WBC STRATEGIC ALLIANCE

GUIDELINES FOR ENGINEERING WORKS

AUGUST 2009

VERSION 4

These Guidelines were developed by staff from Wellington, Blayney, Cabonne Councils and Central Tablelands Water, and remains the IP of the WBC Strategic Alliance.

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Amendment Record

Proposals for amendment or addition to the contents of this manual are to be forwarded in writing to:

The Director Engineering
Blayney Shire Council
PO Box 62
BLAYNEY NSW

Amendments promulgated should be certified in the following table when entered into the manual.

AMENDMENT			ENTERED
No.	DATE	DESCRIPTION	NAME

Section 1.0 GENERAL

1.1 INTRODUCTION

These Guidelines for Engineering Works have been developed to provide consistent guidelines for the design of engineering works within the Strategic Alliance Local Government areas of Blayney, Cabonne and Wellington and the Central Tablelands Water Distribution Area to facilitate the expeditious processing of engineering plan submissions, construction approvals, and linen plan releases for subdivisions and developments within these Council areas.

The Councils welcome the submission of innovative design solutions which vary from the provisions contained within these guidelines and will consider these proposals on their merits, having regard to such matters as the infrastructure design life, long-term maintenance requirements and conformance generally with accepted Engineering standards.

There are, however, variations from Council to Council on some requirements and need to be taken into account where they are highlighted in the Guidelines.

Applicants should be aware that all development applications are considered on the merits of the development and its overall impact on the area, and not solely in compliance with minimum engineering standards. It is imperative that all conditions of development consent imposed under the Environmental Planning and Assessment Act 1993 are addressed within the detailed engineering plans, as these conditions take precedence over the information contained herein.

When development approval includes conditions of construction which are embodied in the approved plans and specifications, the onus is on the applicant to whom the approval is given to ensure works are carried out in compliance with these conditions.

The relevant Council will hold the applicant, to whom the development approval was issued, solely responsible for constructing the approved infrastructure works and maintaining them for the duration of any maintenance period. Any contractor carrying out subdivision or development works is directly responsible to the developer, and not to Council.

1.2 DEFINITIONS

Throughout these guidelines, the following definitions and interpretations are adopted:

Applicant / Developer	Refers to the person seeking development approval
Alliance Councils	The Local Government bodies responsible for *their area within Blayney, Cabonne or Wellington Local Government Areas.*
Director of Engineering	The Director of Engineering for Blayney, Cabonne or Wellington Councils and Central Tablelands or their nominated representative.
Construction Certificate	Certificate provided by either Director of Engineering, Director Environmental Services, or their delegate, or Private Certifier, which allows construction of works to proceed.
Council's Engineer	Council officer with delegated authority from the Director of Engineering to carry out inspections.
Cross Drainage	Drainage used to convey storm water from one side of a road carriageway to the other, nominally at right angles to the road centreline.
Development	Approved works to be carried out by the Applicant.
Development Application	Application for approval to carry out building, engineering or other works as defined in the Local Government Act.
Drawings	Documents presenting information in pictorial form, with or without text, including long sections, elevations, sections and other detail as necessary to fully describe the works to be carried out.
Private Certifier /Engineer	A suitably qualified person, engaged by the Applicant to certify that engineering works have been designed and constructed to Council's Engineering Guidelines for Development and Subdivision Works. The relevant Director may perform the role of the Private Certifier. Note that the private certifier must be independent.
Registered Surveyor	A person registered under the Surveying Act, 2002, as amended.
Specifications	A written document with technical information, directions and conditions which deal with the quality of materials, standard of workmanship and other requirements of a project.
Subdivision	The division, by a land owner, of all or parts of a parcel of land into separate allotments of land, each with a separate title.
Traffic Controller	Must be suitably qualified in accordance with the RTA Guide for Traffic Control

1.3 SUBMISSION OF DRAWINGS AND SPECIFICATIONS

1.3.1 Engineering Drawings

The Applicant is required to submit three complete sets of Engineering Drawings to Council prior to the commencement of any development or subdivision site works.

As a minimum, the engineering plan submission must include one A1-sized set, two A3 sets and an electronic version (eg Autocad) format of all drawing sheets, and contain the following:

- **Cover Sheet**
- **Road Details**
- **Drainage Details**
- **Sewerage Infrastructure**
- **Water Infrastructure**
- **Electricity and Telecommunications Plan**
- **Landscaping Plan (where applicable)**
- **Erosion & Sediment Control Plan**
- **Traffic Management Plan**
- **Certification Report**
- **Safety Audit**

One set of the final approved engineering plan sets will be returned to the developer.

For uniformity of plan presentation and to facilitate filing and microfilming, all plan sizes, lettering, linework, and symbols are to conform to the latest edition of Australian Standard 1100 - Technical Drawing.

Each sheet shall include bar scales showing the reduction ratio of all works shown on that sheet, with a ratio scale shown adjacent thereto. All sheets are to be signed by the Consultant / Engineer responsible for the design of the works.

1.3.2 Persons Qualified

Council requires that engineering works be designed to Council standards by a person, either holding qualifications acceptable for Corporate Membership of the Institution of Engineers, Australia, or approved by the relevant Director, and/or who has proven experience in the preparation of plans and specifications for land development.

1.3.3 Construction Specification

These Guidelines shall not be interpreted as being a specification, even though some design criteria are included throughout.

The minimum standard of Construction Specifications to be used are the relevant NSW Roads and Traffic Authority (NSW RTA) construction specifications. However, the developer may submit their own job-specific specifications for approval where there is any variance from these standard specifications.

Two copies of any job-specific specification are to be submitted with the initial set of engineering plans, for examination by Council. A total of three sets of the final specification are to be left with Council. One copy of the approved specification will be returned to the applicant.

1.3.4 Approval of Engineering Drawings and Specifications

Approval of Drawings and Specification may be made by either a Private Certifier, or by the relevant Director of the Alliance Council.

Where the Applicant wishes the relevant Director to certify the development or subdivision works, the correct fee must be paid at the time of plan lodgement, and three sets of engineering plans and calculations submitted to Council for examination. Upon approval of the preliminary plans, the developer shall make all necessary amendments and submit a final set of engineering plans. At this time the Construction Certificate will be issued.

Council's approval is conditional on the above basis and does not relieve the developer from rectifying any errors or omissions which may become evident during construction.

Further, the approval of engineering plans and specifications is current for a period of twelve months only. Should these guidelines change before the works are substantially commenced, the developer shall comply with the most recent version. If work has not substantially commenced inside of this twelve month period, the relevant Director may require revised Engineering Plans and Specifications to be submitted for approval.

1.3.5 Submission of Works Contractor Details

The applicant should provide written notice of the name, address and telephone number of the works contractor to the relevant Director at least seven days prior to the proposed date of commencement of any construction.

1.4 INSPECTION OF WORKS

All road, drainage, water, and sewerage construction works shall be inspected by either Council staff or a Private Certifier during construction. The type and frequency of inspections are detailed in Section 1.6.

The Applicant shall at all times give uninterrupted access and afford every facility for the examination of any works and materials requested by the relevant Director.

1.5 FEES AND CONTRIBUTIONS

Engineering drawings will be released upon payment of the appropriate plan checking and site inspection fees, current as at time of plan lodgement. Subdivisions and developments may also incur charges levied under Section 94 of the Environmental Planning and Assessment Act, Section 25 of the Water Supply Authorities Act, or as otherwise detailed in the development consent. The current value of these fees will be supplied upon request.

1.6 INSPECTION AND TESTING

All road, drainage, kerb and gutter, water and sewerage reticulation works associated with a development will be inspected by Council's Engineering Department or appropriate certifier.

The procedure for testing road pavements, water reticulation and sewer reticulation is shown in Section 8.0 of these guidelines.

The developer shall at all times give uninterrupted access and afford every facility for the examination for any works and materials requested by the relevant Director or his authorised delegate.

The whole of the works are to be carried out to the satisfaction of the relevant Director of the relevant Council.

Council will inspect engineering works at the following stages:

- Following site regrading and shaping, and prior to installation of footway services;
- Installation of erosion and sedimentation control measures;
- Storm water drainage lines prior to backfill;
- Water and sewer lines prior to backfill;
- Testing of water and sewer lines;
- Subgrade preparation, before placing pavement;
- Establishment of line and level for kerb and gutter placement;
- Completion of each pavement layer ready for testing;
- Road pavement surfacing;
- Completion of works

The developer or contractor shall give Council a minimum 24 hours notice when requesting an inspection to ensure that development works are not delayed.

The developer shall, if required by Council's Engineer, submit delivery dockets for all materials used, and all material and performance test results obtained in the development.

1.7 PUBLIC SAFETY

The developer shall not obstruct and will be held responsible for the safety of the public, traffic and utility services such as electricity, water, telecommunications and the like, and shall provide all watchmen, lights, barriers, signs and fences to prevent accidents to public or private damage or loss.

The applicant shall provide, erect and maintain all necessary temporary roads, bridges, footways, drains, supports and protection in order to ensure the above. These traffic control facilities shall be carried out in accordance with Australian Standards 1742.

1.8 DAMAGE TO PROPERTY

In the event of any utility service being damaged or interrupted the developer should forthwith notify the responsible authority and take all necessary steps to provide for the safety of the public and to have the damage repaired as quickly as possible. The cost of all repairs is to be resolved between the applicant, his contractor and the relevant Authority.

Where private property is damaged, the applicant shall arrange with the concerned party replacement, repair, or otherwise. This cost is to be resolved between the applicant and the relevant party.

1.9 COMPLETION OF WORKS

When the developer is of the opinion that all works have been satisfactorily completed, the developer should make arrangements with Council's Engineer for a Final Inspection to be performed.

The applicant, superintendent, or contractor shall be present for the Final Inspection and shall assist Council's Engineer in checking of levels, opening of manholes etc. as required.

All street name signs, advisory / warning signs, and traffic control devices should be installed prior to Council's Final Inspection.

If all engineering works are satisfactory, Council will issue a Notification of Completion. Council's Engineer may allow minor errors, omissions, or defects to be bonded or completed during the maintenance period; however, any major defects or omissions must be repaired before a Notification of Completion will be issued.

1.10 WORKS AS EXECUTED PLANS

Following the satisfactory completion of engineering works for a development or subdivision, 'Works-As-Executed' (W.A.E.) plans prepared by a registered surveyor or professional engineer shall be submitted, in a hard and electronic format, to Council's relevant Director. Such plan must be lodged prior to the release of the subdivision linen plan, or prior to occupation or use of the development.

The W.A.E. plans shall be Engineering Drawings as modified, and shall include the following items:

- invert levels of all drainage and sewerage lines at entrance and exit;
- location, class, size, and material of all pipes and subsoil lines;
- location and diameter of service conduits;
- pavement thickness as constructed;
- road centreline and kerb levels at all TPs, crests, sags, end of construction, and at 50 metre intervals on straights;
- footway widths at all TPs, centre of curves, and at each end of construction;
- location of kerb laybacks and vehicular driveways;
- location of stop valves, hydrants, water services, sewer manholes, sewer junctions, storm water and interallotment drainage pits;
- site regrading details - finished surface levels at centre of front and rear boundaries;
- contour depth of fill plans with depths in 0.25m increments shaded or hatched;
- the location and level of any permanent survey marks;
- any departure from approved plans, and additional work undertaken;
- show areas of lots which are unsewerable (ie, area where 1.667% fall from 0.6m below ground level to the sewer junction is not possible)

Each Works-As-Executed plan must include the following certification by the Registered Surveyor responsible for the preparation of the plan:

I certify that:

1. *This survey is a true record of the works that have been constructed, and*
2. *All drainage pipes and pits are located within the drainage easements and / or reserves shown on the linen plan.*
3. *All sewerage pipes and manholes are located within the sewerage easements and / or reserves shown on the linen plan.*
4. *All water pipes and fittings are located within the water easements and / or reserves shown on the linen plan.*

Signature: .....

Date: .....

Name: .....

Address: .....

.....

1.11 BONDS AND GUARANTEES FOR PERFORMANCE

Where Council holds a bond or bank guarantee and works have not been satisfactorily completed within the agreed time frame, the relevant Director may either grant an extension of time, or complete the works at the developer's expense. If serious defects arise which require urgent attention due to safety concerns or otherwise, Council may rectify works and shall either use the bond money as payment or bill the Applicant.

1.11.1 Maintenance Bond

Where a developer constructs or provides public infrastructure, a maintenance bond equal to 5% of the total development cost shall be lodged with Council prior to acceptance of the facility. A minimum bond amount of $1500 shall apply.

The maintenance bond is held by Council to ensure that all public infrastructure works have been constructed to a satisfactory standard, and can withstand the rigours of service conditions. Unexpended bond monies are refunded to the developer at the expiry of the maintenance period.

1.11.2 Maintenance Defect Period

The duration of the maintenance period shall be a **minimum** of 12 months from the date of lodgement of the bond or from the date of a satisfactory Final Inspection of the works, whichever is the later. However, if in the opinion of the relevant Director, the infrastructure has not been subjected to normal operating conditions during this time, the maintenance period may be extended until such time as the facility has been adequately tested under operating conditions.

Within the maintenance period, the developer is expected to rectify any defect or omission which becomes apparent in the Development works. Council may seize bond money to rectify faults if they have not been repaired within a reasonable time or if necessary to urgently repair a defect, which could conceivably cause harm or injury to persons or property.

1.11.3 Bond for Early Release of Linen Plan

Where engineering works for a subdivision or development are nearly complete, the Director of Environmental Services may accept a bond from the applicant for completion of works within a specified time after release of the linen plan. A non-refundable fee applies for preparation of the early release by the relevant Director and the amount of the bond or bank guarantee shall be at least double the estimated cost of the works and the completion of the bonded works will be required within an agreed time as defined within the agreement.

Early Release shall not be permitted in cases where the construction of water, sewer and stormwater infrastructure is not complete, nor if individual blocks are not accessible by an all weather road.

1.12 SURVEY REQUIREMENTS

All surveys shall be undertaken on Australian Height Datum.

All plans of survey are to show connection to at least two survey control permanent marks where practicable. Where it is intended to open a new road, at least two control marks per sheet of the subdivision plan are to be established in the road by the Surveyor, and connected to the nearest allotment corner.

The location and level of all permanent survey marks established as part of the works are to be clearly shown on the Works-As-Executed plans.

Survey Control Marks and lot boundaries shall be placed in accordance with the Surveying Regulation 2006, prior to the Final Inspection of the works.

1.13 MISCELLANEOUS

1.13.1 Tree Preservation

Each Council have varying Tree Preservation Orders on trees situated within the Shire.

This order prohibits, without the express prior approval of Council, the ring-barking, cutting down, topping, lopping, removal or wilful destruction of trees, notwithstanding whether such trees are on public or private land.

Plans for proposed development works are to show trees which may be affected together with species identification. Any approval to remove trees will be assessed in the overall development approval process. No trees are to be removed until approval is given in the approval process.

Scarred or significant trees (Heritage/Aboriginal or endangered species) must be labelled on the plans.

1.13.2 Adjoining Owners Consent

Where an applicant proposes to carry out work on an adjoining property, the applicant must submit the property owners written consent to Council before approval of engineering drawings will be issued.

At the completion of engineering works, a written clearance is to be obtained from the adjoining property owner and submitted with Council prior to the Final Inspection.

1.13.3 Lot Filling / Grading

Any areas to be filled or regraded are to be clearly identified on the engineering drawings. Provision shall be made to ensure that no ponding of water occurs on adjoining properties as a result of filling or regrading.

Where fill is to extend onto adjoining properties, or require a retaining wall at the property boundary, the adjoining owners consent is required.

The minimum lot grading shall be 1% towards a public road or interallotment drainage line, and a minimum 100mm of topsoil placed over all fill areas. All filled areas should be compacted to a level commensurate with the proposed land use. Residential, commercial and industrial areas should be compacted to a minimum 95% Standard, with certification from a NATA registered laboratory.

1.13.4 Compliance with Acts

It is the responsibility of the applicant and contractor/s to ensure that all works are undertaken in a safe manner. In particular, the applicant and all contractor/s shall ensure compliance with the Occupational Health and Safety Act and any other relevant Acts, Ordinances, and Regulations.

1.13.5 Public Utility Services

Existing Road: Utility services to be installed across an existing roadway are to be under bored at a depth required by each individual utility service provider, as per the respective Specifications.

At no time whatsoever is an open trench to be cut, unless approved by the relevant Council.

Existing Footpath with Concrete Paving: The utility service provider is to install the service on its correct alignment and depth. Saw cuts are to be in the same alignment as existing dummy joints or construction joints where existing. Dowels may be considered where new paving is placed on disturbed ground or material. The trench is to be backfilled with a granular material to the underside of the concrete footpath to a maximum dry density of 98% standard. The concrete is to be 20MPa, and comply with the Australian Standard Mix Design.

Traffic Control: Both vehicular and pedestrian traffic is to be guided by signage conforming to AS1742.3. A Certified Traffic Planner must complete a Site Traffic Control Plan, and a copy of the Plan is to be kept on site during the works.

Services should be located in accordance with Alliance Standard Drawing WBC005.

All services should generally run parallel to the road centreline and cross the road perpendicular to the centreline unless otherwise approved by Council's Engineer.

All service authorities are to have completed the installation of services prior to the final inspection of the works by Council.

Should the installation of utility services require the opening of any public roads, reserves etc., then a road opening permit is to be obtained from Council. Restoration of disturbed areas must be completed to the satisfaction of Council's Engineer prior to the final inspection and release of linen plan.

1.13.6 Electricity and Telecommunications

The applicant is required to supply electrical and telecommunications infrastructure, enabling all blocks to be serviced. The infrastructure shall be installed in the service corridor as shown in Drawing WBC005.

All infrastructure shall be installed in accordance with the requirements of the relevant Authorities.

1.13.7 Street Lighting

The applicant is required to provide appropriate street lighting for the whole of the development with design in accordance with AS 1158 and the requirements of Country Energy who will be responsible for maintenance.

The use of energy-saving lighting fixtures is encouraged; however no rebate will be issued to the developer if these type of lamps are approved.

Section 2.0 ROADS

2.1 INTRODUCTION

This section of the Guidelines for Engineering Works outlines the Alliance Council's recommended practice for the design of roads. It is not a comprehensive design manual, and is intended to complement the relevant Austroads and Roads and Traffic Authority publications.

2.2 ENGINEERING DRAWINGS

2.2.1 General

Engineering Drawing submissions are to include all information requested in Section 1.3.1 of these guidelines. The following section provides an outline of the road details which should accompany all design submissions.

2.2.2 Plan

Plans of all proposed development works are to include the following-

(i) lot boundaries and numbers
(ii) road centreline chainages, radii, tangent points and deflection angles
(iii) a benchmark within 100 m of the development site, with survey co-ordinates shown
(iv) street names and north point
(v) bar scales
(vi) existing services, trees, structures, and other significant landmarks
(vii) proposed service crossings
(viii) existing and new easements
(ix) road reserve and carriageway width
(x) all datum references to the Australian Height Datum
(xi) symbol legend
(xii) radii on kerb returns and kerb lines
(xiii) vehicular crossings (both urban and rural)
(xv) existing and proposed contours
(xvi) proposed location of all street signs and pavement markings
(xvii) location of soil test sites, and CBR values so determined
(xviii) cycleways and footpaths
(xix) cut and fill areas
(xx) building envelopes
(xxi) culvert locations with catchment areas and velocities.
(xxii) proposed tree removal – number and species

2.2.3 Longitudinal Section

A longitudinal section of the centreline of the roads should be supplied at scales of 1:500 horizontal, and 1:100 vertical (for urban roads) and 1;1000 horizontal and 1:200 vertical for rural roads.

The longitudinal section of the road centreline shall include chainages, reduced levels at the existing and design surfaces, design grades, length of vertical curves, guidepost schedule and location and type of services.

Longitudinal levels should be taken at 20 m for urban and 50m for rural intervals and at all intermediate changes of grade.

Longitudinal sections and cross-sections should be taken along existing intersecting roads for a sufficient distance (approximately 50 m) to enable kerb returns, dish crossings and any necessary drainage to be designed.

