at tops of cut and fill slopes. Discharge to street drainage or natural water courses. Provide general falls to prevent blockage by siltation and incorporate silt traps. Line to minimise infiltration and make flexible where possible. Special structures to dissipate energy at changes of slope and/or direction.	Discharge at top of fills and cuts. Allow water to pond on bench areas.
SUBSURFACE	Provide filter around subsurface drain. Provide drain behind retaining walls. Use flexible pipelines with access for maintenance. Prevent inflow of surface water.	Discharge roof runoff into absorption trenches.
SEPTIC & SULLAGE	Usually requires pump-out or mains sewer systems; absorption trenches may be possible in some areas if risk is acceptable. Storage tanks should be water-tight and adequately founded.	Discharge sullage directly onto and into slopes. Use absorption trenches without consideration of landslide risk.
EROSION CONTROL & LANDSCAPING	Control erosion as this may lead to instability. Revegetate cleared area.	Failure to observe earthworks and drainage recommendations when landscaping.
DRAWINGS AND SITE VISITS DURING CONSTRUCTION		
DRAWINGS	Building Application drawings should be viewed by geotechnical consultant	
SITE VISITS	Site Visits by consultant may be appropriate during construction/	
INSPECTION AND MAINTENANCE BY OWNER		
OWNER'S RESPONSIBILITY	Clean drainage systems; repair broken joints in drains and leaks in supply pipes. Where structural distress is evident see advice. If seepage observed, determine causes or seek advice on consequences.	

Extract from "Landslide Risk Management Concepts and Guidelines", Australian Geomechanics Society Journal, Volume 37 No. 2, May 2002, p43.

Figure 2 – Illustration of good and poor hillside practices



Extract from "Landslide Risk Management Concepts and Guidelines", Australian Geomechanics Society Journal, Volume 32 No. 2, May 2002, P44.

5.0 PLANNING SCHEME POLICY 5 – STRUCTURE PLANS

5.1 Relationship with the planning scheme

(1) This part sets out information council may request where development involves a large or greenfield development site to address the Performance Outcomes of the Emerging Community Zone Code and Reconfiguring a Lot Code.

5.2 Information Council May Request

5.2.1 General

(1) The planning and design process is expected to occur at a series of scales, with an increasing level of detail at each. All subdivisions must demonstrate how the proposed development meets the relevant performance outcomes. Accordingly, a broader structure plan may be required to determine that the proposal integrates well with the surrounding urban fabric. The preferred approach to the design process and the outputs expected from each stage are outlined below.

5.2.2 Site and context assessment

(1) Prior to preparing the structure plan, an assessment of the site and its context should be undertaken. A site analysis should investigate the following features as a minimum:

(a) environmentally significant areas including areas of bushland habitat, connecting corridors, foreshores, waterways, wetlands and significant individual trees;
(b) any natural hazards affecting the site and surrounds;
(c) topography and landscape features, views and vistas;
(d) the existing movement network and future connections, and their treatments; including public transport routes and their stops and pedestrian and cyclist paths;
(e) existing and proposed open space networks;
(f) existing and proposed social and physical infrastructure networks;
(g) the existing residences and structures, land uses and approvals on the site and surrounding sites; past land uses where relevant;
(h) the location of nearby schools, shopping centres, employment generators and other community facilities; the location of operating poultry farms or other potentially impacting activities; and
(i) where relevant, the location of breeding and sheltering areas for mosquitoes and biting midges;
Note: Refer to Queensland Health's guidelines to minimise mosquito and biting midge problems in new development areas.

5.2.3 Preparing a structure plan

(1) A structure plan is a conceptual plan which allows for a degree of flexibility, refinement and improvement at more detailed design stages.

(2) The extent of the information contained in a structure plan will depend upon the issues and their resolution, the context of the development in the surrounding area and the nature of site constraints and characteristics. Where necessary, it may be supported by technical information that provides the rationale for the approach adopted.

(3) A structure plan must clearly demonstrate how the proposed development will integrate with the surrounding community including existing parks, services and infrastructure networks including the movement system (road network, public transport facilities and pedestrian and cyclist paths), as well as the nature and staging of the proposed development.

