

TWEED SHIRE COUNCIL

**DEVELOPMENT
DESIGN
SPECIFICATION**

D6

SITE REGRADING

VERSION 1.4

SPECIFICATION D6 – SITE REGRADING

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DEVELOPMENT DESIGN SPECIFICATION D6

SITE REGRADING

GENERAL

D6.01 SCOPE

1. The subdivision of land and associated construction of subdivision works and infrastructure is likely to require some earthworks that will change the natural levels and topography of the site. Site regarding is defined as earthworks that result in a change to the pre-existing levels of a landform.

Whilst some site regrading may often be necessary, subdivision design should recognise and as far as is practical, accommodate, without undue disturbance, the natural topography of a site.

This design specification sets out requirements for site regrading included in or required as a consequence of subdivision works.

2. The Designer should be familiar with requirements cited in the various construction specifications, specifically those related to earthworks, clearing and grubbing, erosion and sedimentation. Additionally the Designer needs to make reference to the associated design specifications related to drainage design, road design and stormwater quality.

Familiarity with other Specifications Required

D6.02 SITE REGRADING PRINCIPLES

- . Subdivision site regrading and landform changes shall be designed in accordance with the following principles:

Principles

- (a) Natural topography is an important characteristic of an area. The extent of landform change to render a site suitable for subdivision should be kept to a minimum. Site regrading should be sensitive to existing landforms and topography (of both the subdivision site and neighbouring areas) so that the natural setting may be preserved to the greatest extent possible. The subdivision should be designed to fit the topography rather than altering the topography to fit the subdivision.
- (b) Site regrading must not adversely impact on other land, persons or public infrastructure.
- (c) Natural watercourses with catchments of more than 100ha, associated riparian vegetation and significant environmental features are to be preserved.
- (d) The visual character of the subdivision site landform as viewed from both within and outside the site should be preserved. Artificial abrupt grade changes should be avoided. Regraded slopes should mimic the shape (concave/convex etc) and character of the natural landforms of the site and neighbouring area.
- (e) Cross boundary drainage conditions shall be preserved.
- (f) There must be no adverse geotechnical impact or risk caused to the subdivision site or other land.

- (g) Subdivision design is to ensure that the vertical dimensions and total volume of earthworks are to be minimised
- (h) Cut and fill earthworks should be balanced to minimise haulage on or off the site.
- (i) Water sensitive design principles shall be adopted (see Specification D7). Where practical, areas should be regraded to minimise the necessity for underground drainage systems.
- (j) Use of site regrading on sloping (natural slope >10%) residential subdivision sites to manufacture flat earth platforms suitable for construction of concrete slab-on-ground dwellings is not permitted. Future dwellings on these sites are to use building techniques suitable to sloping sites.

Drainage

Flat earth platforms for slab on ground dwellings

D6.03 REFERENCE AND SOURCE DOCUMENTS

(a) Council Specifications

Construction Specifications

- C211 - Control of Erosion and Sedimentation
- C212 - Clearing and Grubbing
- C213 - Earthworks

Design Specifications

- D1 - Road Design
- D5 - Stormwater Drainage Design
- D7 - Stormwater Quality

(b) Australian Standards

- AS 3798 - Guidelines on earthworks for commercial and residential developments
- AS 2870 - Residential slabs and footings
- AS 4678 - Earth Retaining Structures

(c) Standard Drawings that apply to this Section:

D6.04 WHAT IS THE PURPOSE OF SITE REGRADING?

1. A development site, or portion of the site, may not have a natural or existing landform that is considered suitable for its proposed use. In such cases site regrading may be proposed to:
 - (a) Alleviate flooding of low-lying ground
 - (b) Provide a reshaped landform that has gradients suited for the proposed development.
 - (c) Improve drainage and provide overland flowpaths.
 - (d) Regrade excessively steep slopes

Why regrade the site

D6.05 SITE REGRADING ACCEPTANCE CRITERIA

D6.05.1 Limits to Site Regrading

Limits

Site regrading must comply with the principles in D6.02 and in this regard must not exceed the criteria in this section.