2.2.4 Cross-Sections

Cross-sections should be supplied at intervals not exceeding 50 m for straights and 20 m at curves, at scales of 1:100 natural. Cross-sections shall show chainage, reduced level of existing surface, design levels of pavement, kerb, gutter, and footpath.

Cross-sections should not be terminated at the property alignment but should be levelled sufficiently beyond the road boundaries, to enable batters of cutting and embankment to be shown. Cross sections should also identify boundary and fence lines.

A typical cross-section is to be included showing the following information -

(i) crossfalls on carriageway and footway

(ii) type of kerb and gutter

(iii) depth, type of material to be used, compaction required for each layer of pavement

(iv) subgrade depth, compaction required and design CBR

(v) subsoil drainage

(vi) concrete footpath, if required

(vii) type of surfacing

2.2.5 Kerb Returns

Kerb profiles should be shown for all kerb returns and cul-de-sac bulbs. A scale of 1:200 horizontally and 1:100 vertically is suggested.

2.2.6 Intersection Details

A contour plan shall be provided at all proposed intersections, roundabouts, and cul-de-sac bulbs. The contour interval should be selected to show variations in the design pavement surface levels, and so that the direction of surface runoff can be determined. A plan scale of 1:200 and contour interval of 0.1 metres is recommended.

2.2.7 Supporting Information

The following supporting information is to be submitted with the Engineering Drawings:

- A copy of the site investigation report, including test results
- Pavement design calculations
- A certification from the designer responsible for the pavement design.

2.2.8 Road Dedication

Where a survey is carried out for the purposes of a development and it is found that the constructed road falls outside the road reserve and into the development area, such land is to be dedicated as a public road as it is currently fenced, or if unfenced, a minimum of 5 metres from the edge of the road formation as constructed, for road purposes

2.3 DESIGN STANDARDS

2.3.1 Road Hierarchy

In all areas, a road hierarchy must be established to ensure that a safe and efficient environment is provided for motorists and pedestrians. The road network shall be designed to passively discourage through traffic in residential areas, by creating a noticeable difference in speed environment and geometric characteristics relative to arterial routes.

Roads shall be designed for the maximum likely traffic volumes at the end of a 20 year design life, using the growth factors recommended in Section 7 - Design Traffic of the Austroads publication "Pavement Design".

The following classes of road have been adopted for use in areas administered by Alliance Councils:

Function	Max. No. of Dwellings/Lots Served	Design Traffic (ESA's)	Frontage Access	Design Speed Environment (km/h)
Urban				
Urban Collector	300	2.0×10^6	Yes	50
Urban Local Access	100	6.0×10^5	Yes	50
Urban Cul-de-sac	25	2.0×10^5	Yes	40
Industrial		1.0×10^7	Yes	50
Rural				
Rural Collector		2.0×10^6	Yes	80 - 100
Rural Local Access		1.0×10^5	Yes	60

Table 2.1 - Road Hierarchy

2.3.2 Speed Environment

Speed Limits are determined by the Roads and Traffic Authority, and are typically 100km/h on highways and rural roads, 60km/h on local distributors, and 50km/h on residential streets. A speed limit of 40km/h applies within school zones for restricted periods.

Speed Environment is defined as the speed at which the 85th percentile driver will travel on the road network, and is largely controlled by design elements such as horizontal road geometry. Safe operating conditions are achieved by ensuring that sight distance is adequate for the speed environment thus created.

Table 2.1 above indicates the design speed environment of the road hierarchy in residential, industrial and rural areas.

2.3.3 Kerb & Gutter

An approved sealed pavement, including kerb and gutter, is to be provided to all classes of road having speed limits of 80km/h or less. It should be noted that Rural

roads are normally provided with a sealed shoulder, incorporating full depth pavement, in lieu of kerb and gutter.

Where it is considered impractical to construct an isolated section of kerb and gutter and road pavement, Council will require the developer to pay a contribution in lieu of construction, based on the estimated full cost of the works calculated by the relevant Director.

Note that sealed shoulders are only permitted where storm water velocity on the road shoulder is kept below 2m/s in the 5% AEP event. In cases where this velocity is exceeded, the shoulder shall incorporate a concrete lined edge drain.

The following table outlines the requirement for the different classes of kerb and gutter shown on Council's standard drawing number WBC 001.

Road Edge Treatment	Used For:
1.0m wide sealed shoulder	• Rural Collector roads • Rural Local Access roads
150mm High Integral Kerb and Gutter	• Urban Collector roads • Industrial roads
Concrete Edge Strip	• Adjacent to public reserves
Roll Kerb and Gutter	• Urban Local Access roads • Urban Cul-de-sacs
Semi-Mountable Kerb	• Adjacent to Medians, Traffic Islands and Roundabouts

* K & G subject to assessment of surrounding locality standards

Table 2.2 - Road Edge Treatments

2.3.4 Cross Sections

2.3.4.1 Standard Road Widths

Class of Road	Width of Road Reserve	Footway Width	C'way Width	Traffic Lanes	Parking Lanes	Seal Width	Formation Width	Shoulder Width
Urban								
Urban Collector	20	2 / 3.5	13.0	2 / 3.5	2 / 3.0			
Urban Local Access	17	2 / 3.5	10.0	2 / 3.0	2 / 2.0			
Urban Cul-de-sac	15	2 / 3.5	8.0	2 / 3.0	2 / 1.0			
Industrial	20	2 / 3.5	13.0	2 / 3.5	2 / 3.0			
Rural*								
Rural Collector	20					8.0	10.0	2 / 1.0
Rural Local Access	20					6.0	8.0	2 / 1.0
Pedestrian Facilities								
Pathway	5	1.2						
Cycleway	5	2.0 – 2.5						

(* Not applicable to a proclaimed Main Road)

Table 2.3 - Standard Road Widths

Table 2.3 provides guidance on the cross section characteristics which Council considers necessary to accommodate design traffic. The relevant Director will consider variations to the above standards where it can be demonstrated that such departure enhances the amenity of the locality and retains an appropriate road hierarchy.

Carriageway widths are measured at a location 150mm from the outside edge of the kerb. The carriageway widths shown in Table 2.3 include the width of all traffic and parking lanes.

Road shoulder widths shown in Table 2.3 shall be widened to 3.0 metres adjacent to barrier centrelines.

2.3.4.2 Pavement Crossfall

The standard crossfall on bituminous pavements is 3% from a central crown. Cross-falls of up to 7% may be used for super-elevated curves or at road intersections. Super-elevation is not normally provided (with the exception of rural development) but where design speeds so require, the super-elevation of horizontal curves is to be based on Austroads design policy for urban roads and the Roads and Traffic Authority "Road Design Guide" for rural areas.

In the cases where cross-fall from a central crown is not feasible, then one way cross-fall shall be permitted. One way cross-fall shall be nominally at a grade of 3%, up to an absolute maximum of 6% in isolated cases. One-way crossfalls towards the gutter are required on any split-level carriageways.

Any proposal to vary these standards will require approval from the relevant Director

2.3.4.3 Offset Crown

Where local topography dictates that it is not practical to have the crown located on the centre of the road, the crown may be shifted towards the higher side of the road and designed and constructed in accordance with the Austroad Design Guidelines.

2.3.4.4 Footway Crossfalls

The footpath reservation shall have a crossfall of between 2% - 4% towards the kerb.

2.3.4.5 Batters

All roads shall be cleared to the width of the road reservation, or to a width sufficient to permit cut and fill batters, whichever is the greater.

Road batters should not be steeper than 1:2 (vertical: horizontal) in cuttings, and 1:3 in embankments, except with the approval of the relevant Director.

Any cutting or filling undertaken by the developer which is designed to retain a structure, or could possibly undermine or remove the support of any existing structure, will require the construction of a retaining wall. Plans and design calculations are to be submitted to the relevant Director for approval before the commencement of construction.

2.3.4.6 Split-Level Carriageways

Where sloping terrain necessitates split level construction, the width of the road reservation shall be increased to accommodate the standard width footways, as well as the approved carriageway and median widths.

Long lengths of split level road will not be permitted, nor may this type of construction be carried across street intersections without the written approval of Council.

Carriageways shall be widened to permit the maximum dimension emergency and service vehicles to have free and unimpeded access, in the event that vehicles are parked parallel to the kerb line. The width of the carriageway and median are to be determined in consultation with the relevant Director

The median may include a permanently retained batter not steeper than 1:4 (25%) to allow regular maintenance to be undertaken. Where minimum batter slopes cannot be achieved, retaining walls shall be designed to accommodate the Austroads W7, T44 (Truck), and L44 (Lane) design traffic loadings.

Mountable type kerb and gutter is to be provided on the perimeter of the median island.

Section Six of the Roads and Traffic Authority "Road Design Guide" shall be referenced to determine whether safety barriers are warranted. Where necessary, the design and construction guidelines within this publication are to be followed.

2.3.4.7 Cul-de-Sacs

Cul-de-sacs are to be constructed so that a minimum kerb line radius of 9.5 metres is achieved from the centre of the cul-de-sac, depending on usage and to ensure it is capable of accommodating service vehicles. The boundary of the road reserve should be curved with a minimum radius of 13 metres, to provide for a minimum 3.5 metre wide footpath.

Where the head of the cul-de-sac is located on the low side of the road, special provision should be made to convey overland storm water flows through easements or drainage reserves.

Rural cul-de-sacs are to have a minimum radius (to edge of carriageway) of 12.5 metres, plus an additional 1 metre sealed shoulder. The boundary should be curved, to a minimum of 17 metre radius, to provide for a 4.5 metre verge.

Turning heads may be acceptable in lieu of cul-de-sac heads in some instances, where approved by the Relevant Director.

2.3.4.8 Half-Road Construction

Where proposed subdivisions or development front one side of an existing sealed road, and the existing pavement is assessed as having adequate strength, and the vertical alignment complies with current standards, the existing pavement may be retained. The remainder of the half-width construction can then be carried out to the standard of the existing road. In all cases, the new seal should extend to the crown of the road to avoid irregularities.

Where existing pavement strength or road alignment is unsatisfactory, pavement construction shall extend to the road centreline.

2.3.5 Geometric Standards

The following guidelines have been developed to ensure that carriageways provide:

- smooth, safe and trafficable horizontal and vertical alignments;
- adequate sight distance;
- suitable vehicular and pedestrian access to building allotments;
- measures to prevent ponding of stormwater;
- a path for overland flow in major storm events.

2.3.5.1 Horizontal Alignment

Where an obstruction off the pavement, such as a street tree, restricts sight distance, the minimum radius of curvature shall be selected as the stopping sight distance for the adopted design speed.

However, it is preferred that the radius adopted should be determined using intermediate sight distance criteria as described in Section Two of the Roads and Traffic Authority "Road Design Guide".

2.3.5.2 Longitudinal Centreline Grading

Local distributors roads (depending on hierarchy definition), and those which are likely to be used as bus routes, are to have a maximum longitudinal centreline grading of 8%. All other roads should be designed with a maximum grade of 12%. However, grades of up to 16% may be permissible on straights for a maximum distance of 150 metres, depending on traffic volume and type. The gradient at street intersections where stop or give way signs are used should not exceed 3%.

A maximum grade of 10% shall be used adjacent to all street intersections, at locations of poor visibility, on horizontal curves of radius 15 metres or less, and at cul-de-sac. Cul-de-sac turning heads are limited to maximum grades of 5%.

Any road greater than 10% shall be bitumen or concrete sealed.

Gutters are to have a minimum longitudinal grading of 1% for all roads, however consideration should be given to increasing this grade where changes of direction or drainage concentration occurs.

Proposals to vary the maximum and minimum permissible grades over short road lengths will be considered by the Relevant Director, however such approvals will be strictly limited, and should be sought prior to incorporating these variations in the road design.

When designing roads on steep grades, considerable attention should be given to alternative road layouts, as the cost of constructing special storm water drainage structures on steep grades may be prohibitive.

2.3.5.3 Vertical Curves

Vertical curves are to be provided at all changes in grade. Where possible, vertical curves should coincide with horizontal curves.

The length of crest vertical curves shall be determined from the Roads and Traffic Authority "Road Design Guide", based on stopping sight distance for the design speed environment, and an object height of 0.2 metres. Sag vertical curves should provide acceptable levels of comfort and allow adequate headlight sight distance.

2.3.5.4 Intersections and Roundabouts

Intersections involving only Non-Classified roads are to be designed in accordance with the standards shown in the Austroads "Guide to Traffic Engineering Practice, Part 5 - Intersections at Grade". Intersections where at least one road is Classified shall be designed in accordance with the Roads and Traffic Authority "Road Design Guide".

In all cases, roundabouts shall be designed in accordance with the Roads and Traffic Authority publication, "Roundabouts - Geometric Design Method".

2.3.5.5 Overtaking and Turning Lanes

Overtaking (or auxiliary) and turning lanes are to be provided where recommended by the roads and Traffic Authority publication “Road Design Guide.”

2.3.5.6 Kerb Returns

Kerb returns shall be designed for all roads to ensure a smooth trafficable surface around the return. The maximum longitudinal kerb grade and maximum pavement crossfall should not exceed permissible values.

Kerb returns shall be based on a minimum of 6 metre and maximum of 10 metre radius. However consideration should be given to increasing this radius where it is necessary to accommodate the turning circle of large vehicles and public transport.

As far as practical, low points within the kerb return should be avoided to prevent the use of pits with curved lintels.

2.3.5.7 Vehicular Access

Roads shall be located and designed so that vehicular access is readily available to all allotments using the standardised design vehicles detailed in Section 1.6.2 of the Roads and Traffic Authority “Roads Design Guide”.

At intersections, roads and building allotment layouts should be designed so that driveway access is not required directly opposite and within six metres either side of the prolongation of the side road property line on any terminating road, or within six metres of either kerb return tangent point.

A maximum of two vehicle crossings will be permitted to any allotment having sufficient street frontage, with the approval of the Relevant Director.

2.3.5.8 Staged Road Construction

Where roads are constructed in stages of a subdivision, a permanent-type barricade shall be constructed at the end of that stage to warn motorists of the terminating road. These barricades, warning signs, and/or reflectors should comply with all requirements of Australian Standard 1742 - Manual of Uniform Traffic Control Devices, and only be removed upon commencement of the adjoining stage.

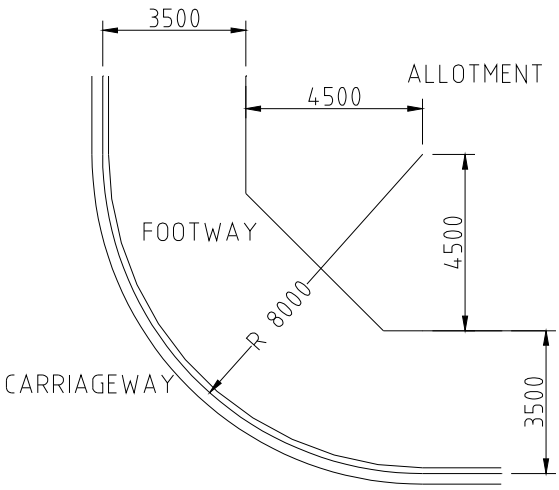
A temporary gravel turning area of minimum radius 11 metres is to be constructed at the end of the terminating roadway to permit the manoeuvring of service vehicles.

2.3.5.9 Road Reservation and Corner Splays

Road boundaries may be curved, but where they are to be fenced as chords, these should be not less than 10 metres in length. Where a number of such chords occur adjacent to each other, they should be of equal length where practicable.

Corner splays shall be incorporated on corner allotments to provide:

- sufficient space for utility service allocations to standard drawing WBC 005;
- a full width footway for pedestrian movement;
- sight distance for vehicles to Austroads standards.



These splays shall be determined so to provide for the above, however, should nominally measure 4.5 metres parallel to front and side boundaries of the corner allotment and having a diagonal approximately 5.0 metres in length.

2.3.6 Footpaths and Cycleways

Footpaths and cycleways will be designed in accordance with the relevant Australian Standard.

2.3.7 Driveway Construction

2.3.7.1 Urban Access Driveway

Driveways from the kerb layback to the property boundary are to be constructed with the requirements below. The factors to be considered when designing vehicle access driveways include:

- Ensuring gradient is compatible with future footpath requirements (nominally, this will require a cross fall of no greater than 4% on the future footpath alignment);
- Existing natural surface levels at the property boundary;
- Where kerb and gutter does not exist, the design gutter invert level;
- Clearance requirements for the critical design vehicle;
- Preventing ingress of road water into the property;
- Ensuring driveway does not obstruct major flows within the roadway;
- Consideration of traffic loading,
- Location of existing utilities and services;
- Sight distances shall be as required by the RTA Road Design Guide.

Driveways shall be constructed of full-width, 100mm thick reinforced concrete, having a characteristic strength of not less than 25MPa. Expansion joints should be provided using 9mm thick bitumen impregnated filler boards.

Alternatively, plain or coloured asphaltic concrete (hotmix) of 40mm thickness laid over 150mm compacted roadbase; 140mm thick asphaltic concrete; or paving bricks or blocks of minimum 65mm thickness laid in stretcher bond, herringbone or basket weave pattern on a 5mpa concrete bedding 75 mm thick and to manufacturer's recommendations may be used, with a 150x150mm concrete edge each side.

Other materials will be considered on request; however they shall provide a durable, hard-standing crossing which is not subject to erosion, does not overly hinder access to footway services.

Commercial driveways will require consideration of axle loadings to determine the minimum required construction standard – see Section 2.3.7.3 "Commercial Driveways".

All crossings are to be constructed to levels issued by the relevant Council's Engineering Department. A compliance certificate should be obtained from the Council or an accredited certifier, certifying that the driveway has been constructed in accordance with the design levels.

Due consideration should be given to the position and floor level of building construction to ensure that vehicular access is possible.

2.3.7.2 Rural Access Driveways

Vehicular access locations shall be sited to take into account the following factors:

- Existing natural surface levels at the property boundary;
- Sight distances shall be as required by the RTA Road Design Guide
- Clearance requirements for the critical design vehicle;
- Preventing ingress of road water into the property;
- Ensuring driveway does not obstruct major flows within the roadway;
- Consideration of traffic loading,
- Location of existing utilities and services;

The rural access treatment shall be in accordance with the RTA Road Design Guide.

2.3.7.3 Commercial Driveways

For commercial zoned lots, driveways shall be designed and constructed (noting the requirements of Section 2.3.7.1 "Urban Driveways" to take into consideration axle loadings etc. Driveways shall be a minimum of 200mm of 25MPa concrete, with 2 layers of SL72 mesh, 50 top and bottom cover. Due consideration shall be given to the location of expansion and control joints.

2.3.7.4 Urban Battleaxe Lots

For urban battleaxe blocks, the full length of the access handle (including footway crossing) shall be paved with 25MPa, 150mm (min) thick concrete, with a minimum width of 2.4m. The subgrade shall be compacted to a minimum of 95% standard.

Keyed expansion joints should be provided using 9mm thick bitumen impregnated filler boards at 12m (max) spacing, with sealed control joints (e.g. 3mm wide, 40mm deep sawcuts) at no greater than 3m spacing.

Where such driveways will be used by commercial vehicles, the construction detail should be increased to accommodate the increased loading – see Section 2.3.7.3 “Commercial Driveways”.

2.3.7.5 Rural Battleaxe Lots

For rural battleaxe blocks, the full length of the access handle (including footway crossing) shall be provided with a minimum of 4m wide granular pavement with a minimum thickness of 150mm. A sealed coat could be required subject to the Statement of Environmental effects.

2.4 PAVEMENT DESIGN

2.4.1 General

This section provides guidance on the design of flexible pavements consisting of two or more layers of unbound granular or cemented materials, where the primary distress mode is load related. The pavement designer shall also consider the effects of environmentally induced stresses from moisture and temperature which may affect pavement performance.

In general, residential pavements are to be designed in accordance with the requirements of the Austroads publication, “Pavement Design - A Guide to the Structural Design of Road Pavements”, by a qualified designer, as per Section 1.3.2

Note that Section 8.2 (Testing) of this Guide shall be read in conjunction with this section.

2.4.2 Subgrade Evaluation

A site investigation is to be performed which is to include logging of test holes to a depth not less than one metre below design subgrade levels (unless rock is encountered). Soil tests shall be taken at the design depth and samples taken for CBR testing in accordance with Australian Standard 1289.