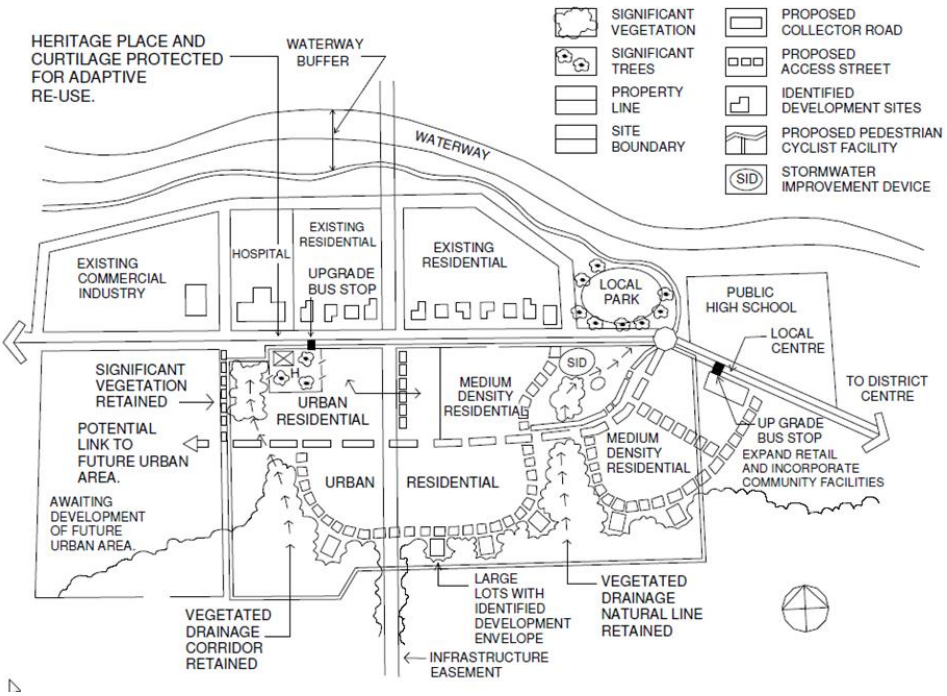
(4) At a minimum, the structure plan should set out:
- (a) the vision and guiding principles for the development or component precincts;
- (b) the approximate lot or dwelling yield for each part of the site (density);
- (c) the proposed mix of uses and location of each proposed land use, including (where applicable), the extent of facilities proposed such as community facilities, centres, employment and schools;
- (d) key urban design and landscaping elements or themes of the development and how these contribute to overall character, functionality and quality of the streetscape, built form and public realm components;
- (e) how development interfaces to the surrounding neighbourhood, and to other buildings or uses;
- (f) how significant environmental values are protected and enhanced, including continuation of environmental corridors;
- (g) how and where infrastructure is to be provided such as water, sewerage, stormwater and community infrastructure;
- (h) the proposed open space network; and
- (i) the proposed movement network (roads, public transport and pedestrian and cyclist facilities).

(5) Applicants must have regard for plans for trunk infrastructure and desired standards of service identified in the local government infrastructure plan.

(6) Mapping should be provided at a maximum scale of 1:2,000 and include a bar scale and north point.

(7) Where the site or the proposal entail complex issues or involves a large site with multiple precincts and land use, community and stakeholder consultation is encouraged to assist in the preparation of a structure plan.

Figure 1 - Example Structure Plan



6.0 ENVIRONMENTAL EMISSIONS

6.1 RELATIONSHIP WITH THE PLANNING SCHEME

(1) The purpose of this policy is to set out the requirements for the preparation and submission of development applications, including technical reports, for sites that have the potential to emit, or be impacted adversely from, environmental emissions such as air or noise.