D6.05.2 General Criteria

No go areas

1. Significant Natural Features

Site regrading is not to take place on

- topographical features that are significant to the character of the site or locality
- existing or natural watercourses with catchment areas of 100 ha or more
- riparian zones (see table) associated with above

Table
Riparian Zone Widths

Upstream Catchment Area (ha) of streams or drains	Riparian Zone Width (m) (either side of high bank)
<100ha	nil
>100ha and <500ha	10m
>500ha and <1,000ha	20m
>1,000 and <5,000ha	30m
>5,000ha and <10,000ha	40m
>10,000ha	50m
Environmentally sensitive*	50m

* >75% of the catchment and >1,000ha is land zoned “Environmental Protection” 7a, 7f, or 7l or “National Parks & Nature Reserves” 8.

2. External & Perimeter Issues

(a) Cross Boundary Drainage

- Runoff from the subject land to other land shall not be significantly increased
- Runoff from upstream or upslope of the subject land shall be conveyed unimpeded across the land
- Public infrastructure in land to be regraded shall be preserved and if necessary for its continued viability be reconstructed to suit the new landform. Public infrastructure continuity shall be preserved at external boundaries.
- Alteration of the locations of cross boundary stormwater drainage/watercourse discharge should be avoided. If alterations are proposed, then the written agreement of all effected downstream landowners is required.

(b) Perimeter levels

Pre development levels must be preserved at external (perimeter) boundaries of a subdivision, preferably without the use of boundary (or within 3m of the boundary) retaining walls exceeding 1.2m in height. The application of this criteria may be varied in infill subdivisions in flood liable areas where there is general filling to provide flood immunity

D6.05.3 Mass Landform Change Criteria**Limits for mass
landform
change****1. Residential, Includes residential subdivisions in Village, Urban Expansion and Rural Living zones**

The proportion of a subdivision site (plan area) that contains cut or fill areas with finished surface levels that depart from natural surface levels by more than 5m shall not exceed 10%. Variations up to 15% of site area may be considered if such variations have a demonstrated environmental benefit (eg. avoidance of importing borrowed fill off site)

2. Industrial, Business and Mixed Use Subdivision, includes industrial, business and mixed use subdivisions in Village and Urban Expansion zones

The proportion of a subdivision (plan area) that contains cut or fill areas with finished surface levels that depart from natural surface levels by more than 8m shall not exceed 20%.

For the purpose of this section "subdivision site" includes the parcels of land created for private sale and formal parks, and does not include undeveloped areas, areas retained for environmental purposes, roads, or residual allotments. If a subdivision contains a mix of urban and rural/rural residential uses, the rural/rural residential areas must be excluded from the urban areas for the purposes of complying with this clause.

D6.05.4 Shape/Surface Criteria**Surface and
shape criteria****1. Residential and Rural Living Subdivision, includes residential subdivisions in Village and Urban Expansion zones**

- The finished landform shape (concave/convex, rolling, stepped etc) of the subdivision site should mimic existing and local surrounding natural topography
- Except as provided in Note 1. below, no sharp changes of gradient (eg. associated with batters or retaining walls) are permitted at or near inter lot boundaries or within lots.
- Batters and retaining walls are not permitted for the purpose of creating terraced lots
- Sharp changes of gradient are permitted at road and public land boundaries (e.g. Drainage reserves, parks).

See Figure 1.

Note 1: A retaining wall or batter of maximum "combined height" (as defined in clause D6.05.6) of 1.2m at or adjacent to inter lot boundaries may be permitted to ease lot gradients, where lot longitudinal or cross gradient would exceed 10% in the absence of such retaining wall or batter

2. Industrial, Business and Mixed Use Subdivision, includes industrial, business and mixed use subdivisions in Village and Urban Expansion zones

- Terraced lots with sharp changes of gradient associated with retaining walls or batters are permitted
- Sharp changes of gradient (i.e. associated with batters or retaining walls) are permitted at or near lot, road and public land boundaries. Sharp changes of gradient are permitted within lots.