The design California Bearing Ratio (CBR) shall be selected following a careful assessment of the materials encountered in the site investigation, and the variability of subgrade moisture and density conditions likely in service. The design CBR value should assume poor drainage and shall be determined from soaked CBR.

A copy of the site investigation, including test results, is to be included with the Engineering Drawings.

Where the design subgrade CBR is below 3, the subgrade shall be chemically stabilised to a minimum depth of 150mm, and the pavement design based on a CBR of 3.

2.4.3 Pavement Materials

Pavements are to be constructed from a minimum of two layers using either unbound granular, cemented, or a combination of these materials. Layers are to be a maximum of 200mm thick after compaction.

Unbound granular materials are to consist of gravels or crushed rocks, and have a grading which makes them mechanically stable, workable, and able to be compacted. Small amounts of stabilising agents may be added to improve performance. Cemented materials are produced by the addition of cement, lime, or other hydraulically binding agent to granular materials, to improve the strength of the bound layer. Laboratory testing will be necessary to determine the proportion of cementitious materials to mix with the granular pavement materials.

The type, grading, and strength of materials specified for use within the proposed pavement are to be shown on the typical cross sections submitted with the Engineering Drawings

2.4.4 Design Traffic

Pavements should be designed using the number of Equivalent Standard Axles (ESA's) shown in Table 2.1 of these guidelines.

Where circumstances dictate that a variation to these figures may be warranted, the developer should apply to Council for approval of the alternative. Such proposals are to be accompanied by careful estimates of the number of vehicles using the roadway by vehicle type, axle loading, and traffic growth over the life of the pavement. A minimum design life of 20 years shall apply for pavement design.

2.4.5 Subsoil Drainage

The need for subsoil drainage should be assessed through the design process and influenced by factors such as cuttings, low lying areas, etc.

Subsoil drainage pipes shall be installed as required and graded at a minimum longitudinal slope of 1% towards a suitable outlet, in accordance with Standard Drawings WBC017 and 018. Where this slope is not achievable, subsoil drainage shall not be used and guidance should be obtained from the relevant Council.

Subsoil pipes shall consist of a 100mm diameter slotted corrugated PVC pipe (or equivalent) enclosed in a geofabric sock, bedded in well graded filter material. Flush out points shall be installed at the upstream end of the pipe, and at regular intervals a maximum distance of 100 metres apart.

2.4.6 Design of Flexible Pavement

Pavement thickness design shall be based on the assessed sub grade strength, in accordance with guidelines contained in the Austroads publication, "Pavement Design".

Road shoulders are to be constructed using the full depth of pavement required for the adjacent traffic lanes. Note that the minimum depth shall be 250mm.

2.4.7 Pavement Surfacing

All new sealed roads will be surfaced with a minimum 2 coat flush seal, (14/7) designed in accordance with the RTA publication "Sprayed Sealing Guide".

Alternative surface treatments may be submitted to the relevant Director for approval, provided the surfacing exhibits the following characteristics:

- impermeable to air and moisture;
- a long service life, and is maintenance free for a considerable period;
- flexible;
- acceptably low longitudinal roughness;
- adequate low speed skid resistance;

2.4.8 Service Crossings

Where possible, all underground conduits, services and utilities shall be placed under the road prior to construction of the initial pavement course, and their location marked on the kerb and gutter or by provision of marker post where kerb and gutter

does not exist. Trenches should be constructed at a minimum grade of 1% to permit drainage of sub-surface water.

Road crossings through existing pavements will require backfill using a 27:1 sand:cement mix on sealed roads.

2.5 BRIDGES AND CULVERTS

Bridges and culverts shall be designed in accordance with Section 3 of these Guidelines.

2.6 ROAD FURNITURE

Road furniture shall be designed to minimise the number of roadside obstructions, and to ensure that the risk of injury to vehicle occupants and pedestrians is minimal.

2.6.1 Street Signs

Street signs are required at all road junctions as per AS 1742.5 The location of street signs is to be shown on the Engineering Drawings.

2.6.2 Traffic Control Devices

Traffic signs, traffic signals, pavement markings, guide posts, delineators, safety barriers and the like, whether permanent or temporary, are to be designed and installed at all roads in accordance with guidelines contained within the Austroads publication, “Guide to Traffic Engineering Practice - Part 8: Traffic Control Devices”, Australian Standard 1742 - Manual of Uniform Traffic Control Devices and the Roads and Traffic Authority “Road Design Guide”.

The consent of the relevant Council’s Traffic Committee and Road Authority, will be required prior to the installation of any traffic control devices on existing roads.

2.6.3 Local Area Traffic Management

Where conditions of a development consent so indicate, Local Area Traffic Management (LATM) devices are to be designed and installed to Austroads “Guide to Traffic Engineering Practice - Part 10: Local Area Traffic Management” and Australian Standard 1742.13 - Manual of Uniform Traffic Control Devices: Local Area Traffic Management.

2.6.4 Public Transport

Roads used as public transport routes may require the provision of facilities such as bus shelters, bays, and low kerbing. Intersections, roundabouts, and median storage lanes on these routes shall be designed to cater for the maximum dimension single unit truck/bus, without requiring reversing manoeuvres.

When placing road furniture, consideration shall be given to the swept path of overhanging bodywork and the location of passenger waiting areas.

Bus stops and shelters should always be located on the departure side of walkways and cyclepaths. The need to locally widen verges to provide visibility from adjacent driveways and intersections should be ascertained.

2.6.5 Road Lighting

Illumination shall be provided on all new roads and public thoroughfares in accordance with Australian Standard 1158 - Road Lighting. Not withstanding these requirements, lighting shall be provided at all intersections, at the end of all cul-de-sac, and immediately in line with all pathways.

Lighting columns shall generally be located on the footway alignment shown in Council's standard drawing WBC005

Slip-base lighting columns are to be used where the light column will be located near the carriageway. Energy absorbing columns may be required where fallen columns would be particularly hazardous.

2.7 LANDSCAPING

Landscaping within the road reserve may be used for aesthetic reasons, or functional purposes such as screening headlight and sunlight glare, screening undesirable views, and providing visual guidance.

Plantings within the road reserve shall be designed so as not to obstruct sight distances. Particular care shall be taken with planting around curves, near intersections and driveways, and on pedestrian desire lines.

Only non-frangible trees, having a mature diameter of less than 100mm, shall be planted near road verges and medians.

Slopes steeper than 1:4 will not be mown, and consequently mulched groundcover or stone pitching should be specified if steep slopes are required in urban areas.

If landscaping works are to be carried out, then a landscaping plan showing, but not limited to, plant species and estimated height and spread of mature trees.

2.8 DESIGN REFERENCES

The following publications should be read in conjunction with the recommendations in these guidelines.

- AUSTRALIAN STANDARDS
  - 1100 Supplement 4. Technical Drawing - Engineering Survey Engineering Survey Design Drawing - Roads
  - 1158 Road Lighting
  - 1289 Methods of Testing Soil for Engineering Purposes
  - 1348 Roads and Traffic Engineering - Glossary of Terms
  - 1428 Design for Access and Mobility
  - 1742 Manual of Uniform Traffic Control Devices
- AUSTROADS, *Guide to Traffic Engineering Practice*. (1988)
  - Part 1 Traffic Flow Characteristics and Theory
  - Part 2 Roadway Capacity
  - Part 3 Traffic Studies
  - Part 4 Traffic Accidents
  - Part 5 Intersections at Grade
  - Part 6 Roundabouts
  - Part 7 Traffic Signals
  - Part 8 Traffic Devices and Road Facilities
  - Part 9 Arterial Road Traffic Management
  - Part 10 Local Area Traffic Management
  - Part 11 Parking
  - Part 12 Roadway Lighting
- AUSTROADS, *Pavement Design - A Guide to the Structural Design of Road Pavements*, Sydney. (1997)
- MULHOLLAND, P.J., *A Structural Guide for Flexible Residential Street Pavements*, Australian Road Research Board. Special Report Number 41. (1989)
- ROADS AND TRAFFIC AUTHORITY, *Guide to Traffic Generating Developments*, Issue 2.0. (1993)
- ROADS AND TRAFFIC AUTHORITY, *Road Design Guide*. (1995)
- ROADS AND TRAFFIC AUTHORITY, *Sprayed Sealing Guide*. (1997)

Section 3.0 STORMWATER DRAINAGE

3.1 INTRODUCTION

These guidelines outline the Alliance Councils' recommended practice for storm water drainage design. The broad objectives of these guidelines are to:

- Convey stormwater to receiving waters with minimal damage, danger & nuisance
- Stabilize landform and control erosion;
- Enhance the urban landscape, whilst maximizing land available for urbanization;
- Maintain the water quality of receiving waters
- And is managed in an environmentally sustainable manner.

Developers of land are to be wholly responsible for disposing of all storm water run off which passes over or through the respective properties, roads and reserves.

The developer is required to maintain drainage works and to repair all defects which are, in the opinion of the relevant Director, due to faulty workmanship or materials, for a period of twelve (12) months from the date of Council approving the works. The developer is advised to ensure that all Contractors are bound by a similar maintenance clause.

3.2 ENGINEERING DRAWINGS

Engineering drawing submissions are to include all details requested in Section 1.3.1 of these guidelines. In general, storm water drainage designs should be presented in the format shown in Chapter 14 of Australian Rainfall and Runoff. Notwithstanding this, the following requirements shall apply:

3.2.1 Plans

Drainage plans shall be drawn at a scale sufficient to show all necessary details, nominally 1:200, 1:500, 1:1000 or 1:2000. The following data is to be included with a contoured catchment area plan:

(a) catchment areas and sub-areas, watershed (catchment boundary), overland flow paths, existing and proposed pipe layout. For large catchments, the total catchment area should be shown at a large scale on a separate plan or inset.

(b) all sub-areas, drainage lines and pits are to be logically numbered.

(c) a schedule of pipe details, including pipe number, size, class, bedding type, joint type, invert levels at inlet and outlet, slope, and length.

(d) a schedule of pit details, including pit number, type, road chainage, surface level to the Australian Height Datum (AHD), invert level to AHD, depth, and lintel length.

(e) north point and legend.

(f) set out information.

(g) accurate position and level of all services and utilities which cross underground drainage pipelines.

(h) identify those building allotments adjacent to channels and major storm flow paths which may be liable to flooding in major flood events, and the minimum design habitable floor level adjacent to prevent flooding in the design flood event.

(i) inlet and outlet treatments.

(j) measures for the prevention of erosion and sedimentation.

3.2.2 Longitudinal Sections

Longitudinal sections shall be drawn at a scale sufficient to show all necessary details, nominally 1:250 or 1:500 with a vertical exaggeration of 5, for all road drainage, interallotment drainage, and open channels. The following details shall be included:

(a) Road chainage (where applicable), cumulative pipe distance, design surface level, and design pipe invert level - all marked beneath the longitudinal pipe section. Longitudinal sections for channels and floodway's shall be provided in a similar format to road longitudinal sections.

(b) Pit number, design pit inflow, pit type, pipe size, pipe class, trench installation, pipe velocity, and design pipe discharge.

(c) Hydraulic grade line.

3.2.3 Cross Sections

Cross sections shall be provided at all culverts, and for open channels at maximum 20 metre spacings.

Culvert details are to include all items required for longitudinal sections, and whether the inlet or outlet is the factor governing flow capacity.

Channel and floodway cross sections shall include details of hydraulic grade levels and available freeboard.

3.2.4 Supporting Information

All storm water drainage design submissions shall include drainage calculations and a certification from the designer. The designer must be a person, either holding qualifications acceptable for Corporate Membership of the Institution of Engineers, Australia, or approved by the Relevant Director, and/or who has proven experience in the preparation of plans and specifications for land development.

3.2.4.1 Drainage Calculations

Hydrologic and hydraulic calculations shall be submitted with the design plans and based on a fully developed catchment. Details shall include:

(i) flow lengths, slopes and travel times, for overland and gutter flows.

(ii) full and partial area calculations.

(iii) the adopted return frequencies, runoff coefficients, and rainfall intensities.

(iv) pit inlet capacities.

(v) pipe lengths, full-pipe flow velocities, hydraulic grade line and pipe slopes.

(vi) pit pressure change coefficients.

(vii) pit and pipe invert and surface levels.

(viii) velocity times depth relationship for all overland flow paths.

(ix) design discharges.

3.2.4.2 Software Design Packages

Where commercially available software packages are used to design storm water systems, a copy of all data files shall be provided to the Council prior to approval being granted. Note that the use of software does not negate the designer of his responsibility in ensuring an appropriate design which meets the requirement of this guide. The applicant will still need to submit detail as per Section 3.2.4.1 above.

3.2.4.3 Certification

The designer shall provide a statement to accompany the design plans, certifying that:

(i) all requirements contained within these guidelines have been met, and any proposed deviations from these guidelines have been documented in full.

(ii) Drainage reserves, parklands, and roadways are adequate to safely contain all flows from the design 1% Annual Exceedance Probability flood event, and further, that the maximum velocity, maximum depth, and the product of velocity and depth, are all within prescribed limits.

(iii) That 500mm freeboard has been provided in the 1% AEP event with respect to building floor levels and all ground surface levels on each allotment within the development.

3.3 GENERAL REQUIREMENTS

Pipe capacities shall be calculated for pipes flowing full under gravity conditions.

The design flood frequency shall be the 1% Annual Exceedance Probability (AEP) event.

Storm water drainage systems in new areas of the Alliance LGA's shall be designed using a major/minor approach.

The minor drainage system consists of underground pipes designed to control nuisance flooding, while the major system consists of an overland flow path or floodway to accommodate less frequent flood events.

Where the drainage catchment includes an existing pipe system of unknown or limited capacity, the developer shall either:

- Replace or augment the existing pipe system;
- Modify the existing system, by acquiring land if necessary, to provide a safe major flow route;
- Hydraulically improve the existing system to reduce energy losses; or
- Limit the flows from new developments to keep downstream flows within the capacity of the system.

Major system drainage designs shall aim at controlling flood flows so that the severity of flooding downstream, and afflux upstream, is not increased. In all

designs, consideration must be given to the effect of floods greater than the design flood, and in no circumstances should the design create conditions where the capacity of the downstream drainage system is exceeded.

The design flood shall be accommodated by the use of pipe drainage, drainage channels, overland flow paths, floodways, etc, as necessary, to accommodate the safe passage of floods in the event that the minor system is blocked.

Storm water flows up to the design flood frequency shall be carried in a formal designed system of channels and/or pipes within the neighbourhood. No uncontrolled overland flow will be permitted for return periods less than the design flood.

Where storm water discharge is concentrated onto other property, and/or works are necessary on the other property, it is the responsibility of the developer to make appropriate arrangements and provide Council with a copy of the owners consent, prior to the release of a construction certificate for the works. This may necessitate the creation of an easement to drain water through downstream properties, and all costs and compensations are to be borne by the developer.

Note: where reference is made in this section to pipes consideration can be given to other structures eg reinforced concrete boxes

3.3.1 Annual Exceedance Probabilities

Annual exceedance Probabilities for general use are shown in Table 3.1 below:

Land Use	**Annual Exceedance Probability (AEP)**
Road Drainage - Minor (Piped) System	
Arterial Roads (Cross Drainage)	2%
Rural & Rural Residential (Cross Drainage)	20%
Urban Residential	20%
Sag Point (must have a defined 1% AEP overflow route)	20%
Commercial	20%
Floodway 'low-flow' system	100%
Interallotment Drainage	20%
Trunk Drainage	1%

Table 3.1 - **Annual Exceedance Probabilities**

The major system drainage shall be designed to cater for flows from the 1% AEP storm event, with 500mm freeboard, on the assumption that the minor system is totally blocked. Continuous designated overland flow paths are to be provided from the top of the catchment through the entire urban area.

The designer shall consider special damage or danger to life and property which may occur in specific situations. In such cases, the design frequency of flooding recommended or adopted shall be the subject of specific advice and reports to Council for determination. In no circumstances shall the design flood be less than the 1% AEP flood even.

3.3.2 Design Rainfall Intensities for Alliance Council Areas

Design rainfall intensities for the Alliance Council Local Government Areas shall be selected from Tables 3.2 a-c, based on the design storm duration and Average Recurrence Interval.

Duration	Average Storm Recurrence Interval (years)						
	1	2	5	10	20	50	100
5m	60.2	79.1	105.8	123.2	146.1	178.2	204.1
6	56.3	74.1	98.9	115.0	136.3	166.1	190.1
7	53.4	70.1	93.5	108.6	128.7	156.7	179.3
8	50.4	66.1	88.1	102.3	121.1	147.3	168.5
9	48.1	63.2	84.1	97.5	115.4	140.4	160.4
10	45.9	60.2	80.0	92.8	109.8	133.4	152.4
12	42.4	55.5	73.6	85.3	100.8	122.4	139.8
15	38.2	50.0	66.2	76.6	90.4	109.6	125.1
20	33.2	43.4	57.3	66.1	78.0	94.3	107.5
30	26.9	35.1	46.0	53.0	62.3	75.2	85.5
40	22.9	29.9	39.1	44.9	52.7	63.5	72.1
50	20.2	26.3	34.3	39.3	46.1	55.4	62.9
60	18.2	23.6	30.7	35.2	41.2	49.5	56.1
75	15.7	20.4	26.4	30.1	35.2	42.1	47.6
90	14.0	18.1	23.3	26.5	30.9	36.9	41.6
2h	11.5	14.9	19.0	21.6	25.1	29.8	33.5
3	8.8	11.3	14.3	16.1	18.6	22.0	24.7
4	7.3	9.3	11.7	13.1	15.1	17.7	19.8
5	6.2	8.0	9.9	11.1	12.8	15.0	16.7
6	5.5	7.0	8.7	9.8	11.2	13.1	14.5
8	4.6	5.8	7.1	7.9	9.0	10.5	11.7
10	3.9	5.0	6.1	6.8	7.7	8.9	9.9
12	3.5	4.4	5.4	5.9	6.7	7.8	8.6
14	3.1	3.9	4.8	5.3	6.0	7.0	7.7
16	2.8	3.6	4.4	4.8	5.5	6.4	7.0
18	2.6	3.3	4.0	4.4	5.0	5.8	6.5
20	2.4	3.1	3.7	4.1	4.7	5.4	6.0
22	2.3	2.9	3.5	3.9	4.4	5.1	5.6
24	2.1	2.7	3.3	3.6	4.1	4.8	5.3
36	1.6	2.0	2.4	2.7	3.1	3.5	3.9
48	1.3	1.6	1.9	2.2	2.4	2.8	3.1
60	1.0	1.3	1.6	1.8	2.0	2.4	2.6
72	0.9	1.1	1.4	1.5	1.8	2.0	2.3

Table 3.2a –Design Rainfall Intensities (mm/hr) – Blayney

Duration	Average Storm Recurrence Interval (years)						
	1	2	5	10	20	50	100
5m	63.8	83.9	111.6	129.7	153.7	187.2	214.4
6	59.8	78.5	104.4	121.3	143.6	174.9	200.2
7	56.6	74.3	98.8	114.7	135.8	165.3	189.1
8	53.4	70.1	93.2	108.1	128.0	155.7	178.1
9	51.1	67.0	89.0	103.2	122.1	148.5	169.9
10	48.7	63.9	84.8	98.3	116.3	141.4	161.6
12	44.9	58.9	78.1	90.5	107.0	130.0	148.6
15	40.5	53.1	70.3	81.4	96.2	116.8	133.5
20	35.2	46.1	60.9	70.5	83.2	101.0	115.3
30	28.5	37.3	49.1	56.7	66.9	81.0	92.4
40	24.3	31.8	41.8	48.2	56.8	68.7	78.3
50	21.4	28.0	36.7	42.3	49.8	60.2	68.6
60	19.3	25.1	33.0	38.0	44.7	53.9	61.4
90	14.6	19.0	24.8	28.4	33.4	40.1	45.6
2h	12.0	15.6	20.2	23.1	27.0	32.4	36.7
3	8.8	11.3	14.3	16.1	18.6	22.0	24.7
4	7.4	9.5	12.2	13.9	16.1	19.2	21.7
5	6.3	8.1	10.4	11.8	13.6	16.2	18.3
6	5.5	7.1	9.1	10.3	11.9	14.1	15.9
8	4.5	5.8	7.4	8.3	9.6	11.4	12.8
10	3.9	5.0	6.3	7.1	8.2	9.6	10.8
12	3.4	4.4	5.5	6.2	7.1	8.4	9.4
14	3.1	3.9	4.9	5.6	6.4	7.6	8.5
16	2.8	3.6	4.5	5.1	5.9	6.9	7.8
18	2.6	3.3	4.2	4.7	5.4	6.4	7.2
20	2.4	3.1	3.9	4.4	5.0	5.9	6.7
22	2.2	2.9	3.6	4.1	4.7	5.6	6.3
24	2.1	2.7	3.4	3.8	4.4	5.3	5.9
36	1.6	2.0	2.5	2.9	3.3	3.9	4.4
48	1.2	1.6	2.0	2.3	2.7	3.2	3.6
60	1.0	1.3	1.7	1.9	2.3	2.7	3.0
72	0.9	1.2	1.5	1.7	1.9	2.3	2.6