(2) This part sets out:

(i) information council may request to demonstrate compliance with the performance outcomes of the code. These are contained in the following subsections:
- 6.2.1.1 Air quality reports
- 6.3.1.1 Noise reports
- 6.3.1.2 Noise management plans

(ii) guidance for applicants on approaches to air quality and noise management. These are contained in the following subsections:
- 6.2.2.1 Air quality management
- 6.3.2.1 Noise impacts
- 6.3.2.2 Alternative noise criteria
- 6.3.2.3 Noise management and reduction
- 6.3.2.4 Noise barriers

Note: Where a development includes a devolved Environmentally Relevant Activity as defined under the Environmental Protection Act 1994, this part of the development is assessed for environmental impacts in accordance with the Environmental Protection Act 1994.

The Department of Environment and Heritage Protection has developed the following guidelines to support environmental authority applications with air and noise impacts:
- *Guideline - Environmental Protection Act 1994 - Application requirements for activities with impacts to air; and*
- *Guideline - Environmental Protection Act 1994 - Application requirements for activities with noise impacts.*

6.2 AIR QUALITY

6.2.1 Information Council May Request

6.2.1.1 Air Quality Reports

(1) An air quality report may be required for a proposed development that has the potential to emit air pollutants that could have an adverse impact on air quality due to the volume or type of emissions and/or the proximity of the development to a sensitive land use.

(2) An air quality report is required to determine potential air quality impacts and matters that must be addressed to ensure the proposal meets the air quality requirements of the relevant codes.

(3) The report must describe the existing air environment, the predicted air quality and any health risk impacts and assess these impacts in comparison to the applicable air quality objectives.

(4) Air quality reports must be prepared by a suitably qualified person who has demonstrated practical and theoretical knowledge of air quality assessments.

(5) An air quality report must contain the following –

(a) A detailed site plan showing the layout of the site including main emission sources and the surrounding environment including local industries, sensitive receptors and topography;

(b) A detailed description of site activities including:
  (i) the type of emissions, such as stack, area/volume, fugitive;
  (ii) the operational parameters of all emission sources, including information such as variations to emission rates due to “peak” or “average” emissions, or upset conditions;
  (iii) a description of the processes conducted at site, including operational hours;
  (iv) the technology and design required to achieve best practice environmental management;

(c) A discussion of the prevailing meteorology based on on-site data (where available) or the closest monitoring information representative of the proposed site. This should include wind roses and an analysis of wind characteristics that are important to the dispersion of pollutants;

Note: The Queensland Department of Environment and Heritage Protection’s Air Quality Sampling Manual provides guidance on measuring meteorological parameters when completing air dispersion modelling.

(d) An estimation of emissions. Emissions can be estimated using various methods such as -
  (i) National Pollutant Inventory Emissions Estimation Technique Manuals;
  (ii) USEPA AP 42 Emissions estimations handbooks;
  (iii) from monitoring or stack testing;
  (iv) industry specific best practice guidelines;

(e) An assessment of the existing air quality including a description of the surrounding land uses that may affect ambient air quality. Where available, air quality information from nearby monitoring stations should be included. The Queensland Department of Environment and Heritage Protection has accepted the use of the 99th percentile for determining background pollution concentrations;

(f) Dispersion Modelling (where undertaken) should consider the following:
  (i) an appropriate dispersion model (e.g. CALPUFF) should be chosen in accordance with the New South Wales government’s *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW;*
  (ii) if the AERMOD model is selected, then the meteorological data file needs to be prepared in accordance with the Victorian Environmental Protection Agency document entitled: *Construction of input meteorological data files for Environmental Protection Agency Victoria Regulatory Air Pollution Model (AERMOD), Publication No. 1550, 2013*; meteorological data is site representative across all seasons over at least one year;
  (iii) simulated meteorological files may be used provided the data is demonstrated to be generated using appropriate methodologies and is representative of conditions of the site;
  (iv) building wake effects are included where there is an on-site or nearby building that may impact on plume dispersion;
  (v) terrain effects are accounted for where terrain may affect emission impacts;
  (vi) cumulative impacts are accounted for either in the model or in background monitoring data;
  (vii) variation to operating conditions and worst case scenarios. Apart from the normal suite of emission data such as emission rate, temperature, exit velocity or stack dimensions, the variation in process characteristics that impact on

emissions need to be considered, such as hours of operation, upset conditions, different feedstocks and fuels, and changes in process controls;