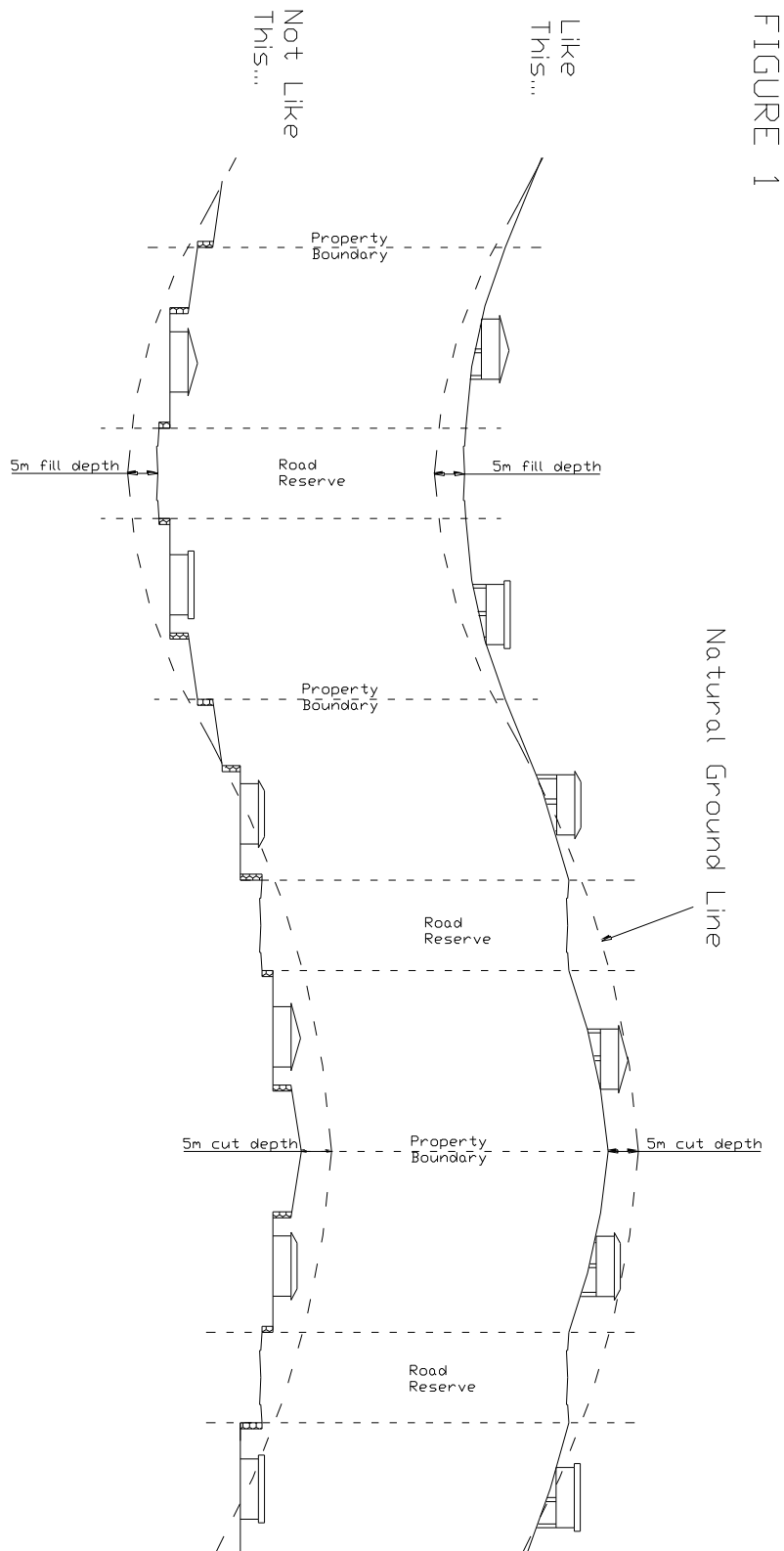


FIGURE 1

D6.05.5 Plans Required

Site regrading proposals must be accompanied by the plans specified in Development Design Specification D13 – Engineering Plans (Subdivisions) clause D13.03 5(a)

Plans required with DA

D6.05.6. Permissible Retaining Walls and Batters

(a) Definitions:

“retaining wall” is defined as a structure required to retain soil, rock and other materials. It includes retaining and revetment structures as defined in AS 4678 - 2002

“batter” is defined as the sloping surface of artificial cuttings and embankments that have a gradient exceeding 25%. It excludes natural slopes.

"Combined height" is defined as the vertical height difference at or adjacent to the boundary between top of batter or retaining wall and bottom of batter or retaining wall. Adjacent to a boundary includes any batters or retaining walls that lie either wholly or partly within a distance of 5m measured horizontally from the allotment boundary.

(b) The combined height of retaining walls or cut/fill batters at an allotment boundary shall conform with Table D6.1.

Height of batters and retaining walls at allotment boundaries

TABLE D6.1 MAXIMUM PERMISSIBLE COMBINED HEIGHT OF RETAINING WALLS OR BATTERS				
Type of Subdivision	Perimeter boundary of subdivision	Boundaries of lots created within subdivision		
		Side and Rear Boundaries	Street Boundary	
			Above Street Level	Below Street Level
Residential	1.2	1.2 (see Note 1 of D6.05.4)	1.8	2.4
Industrial	1.2	5	2.5	5
Business	1.2	5	1.2	2.4
Rural Living	1.2	Nil	1.2	2.4

Table D6.1

c. Where retaining walls or batters are utilised to create a level difference between adjacent allotments and the retaining wall is located in the lower allotment, the top of batter or top of retaining wall shall be located a minimum 0.9m horizontally from the boundary.

Boundary setbacks

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- d. Where batters or retaining walls are constructed they shall be equipped with necessary barriers to ensure compliance with occupational health and safety requirements. Road safety barriers shall be provided where warranted by RTA or Austroads standards. **Safety barriers**
- D6.05.7. Overland Flow** **Overland Flow**
- Care shall be taken to provide depressions for overland flow from low points and over major drainage lines, to direct stormwater for storms up to a 100 year average recurrence interval.
- D6.05.8. Longitudinal Road Gradient** **Road Gradient**
- Where constrained by landform alteration limits, use of the absolute maximum (longitudinal road) grades in Table D1.6 of Development Design Specification D1 - Road Design may be justified.
- D6.06 SPECIAL TREATMENT OF PARTICULAR AREAS**