Table 3.2b –Design Rainfall Intensities (mm/hr) – Molong

Duration	Average Storm Recurrence Interval (years)						
	1	2	5	10	20	50	100
5m	64.9	85.1	112.7	130.6	154.5	187.8	214.7
6	60.8	79.7	105.4	122.1	144.4	175.4	200.4
7	57.5	75.4	99.7	115.5	136.5	165.7	189.3
8	54.3	71.2	94.0	108.8	128.6	156.1	178.3
9	51.9	68.0	89.8	103.9	122.7	148.9	170.0
10	49.5	64.8	85.6	98.9	116.8	141.7	161.7
12	45.7	59.8	78.8	91.1	107.5	130.3	148.7
15	41.2	53.9	71.0	81.9	96.6	117.0	133.5
20	35.8	46.8	61.5	70.9	83.6	101.1	115.3
30	29.0	37.8	49.6	57.1	67.1	81.1	92.3
40	24.7	32.3	42.2	48.5	57.0	68.8	78.2
50	21.8	28.4	37.0	42.6	50.0	60.3	68.5
60	19.6	25.5	33.2	38.2	44.8	53.9	61.3
90	14.9	19.4	25.1	28.8	33.7	40.5	45.9
2h	12.2	15.9	20.5	23.5	27.4	32.9	37.2
3	9.2	12.0	15.4	17.5	20.4	24.4	27.6
4	7.6	9.8	12.5	14.2	16.6	19.8	22.3
5	6.5	8.3	10.7	12.1	14.1	16.8	18.9
6	5.7	7.3	9.4	10.6	12.3	14.7	16.5
8	4.7	6.0	7.6	8.6	10.0	11.9	13.4
10	4.0	5.1	6.5	7.4	8.5	10.1	11.4
12	3.5	4.5	5.7	6.5	7.5	8.8	9.9
14	3.1	4.1	5.1	5.8	6.7	7.9	8.9
16	2.9	3.7	4.7	5.3	6.1	7.2	8.2
18	2.6	3.4	4.3	4.9	5.6	6.7	7.5
20	2.4	3.1	4.0	4.5	5.2	6.2	7.0
22	2.3	2.9	3.7	4.2	4.9	5.8	6.5
24	2.1	2.7	3.5	4.0	4.6	5.5	6.2
36	1.6	2.0	2.6	2.9	3.4	4.1	4.6
48	1.2	1.6	2.1	2.4	2.8	3.3	3.7
60	1.0	1.3	1.7	2.0	2.3	2.8	3.1
72	0.9	1.1	1.5	1.7	2.0	2.4	2.7

Table 3.2c –Design Rainfall Intensities (mm/hr) - Wellington

3.4 ROAD DRAINAGE

The function of road drainage is to capture surface runoff from the design storm event, and safely convey it to an approved reserve or receiving waters with minimal damage, danger and nuisance to life, property and the environment.

3.4.1 Drainage Pits

3.4.1.1 General Requirements

(i) Pits shall be provided in drainage lines at all changes in grade, level, and direction, and at all pipe junctions and shall be spaced at no more than 85m apart.

(ii) Drainage pits are to conform with Council's standard drawings, or RTA standards for Classified Roads. Non-standard structures shall be constructed as detailed in the design drawings. Such designs shall comply with AS3600 – Concrete Code, AS4100 – Steel Structures, AS1657 – SAA code for fixed platforms, walkways, stairways and ladders; and any other relevant standard.

(iii) Pits used for storm water drainage shall be fitted with square lids to distinguish them from sewer manholes.

(iv) Junction pits shall be fitted with reinforced lids and approved lifting eyes.

(v) Precast pits, incorporating insitu bases, may be used if the prior approval of the pit type and design are approved by the relevant Director.

(vi) Every endeavour shall be made to maintain flow velocities through pits. Excessive drops will not be permitted.

(vii) Pipe grading across pits should be designed on the following basis:

- No change in direction or diameter - minimum 50mm;
- Direction change but no change in diameter - minimum 70mm;
- Changes in pipe diameter should be graded from obvert to obvert;

(ix) At pit connections, a 3 metre length of approved subsoil drainage pipe enclosed in a geofabric sock shall be placed alongside the main pipe so as to enter the pit at the same invert level and adequately drain the main trench, in accordance with Council's standard drawing WBC009.

3.4.1.2 Location of Kerb Inlet Pits

The following criteria govern the location of pits in roadways, for the adopted minor drainage system annual exceedance probability.

(i) Inlet pits shall be located so as to restrict the maximum gutter flow width to 2.5 metres.

(ii) Maximum spacing between any two consecutive pits is 85 metres.

(iii) Pit bypass flows should be limited to 15% of the gutter flow at that location.

(iv) At intersections, kerb inlet pits shall be constructed adjacent to the upstream kerb return tangent point where flows exceed 20 litres per second or gutter flow width is more than 1 metre.

(v) The minimum clearance from the top of the manhole to the design pit water level should be 150mm.

(vi) The product of flow velocity and depth of flow in the kerb and gutter should not exceed 0.4 m^2/s.

(vii) Kerb inlet pits should be located clear of horizontal curves, pedestrian desire lines, and vehicle driveways.

(viii) Inlet conditions shall be designed so that the potential for blockage by silt and debris is minimised. This may require special treatment of the inlet sump under some conditions.

3.4.1.3 Hydraulic Design

(i) Pit inlet capacities shall be estimated from design charts and formulae, based on lintel size for on-grade pits and depth of ponding for sag pits. The calculated inlet capacity shall be reduced by a factor of 50% for sag pits, and 20% for on-grade pits, on the assumption that debris is preventing some inflow.

(ii) Standard lintel sizes of 1.8, 2.4, 3.0, or 3.6 metres should be used when possible.

(iii) The minimum internal lintel size on a sag should be 2.4 metres.

(iv) The head loss through pits shall be determined from Missouri Charts or other recognised methods.

3.4.2 Drainage Pipes

3.4.2.1 General Requirements

(i) The inlet and outlet of all pipe systems shall be fitted with approved headwalls and energy dissipating devices to provide protection against scouring.

(ii) When constructing pipes under existing roads, pipelines should cross roads perpendicular to the centreline. For new roads, the length of pipes beneath roads should be minimised.

(iii) Pipe supports shall be Type H2 trench installation within footways, and Type HS2 trench installation under carriageways, as defined in Australian Standard 3725 - loads on buried concrete pipes.

3.4.2.2 Diameter

(i) Pipes in public road reservations shall have a minimum diameter of 375mm in urban areas and 450mm in rural areas.

(ii) For single cell pipeline systems of diameter less than 900mm, a downstream pipe of smaller diameter than the upstream pipe will not be permitted.

3.4.2.3 Material

(i) All drainage pipes used within public roads or paths shall be steel or fibre reinforced concrete (ie, RCP or FRCP, respectively) and this shall be clearly indicated on the design plans.

(ii) Where curved pipelines are permitted, they are to be constructed using long-socketed rubber ring jointed pipes, installed strictly in accordance with the manufacturer's recommended radii, and must follow the service corridor as shown in standard drawing WBC005.

(iii) Pipe class shall be determined for a given pipe diameter, cover, trench installation and loading, using the tables in "Concrete Pipe Selection and Installation", published by the Concrete Pipe Association of Australia.

(iv) Other pipe materials will be considered by the relevant Director and must comply with the Australian Standards

3.4.2.4 Gradient

(i) Pipes shall have a minimum grade of 1%, wherever physically possible, to permit self-cleansing under low flow conditions. Actual pipe velocity should be greater than 0.6m/s for self-cleansing, and less than 8m/s to prevent cavitation and scouring.

(ii) Concrete bulkheads shall be constructed for all drainage lines exceeding 16% grade, at intervals not exceeding 15 metres, in accordance with standard drawing WBC013.

3.4.2.5 Alignment

The normal alignment for storm water drainage pipelines of diameter up to and including 675mm shall be 0.6 metres under the kerb line. However, this may be increased to 1.2m or 1.8m if required to clear power poles.

3.4.2.6 Cover

(i) Pipe cover shall be in accordance with manufacturer's requirements. An absolute minimum cover of 300mm shall be adopted.

(ii) The normal minimum vertical clearance between drainage pipelines and other services is 75mm.

3.4.4 Easements

Drainage easements shall be created pursuant to Section 88B of the Conveyancing Act, 1919, where stormwater drainage pipelines pass through, or concentrate water onto, private property. When conveying surface runoff from road reservations, such easement should be in favour of Council. All other easements should be in favour of the allotments benefited only.

The width of these easements shall be sufficient to contain all storm water drainage infrastructure, and provide for future maintenance requirements. The minimum width of such easements are generally as follows:

Type of Drainage	Minimum Easement Width (metres)
Piped Drainage	
Up to 600 mm diameter	2.5
675 - 1050 mm diameter	3.0
1200 - 1500 mm diameter	3.5
1650 - 1800 mm diameter	4.0
Twin Pipes	(2 * Diameter) + 2.5
Floodway / Open Channel	Surface width of 1% AEP flow + 0.5m freeboard + 1.0m horizontally

Table 3.3 – Minimum Easement Widths

3.4.5 Special Provisions

3.4.5.1 Major Traffic Routes

Arterial routes shall be kept free of surface runoff in the 2% AEP flood event. Bridges and other major drainage structures shall be designed to pass the 1% AEP flood with freeboard of 500mm. Afflux and hydraulic gradients shall be determined in all cases. Note that bridges shall be designed in accordance with the AUSTROADS publication *Bridge Design Code.*

Where surface flows cross a major road in the 1% AEP event, the maximum flow depth shall be limited to 150mm at the road centreline, and maximum flow length of 10 metres.

3.4.5.2 Cul-de-Sacs

Cul-de-sacs, where the fall is towards the turning head, shall have a floodway reservation or formed pathway in accordance with Standard Drawing WBC014 at the sag point to ensure that major flows can be conveyed to a drainage reserve or overland flow path without flooding private properties.

3.4.5.3 Steep Grades

Close attention shall be given to the placement and location of drainage inlets to intercept surface water off steep grades. This particularly applies where a steep side street intersects a flat cross street. Mounding may be necessary opposite the intersection to protect properties from flooding, or a

floodway reservation provided opposite the steep street. Concrete bulkheads will be required for all piped drainage systems in accordance with Section 3.4.2.4.

3.4.5.4 Energy Dissipation Structures

In certain circumstances, it will be necessary to provide energy dissipating devices on stormwater outlet structures, to minimise the effect of erosion. Warrant for such structures will determined using the procedure as described in the Roads and Traffic Authority publication "Road Design Guide".

3.4.5.5 Rural – Residential Subdivisions

Rural residential subdivisions shall have an appropriate combination of natural drainage courses and constructed contour banks and channels, to control the flow of storm water through the subdivision, up to and including a 1% AEP storm event, with 500mm freeboard.

3.5 TRUNK DRAINAGE

Trunk drainage systems are typically large capacity channels, which carry storm water runoff from local street drainage systems to receiving waters. They typically serve large areas and overtopping is likely to cause nuisance and/or property flooding.

Trunk drainage generally comprises flood ways and open channels to cater for 1% AEP flood events, with 500m freeboard. Flood ways should be located along existing water courses or drainage depressions, unless exceptional circumstances exist and the prior approval of the relevant Director has been obtained.

3.5.1 Calculation of Flows

Flows through a trunk drainage network should be calculated using an appropriate runoff-routing computer model. The model shall be calibrated against a known discharge, or one calculated using a different method. Details of the method used to calibrate the model shall be submitted to Council with a hard copy of the model results.

Once calibrated, the model shall be used to analyse the impact of the development on existing flows, based on zero initial and continuing loss rates.

For design of new channels, a fully developed catchment shall be assumed.

3.5.2 Hydraulic Design

Open channels shall be designed using backwater calculations. A freeboard of 500mm above the 1% AEP flood level should be adopted.

The relevant Director will consider requests to vary the required freeboard, based on the risk of damage to life and property in large flood events.

Terracing may be introduced into the floodway where ancillary land uses, such as sports ovals, are also available for conveying the design 1% AEP flood event.

The product of velocity and depth should not exceed 1.0m^2/s in the 1% AEP event.

Centreline horizontal curves should have a radius not less than twice the 1% AEP surface flow width, with a minimum of 30 metres.

Recommended values for Manning's Roughness Coefficient are 0.013 for concrete lined inverts, 0.03 for gabions, 0.035 for maintained grass channels, and 0.02 for clear earth.

3.5.3 Low Flow Drainage

All open channels shall be provided with a low flow pipeline, or concrete lined invert of equivalent capacity, to cater for flows with an annual exceedance probability of 100%.

Low flow pipes shall have a minimum diameter of 375mm, and minimum longitudinal grade of 1%.

Road and interallotment drainage shall be connected to low-flow piped systems using a surcharge pit to Standard Drawing WBC012 sized to cater for the maximum discharge in the side line.

3.5.4 Flow Velocities

Piped low-flow systems shall have a minimum velocity of 0.6m/s for self-cleansing purposes.

Grass-lined channels shall be designed to ensure sub-critical flow with a Froude Number no greater than 0.8. Maximum velocity should be limited to 2m/s in the 5% AEP flood event, to prevent scouring. This velocity shall be reduced where necessary in highly erodable soils.

Where necessary, drop structures shall be provided, or flow lengths increased, to reduce velocities to acceptable levels.

3.5.5 Channel Stabilization

Permanent scour protection devices shall be designed for all discharge points into and out of the channel, and at all points where a significant change in flow conditions is likely.

Suitable species of grass should be planted in open channels.

Approved measures shall be taken to ensure that erosion does not occur at the interface between the concrete invert and the grassed floodway.

Open channels should be stabilised by turfing, hydromulching, or by installing a geotextile material having a minimum life expectancy of two years.

3.5.6 Batter Slopes

Batter slopes of grassed waterways should be a minimum of 1:4 (vertical:horizontal).

Minimum crossfalls in channels should be 2% with a depressed invert.

3.5.7 Road Crossings

In urban areas, the length of culverts shall be extended to the width of the road reservation, so that the standard width footways are provided on either side of the road. Headwalls, wingwalls, aprons, hand rails, guard rails, and safety barriers shall be provided in accordance with accepted practice, and relevant legislation and/or standards.

Trenches through existing roads where required shall be backfilled using a full depth, 5 MPa, 27:1 sand:cement mixture as per standard drawing WBC010. Where trenches are cut in areas where a new road is to be built, this treatment shall not be used.

Road crossings shall be constructed perpendicular to the road centreline.

3.6 OVERLAND FLOW PATHWAYS

Overland flow paths are required to convey runoff from major events to the trunk drainage system, without causing erosion, scouring or the like. All overland flow paths shall be designed to cater for the 1% AEP flood event without overtopping. These pathways should not be required to convey any runoff in minor events.

The design overland flow path may consist of public roads, pathways, catch drains, parks, open space areas and other public spaces only. Overland flow paths are not to be constructed over private property. For design purposes, the minor (piped) system shall be assumed to be fully blocked.

3.6.1 Public Roadways

The catchment area feeding roads that also act as overland flow paths shall be limited, to satisfy public safety and roadway flow capacity criterion. In general, a standard 11 metre wide road reserve should have a maximum catchment area of 20 to 30 hectares, and be designed for a peak flow of $2.5m^3/s$. The product of velocity and depth should not exceed $0.4m^2/s$.

Special care shall be exercised to ensure that continuity of flow is achieved, and that the floodway cross section is maintained at driveway entrances and the like.

Ready discharge shall be provided at the low point, and other relief points along the road, to quickly remove water and avoid ponding and deposition of gravel and silt.

Overland flow paths should, where practicable, be provided within open space areas in preference to roadways.

3.6.2 Floodways in Open Space Areas

A suitably designed depression or flow path shall be provided for the entire length of the floodway. This particularly applies to smaller footpath reserves designed as flood ways.

Special consideration shall be given to trapped low points where the overland flow path may divert surcharge into properties. This is especially important in the design of 'downhill' facing cul-de-sac, and kerb return adjacent to a sag vertical curve.

Where possible, tree and shrub plantings within floodway reserves should be located clear of the designed flow path. If the use of shrubby plant material can not be avoided, the floodway width shall be increased to accommodate this factor.

Foot paving should be kept clear of the main flood flow, and be sufficiently thick and anchored to withstand the design discharge in areas of high velocity.

Grassed flood ways shall be designed to avoid velocities in excess of 2 m/s in the 5% AEP flood event. Concrete inverts, or other approved erosion control measures shall be designed and constructed where flow velocities are excessive.

Where the ponding of water is likely at a road embankment, either:

(a) a larger return frequency shall be adopted when designing the underpass or culvert;

(b) property and floor levels shall be kept above roadway levels, or 500mm above the 1% AEP flood, whichever is the higher;

(c) the safety of the embankment for rarer floods must be considered, particularly if there is a hazard to urban development, or if a roadway or any other structure diverts flow away from the natural drainage path;

Where practical, open space, parkland reserves and retarding basins should be strategically designed on a whole-catchment basis to improve downstream flow conditions and reduce flow velocities.

For major grassed channels and natural floodways (not small floodways in urban areas), signage shall be provided as shown in Figure 3.1 at all principal means of pedestrian access to the creek or floodway, advising people to take care at certain times. These signs shall include black lettering on white reflective plate, and have dimensions of 450mm x 600mm. The graphic is a 300mm triangle depicting a child in trouble within blue water.

Figure 3.1 Floodway Signage

3.7 RETARDING BASINS

Where the downstream hydraulic capacity of one or more components in a drainage system is inadequate for the design flow, and/or where economically feasible, retarding basins are required at the discretion of the relevant Director.

3.7.1 Dual Use

Basins should provide for multiple land uses where possible. Active and passive open space areas may be viable alternative uses. However, landscaping and permanent structures shall be designed with due consideration of the basin's prime drainage function. Where possible, the floor of the basin shall be designed so to have a minimum slope of 1%.

Where recreational uses are proposed, the basin should be provided with low-flow drainage pipes or channels, each having minimum longitudinal grades of 1%. Advisory signs should be erected, warning of the intermittent safety hazard.

3.7.2 Design

While basins are generally designed and constructed to a specific brief, the following general guidelines shall apply.

3.7.1.1 Annual Exceedance Probability

The design shall be based on a critical storm event with an annual exceedance probability of 1%, however consideration shall be given to the

provision of non-catastrophic failure mechanisms and public safety up to the Probable Maximum Flood (PMF) event.

The design flood shall be passed entirely through a controlled system, and no uncontrolled outflow should occur. Defined spillways should be provided for flows in excess of the design flood.

Basin shall be sized depending on the degree of flow attenuation necessary to ensure that the downstream drainage system can pass the design storm event.

3.7.1.2 Embankments and Batters

Grassed batters and embankments should be no steeper than 1:6 (vertical:horizontal) for maintenance purposes, although steeper slopes may be accepted by the relevant Director in special circumstances.

All pipelines under embankments shall be rubber-ring jointed, and consideration should be given to the provision of suitable cut-off walls or seepage collars.

3.7.1.3 Water Levels and Freeboard

Where suitable land is available, basins should be designed for a maximum 1.2m depth of water in the 5% AEP flood event. Where constraints preclude this, the designer shall ensure that adequate safety precautions have been taken, such as the provision of raised refuge mounds, fences, and warning signs.

A freeboard of 500mm above the 1% AEP flood level shall be incorporated into the basin embankment, unless otherwise specified.