(viii) the grid spacing of the receptor grid is chosen so that the predicted maximum concentration is not underestimated. Discrete or elevated receptors are included in the assessment in order to assess the impact where applicable;

(ix) pollution contours for all pollutants, and tables summarising the predicted ground-level concentrations at sensitive receptors, are included with comparisons against relevant air quality standards; and,

(g) where there is potential for odour impacts on sensitive receptors, the following additional information is required to determine the likelihood of adverse odour impacts:

(i) details of the modelled odour concentrations at the "most exposed existing or likely future off-site sensitive land uses" including a comparison with the odour criteria list in the relevant planning scheme code

(ii) recommendations to minimise as much as reasonably practicable the impact of odour emissions at sensitive land uses which may include the provision of adequate separation distances, edge/buffer treatments, waste minimisation and best practice control activities, refer to Table 1 of this policy for further information.

Note: For further guidance on odour impact assessment reports refer to the Queensland Department of Environment and Heritage Protection's Odour Impact Assessment from Development Guideline. For additional reference material for assessment and measurement of air quality refer to Australian Standard 4323.3:2001 Stationary Source Emissions - Determination of Odour Concentration by Dynamic Olfactory.

(h) recommendations to minimise the impact of air quality/odour emissions, including emission control technology and adequate setback distances where a sensitive land use may be affected.

6.2.2 Guidance for Applicants

6.2.2.1 Air quality management

(1) Applicants are encouraged to take opportunities to reduce air emissions through best practice management and the application of the management hierarchy for air emissions. This management hierarchy is based on; avoid, recycle, minimise and manage, as described in the *Environmental Protection (Air) Policy 2008*. Some examples of waste prevention and minimisation, cleaner production and best practice environmental management are provided in Table 1 below.

Table 1 – Methods to minimise impacts from air emissions

Design and operations management	Maintain adequate buffers between operations and nearest sensitive land use.
	Incorporate alternative attenuation measures into the development to reduce nuisance impacts at sensitive land use.
	Locate and design the buildings and infrastructure to reduce potential impacts on adjacent land uses, for example locate building openings, exhaust vents, stacks, and refuse storage areas furthest from sensitive land uses.
	Provide sealed areas on site for vehicle manoeuvring and access.
	Clean equipment, work and traffic areas regularly to minimise the sources of dust and clean spilt materials immediately.
	At sites which have potential organic vapour emissions such as bulk fuel storage facilities and service stations, where practicable, install vapour recovery systems. Vent pipes are located as far away as possible from sensitive land uses.