1. Council's policy for development and filling in flood liable areas is contained in DCP Section A3 *Development of Flood Liable Land*. **Flooding**
2. The finished surface of filled areas shall be designed to levels allowing an adequate cover depth over underground services. If the proposed landform increases the depth of cover over existing underground services these services shall be relocated/reconstructed if necessary to ensure cover is not excessive. The continuity of all existing public infrastructure shall be maintained internally and at the external interface. **Public Infrastructure and services, cover and continuity**
3. The location of dams, watercourses and other areas likely to contain unstable material shall be clearly defined on the site regrading plans and defined by distance to corner boundaries, monuments, etc for purposes of relocation at the geotechnical testing stage for work as executed plans. A geotechnical report specifying the site specific preparation and compaction requirements will be required to be incorporated with the site regrading plan. A description of the minimum acceptable quality of the fill shall also be specified on the plans, supported by geotechnical recommendations. All documentation necessary from various authorities to support the filling of dams and watercourses shall be supplied with the design plans. **Dams and Water Courses and other unstable areas.**
4. Urban subdivision lots that are filled must be graded at a minimum of 1% towards the street frontage or other approved drainage system. **Minimum gradients**
5. A geotechnical engineers report is required for building sites containing ground slopes greater than 25%. The report will advise on compatibility with dwelling types proposed. Minimum factors of safety and specific requirements shall be noted on the design plans. **Steep Slopes**
6. Where underground infrastructure is to be located on land supported by a batter or retaining structure, the horizontal setback of the invert of the pipeline from the top of the back of the batter/retaining wall shall not be less than the depth plus 1 metre off the back of the excavation. **Infrastructure on supported land**
7. "Terraced subdivisions" includes those subdivisions, where sloping land, by means of cut/fill and batters and/or retaining walls, has been transformed into a stepped series of generally flat allotments. In residential areas this form of subdivision is generally undertaken to transform a sloping landform into a series of flat homesites suitable for slab on the ground technique dwelling construction. In industrial/business areas it is used to create flat industrial/business sites that are suitable for those purposes. **Terraced subdivisions**