3.7.1.4 Erosion and Sediment Control

Inlet and outlet structures shall be designed to minimise scour.

Peak flow velocities shall be limited to a maximum of 2m/s over grassed spillways and swales in the 5% AEP flood event.

3.7.2 Hydraulic Analysis

When calculating inflows, a fully developed catchment shall be assumed.

Basins shall be analysed using a suitable reservoir routing runoff model using a recognised method. The model should be calibrated using either the Rational or Unit Hydrograph method.

The designer shall ensure that at no time will the basin outflow interact with the downstream system so as to produce peak flow rates above the capacity of the system.

Backwater profiles shall be checked to ensure that flood waters do not back up onto roads and properties in the 1% AEP event.

3.7.3 Spillways and Outlets

Spillways shall be designed to pass the 1% AEP and PMF events with minimal damage and no catastrophic failure.

Special attention shall be given to the surfacing of spillways using turf, concrete, stone pitching, gabions, or other approved low-maintenance, durable material.

Outlets shall be designed to minimise the risk of blockage. Clear access for machinery should be provided to permit removal of silt. Outlets should be designed to restrict access.

3.8 PROPERTY DRAINAGE

Property drainage systems are designed to convey surface runoff from roofs, paved areas, and other surfaces to a suitable outlet. Property drainage systems should be designed so that all runoff can drain naturally to the street gutter, interallotment drainage system, or road drainage system. Hydraulically 'charged' roof water systems, where the pipe outlet is at a higher elevation than some parts of the pipe invert, are not desirable within the relevant Council area, as sediment and debris will tend to block the pipe.

Easements to drain water must be created where any component of the storm water drainage system is located within adjoining, privately-owned lands.

Two guiding principles which should be adhered to when designing drainage systems are:

(i) cause no detriment to downstream properties by either increasing, concentrating, or diverting flows;

(ii) cause no detriment to upstream properties by ponding or damming flows.

Australian Standard 3500 provides guidance for the design and construction of property drainage systems.

Note that stormwater shall be piped to the underground system whenever the discharge flowrate at the gutter is in excess of 30L/s per allotment, in a 5% AEP storm event.

3.8.1 Building Floor Levels

The floor level of new buildings should be carefully determined so that flood damage does not occur in major storm events. In particular, houses should not be cut into the natural surface, or located within a natural drainage depression, unless provision has been made for surface runoff to safely bypass the dwelling.

Those properties which are located on the low side of the public road, or adjacent to road sag points and drainage structures, should also take particular care when selecting the design floor level, in anticipation of a pit surcharge during major flow events.

Landscaping works such as terracing and the construction of retaining walls should be designed to protect the dwelling, all site embellishments, and neighbouring properties, from inundation.

3.8.2 Building Adjacent to Overland Flow Paths

The floor level of properties located adjacent to overland flow pathways, trunk drainage channels, and natural streams shall be located a minimum 500mm above the top of bank level, or the surface of the 1% AEP design flood event, whichever is the greater.

3.8.3 Drainage Easements

Easements are generally created over all pipelines conveying road and interallotment drainage. Where road water is conveyed within an easement, generally no construction shall occur on or above the easement.

Construction works within storm water easements may be considered by the relevant Director, provided that the below criteria are met:

(i) The stormwater pipe's condition shall be surveyed (using CCTV or similar) and evidence of this survey presented to Council. The survey shall extend 3m, or past the zone of influence (whichever the greater) beyond the structure. Where the pipe condition is not acceptable, or comprises flush jointed pipes, the developer will be required to replace the stormwater main with a size and material type as directed by Council.

(ii) The stormwater system shall be designed for a 1% AEP storm event, with the incorporation of a defined overland flow path to provide for stormwater system failures.

(iii) Structural loads shall be transmitted to the foundations outside of the zone of influence, as depicted in Figure 3.2 below. Concrete encasement of the pipe may be approved by the relevant Director in special circumstances, where some additional loads on the pipe are unavoidable.

(iv) Maintenance access shall be provided in accordance with Section 3.4.1.

(v) Where applicable a Flood Impact Assessment shall be carried out, considering major event storms and system failure, to determine the effect upon the proposed construction works and neighbouring properties.

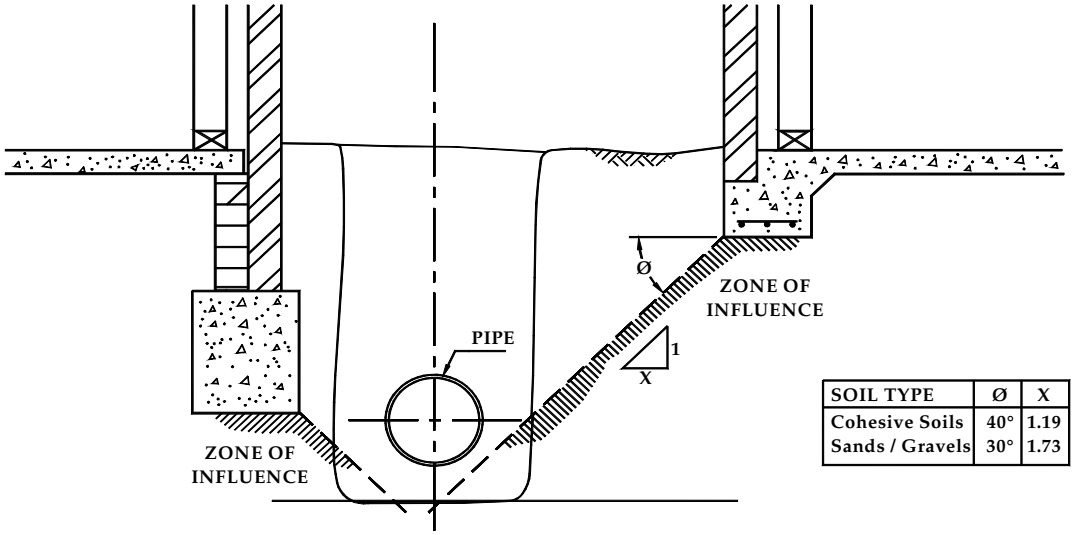


Figure 3.2 Zones of Influence

3.8.4 Interallotment Drainage

Interallotment drainage systems are required whenever the lowest point in a building allotment can not be drained directly to the street gutter. These pipes are designed to drain both roof water and surface water to Council's drainage system.

3.8.4.1 General Requirements

(a) The interallotment drainage system shall be designed using the same principles as road drainage, based on a fully developed catchment area.

(b) Where existing allotments discharge runoff directly onto the development site, an interallotment drainage system (with appropriate easements) shall be provided to alleviate this runoff.

(c) Easements shall be provided over all interallotment drainage in accordance with Section 3.4.4 of these guidelines.

3.8.4.2 Pits

(a) Square grated surface inlet pits shall be provided at a suitable location on each affected allotment. The pit surface level shall be designed for the finished surface level of the property, taking into account likely cut and fill operations during building works.

(b) Pits greater than 1.2 metres in depth will require step irons in accordance with the relevant Australian Standard

(c) Pits shall be provided at all changes in level, grade, and direction, and at all pipe junctions. Notwithstanding these requirements, the maximum pit spacing shall be 85 metres.

(d) All pits shall be provided with a 100mm diameter junction inlet, for the reception of underground roof water drainage pipes.

3.8.4.3 Pipes

(a) For minor developments and urban residential subdivisions of lot size not more than 800m^2, the following guide may be used to determine the minimum permissible pipe diameter:

Number of lots	Minimum pipe size	Minimum pipe grade (%)
1 - 2	150 mm	2
3 - 5	225 mm	1

Table 3.3 - Minimum Pipe Diameter for 1-5 lots

Detailed designs and calculations are required for medium density developments, and subdivisions of more than five allotments.

(b) Pipes shall nominally be located a distance of one metre from side and rear property boundaries. Where sewer lines are laid parallel with interallotment drainage lines, the drainage line shall be located closer to the property boundary.

(c) Pipes shall be laid with a minimum cover of 300mm.

(d) Pipe material and class shall be selected upon consideration of installation and maintenance costs, pipe depth and the design loads.

Materials which may be used without obtaining the separate approval of the relevant Director are rubber-ring jointed sewer grade unplasticised polyvinyl chloride (uPVC), fibre reinforced concrete, or reinforced concrete.

(e) Pipes shall be laid at a minimum longitudinal grade of 1%.

(f) In steep terrain, trench stops will be required in accordance with the requirements for sewer mains.

3.8.4.4 Pump-out systems

Pump out systems are not permitted for use within the Alliance Council areas.

3.8.5 Absorption Trenches

Absorption trenches may be constructed in rural or rural-residential areas, where the property area and soil types are suitable, and no nuisance will be caused to neighbouring properties. Absorption trenches are not acceptable in new urban areas.

The sizing of "soakaways", absorption, or seepage trenches is dependent on the hydraulic conductivity of the soils, and the consequences of any surcharging.

3.9 LANDSCAPING OF OPEN SPACE AREAS

The following general guidelines should be used for landscaping open space areas:

- No vegetation, other than grass, should be planted in channels and overflow paths beneath the surface level of the 5% Annual Exceedance Probability flood event;
- Grassed swales should have a minimum width of 2.5 metres;
- Batter slopes should have a maximum gradient of 1:6 (vertical:horizontal);
- Trees with clean boles, strong crown structure, and with no propensity to root suckering may be planted at minimum 3 metre spacings between the 5% and 1% AEP flood levels;
- No shrub or flow interference landscaping should be designed below the 1% AEP flood level;
- Open space areas should be grassed, and free of boulders, dirt and debris;
- All open space areas and drainage reserves should be trimmed to facilitate easy mowing.

3.10 DESIGN REFERENCES

The following publications should be read in conjunction with the recommendations in these guidelines.

- AUSTRALIAN STANDARDS 3500 National Plumbing and Drainage Code
- DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT, *Urban Erosion and Sediment Control*, Revised Edition. Sydney. (1992)
- DEPARTMENT OF PLANNING, NSW, *Better Drainage - Guidelines for the Multiple Use of Drainage Systems*, Sydney. (1993)
- ENVIRONMENT PROTECTION AUTHORITY, NSW, *Managing Urban Stormwater - Treatment Techniques*, Sydney. (1997)
- ENVIRONMENT PROTECTION AUTHORITY, NSW, *DRAFT Managing Urban Stormwater - Construction Activities*, Sydney. (1996)
- INSTITUTION OF ENGINEERS, AUSTRALIA, *Australian Rainfall and Runoff - A Guide to Flood Estimation*, Third Edition, Canberra. (1987)

Section 4.0 WATER INFRASTRUCTURE

4.1 INTRODUCTION

This section outlines the relevant Council's recommended practice for the design of water reticulation. It is in no way a comprehensive design manual, and is intended to be read in conjunction with and as a supplement to the relevant New South Wales Department of Commerce and Water Services Association of Australia (WSAA) publications, and manufacturers recommended procedures.

4.2 SUBMISSION OF ENGINEERING DRAWINGS

Engineering drawing submissions are to include all details requested in Section 1.3.1 of these guidelines, and detail all works necessary to extend water reticulation such that each lot includes a water service located entirely within the property boundary and the main to be extended just past the extent of the subdivision boundary.

4.2.1 Plan

Three copies of the water reticulation plan shall be submitted to as per Section 1.3.1 of this Guide, and should include the following details:

(a) Boundaries of allotments, roads, paths, easements, and reserves;
(b) Allotment numbers;
(c) Street name
(d) Location of water main and all fittings (hydrants, valves, tees, tapers etc.);
(e) Road centreline chainages;
(f) Existing water mains, and all other utility service lines crossing the main;
(g) Pipe class, diameter and material;
(h) North point and bar scale.

Longitudinal sections along the centreline of all water mains may be required in undulating terrain, or where necessary to show the arrangement of pipe bends and other fittings. These sections shall include pipe class, diameter and material, and the reduced level of the pipe invert and design surface at 20 metre intervals, and at all high points, low points, and pipe junctions. Where other utility services cross the water main, their location and size shall also be shown.

4.2.2 Structures

Detailed engineering drawings and supporting information will be required for any structures such as reservoirs and pumping stations proposed for construction with water supply works.

Designs and construction are to comply with Water Services Association of Australia (WSAA) or the Department of Commerce standards. Developers are advised to contact the Director Engineering Services at an early stage to discuss the requirements of Council.

4.2.3 Calculations

Calculations showing water demand and anticipated flow conditions are to be submitted for approval with the engineering drawings, by persons qualified in accordance with Section 1.3.2.

4.3 DESIGN REQUIREMENTS

Council requires that all allotments, including areas set aside for recreation, be provided with a reticulated water supply sufficient for both domestic and fire-fighting purposes. Industrial developments shall comply with AS 2118, as appropriate.

4.3.1 Water Demand

The design water demands, including pressure an flows which should be suitable for both domestic and fire-fighting requirements, should be calculated in accordance with the New South Wales Department of Commerce Standards. The design must cater for proposed future development in accordance with the relevant Council's Local Environmental Plan.

4.3.2 Service Reservoirs

The minimum capacity is one day's supply at peak daily demand.

Designs and construction are to comply with Water Services Association of Australia (WSAA) or the Department of Commerce standards. Developers are advised to contact the relevant Director at an early stage to discuss the requirements of Council.

Internal and external lockable ladders must be provided to the relevant Australian Standard and WorkCover requirements. The roof must be bird-proof, and incorporate either full railing or handrails around the lockable access hatch.

The scour line must be installed through a pit, followed by a rubble drain, and erosion control measures provided to prevent scouring.

NSW WorkCover approved fall arrest systems covering the whole of the reservoir shall be provided.

4.3.3 Reticulation Mains

The minimum static head required to each lot is minimum 20 metres, when the reservoirs are one-third depleted.

Mains shall be extended to the extremities of the subdivision or development to allow for future extensions, without disturbing established areas.

Mains shall be provided on both sides of the road in industrial areas.

4.3.4 Alignment

Water mains are to be located within the footway with the pipe centreline 1.8m from the property boundary, as shown in Council's standard drawing number WBC005.

4.3.5 Easements

Where any watermain or water service is not located on a public road, a 3m wide easement, with the pipe(s) centrally located will need to be created, in the favour of Council.

4.3.6 Material, Size, and Cover Requirements

4.3.6.1 Pipes

All water mains shall be constructed from Tytonexcel PN20 Ductile Iron Cement Lined (DICL) or minimum Class 12 MPVC pipe, spigot and socket, rubber ring jointed pipe manufactured in accordance with Australian Standard 2280.

Pipes shall be sized according to the calculated demand flows, however the minimum acceptable pipe diameter is 100mm. Pipes with diameter of not less than 150mm should be used in commercial and industrial areas.

The minimum acceptable cover for DICL and MPVC pipes is in accordance with the applicable standards.

4.3.6.2 Fittings

All fittings should be of cast or ductile iron, cement-lined, and conform to AS 2544 and AS 2280 respectively, or thermal bonded polymeric coating to AS Standard 4158. Stop valves and scour valves are to be clockwise (CC) closing, with the exception of Central Tablelands Water which is anticlockwise closing. Other materials may be accepted with the written approval of the relevant Director.

Council endeavours to standardise on fittings so that maintenance and repair stocks can be minimised. It is important that developers obtain details of approved manufacturers prior to ordering pipe fittings.

4.3.6.3 Service Connections

Water services should be of single service polyethylene pipe, minimum Class 12.5 in accordance with AS 4130 Services are to be a minimum of 25mm OD.

Compression fittings are to be installed at all joints. Maincocks and elbows are to be brass and of a type approved by the relevant Director.

4.3.7 Service Connections

Separate metered water services are to be provided to every allotment, as well as parks, reserves and landscaped roundabouts.

The meter box for each lot should be located approximately 500mm inside the front and side property boundaries. Services should be located in pairs at side property boundaries.

Meters are generally installed by Council and or the Water Authority upon receipt of a Development Application for construction on each individual lot.

All service connections should cross the road perpendicular to the road centreline, and be located within a 50mm diameter Class 12 uPVC conduit. Such connections should be marked on each kerb with a “W”

4.3.8 Road Crossings

Trenches through existing sealed roads where required shall be backfilled using a full depth, 5 MPa, 27:1 sand:cement mixture as per standard drawing WBC021, with the exception of underboring. Where trenches are cut in areas where a new road is to be built, this treatment shall not be used.

Road crossings shall be constructed perpendicular to the road centreline.

4.3.9 Pipe Fittings

Fire hydrants of an approved type are to be installed along the water main at maximum spacings of 60 metres. Hydrants shall also be provided at dead ends and all high points

Scour valves should be provided at all low points, and are to be discharged via a pipe to a storm water drainage pit.

Stop valves are generally located adjacent to tees, and so that no more than 25 properties are isolated at any one time, by closing no more than four valves.

All main cocks, tees, hydrants, stop valves, scour valves, and air valves should be located within the public footway.

All gibaults are to be long sleeved.

At road intersections, two forty-five degree (45^{o}) bends should be used to negotiate the corner.

Thrust blocks shall be provided at all bends, tees, and dead-ends, in accordance with standard drawing number WBC022.

All valves and hydrants shall be enclosed within valve chambers in accordance with standard drawing number WBC020.

Markings and indicator posts shall be provided at all hydrants and valves in accordance with standard drawing number WBC024.

4.3.10 Testing

Prior to acceptance of the water reticulation network, all pipelines shall be inspected and pressure testing will be carried out. Refer to Section 8.3 (Testing) of this Guide for inspection and testing details.

4.3.11 Telemetry

Council and the Water Authority operate a telemetry system to monitor the current status, and permit the remote control, of strategic water equipment.

Developers are required to fund the incorporation of new system components, such as flow meters, valves, and pumps into Council's current telemetry system.

All works will be undertaken by Council.

4.3.12 Connection to Existing Mains

Where it is necessary to connect to, tap into, or relocate an existing water supply main, this work should be carried out by staff of the relevant Water Authorities or Council at the developer's expense.

The developer should lodge payment for the work in advance and give 14 days notice of when connection is desired.

4.3.13 Mains in Cul-de-Sacs

Where the cul-de-sac incorporates an adjacent street connected by a pathway, or ends in a public reserve, the water main shall extend through the pathway or reserve so that a dead-end is not created in the main.

In all other cases, the main is to be looped around the cul-de-sac in accordance with Council's Standard Drawing number WBC019.

4.3.14 Building Over Water Mains

No footing of buildings will be permitted to be built within the zone of influence of any Council water reticulation pipe.

Section 5.0 SEWERAGE INFRASTRUCTURE

5.1 INTRODUCTION

These guidelines outline the Alliance Group of Council's recommended practice for the design of sewerage reticulation. It is not intended to be a comprehensive design manual, and should be read in conjunction with and as a supplement to the relevant New South Wales Department of Commerce.

5.2 ENGINEERING DRAWINGS

Engineering drawing submissions are to include all details requested in Section 1.3.1 of these guidelines, and detail all works necessary to extend sewerage such that each lot includes a junction located entirely within the property boundary. Where software packages are utilised in the design process, a copy of the electronic data files shall be submitted in addition of all other information.

5.2.1 Plan

Three copies of the sewerage plan shall be submitted ~~to~~ as per Section 1.3.1 of this Guide, and should include the following details:

(i) Boundaries of allotments, roads, paths, easements, and reserves;
(ii) Allotment numbers;
(iii) Street name
(iv) Location of sewerage and all sidelines, dead ends, junctions and manholes;
(v) Distances from downstream manholes to proposed junctions;
(vi) Discrete sewer main and manhole numbers as provided by Council;
(vii) Natural surface contours and proposed ground surface levels (if different);
(viii) Existing sewerage, and all other utility service lines crossing the main;
(ix) Pipe class, diameter and material;
(x) North point and bar scale.

5.2.2 Longitudinal Sections

Longitudinal sections along the centreline of all sewer mains at scales of 1:500 horizontal and 1:100 vertical. The following details should be included on longitudinal sections for each main:

(i) Invert, natural surface, and proposed ground surface levels;
(ii) Depth from invert to proposed ground surface level;
(iii) Chainage along pipe;
(iv) Pipe gradient, class, diameter, and material;
(v) Sewer main and manhole numbers as provided by council;
(vi) Depth and size of utility services which cross the main, and vertical clearance to pipes;

All length measurements should be in shown in metres. Distances are to be measured to the nearest centimetre (e.g. 77.24m), and levels shown to the Australian Height Datum to centimetre accuracy (e.g. 687.81m). Grades should be shown as percentage figures to two decimal places (e.g. 1.28%).