	Develop and implement an environmental management plan that details the procedures for air quality management and pollution prevention, staff training, role definition and responsibilities and monitoring of performance.
Dry materials/stockpile handling	Maintain exposed stockpiles of raw or processed material to prevent fugitive dust emissions.
	Maintain stockpiles with walls on three sides and use water sprays to keep material damp where practicable.
	Keep stockpile materials 0.5 metres below wall tops and 0.5 metres inside open ends of stockpile walls.
	Enclose conveyors and chutes to minimise wind-generated dust emissions and provide a belt scraper on each conveyor.
	Use water sprays at receival areas and transfer points to keep material damp. Minimise drop height between conveyors.
	Store materials which are of fine or small particle sizes in sealed containers where practical.
Surface cleaning and/or coating	Surface coating by spraying is conducted in spray booths fitted with adequate filters to catch overspray. Filters can be waterwash, fibre or baffle. A baffle filter is only acceptable for small paint rates where paint is applied electrostatically. Where practicable surface coating and cleaning are conducted inside of buildings or enclosures.
	Spray booths are fitted with a stack of adequate height to ensure there is sufficient dispersion of exhaust gases. Stack outlets should not be fitted with conical weather caps, spinning tops or the like which would interfere with the free vertical discharge of the exhaust gases.
	Where possible, use water-based coatings or those which produce low emissions.
	Replace lids or cover odorous materials promptly after use to minimise evaporation, off site impacts and wastage.
	For surface coating processes, train staff in proper application techniques of materials to improve drying times and minimise odour impacts.
	Surface finishing equipment using abrasive and water blasting, sanding and grinding should have dust collection devices fitted, such as an enclosed booth, unless the object is too large or too heavy to fit in the booth or a fixed structure. Outdoors blast cleaning should preferably be carried out using a blasting gun or an airless applicator which sucks away the blasting agent together with any dust generated to a dust collector. Outdoor abrasive blasting should also be avoided during high wind conditions. Where impractical, adequate buffer distances are provided with effective barriers or screens to prevent adverse particulate emissions.
Emission controls	Point source particulate and odour emissions are vented through a filter to minimise the discharge. Filters include devices such as: wet scrubber, cyclone, bag, electrostatic, paper, activated carbon, and fibre. Odour control equipment can include one or a combination of technologies including condenser, scrubber biofilter and/or afterburner.
	Use mechanical ventilation systems and activated carbon filters or scrubbers to prevent the release of any uncontrolled and objectionable odours from buildings or rooms.
	Fabric or bag filters are installed to vent silos. Silos should also include automatic level sensors, air tight inspection hatch and an alarm or shut off valve to prevent overfilling and a burst bag detector system with ducting to ground level near tanker filling point.
	Dust extraction systems exhausting through fabric filters may be an effective alternative to water sprays. Water spray systems are installed for outdoor operations with a high dust generating potential.
	Fuel burning should not be carried out under reducing conditions which has the potential to cause smoke nuisance.
	Where facilities include bulk storage facilities for organic liquids, such as petroleum, implement design features and install suitable controls to manage organic vapour emissions.

	Volatile liquids are pumped instead of poured.
Waste management	Putrid or tainted organic materials should be stored in enclosed containers and refrigerated until removed from premises.
	The transportation of odorous wastes including sewage effluents, food processing waste, offal, manure or carcasses is in covered vehicles or containers/bins to minimise odours or dust emissions.
	Wastes are recycled and reused where possible. No wastes are burned as a disposal method, except where it can be demonstrated it is a form of energy recovery.

6.3 NOISE

6.3.1 Information that may be requested

6.3.1.1 Noise Reports

(1) Where a proposed development may cause a noise impact on a sensitive land use, a noise report may be required to confirm the development will not adversely impact on the sensitive receiving environment.

(2) Noise reports must be prepared by a suitably qualified acoustic consultant who has demonstrated practical and theoretical knowledge of noise assessments.

(3) A noise report must include the following information as a minimum:

(a) A site analysis plan at a scale of 1:100 or 1:200 indicating the location of the development noise sources and sensitive land uses;

(b) Plans showing the orientation of buildings and facilities including:
- (i) the location of openings such as delivery areas, loading bay areas, car parking and refuse collection;
- (ii) the location of noise generating plant such as air conditioning, pumps, compressors and fans with respect to adjacent sensitive land uses;
- (iii) details of proposed noise attenuation devices;
- (iv) design and construction materials to be used;
- (v) sketch plans and elevations showing building design, building layout and materials;
- (vi) the façade noise level used as the basis for calculating building attenuation requirements at each location including reduction weightings (Rw) for the building;

(c) Proposed operations including a comprehensive description of -
- (i) the proposed operational hours, site operations and activities;
- (ii) plant and equipment to be used, including its location, time and period of operation, and frequency of use;
- (iii) the operating sound power level in dB(A) and frequency analysis for all proposed equipment and plant;
- (iv) an accurate description of any noise with annoying characteristics described in terms of the noise level, frequency and duration of occurrence;
- (v) details of the frequency of proposed transport to and from the site including deliveries;
- (vi) noise sources from surrounding businesses and activities including the location, nature and operational hours;

Note: If an exact description of equipment cannot be supplied, noise data from equivalent equipment operating at similar operating conditions may be accepted as a substitute. Ensure transport routes are located to cause minimum noise impact in surrounding areas and are identified on a suitable map.