5.2.3 Rising Mains and Structures

Detailed engineering drawings and supporting information will be required for any rising mains and structures such as pumping stations and specialised manholes proposed for construction with the sewerage works.

5.2.4 Supporting Information

Calculations detailing anticipated pipe loadings, velocities and flow rates, and pumping station data (where necessary) are to be submitted for approval with the engineering drawings.

Where commercially available software packages are used to design sewer systems, a copy of all data files shall be provided to the Council prior to approval being granted. Note that the use of software does not negate the designer of his responsibility in ensuring an appropriate design which meets the requirement of this guide.

5.3 DESIGN REQUIREMENTS

Council requires that all allotments be provided with a sewer junction, located so that the entire property can be sewered.

5.3.1 Design Flows

Design sewer flows should be calculated in accordance with the relevant New South Wales Department of Commerce Standards.

5.3.2 Component Design

Components of the sewerage system shall be designed in accordance with the Sewerage Code of Australia, published by the Water Services Association of Australia.

5.3.3 Pumping Stations

Wet well capacity shall be sufficient for the total ultimate Peak Wet Weather Flow (P.W.W.F.).

Pumps are to be sized for a maximum 8 starts per hour and provide a self-cleansing velocity of 0.6 metres per second in the rising main.

Minimum volume from top water level to bottom water level is to be the volume pumped in 90 seconds.

Full stand-by pump capacity is required, with the pumps on an automatic changeover from duty to standby. There shall be at least a 4 hour retention time at average dry weather flow (ADWF) or 8 hours at ADWF if discharging to Class P, U or S waters within the sewer reticulation system before any surcharges.

All wet wells and any other exposed concrete shall be covered with a two pack epoxy liner or equivalent.

5.3.4 Easements

Where any service is not located on a public road, a 3m wide easement, with the pipe(s) centrally located will need to be created, in favour of Council.

5.3.5 Telemetry

The Alliance Council's each operate a telemetry system to monitor the current status, and permit the remote control, of strategic sewerage equipment.

Developers are required to fund the incorporation of new system components, such as flow meters, valves, and pumps into the Council's current telemetry system. All works will be undertaken by Council.

5.3.6 Rising Mains

5.3.6.1 Design Guidelines

The rising main should be capable of withstanding maximum working head, including an allowance for water hammer and creep. Minimum class pipe for uPVC pipelines shall be Class 12.

Velocity in the rising main should not exceed 3.0 metres per second.

Rising mains should be designed to ensure self cleansing and that the detention time in the main shall not exceed 4 hours

5.3.6.2 General Requirements

Each pump discharge line is to be provided with a reflux valve and stop valve, with the stop valve located upstream of the reflux valve.

An approved air valve is required at high points in the main.

A scour valve and line is required to enable the rising main to be completely drained of sewage. The receiving manhole shall be vented. Rising mains from pumping stations shall be constructed with rubber ring jointed pipe Titonexcel PN20 to AS 2280 or Class 12 MPVC Series 2 or Class 12 poly pipe to AS 4130

A flow meter shall be incorporated in the rising main immediately downstream of the pumping station.

5.3.7 Low Pressure Systems

Low pressure sewer systems are allowable in certain locations throughout the Alliance area, and it is recommended that the applicant consult the respective Alliance Council's Technical Services Department in the first instance.

Design and construction shall be in accordance with the Pressure Sewer Code of Australia, published by the Water Services Association of Australia.

Design and installation of such systems will be subject to the normal Development Application Approval processes, via the respective Alliance Council's Planning and Development Department.

5.3.7.1 Location

Sewer mains shall be generally be positioned so they run parallel to the lowest boundary of the lots, and one metre from front, rear, or side boundaries. However, where interallotment drainage is also constructed, sewerage should be located nearest the centre of the lot by a clear distance not less than 500mm.

The minimum clearance between sewer mains and adjoining services should be 400mm in the horizontal plane, and 150mm in the vertical direction (or 300mm for high voltage electrical cables).

The minimum clearance between sewer mains and adjoining structures is 1.2 metres for 150mm diameter mains, or 2.0 metres for mains of diameter 225mm or greater. This clearance is measured from the outside edge of the main to the nearest edge of the footing. Additional requirements may be imposed depending on whether easements exist.

Mains shall be extended to the extremities of the property to permit future extension without disturbing established areas.

5.3.7.2 Material

All sewer pipes laid within the Alliance Council *areas* shall be constructed from Class SeH SN8 uPVC in accordance with AS 1477.

5.3.7.3 Sizing

Sewer capacity should be greater than or equal to P.W.W.F. and grading sufficient to achieve self-cleansing velocity at Peak Dry Weather Flow (P.D.W.F.).

Mains shall be sized to cater for P.W.W.F, and graded sufficient to achieve self-cleansing at Peak Dry Weather Flow (P.D.W.F.).

The minimum pipe diameter shall be 150mm.

The developer should liaise with Council's Engineering Department when mains exceed 225mm in diameter as special considerations may apply.

5.3.7.4 Gradient

Minimum Grades

The minimum permissible grade of a sewer main is governed by the number of contributing Equivalent Tenements (ET), where each urban residential lot is equal to 1 ET. The calculation of the design equivalent tenements for residential and non residential development shall be as per Department of Commerce requirements

Table 5.1 (from Sheet 1, Appendix A of the New South Wales Public Works Department Manual of Practice for Sewerage Design) shall be used to determine the minimum grade of 150mm diameter sewer mains. The Council's Engineering Department may able to provide advice on minimum sewer grades where larger diameter mains are required.

Minimum Sewer Grade		Minimum ET		Maximum ET
1 in x	%	Absolute	Normal	Normal
80	1.25	1	1	221
90	1.11	2	3	208
100	1.00	4	6	196
110	0.91	7	9	186
120	0.83	10	13	178
130	0.77	14	18	170
140	0.71	18	23	164
150	0.67	24	30	158
160	0.63	30	35	152
180	0.56	41	48	143
200	0.50	56	65	135

Table 5.1 - Minimum Sewer Grades for 150mm Diameter Mains

Maximum Grades

The maximum sewer grade may be governed by the need to service upstream properties.

Special measures are required for sewer grades in excess of 6.5% to prevent scouring of the trench, as follows:

For grades between 6.5% and 10%:

Trench stops, consisting of polyethylene bags of minimum thickness 0.25mm filled with clay or other approved material, and sealed in an approved manner, shall be placed under, around and to 300mm above the pipe at every third collar. Bags shall not be placed onto sand bedding.

For grades between 10% and 15%:

Concrete bulkheads 150mm thick, and constructed from 20MPa concrete, shall be constructed at a spacing of D metres along the trench, where:

$$D(m) = \frac{100}{PipeGradient(\%)}$$

The spacing shall be reduced as necessary to ensure that the bulkhead is constructed at a collar. The concrete bulkheads shall protrude 150mm above and below the pipe, and extend 150mm into the trench walls. Mastic shall be placed around the pipe.

For grades in excess of 15%:

The pipes shall be embedded on 100mm thick freshly laid 20MPa concrete, with the concrete keyed into both sidewalls by a minimum of 150mm, and extending to surface level or such lower level as directed by the relevant Director.

5.3.7.5 Cover and Clearance

Minimum cover to uPVC Class SeH (SN8) piping shall be as per Department of Commerce requirements.

In exceptional circumstances, and where ductile iron pipes are used from manhole to manhole, cover may be reduced to 450mm.

5.3.7.6 Road Crossings

Trenches through existing roads where required shall be backfilled using a full depth, 27:1 sand:cement mixture as per standard drawing WBC025. Where trenches are cut in areas where a new road is to be built, this treatment shall not be used.

Road crossings shall be constructed perpendicular to the road centreline.

5.3.7.7 Sidelines

Sidelines shall not exceed 10 metres in length, or provide more than two house connections. Where only one property is served, sidelines shall have a minimum grade of 1.67%.

Sidelines originating from dead-end mains shall not exceed 3 metres in length, in accordance with the Department of Commerce standards.

5.3.7.8 Junctions

A 150mm diameter sewer junction shall be provided within each allotment, at a depth sufficient to permit at least 90% of the allotment to drain via a pipe having minimum 600mm cover and laid at a minimum grade of 1.667%.

The maximum desirable depth to invert of the sewer main at a junction is 1.5 metres. Where the invert exceeds 1.5 metres in depth, a temporary vertical shaft shall be constructed and will be capped 500mm above the natural surface, and in accordance with standard drawing WBC028.

Junctions should generally be located one metre from the property boundary, on the lowest side of the allotment.

5.3.8 Manholes

5.3.8.1 Location

Manholes shall be located along sewer mains at all changes in grade, level, and direction, and at intersections with other mains or dead-ends in accordance with Sewerage Code of Australia, standards. Manholes will not be accepted within the carriageway of public roads.

The maximum permissible spacing between adjoining manholes is 90 metres.

Manholes are to be designed so that sewage is not forced to deflect by an angle of more than 90 degrees.

The maximum permissible spacing between adjoining manholes is 90 metres.

Manholes are to be designed so that sewage is not forced to deflect by an angle of more than 90 degrees.

5.3.8.2 Materials

Manholes shall be constructed using a 20MPa concrete cast in-situ base. Either Type C or Type D cement shall be used in the concrete mix.

Sidewalls and covers shall be constructed from precast concrete components.

5.3.8.3 Construction

Manholes shall be constructed in accordance with standard drawings WBC026 and WBC 028 for drop manholes. The minimum desirable fall through the manhole is defined in these drawings.

Note that step irons are not to be used in sewer manholes

5.3.8.4 Drop Manholes

Drop manholes may only be used to avoid underground services, or at the intersection of shallow and deep mains where the difference in invert levels exceeds 450mm. The maximum difference in invert levels is 2.0 metres.

5.3.8.5 Building over Council Sewer Mains

No building shall be constructed over Council's sewer reticulation system without the express approval of the relevant Director.

Where permissible, sewer reticulation mains of up to 225mm diameter may be built over, provided that the following conditions are met:

a) The existing main shall be replaced in ductile iron cement lined pipe and concrete encased with a minimum of 150 mm of cover from the pipe surface

b) The building footings shall be piered and beamed to below the sewer main invert level. The design hall be carried out by a practicing structural engineer

c) If a building is not directly over the were main but within the zone of influence ie within 45 degree line down from the sewer main invert to ground level, the building shall be piered and beamed to below the zone of influence line. The design shall be carried out a by a practicing structural engineer.

No buildings will be permitted to be built within the zone of influence of any sewer rising main.

5.3.8.6 Septic Systems

Septic systems are only allowable in locations as defined by the relevant Council Local Environment Plan (L.E.P.) Design and installation of such systems are subject to the normal Development Application Approval processes, via the relevant Alliance Council's Planning and Development Department.

Section 6.0 ENVIRONMENT

6.1 INTRODUCTION

Land development can lead to significant environmental impacts, even on relatively small projects. These impacts include erosion, sedimentation, land degradation, habitat destruction, water pollution, air pollution, noise pollution and waste generation. With adequate planning and management, these impacts can be minimised or prevented altogether.

It is the requirement that the Development complies with the Clean Air Act, the Water Act and all other environmental Acts throughout the course of the development. Particular attention to the POEO Act which requires notification to Department Environment and Climate Change for a pollution event.

An Environmental Management Plan must be submitted and approved prior to commencing any development work.

6.2 ENVIRONMENTAL IMPACTS FROM LAND DEVELOPMENT

6.2.1 Soil Erosion

Erosion is the wearing away of the land by the action of running water, rainfall, wind or ice. Human activities, including land development, often accelerates and intensifies this process. The factors influencing erosion include soil erodibility, rainfall intensity, surface slopes and vegetation cover.

According to information published by the Soil Conservation Service (now incorporated into the Department of Land and Water Conservation), the majority of the soils in the Alliance Council's areas have moderate to high erodibility.

The vast majority of erosion occurring on land development projects is due to the action of water.

6.2.2 Sedimentation

Sedimentation occurs when eroded soil is deposited at a new location either on land or in a water course. Once the runoff containing the eroded soil slows, heavier soil particles (coarse sands and gravels) will be deposited as sediment, then followed by smaller particles.

6.2.3 Land Degradation

Land degradation is the combined result of the soil erosion and sedimentation. The loss of the fertile topsoil layer causes sensitive plant species struggle to survive or re-establish. Under these conditions, infestations of noxious weeds can occur due to the weeds being more adapt to low fertility soils.

6.2.4 Destruction of Habitat

Remnant vegetation, especially native vegetation, may form part of a valuable habitat for native fauna or act as a "corridor" between such areas. These habitats may contain rare and endangered species of both flora and fauna.

6.2.5 Water Pollution

Not all eroded soil particles will go through the sedimentation process, with fine soil particles, nutrients and heavy metal contaminants. As a result, waterways become turbid (cloudy) and will have the effect of causing algal blooms and changing the biological composition of the waterway.

6.2.6 Air Pollution

The main forms of air pollution are:

- Dust
- Burning waste
- Vapours from volatile compounds

6.3 EROSION AND SEDIMENT CONTROL

The NSW Department of Environment and Climate Change has produces a variety of documents including "*Managing urban Storm Water: soils and construction* by Landcom, are useful in designing erosion and sediment controls for a site. It is recommended that these documents be referred to in conjunction with the following information when preparing any erosion or sediment control works.

This is the major component of the environmental management of a land development site. The Erosion and Sediment Control Plan (ESCP) is required to be submitted and approved by Council prior to any work taking place. The object of a ESCP is to minimise, preferably eliminate, the impacts of soil erosion and sedimentation resulting from land development activities.

The following is a guide as to the Alliance Council's expectations for inclusion in an ESCP. Please note that if the requirements as set out below do not met the satisfaction of Council, you will be asked to amend and re-submit the ESCP.

The ESCP is required to be presented as a suitably scaled drawing(s) (1:1000 or less) with the north point clearly marked and accompanied by detailed specifications and notes. The drawings, specifications and notes must be sufficiently clear so that they can be understood by on site staff.

6.3.1 Site Characteristics

6.3.1.1 Topography

The contours, drainage lines and the catchment area are to be identified. The contour intervals as drawn on the ESCP should be in 0.5m intervals or less.

6.3.1.2 Soils

The ESCP should show the locations of the main soil types present on the site. In addition, the erodibility of the soil types should be presented. As a general guide, soils containing a large proportion of fine sands and silts or dispersive clays are usually moderately to highly erodible (specialist advice can be sought from the Department of Land and Water Conservation). Areas of rock outcrops should also be highlighted.

The areas of existing erosion and sedimentation problems (if any) should also be shown on the ESCP. These areas are more than likely to become

a greater problem once land development starts and will require special attention.

6.3.1.3 Vegetation

The types of the existing vegetation and the areas that they occupy should be shown on the ESCP.

The different classes of vegetation should be identified as they vary in their capability to prevent erosion and filter sediments. A detailed flora survey using scientific names is not required to complete this component of the ESCP.

Where significant groupings of shrubs / trees are concerned, descriptions such as Acacia (Wattle), Eucalyptus (Gum), Melaleuca, Willow, Pine, etc are sufficient. Grasses can be described broadly as either native grasses or pasture grasses. Some indication should be given to the percentage ground cover the grasses provide.

Areas of weed infestation, especially noxious weeds, should also be noted on the ESCP.

6.3.1.4 Sensitive Areas

The areas within and adjacent to the development site, in particular, environmentally sensitive areas, should be highlighted in the ESCP. Sensitive areas may include rivers, flood ways, creeks, wetlands, significant areas of native vegetation, national parks and heritage areas. Residential areas should also be considered as sensitive as significant erosion and sedimentation and affect the amenity of the area and possibly cause inundation from altered drainage patterns.

6.3.2 Extent of Proposed Works

6.3.2.1 Clearing of Vegetation

The area of vegetation proposed to be cleared must be shown clearly on the ESCP. Areas proposed for clearing must be kept to the minimum required to carry out the development. Excessive clearing of vegetation will not be considered as satisfactory.

6.3.2.2 Earthworks

All areas where topsoil is proposed to be stripped and proposed areas of cut and fill need to be shown on the ESCP. Excessive stripping / cut and fill works will not be considered satisfactory.

The ESCP should also include the plan / method proposed to be used to stabilise / repair any areas of erosion and prevent further sedimentation.

6.3.2.3 Materials Storage Areas & Stockpiles

All locations where stored materials and stockpiles are proposed to be positioned are to be shown on the ESCP.

Generally, stockpiles and material storage areas should be at least 2m, preferably 5m, from concentrated water flows and traffic areas and on slopes less than 1 (vertical) in 10 (horizontal).

6.3.2.4 Scheduling of Works

A schedule of the proposed works to be carried out is to accompany the ESCP. Obviously, the actual timing of the works will depend heavily upon the weather and other work commitments. The schedule is required to assess whether the works as proposed are staged correctly and that vulnerable areas are not left exposed for prolonged periods.

6.3.3 Proposed Erosion & Sediment Controls

The NSW Environment Protection Authority and the State Stormwater Co-ordinating Committee have produced a series of three draft documents titled "Managing Urban Stormwater". Two of these documents, "Construction Activities" and "Treatment Techniques" are very useful in designing the erosion and sediment controls for a site. It is recommended that these documents be referred to in conjunction to the information presented below when preparing this part of the ESCP.

6.3.3.1 Diversion of "Clean" Runoff

The ESCP should show how it is proposed to minimize the amount of storm water entering the site. Whilst the building site may be well vegetated and suitable erosion control measures in place, large volumes of storm water runoff can still cause erosion and damage or destroy sediment controls. "Clean" water should be intercepted upgradient of the development site by an earth bank and diverted to a stable and undisturbed area.

6.3.3.2 Erosion Controls

There are likely to be situations where the existing vegetation and diversion of storm water may not be adequate by themselves as erosion control. When this is the case, the ESCP should show the methods proposed to be used as further erosion control. This may include the use of soil binders, mulches, blankets and revegetation (see Section 6.3.3.5).

6.3.3.3 Interception & Treatment of "Dirty" Runoff

The ESCP should show the locations and details of the proposed sediment controls. These controls should have the aim to eliminate sediments entering sensitive areas and / or leaving the site.

The use of the existing vegetation will not be totally suitable as the only sediment control measure. Other sediment controls (eg. sediment filter (silt) fences, straw bale sediment filters, sediment retention basins, etc.) will be required. This applies to on site stormwater inlets as well as site boundaries. The use of sediment filter fences is preferred as these structures can perform better in situations of high flow and the materials can be reused from site to site if undamaged.

If, for some reason, it is felt that sediments may escape from the site in heavy rainfall events, due to site slopes, soil types, etc. then the relevant Council Engineer's Department is to be contacted to help arrange sediment controls for Council's stormwater system. This measure is to be used as a last resort only.

6.3.3.4 Access to Site

Access to the site, as shown on the ESCP, should be limited to one point only where possible. This all weather access will improve access to the site in wet conditions, reduce disturbance of the site and reduce the amount of mud that is deposited on the roadway that will be washed away by rain, possibly causing sedimentation problems and water pollution.

Where possible, the access should be 15m long by 3m wide. A berm (height 300mm) should comprise part of the all weather access adjacent to the site boundary (not the roadway). Compacted decomposed granite with a surface cover of 50-75mm gravel should be the used for the construction. The materials used in the construction of the all weather access can be reused once the building activity is completed.

Runoff from the access should be treated as “dirty” runoff and directed back into the site to the existing sediment controls.

6.3.3.5 Revegetation

A plan to revegetate the disturbed areas should be provided with the ESCP. This applies to both temporary revegetation (for disturbed areas, batters, stockpiles, etc.) and permanent revegetation (at the completion of the project)

The method of preparing the seedbed also required as part of this information. If in doubt, seek the advice of a professional landscaper, gardener or refer to the Department of Housing documents *Guidelines for Grass Selection in NSW* (1993) and *Guidelines for Plant Selection* (1993).

6.3.4 Inspection and Maintenance

A program of inspection and maintenance is required to be provided with the ESCP**.** Suggested inspection intervals are:

- Once a week (on Friday), or;
- After a rain event, or,
- Prior to the site being unattended for a period in excess of 24 hours

All sediment and erosion controls should be repaired / cleaned if they are damaged / filled with sediment promptly.