(d) Noise issues - all noise issues associated with a proposed development must be clearly defined, preferably in a table or a list. Minor noise issues which do not justify a full analysis should still be identified and reasons given to explain their insignificance.

(e) Noise control strategy - a clear and concise statement and plan must be provided which sets out the proposed recommendations to deal with each of the identified noise issues. This may include a combination of-
- (i) source control - such as plant selection;
- (ii) source modification - such as acoustical treatments or management measures;
- (iii) propagation control - such as buffers and barriers;
- (iv) receptor modification - such as a dwelling upgrade;

(f) Provide details of the noise attenuation measure to be implemented to reduce noise levels to achieve the relevant noise criteria including the methods used to calculate this attenuation. Where acoustic barriers are recommended, associated landscaping plans are required demonstrating compliance with diagrams 1, 2 or 3 of Appendix A. For further information refer to section 6.5.5.3 Noise Reduction and Table 6 - Methods to minimise impacts from noise emissions.

(g) Noise monitoring/measurements (where required) must include:
- (i) a map showing the location of measurement positions, detailing microphone height and orientation, and including details of any obstructions or interference such as reductions in the angle of view;
- (ii) reflective surfaces and atypical barriers are avoided where possible when taking measurements;
- (iii) the type of sound being measured and the character of the sound field;
- (iv) the sound power levels obtained, including frequency analysis, where relevant;
- (v) the sound pressure levels measured at each monitoring location, including output data such as log files, traces, and charts from the noise monitoring equipment;
- (vi) The descriptors for all noise measurements for example $L_{A10,}$ L_{Amax}, L_{A90}, L_{Aeq};
- (vii) frequency weighting and response time, fast/slow/impulsive, used for each measurement;
- (viii) duration of each measurement period. Measurement intervals shall not be less than 15 minutes;
- (ix) date and time at which each measurement was performed. It is important the monitoring is carried out at times and over periods that adequately characterise the noise under investigation and the local acoustic climate. Justification of times and periods selected should be included;
- (x) noise levels should represent normal day to day operations;
- (xi) relevant meteorological conditions and other site considerations during assessment. These include, for example, air temperature, relative humidity, barometric pressure, wind speed and direction, rain, aircraft noise, vehicle noise and insect/wildlife noise;
- (xii) A description of the nature of ground cover, for example, thick grass, shrubbery and dense vegetation between the proposed development site and the area likely to be influenced;
- (xiii) noise level or noise contour predictions in the locality both with and without noise attenuation;
- (xiv) the assessment should include an evaluation of a range of noise attenuation options and recommendations to mitigate potential noise nuisance;
- (xv) provide details and justification of the methodology used, including all assumptions made as part of the assessment;
- (xvi) name of manufacturer, type and serial numbers of all monitoring and calibration equipment;
- (xvii) last laboratory calibration date, internal reference check and external calibration results before and after measurement;
- (xviii) name of the person who conducted the assessment and the name of the report author, if different.

(h) Noise predictions and calculations provided must include:
  (i) a description of the modelling methods applied;
  (ii) details of noise measuring and modelling procedures, calculations and assumptions;
  (iii) name of the model used for the predictions;
  (iv) monitoring data which supports calculations resulting from modelling;
  (v) for any source noise that may have tonal or impulsive characteristics, provide details of the calculations for adjustments/corrections;
  (vi) where tonal components are expected to be present, one-third octave band predictions are required to adequately describe the contribution from these noise sources. The level and frequency of occurrence of impulsive noise, or noise with other annoying characteristics such as amplitude or frequency modulation or information content, should be provided;
  (vii) individually predicted components are combined to produce the predicted cumulative noise impact at each receptor site;
  (viii) calculations showing effectiveness of proposed noise attenuation measures such as distance attenuation and building attenuation;
  (ix) predicted noise levels are compared with acceptable levels and/or the acceptable solutions specified in the relevant codes. Exceedences are identified separately and the relevant degree of noise reduction required to achieve compliance with the appropriate criteria is specified.

Note: The noise assessment must comply with the Queensland Department of Environment and Heritage Protection's Noise Measurement Manual and Australian Standards.

6.3.1.2 Noise Management Plans

(1) A Noise Management Plan is required when potential noise nuisance can be effectively controlled through management measures.

(2) A Noise Management Plan allows an applicant to monitor and ameliorate potential noise nuisance through documented processes which can be regularly reviewed and amended as per site requirements.

(3) A Noise Management Plan must include:
  (i) the intended noise reduction measures and their anticipated performance;
  (ii) management measures include all noise control actions which rely on people to behave in a particular way. For example requiring staff to restrict certain activities to certain times or to intervene by closing doors or re-directing activities;
  (iii) performance indicators, a review schedule and indicate the responsible person(s) for achieving the aim of the plan;

6.3.2 Guidance for applicants

6.3.2.1 Noise Impacts

(1) Noise is assessed as part of the development application to enhance or protect acoustic environmental values in a manner consistent with the objectives in the *Environmental Protection (Noise) Policy 2008.* This policy identifies environmental values to be enhanced or protected, these being qualities of the acoustic environment that are conducive to:
  (a) The wellbeing of the community of a part of the community, including its amenity;
  (b) The wellbeing of an individual, including the individual's opportunity to have sleep, relaxation and conversations without unreasonable interference from intrusive noise.

(2) Noise can be defined as unwanted sound that unreasonably intrudes into our daily activities and can cause varying degrees of nuisance and annoyance. Noise that occurs at night is more likely to disturb a community than noise that occurs during the day. Noise may contain annoying characteristics, such as -
(1) tonality - "humming" and "whining";
(2) modulation - regular changes in level or pitch such as a siren;
(3) impulsiveness - "hammering".

6.3.2.2 Alternative Noise Criteria

(1) Where noise criteria cannot be achieved the comparison of like parameters can be applied. Table 3 can also be used to provide a qualitative description in relation to changes in sound pressure level at sensitive receptors.

Table 3 - Subjective Effects of Changes in Audible Sound Pressure

Change in Sound Pressure Level (dB)	Change in Apparent Loudness
+3 dB	Just perceptible
+5 dB	Clearly noticeable
+10 dB	Twice as loud
Reference: Bies D.A. & Hansen C.H. (1996) Engineering Noise Control Theory and Practice, Second Edition; Department of Mechanical Engineering, University of Adelaide: South Australia.	

6.3.2.3 Noise Management and Reduction

(1) Applicants are encouraged to take opportunities to reduce noise emissions through the best practice environmental management measures. Such measures include noise minimisation technology, construction, design, location, form, environmental performance, management considerations and alternatives. Examples are given in Table 4.

Table 4 – Methods to minimise impacts from noise emissions

Siting and design	Select an appropriate site for the use considering the proximity to sensitive land uses and the local meteorological conditions
	Design site layout to ensure building openings, roads, parking areas and other major activities and operational areas are located away from current or future sensitive land uses
	Where possible use the layout of the buildings, site infrastructure and natural topography as noise barriers
	Where possible confine noisy processes to areas protected by enclosures or barriers
	Locate noisy processes such as loading bays and entrances/exits away from sensitive land uses
	Locate noise sources such as air compressors, pumps and similar in areas furthest from sensitive land uses, provide effective noise barriers or enclosures, and keep doors on enclosures closed when operating
Construction standards	Vehicle traffic areas are paved, have low gradients and are maintained in good condition
	Install double-glazing to windows and sound locks to doors facing sensitive land uses
	Buildings housing noisy operations, activities or equipment are constructed of suitable materials to reduce noise transmission such as ceilings and walls lined with sound absorbing material
	Reduce structure-borne noise and vibration by mounting equipment on appropriate isolation systems designed by a specialist in this field
Operation standards	Install noise suppression devices to equipment according to the manufacturer's specifications and ensure the efficiency of these devices is maintained