6.3.5 Noise Pollution

Two goals are set by the NSW Environment Protection Authority in regards to noise. The first is that noise, as measured within one metre of a residence is less than 50 dB(A). A sound level of 50 dB(A) is approximately equivalent to normal conversation at a distance of one metre.

Some areas may have a “background” noise level in excess of 50 dB(A). In these circumstances, the NSW Environment Protection Authority recommends that the noise level not exceed the background level plus 5 dB(A). Any noise above this level is clearly audible over the “background” noise.

These two goals apply to daytime only. Daytime is defined as 7:00 am to 10:00 pm Monday to Saturday and 8:00 am to 10:00 pm on Sundays and Public Holidays.

Construction will only occur during the times as outlined in the Construction Consent.

6.3.6 Consultation

Both the Department of Land and Water Conservation and the NSW Environment Protection Authority may be consulted during preparation of an ESCP. These departments can provide specialist advice on soil types, erodibility, vegetation clearing, erosion controls, sediment controls, legislative requirements and management of sensitive areas.

6.4.3 Use of Chemicals

Many chemicals associated with land development activities can have short or long term effects on the environment and / or on people's health. Therefore, chemicals are always to be handled, used and disposed in accordance with the manufacturer's instructions.

When not in use, chemicals should be sealed to prevent the escape of vapours. Chemicals, if left on an unattended site, should be kept upright and sealed in an unexposed, secure area, preferably on an impermeable surface (such as concrete).

If a spillage or a leak occurs, the following action should be taken:

1. stop the spill or leak;
2. prevent the spill / leak from leaving the site and / or entering watercourses;
3. clean up the spill using a absorbent material (eg. sand or sawdust), and;
4. notify the NSW Environment Protection Authority and the relevant Council so that appropriate arrangements can be made to clean up and dispose of the absorbent material and any effected soil.

Please take note that on site disposal of chemicals is not, and never will be, an acceptable form of waste disposal.

6.4.4 Waste Management

The fees for disposal of waste at the relevant Council's Waste Management Centre are more expensive for mixed waste rather than for sorted waste due to the increased cost of disposal and the lost opportunity of recycling. For current disposal fees, see the relevant Council's Schedule of Fees and Charges.

It therefore makes sense financially, as well as environmentally, to reduce, reuse and recycle wastes produced in the land development process.

Section 7.0 TRAFFIC MANAGEMENT

7.1 INTRODUCTION

This section covers work practices and protective measures for persons whose duties require them to work in the vicinity of traffic or mobile plant, and the safety of persons who may be affected by such work. Guidance is provided for the planning, design, installation and operation of traffic management schemes.

The organisation carrying out construction or maintenance operations on public lands must be aware of its responsibilities for any injury to road users or damage to property as a result of such operations, and should ensure that all works comply with the relevant Australian Standards and WorkCover requirements. There is a further obligation to provide a safe working environment which minimises the likelihood of injury by managing traffic within or adjacent to the work area. Steps should be taken to warn the public of prevailing conditions and to guard, delineate, and illuminate (if necessary) any work which may pose a hazard to traffic.

Four important basic principles to observe when performing road works are:

- Signs and devices shall be used in a standard manner and match the conditions at the work site.
- Signs and devices shall be erected and displayed before work commences at a work site.
- Signs and devices shall be regularly checked and maintained in a satisfactory condition.
- Signs and devices shall be removed from a work site as soon as practicable, however appropriate signs shall remain until all works have been completed (including loose stone removal and line marking).

7.2 SAFETY DEVICES

This section provides guidance on the type of safety devices necessary at construction sites. Details on the minimum number and placement of signs and devices may be found in the Roads and Traffic Authority publication ”Traffic Control at Worksites” Australian Standard 1742.3, and the various field guides for Traffic Control at Works on Roads.

Advance warning signs and devices shall allow adequate time for correct response under the worst anticipated conditions. All approaches to the work area, including any side roads, shall be provided for.

7.2.1 Condition of Traffic Management Devices

All traffic control devices used shall at all times be free from damage and operate as intended. Signs which are damaged, faded or dirty shall not be used and lighting devices shall operate as intended.

7.2.3 Delineation

The travelled path on the approaches and past the work area shall be delineated so that there is no doubt about which part of the roadway is available to traffic, or the path that traffic should follow, under all reasonably expected climatic conditions,

day or night. Long range delineation using signs should provide advance warning to motorists, while short range delineation is usually achieved by line marking or pavement-based devices.

7.2.3 Night Conditions

Where devices are used during night conditions, the following shall apply:

- Signs shall be reflective or floodlit. Fluorescent signs are designed specifically for day time use, and must be illuminated if used at night. However, combination fluorescent/reflective materials may be suitable without floodlighting.
- Delineating devices shall be either lights or reflectors.
- Flashing lamps shall be used only to draw attention to signs, where necessary.
- Steady or ripple lamps may be used to define the limits of a non-trafficable area, and may replace a proportion of reflectors in a line of delineators.
- Pavement markings shall be reflective, using either raised reflective pavement markers, Reflective preformed materials, or reflectorised paint with drop-on beads.

7.2.4 Adjustment to Existing Devices

Existing signs and traffic control devices which are inappropriate to, or conflict with, the temporary work situation shall be covered, obliterated or removed. However, prior approval may be necessary from State or Local Authorities.

7.2.5 Temporary Safety Barriers

Temporary safety barriers shall be considered for long term works where any of the following situations are possible, or where a safe clearance between moving traffic and the hazard cannot be achieved:

(a) Hazardous traffic conflicts (e.g. head-on collisions).

(b) Collisions with hazardous fixed objects, or falls into excavations close to the travelled way (especially road openings where no traffic controller is used).

(c) Safety of workers and/or plant is endangered.

7.2.6 Over-Dimensional Vehicle and Load Requirements

Where the width, height, or load-carrying capacity of the roadway or structure is to be temporarily reduced during works, the roads authority should be notified in advance so that arrangements may be made to divert traffic which would exceed temporary limitations. The authority should also be informed of the estimated finish time so that traffic can resume normal use of the roadway or structure.

Note that for State Highways the officer responsible is the Divisional Engineer of the Western Region, N.S.W. Roads and Traffic Authority, and for other roads, the relevant Director of the relevant Council.

7.3 CONSTRUCTION WORKS

7.3.1 Safety and Convenience

Work schedules should be arranged to use only the minimum practicable length and width of road, sufficient for worker safety and the work method employed, so as to minimise:

- disruption of established traffic movements and patterns;
- interference with traffic at peak movement periods and at night, weekends, holiday periods, or other special events.

The clearance between the edge of the work area and the edge of the adjacent traffic land should be at least 1.2 metres.

Signs and devices shall not direct a motorist to disobey a law unless an authorised person is present to direct traffic.

It is important that signs and devices for which the temporary or permanent need no longer exists, are covered or removed for the duration of the works.

7.3.2 Traffic Through the Work Area

The passage of traffic through a work area shall only be permitted where both the traffic and the work can be adequately controlled. One or more traffic controllers shall be employed as necessary to slow traffic, stop traffic for short periods, or to control single line flow. If necessary, controllers shall also be provided to control the movement of plant within the trafficable area.

7.3.3 Traffic Past the Work Area

This will be the normal method of traffic management at sites where complete elimination of traffic is not required. Traffic paths past the work area shall be clearly delineated and pre-work delineation obliterated where feasible for long term works.

7.3.4 Side Tracks and Detours

Where necessary, traffic may be accommodated by a detour using existing roads, or a specially constructed side track.

7.3.5 Pedestrian and Bicycle Access

Where pedestrians and bicycles must move through or past a work site, they shall be provided with and directed to suitably constructed and protected temporary footpaths, crossing points, or refuges if warranted. The surface condition of any relocated paths or temporary facilities must be suitable for strollers and wheelchairs. Further, lighting should not be less than that provided on the original crossing.

7.3.6 Daily Routine Tasks and Record Keeping

A recommended daily routine for the operation of a work site, including the keeping of daily records for the sign arrangement or traffic guidance scheme, and records of any incidents which may have ongoing consequences, is given in Appendix A of Australian Standard 1742.3.

7.3.7 Illumination

Before darkness falls, the person controlling the work site must ensure that hazards or barriers are conspicuous, and that traffic warning lamps are in good working order, and clearly visible to oncoming traffic. Care should be taken to ensure that any lighting does not cause glare for approaching drivers.

7.3.8 Working With Mobile Plant

Vehicles and plant used in or around the work site should be clearly visible.

Persons should not be placed at risk when working near mobile plant. Special consideration should be given to soil technicians, surveyors, and the like within the workplace.

Where plant and equipment is capable of reversing and the operator may have obstructed vision, it may be necessary to fit an audible reversing alarm unit. However, reversing alarms may cause confusion where multiple plant is using the same area.

7.3.9 Personal Protective Equipment

Before commencing work, the contractor responsible for the work should assess any conditions likely to affect the health and safety of all personnel on the work site. All personnel on site shall wear high visibility garments. During night, or in poor light conditions, garments should be fitted with reflective silver tape front and back, covering not less than 30% of the vest or garment area.

Wet weather clothing should be of fluorescent red, orange, or yellow material. At least two hoops of 50mm wide reflective material should be incorporated into the garment for use in dim conditions.

Eye protection complying with Australian Standard 1337 should be used where hazards dictate.

Persons exposed to sunlight in the course of their work should be protected from ultraviolet radiation using a sunscreen with a sun protection factor rating of at least 15+, and following the manufacturers directions.

Other protective equipment which shall be considered include safety helmets, hearing protection, gloves, safety boots, and respirators.

All personal protective equipment should be regularly inspected and replaced as necessary.

7.4 TRAINING & INSTRUCTION

Traffic controllers are to be trained and certified to at least the equivalent of the RTA's traffic controllers course.

Persons designing traffic control plans shall be trained to the equivalent of the RTA's training course for providing work site traffic control layouts.

7.5 STATUTORY PROVISIONS

Occupational Health and Safety Act, 2000

Occupational Health and Safety Act (Manual Handling) Regulation 1991.

Construction Safety Act and Regulations.

7.6 REFERENCES

The following publications should be read in conjunction with the recommendations in these guidelines.

- AUSTRALIAN STANDARDS
  - 1742 (Set) Manual of Uniform Traffic Control Devices
  - 1742.2 Traffic Control Devices for General Use
  - 1742.3 Traffic Control Devices for Works on Roads
  - 1158 Road Lighting
  - 1165 Traffic Hazard Warning Lamps
  - 1348 Roads and Traffic Engineering - Glossary of Terms
  - 1906 Retroreflective Material and Devices for Road Traffic Control Purposes
  - 4191 Portable Traffic Signal Systems
- STANDARDS AUSTRALIA HANDBOOKS
  - *SAA HB81 Field Guide for Traffic Control at Works on Roads:*
    - Part 1 Short-Term Urban Works, Daytime Only
    - Part 2 Short-Term Rural Works, Daytime Only
    - Part 3 Mobile Works
    - Part 4 Short-Term Night Works
    - Part 5 Works on Unsealed Roads
    - Part 6 Bituminous Surfacing Works
- WORKCOVER NSW PUBLICATIONS
  - *Codes of Practice:*
    - Working Near Traffic and Mobile Plant
    - Electrical Practices for Construction Work
    - Safety Line Systems
    - Amenities
    - Concrete Sawing
  - *Skin Cancer and Outdoor Workers:*
    - A Guide for Workers
    - A Guide for Employers
  - Providing First-Aid at Work
  - Hazpak
- ROADS AND TRAFFIC AUTHORITY PUBLICATIONS
  - Traffic Control at Work Sites
  - So You Want to be a Traffic Controller

Section 8.0 GUIDELINES FOR TESTING

8.1 INTRODUCTION

This section outlines the relevant Council's regime for testing new subdivision and development works which will become public property.

It is in no way a comprehensive Testing Manual, and should be read in conjunction with relevant publications from the Roads and Traffic Authority, Australian Standards, and New South Wales Department of Commerce.

8.2 ROADS

Each layer of pavement shall be tested for compaction as detailed below. The relevant Director or his delegate must approve each layer prior to the placing and compaction of subsequent layers.

8.2.1 Compaction Testing

The subgrade, and all pavement layers, shall be density tested in-situ at the start and finish of the work (within the first/last five metres), and thereafter at intervals of no more than 50 metres, or as indicated by Council's Engineer. A minimum of two tests will be required for road pavements less than 50 metres in length. At cul-de-sacs, additional testing will be required at the turning head.

The test sites selected should be representative of the likely minimum pavement compaction levels achieved.

Density testing must be undertaken by an authorised representative of a laboratory registered by the National Association of Testing Authorities (NATA). Density testing may be conducted using either the sand replacement test, nuclear gauge, or other NATA approved method. Where a nuclear gauge in direct transmission mode is used to determine pavement density, the test method shall comply with RTA Test Method T173.

Results of density testing shall be forwarded directly to Council for approval. No pavement layer shall be covered by a subsequent layer until the results of the density testing have been delivered to and approved by Council's engineer. Table 8.1 sets out the minimum compaction requirement for each pavement layer.

Layer	Compaction Requirement	Standard
Subgrade	98% standard maximum dry density California Bearing Ratio (CBR) test	AS 1289.E1.1 AS 1289.F1.1
Sub-Base	100% standard maximum dry density	AS 1289.E1.1
Base	100% standard maximum dry density • *Unbound Materials* • *Cemented Materials* Density in place test California Bearing Ratio (CBR) test	 AS 1289.E2.1 AS 1289.E3.1 AS 1289.E3.1 AS 1289.F1.1

Table 8.1 - Compaction of Pavement Layers

Laboratory determination of maximum dry density for pavement materials which have been modified with cement must be undertaken within 4 hours of the cement being added to the material. Materials tested outside this time will be subject to an adjustment to correctly determine the maximum dry density of the sample. For either natural or modified material, the laboratory determination of maximum dry density shall be undertaken at a frequency of no less than one determination for each days production of material.

8.2.2 Proof-Rolled Testing

All pavement layers must be proof-rolled, and approved by Council's engineer prior to the placement of subsequent pavement layers.

The proof-rolling will be conducted using either:

(i) a roller having a load intensity of seven (7) tonnes per metre width of roller.

(ii) a tandem axle rigid vehicle, having a maximum load of 15 tonnes per axle group (8 tyres), 12 tonnes per axle group (6 tyres), or 10 tonnes per axle group (4 tyres). Single axle vehicles should have maximum loads of 8.5 tonnes (dual tyres), or 5.4 tonnes (single tyres).

Loading equivalent to one standard axle

Any movement of the pavement layer under loading will be deemed a failure.

8.2.3 Final Road Profile

The mean construction tolerance on pavement surface should be within + 20mm or – 5 mm.

The vertical alignment should not deviate by more than 25mm from the value shown on the drawings.

8.3 WATER RETICULATION

8.3.1 General

All pipelines must be inspected by Council's Engineer Inspections are generally available on Council's normal working days, from 9:00 am to 4:00 pm. A minimum of twenty four (24) hours notice should be given to arrange an inspection.

Pressure pipelines and associated services shall be pressure tested prior to connection to Council's mains, in order to detect any leakage or defects in the pipeline, joints, thrust and anchor blocks. Pressure testing must be witnessed by Council's Engineer.

Pipelines may be tested in isolated sections as soon as practicable after laying, jointing and backfilling, provided:

(i) if specified by Council's Engineer, some or all of the pipe joints should be left uncovered until the whole of the section has successfully been pressure tested;

(ii) the pressure testing should be conducted in fine weather, and testing should not commence until at least four days after the last concrete thrust or anchor block has been set.

8.3.2 Procedure for Field Pressure Testing of Pipeline

The procedure for the field pressure testing of water pipelines is as follows:

1. Slowly open the valve which connects the new work to the existing system.
2. Flush the main using hydrants.
3. Open all stop cocks along the main to allow air and dirt to escape.
4. Close all stop cocks and the isolating valve.
5. Allow 24 hours before topping up the line.
6. Connect the pressure test unit, and apply pump pressure of 1.2MPa (1200kPa).
7. Maintain the test pressure for 8 hours.
8. Check to see there is no visible leakage.
9. Check there is no failure of any thrust block or fitting.
10. Check the leakage rate at the end of the test is less than the permissible value,

$$Q = 0.0105 \times D \times L \times \sqrt{H}$$

where:
Q is the permissible leakage rate (litres per hour);
D is the pipe diameter (mm);
L is the length of pipe in the section tested (km); and
H is the average test head (m)

11. If the leakage rate is acceptable, then check each stopcock works.
12. Open the isolating valve and run each hydrant for 5 minutes.
13. Sterilise and tests mains in accordance with the direction of the local Council or Water Authority.
14. A Works Inspection Sheet will be given to the Contractor, with details of the items tested.

Any failure, defect, visible leakage, and/or excessive leakage rate, which is detected during the pressure testing of the pipeline shall be made good by the Developer at his expense, and a new test arranged.

The developer should provide all material, labour, and equipment required for the pressure testing, including approved pumps and pressure gauges. All expenses in connection with testing should be borne by the developer. The developer should have no claim for compensation or damages in respect of any postponement of the testing.

8.4 SEWERAGE RETICULATION

8.4.1 General

All sewerage must be inspected, and tests witnessed by Council's Engineer Inspections and tests are generally available on Council's normal working days, from 9:00 am to 4:00 pm. A minimum of twenty four (24) hours notice should be given to arrange an inspection.

Should sewers or manholes fail any test, defects should be located and made good, and the test repeated. This process should continue until a satisfactory test has been obtained.

All lines are to be clear and free from soil, slurry, liquids and other foreign substances.

Council's Engineer must inspect all manholes once the base has been poured, and to check and record details of the installation. All pipelines must be inspected for line and grade.

8.4.2 Air Pressure Testing of Gravitational Sewers

Before testing sewer mains, all pipe laying on the section should be completed and backfill should be compacted to the level of the centre of the pipe barrel.

The procedure for air testing of sewer mains is:

1. Plugs are securely fitted to each end of the line.
2. The line is slowly pumped up to 28 kPa (if the line cannot be pumped up, or will not hold, then there is a leak that requires repair).
3. If necessary, hold the pressure at 28 kPa to allow the air temperature to stabilise for 2 minutes.
4. The line is closed off and fittings are disconnected.
5. The pressure is then monitored for 2 minutes for 150mm pipe (4 minutes for 225mm).
6. If the pressure is above 18 kPa, the line has passed the test.
7. A Works Inspection Sheet will be given to the Contractor, with details of the items tested.

Any failures are to be rectified by the Developer, and a satisfactory test obtained before the remainder of backfill is placed.

8.4.3 Testing of Manholes

Each completed manhole must be tested for leakage. The test should be carried out with the manhole cover surround fitted and rendering of the channels and benches completed.

The procedure for the water testing of manholes is as follows:

1. Plugs are securely fitted to the end of each pipe.
2. The manhole is filled to the top.
3. After 10 minutes of absorption, the manhole is refilled to the lip of the surround.
4. The drop in water level over 10 minutes is measured.
5. If the level drops less than 5mm per metre depth, the manhole has passed the test.
6. A Works Inspection Sheet will be given to the Contractor, with details of the items tested.

The procedure for the vacuum testing of manholes is as follows:

1. Plugs are securely fitted to the end of each pipe.
2. Vacuum Manhole testing plate is fitted to the top of the manhole
3. A vacuum of 28kPa is to be achieved.

4. If the pressure drops less than 5kPa over a 3 minute period, the manhole has passed the test.
5. A Works Inspection Sheet will be given to the Contractor, with details of the items tested.

Live manholes which cannot be plugged for enough time to carry out the test, may with Council's approval, not be tested, but will be inspected in detail, for any visible defect.

Any failures are to be repaired by the Developer, and a new test then carried out.

8.4.4 Closed Circuit Television Inspections

This section shall apply where the Development contains more than 40 metres of sewer mains.

8.4.4.1 Sewer Clean and C.C.T.V. Inspection

Prior to the end of the maintenance period, the sewer network shall be cleaned and a colour Closed Circuit Television (C.C.T.V.) inspection of the entire reticulation network within the Development.

The cleaning equipment used shall be capable of removing dirt, grease (fat), rocks, sand, surface encrustations and other material and any obstructions from the sewer lines and manholes. Passing material from manhole section to manhole section shall not be permitted. The Applicant shall also be responsible for the proper disposal of waste material at the Bathurst Waste Management Centre.

The pressure during the initial pass shall not be greater than 800psi. Subsequent passing may be carried out at a higher pressure, but the Developer is responsible for recitifying any damage done.

Distance measurement, in all instances, shall commence from the manhole/pipe entry to the end of the pipe segment being surveyed. The camera and illumination system shall be capable of providing a clear, accurate and in-focus record of the pipe's internal condition.

At the start of each manhole length, the following additional information shall be electronically generated and displayed: -

i) Street Name
ii) Start and Finish Manhole/Node Numbers
iii) Direction of survey from Manhole to Manhole
iv) Diameter of pipe and material type
v) Date of Survey

A copy of the videotape in VHS format will be required to be provided to the Engineering Department of the relevent Council, along with an inspection report in SEWRAT and WINCAT format.

Once any faults are rectified to Council's satisfaction then the responsibility of the sewer main is released from the Applicant and becomes the property of the relevant Council.

Note that if the sewer cleaning and release C.C.T.V. survey is not carried out, then the Bond money shall be used to fulfil the requirements of this Section.

APPENDICES

A ENGINEERING DESIGN CERTIFICATION

B ENGINEERING DRAWING CHECKLIST

C COUNCIL SAFETY AUDIT

D TRAFFIC MANAGEMENT

APPENDIX A - ENGINEERING CONSTRUCTION CERTIFICATION

Project / Development: .....

Development Application Number: .....

Consultant's Plan Number(s): .....

Name of Consultant: .....

Name and Address of Developer: .....

.....

.....

- I certify that the attached engineering and safety audit checklists provide a valid record of the subject development.
- I certify that this development complies with good industry practice, Wellington, Blayney and Cabonne and Central Tablelands Water Council's Guidelines for Engineering Works, and specific instructions from the Director(s) of Engineering, with the exception of any departures cited in the attached check lists.
- I certify that this development will have no significant environmental impact as interpreted under Part V of the Environmental Planning and Assessment Act, 1979, as amended.
- I certify that this development is in strict compliance with all conditions of development consent, unless written confirmation from Council has been received approving of any variance prior to the submission of design plans (including designs for staged construction).
- I certify that all structural elements of the work have been constructed by a competent contractor to the approved design.
- I certify that all pavements comply with the design, using materials complying with Council standards.

Design Engineer / Surveyor:

NAME .....

SIGNATURE .....

DATE .....

QUALIFICATIONS .....

NPER-3 REGISTRATION (if applicable) .....

Contact Details:

PHONE .....

COMPANY .....

POSTAL ADDRESS .....

.....

APPENDIX B – WBC ALLIANCE DRAWING CHECKLIST

To be completed by the Design Engineer / Surveyor.

	YES	N/A
GENERAL		
North point (on all plans).	☐	☐
Locality sketch.	☐	☐
Limit of works / staging details.	☐	☐
Road names.	☐	☐
Existing easements, rights of carriageway etc.	☐	☐
Existing services - water, sewerage, drainage, telecommunications, electricity, gas.	☐	☐
Existing features - structures, major trees, dams, road formations etc.	☐	☐
Existing surface levels and contours (verified by a site inspection as representative of site terrain).	☐	☐
Existing public and private property likely to be affected by the designs, clearly indicated and annotated. Written approval from the owner of such property to accompany the engineering design plans.	☐	☐
Location of soil test sites, and the CBR values so determined.	☐	☐
Proposed allotment boundaries and numbers.	☐	☐
Proposed surface levels and contours.	☐	☐
Proposed easements, rights of carriageway etc.	☐	☐
Fill / regrading areas.	☐	☐
A benchmark within 100m of the site, to the Australian Height Datum.	☐	☐
Origin of levels, and the location of permanent survey marks.	☐	☐
Scales, including a bar scale graduated for both A1 and A3 sized sheets.	☐	☐
Schedule showing the date and description of all amendments.	☐	☐
Legend / schedule of symbols.	☐	☐
Drawing title and sheet.	☐	☐
Consultants name, postal address, and contact phone number.	☐	☐
ROADS		
Road centrelines - chainages, bearings, tangent points, curve radii, deflection angles etc.	☐	☐
Road widths (carriageways, footways etc) comply with Council standards	☐	☐
Kerb radii - where not parallel to the road centreline.	☐	☐
Edge of pavement - where no kerb is constructed.	☐	☐
Location and details of all road furniture, traffic management signs & devices, and pavement markings.	☐	☐
Location of all vehicular kerb laybacks and perambulator crossings.	☐	☐
Location of concrete footpaths, cycleways and driveways.	☐	☐
Proposed location of conduits and service crossings.	☐	☐
Longitudinal sections of all road centrelines, including existing surface levels, gradings, vertical curves, crests, low points, etc.	☐	☐
Maximum and minimum vertical grades are achieved.	☐	☐
Typical cross section of all roads showing pavement details, crossfall on carriageway and footway, type of kerb and gutter, depth and type of materials used in each pavement layer, type of surfacing, subsoil	☐	☐

drainage, concrete footpath (if required).		
Cross sections at natural scale showing crossfall, extent of batters, etc. .	☐	☐
Contour plans showing design finished pavement levels at all intersections, cul-de-sac, and roundabouts.....	☐	☐
Kerb profiles for all kerb returns and cul-de-sac bulbs.	☐	☐
Pavement design calculations, noting design CBR & ESA's.	☐	☐

STORM WATER DRAINAGE

Catchment plans show location of existing surface drainage.	☐	☐
Hydrologic calculations (for major and minor event).....	☐	☐
Hydraulic calculations (for major and minor event).....	☐	☐
Plans show pit, pump, and headwall locations.	☐	☐
Gutter flow width does not exceed 2.5 metres during the design minor AEP storm event (or 2.0 metres on arterial and bus routes).	☐	☐
Pit bypass flow does not exceed 15% of gutter flow.....	☐	☐
Pit spacing is less than 85 metres.....	☐	☐
Pipe class is appropriate, given the design loadings and available cover.	☐	☐
Pipe grade allows for self-cleansing.....	☐	☐
Longitudinal sections of all pipelines, showing pipe material, grade, class, bedding type, hydraulic grade line, pit names/numbers etc.....	☐	☐
Cross section of pipeline showing trench width & bedding details.....	☐	☐
Plan and sectional drawings of all non-standard drainage structures.....	☐	☐
Downstream owners consent (& easements) for discharge of stormwater.	☐	☐

WATER RETICULATION

Pipe location, diameter, material, class and bedding requirements.....	☐	☐
The location and type of all fittings (hydrants, scour valves etc.).....	☐	☐
Location of thrust blocks.	☐	☐
Hydraulic design calculations.	☐	☐
Detailed plans and sections for any non-standard reticulation components, reservoirs, pump stations etc.	☐	☐

SEWERAGE

Annotated plans showing the location of all pipes, manholes, and junctions.	☐	☐
Cross section of pipe showing typical trench width and bedding details...	☐	☐
Longitudinal sections of pipelines showing pipe diameter, material & class, invert, natural & finished surface levels, and vertical clearances to other services.	☐	☐
Hydraulic design calculations & assumed loading data.	☐	☐
The location of all thrust blocks, trench stops and concrete bulkheads....	☐	☐
Table showing distance from downstream manhole to each junction.....	☐	☐
Detailed plans and sections of all non-standard sewerage components and pump stations.....	☐	☐

MISCELLANEOUS

Structural details of retaining walls and other non-standard structures. ...	☐	☐

Details and sections of all traffic management devices.	☐	☐
Design satisfies the intent of conditions of development consent.....	☐	☐
Design complies with Council's 'Guidelines for Engineering Works', ' the Construction Specification, and the relevant Australian Standards.	☐	☐
Roads and Traffic Authority approval for works on classified roads.	☐	☐
Owners consent for works on, or affecting, adjoining property.....	☐	☐
Erosion and sediment control plan.	☐	☐
EPA approval of soil erosion and sediment control measures, for subdivisions of more than 50 lots.	☐	☐
Traffic management plan.	☐	☐

Design Engineer / Surveyor:

NAME .....

SIGNATURE .....

DATE .....

QUALIFICATIONS .....

NPER-3 REGISTRATION (if applicable) .....

Contact Details:

PHONE .....

COMPANY .....

POSTAL ADDRESS .....

.....

APPENDIX C – WBC ALLIANCE SAFETY AUDIT

To be completed by the Design Engineer / Surveyor.

		YES	NO	Not Applicable
1	**HORIZONTAL ROAD ALIGNMENT**			
1.1	Design speed has been selected in keeping with the terrain or importance of the road (85th percentile speed).			
1.2	Alignment is compatible with the design speed.			
1.3	Clearance to roadside hazards is sufficient.			
1.4	Driver and pedestrian sight distance is adequate. No obstruction from safety fences & barriers, boundary fences, street furniture, parking facilities, signs, landscaping, structures, parked vehicles or queued traffic.			
1.5	Provision has been made for pedestrians, bicycles and prams.			
1.6	The design adequately caters for large vehicles such as buses, garbage trucks and emergency vehicles.			
1.7	Intersection layouts meet turning requirements of design traffic including emergency vehicles.			
1.8	Pavement width tapers and merges are adequate.			
1.9	Conflict with existing public utility services has been identified and resolved.			
1.10	All present and future road accesses can be used safely, particularly near intersections and major traffic generating developments.			
1.11	Road does not require screening against glare from adjacent developments, and conversely, adjacent developments do not require screening from vehicle headlight glare.			
1.12	Check maintenance and emergency vehicles can stop without disrupting traffic flows.			
1.13	Median barriers have been specified and properly detailed where necessary.			
1.14	The unprotected median width is sufficient to safely accommodate lighting poles.			

Item Comment Initial

		YES	NO	Not Applicable
2	**VERTICAL ROAD ALIGNMENT**			
2.1	Maximum safe grades are not exceeded (especially maximum grade of 5% for cul-de-sac turning heads).			
2.2	Adequate vertical clearance to overhead structures (bridges, wires, etc.) and underground services.			
2.3	Sight distance sufficient for drivers and pedestrians.			
2.4	Vertical alignment permits disposal of storm water drainage from adjoining properties.			
2.5	Alignment is above 1% AEP flood levels.			
2.6	The gradient on an intersecting road is not greater than 3% at give way and stop signs.			
2.7	Sight distance is acceptable at all pedestrian crossings and accesses to roundabouts.			
2.8	Vertical alignment is co-ordinated with horizontal alignment to AUSTROADS standards.			
2.9	Conflict with existing utility services has been identified and resolved.			
3	**ROAD CROSS SECTIONS & PAVEMENT**			
3.1	Batter slopes are indicated, and batter treatment specified where appropriate. Batters are stable and there is no risk of loose material.			
3.2	Roads are designed for all road users in all likely climatic conditions (e.g. snow, fog, wind, ice).			
3.3	Shoulders and edge treatments are satisfactory for all road users (e.g. pedestrians, cyclists, service vehicles).			
3.4	Pavement design and material specifications are detailed.			
3.5	Pavement surfacing will provide adequate skid resistance in adverse service conditions (check need for anti-skid surfacing in braking areas or on gradients).			
3.6	Will the texture of the pavement affect day or night visibility.			

Item	Comment	Initial

		YES	NO	Not Applicable
4	**INTERSECTIONS**			
4.1	Drivers will be aware of the presence of the intersection (esp. facing stop & giveway signs).			
4.2	Check vehicle swept paths to establish that design caters for all road users.			
4.3	The need for crash barriers and pedestrian fences have been investigated to the relevant standard.			
4.4	Check need for splitter islands and signs.			
4.5	Check safety where vehicles may park or service premises within the intersection / conflict area.			
4.6	Pedestrians can cross roads safely at intersections and roundabouts. (esp. elderly, disabled and children).			
4.7	Check that roundabout deflection angles are adequate, and speeds will be suitably reduced.			
4.8	Intersection lighting will be provided to Australian Standards. Frangible poles provided in high risk areas.			
4.9	Intersection has adequate vehicle storage space for turning movements.			
5	**BRIDGE & CULVERT DESIGN**			
5.1	The design has been performed by a competent practicing Civil or Structural Engineer. Engineering, hydrologic, and hydraulic design calculations are complete and available for audit.			
5.2	Sufficient geotechnical testing has been performed, and is available for audit.			
5.3	The type and function of all bridges and culverts comply with the AUSTROADS bridge design code and relevant Australian Standards.			
5.4	Bridge barriers and culvert end walls are visible, easily recognized, a suitable distance from moving traffic, have collapsible or frangible ends, and adequate signs and markings.			

Item	Comment	Initial

		YES	NO	Not Applicable
6	**ROAD & INTERALLOTMENT DRAINAGE**			
6.1	Proposed drainage is compatible with existing drainage.			
6.2	Design invert of proposed drainage system does not sterilize future land development upstream.			
6.3	Pipe cover and depth is within allowable limits, for the selected pipe class.			
6.4	New road will drain adequately.			
6.5	The effect of headwater and backwater has been assessed.			
6.6	Drainage is provided for local depressions.			
6.7	Subsurface drainage has been provided to prevent the movement of water through trenches and under road pavements.			
6.8	Batter drains have been provided in fills where required.			
6.9	The height and energy level of downstream drainage has been assessed.			
6.10	Drainage flowpaths are located so as to ensure safe vehicular and pedestrian transit. Trunk drainage will not overflow roads or paths in the design 1% AEP flood event.			
6.11	Pits are located so that maximum spacing is 85 metres, & maximum gutter flow width is 2.5m.			
6.12	Emergency flow paths are designed to minimize impact on private property.			
6.13	The underground drainage system has been designed to convey all surface runoff from storm events of the design AEP design storm without surcharging.			
6.14	Suitable land stabilization and velocity controls have been implemented to pipe systems, open channels and embankments.			

Item	Comment	Initial

		YES	NO	Not Applicable
7	**SIGNS, MARKINGS & LIGHTING**			
7.1	Signs are designed to promote good traffic management, and located such that vehicle safety will not be reduced.			
7.2	Signs and linemarking will not be obscured by landscaping or structures.			
7.3	The needs of all road users have been considered, and appropriate signage adopted. (including pedestrians, cyclists, public transport, road maintenance vehicles, equestrians).			
7.4	Are frangible and slip-base poles to be provided.			
7.5	Check the need for high intensity signals and/or target boards if likely to be affected by sunrise/sunset.			
7.6	Pavement linemarking and pavement markings are consistent with those detailed in Australian Standard 1742.2.			
8	**LANDSCAPING**			
8.1	Landscaping will not lower safety with mature or seasonal growth (e.g. through loss of visibility, obscuring signs, shading or lighting effect, or leaves & flowers dropping on the carriageway), or by irrigation water ponding on the roadway.			
8.2	Tree species have been selected so that root growth will not effect the road pavement or underground services.			
8.3	Check that frangible vegetation is appropriate.			

Item	Comment	Initial

Design Engineer / Surveyor:

NAME .....

SIGNATURE .....

DATE .....

QUALIFICATIONS .....

NPER-3 REGISTRATION (if applicable) .....

Contact Details:

PHONE .....

COMPANY .....

POSTAL ADDRESS .....

.....

APPENDIX D – TRAFFIC MANAGEMENT

Daily Routine Tasks & Record Keeping

Record Keeping

Supervisory personnel engaged on works which require the use of a traffic guidance scheme should keep the following records:

(a) Daily records of the sign arrangement or traffic guidance scheme should be kept in a diary or in work sheets.

Special attention should be given to recording the installation, alteration and removal of all regulatory signs and devices, including speed restriction signs. The records should include the hours of operation and the surface condition of the road. Any significant departures from, or additions to, the signs and devices depicted in the relevant Australian Standard figures should also be noted.

(b) In the case of accidents, either witnessed or reported, involving the public or from which legal proceedings may arise, the actual type, location and size of signs and devices in use at the time of the accident should be recorded and the sign arrangement photographed for subsequent reporting. Details of the actual width and condition of the travelled path and weather conditions should also be recorded.

Daily Routine Tasks

General

Supervisory personnel should establish a daily routine which allots specific tasks to personnel, including supervisors, so that:

- loss of production time is minimized;
- plant operations are not disrupted;
- signing at all times is adequate for the safety of personnel and traffic;
- the surface of the travelled path is maintained in a satisfactory condition.

The supervisor's role in this routine procedure is coordination, inspection and correction.

Before Work Starts

The following procedure should be undertaken before work starts each day:

- An inspection of all traffic signs and devices should be made. All signs out of place or damaged during the night should be noted for subsequent rectification.
- All lamps should be switched off and checked and cleaned, if necessary.
- After adjustments have been made to the traffic management provisions for the day they should be checked for safety and effectiveness by an inspection drive through the project, and a record made of the signs erected and their locations.

During Work Hours

The following routine should be followed while work is in progress:

- Periodically drive through the work site to check that all signs, markings and delineating devices as seen by other road users are satisfactory and in their correct position.
- Attend to minor problems as they occur.
- During work breaks (e.g. tea breaks):
    - move personnel clear of the work area;

- park plant clear of traffic lanes;
- remove from view or cover inappropriate signs such as PREPARE TO STOP or Workers Ahead, if workers leave the site or cannot be seen.

- Where there are traffic hazards or where only one lane is open to traffic, instruct traffic controllers to remain on the job and relieve them as necessary.
- Reposition barriers, signs and tapers as necessary. For example, adjust the length of single traffic operation as necessary to keep it to a minimum, and keep records of changes made and the time these occurred.
- Coordinate maintenance of the travelled path with other job operations.

Closing Down at the End of the Day

Special provisions are required if less than one lane in each direction is available after working hours, during weekends or holiday periods. Depending on the situation, this may include rostering traffic controllers to work for the full period of the obstruction, illumination of the work site, or the installation of portable or temporary traffic signals.

In general, the following action is required at the end of each days work:

- Carry out a pre-closedown inspection allowing time for urgent maintenance to the travelled path.
- Remove PREPARE TO STOP, Workers Ahead, and other inappropriate signs.
- In cases where barriers are to remain, affix and light lamps.
- Drive through the work site to confirm that signs and devices are in position and operating before leaving the site.
- Finally, record any changes that have been made to the previously recorded sign arrangement or traffic guidance scheme.

After Hours

During the hours when work is suspended:

- Make arrangements for personnel to check lamps after dark and to maintain the lamp system during weekends and holidays;
- Provide after hours contact so that arrangements can be made to replace damaged signs, delineators or barriers.
- Ensure that a record is kept of signs found damaged, missing or out of place (and their location) at night, weekend or holiday inspections.
- Carry out periodic after-dark inspections on low headlight beam to ensure that all devices are visible and performing their correct function.

APPENDIX E – DRAWINGS

File Name	Description
WBC001	Kerb and Gutter
WBC002	Perambulator Ramps
WBC003	Urban Vehicular Access
WBC004	Rural Vehicular Access
WBC005	Public Utilities Footpath Allocations
WBC006	Concrete Cycleways
WBC007	Intersection Median Islands
WBC008	Street Signs
WBC009	Stormwater – Kerb Inlet Pit Configuration
WBC010	Stormwater – Pipe Bedding
WBC011	Stormwater – Footpath Surface Inlet Pits
WBC012	Stormwater – Surface/Surcharge Pits
WBC013	Concrete Headwall/Bulkheads
WBC014	Stormwater – Floodway Within Pathway Alignments
WBC015	Stormwater – Field Inlet and Interallotment Pits
WBC016	Stormwater – Penstock/Floodgate Pits
WBC017	Stormwater – Subsoil Drainage Lines
WBC018	Stormwater – Subsoil Flushout and Outlet Structures
WBC019	Water – Reticulation Alignment for Cul-de-Sacs
WBC020	Water – Hydrants and Valves
WBC021	Water – Details of Pipe Bedding
WBC022	Water - Thrust Block Locations
WBC023	Water – Water Meter Connections 20-50mm
WBC024	Water – Indicator Posts and Markers
WBC025	Sewer – Pipe Bedding
WBC026	Sewer – Manhole Construction
WBC027	Sewer – Drop Manhole Construction
WBC028	Sewer – Capped Riser Construction