	Design and maintain adequate noise buffers between noise sources and sensitive land uses. In particular, install noise barriers such as screens around noisy equipment, operations and activities
	Fit all diesel engines and noisy vehicles with efficient exhaust mufflers
	Avoid installing machinery that may have humming or whirring components or impulses, or annoying tonal or hammering noises. If such machinery is installed, noise suppression devices are applied to mitigate potential nuisance
	Fit effective inlet and exhaust silencers to air compressors and ensure that air pressure operated controls and air operated valves on silos and hoppers are equipped with silencers
	Where possible, substitute equipment with an equivalent quieter/lower sound power level piece of equipment, for example, electric rather than diesel or air powered
	Where possible replace alarms, horns and telephone bells with visual signs, mobile phones or pagers
	Where blasting of rock or hard ground is involved, use technologies that minimise air blast overpressure and ground vibration
Noise management measures	Ensure that openings including windows and roller-doors facing sensitive land uses are kept closed and all unnecessary openings are sealed. Install signage to alert staff and/or visitors to their responsibilities to minimise the generation and propagation of unnecessary noise
	Limit noisy routine operations to standard working hours of 7am to 6pm Monday to Friday, and 7am to 1pm Saturday. Noisy work should not be carried out on Sundays or public holidays, except where approved as part of the land use or another approval such as an activity under the *Environmental Protection Act (as amended)*
	Conduct noisy activities at times when the likelihood for nuisance is minimised, for example, the middle of the day
	Work outside of standard working hours is limited to quiet "finishing off" work and generally conducted within buildings
	Limit vehicle movements, especially deliveries and truck movements, to standard working hours
	Where possible, activities such as concrete pours are restricted to standard working hours. If activities are required to occur outside of these hours, affected premises are notified of the duration and times in advance of the event
	Employ regular inspection and maintenance programs to ensure noise control fittings such as seals, doors and exhaust systems are in good working order and prompt attention is given to loose or rattling covers, worn bearings and broken equipment
	Develop and implement an Environmental Management Plan including procedures for - (i) noise management; (ii) pollution prevention; (iii) staff training; (iv) customer education where applicable; (v) definition of roles and responsibilities; (vi) monitoring of performance; (vii) contingency actions.

6.3.2.4 Noise Barriers

(1) The use of barriers for noise attenuation is the least preferred option, however, the following should be considered during the design of the development where noise attenuation measures in the form of barriers, fences and vegetated buffers are required.

(a) The design of these noise attenuation measures should not -
   (i) compromise the ability to protect property from crime and vandalism;
   (ii) obstruct or reduce passage by pedestrians to public transport nor contribute to deterioration of accessibility to public transport;

(iii) create sterile areas that are unusable, unsafe and negatively affect the streetscape;
(iv) result in continuous barrier fencing along roadways which have both visual impacts and also impacts on people and wildlife movement;
(v) obstruct the overland flow of stormwater or cause increased flooding or ponding of stormwater;
(vi) compromise the requirements of State Planning Policy – state interest guideline - Biodiversity;
(vii) compromise the Redland City Council's Koala Conservation Agreement Program.

(b) Noise attenuation measures for dwellings or building façades should be designed as architectural features including the stepping of buildings, angling wall alignments, and roof line variation to add interest to the form and enhance the appearance to the street frontage.

(c) Noise attenuation measures are designed to facilitate wildlife movement while maintaining noise attenuation effectiveness by ensuring -
(i) vegetated earth mounds are considered in preference to fences or barriers;
(ii) suitable vegetation is provided adjacent to noise attenuation mounds, barriers and fences to facilitate wildlife movement;
(iii) attenuation barriers and fencing incorporate wildlife movement measures that are suitable to the species expected to use the area;
(iv) vegetation species selected are locally native species.

(d) Continuous barrier fencing is avoided along trunk collector and sub-arterial roads so as to not create sterile traffic corridors.

(e) Views are retained where possible by using appropriate buffer distances, height, orientation and materials.

(f) Where fencing is used it is articulated, landscaped and incorporates multiple access points for pedestrians and cyclists.

(g) Acoustic fencing is of low maintenance design.

(h) It should be demonstrated that other attenuation measures have been considered first as alternatives to structural barriers. For example, at the design phase of a development, consideration should be given to the use of land between the source and receiver which can increase buffers and assist in attenuation. Such land uses could be minor roads and/or parks.