8. In terraced subdivisions, all interallotment drainage and service trenches shall be well drained by necessary pipe or subsoil drainage to ensure groundwater is speedily removed. ***IAD and service trenches to be well drained***
9. Notwithstanding the provisions of *Development Design Specification D5 – Stormwater Drainage Design*, as a minimum, interallotment drainage in terraced subdivisions shall be designed to accommodate Q5 flows. ***IAD in terraced subdivisions***

D6.06A RETAINING WALLS

- 1 Retaining walls are to be designed by appropriately qualified and experienced geotechnical and structural engineers in accordance with the design criteria in AS 4678-2002. In this regard: ***Retaining walls***
- (a) Design
- (i) Site investigation is to be in accordance with section 2 of the Australian standard.
- (ii) It is considered that the failure of any walls (or groups of walls) over 2.5m in combined height (where combined height is the sum of the heights of walls that are horizontally staggered by less than 3.0m between top of lower wall and bottom of higher wall) in residential subdivisions may result in significant damage or risk to life and must therefore be classified Type 1 as defined in Table 1.1 of the standard. Walls lower than 2.5m must be assessed by the designer in accordance with the standard to determine if they also warrant classification as Type 1 or some lower classification.
- (iii) The design must consider all the applicable limit states as defined in section 3 of the standard.
- (iv) Design loads are to be in accordance with section 4 of the standard. For earthquake loads (see Appendix I) all Type 1 walls are to be designed as earthquake design category Cer (which requires design with static loads with a dead load factor of 1.5).
- (v) Material design factors shall be in accordance with section 5 of AS4678-2002.
- (vi) A copy of the design/site investigations, material tests, design calculations and design drawings and specifications of the retaining walls is to be submitted with the construction certificate application. This is to be accompanied by a certificate from the designing geotechnical/structural engineers certifying that the retaining wall designs are compliant with AS 4678-2002 and this condition.

- (b) During Construction
 - (i) Due to the possibility that unexpected site conditions may be revealed during construction, the designing geotechnical engineer shall carry out appropriate inspections during the course of construction work to ensure that the conditions revealed during construction are in accordance with the assumptions made during the design. If the conditions are not in accordance with these assumptions, then necessary alterations shall be made to the design.
 - (ii) The designing geotechnical/structural engineers shall make appropriate inspections during the construction process to enable certification of the retaining walls (as constructed) as AS 4678-2002 compliant.
- (c) After construction is completed
 - (i) A certificate from the designing geotechnical/structural engineers shall be submitted with the subdivision certificate application certifying that the retaining walls (as constructed) are compliant with AS 4678-2002 and this condition.
 - (ii) The applicant shall submit with the subdivision certificate application a retaining wall management plan that has been approved by Council. This management plan shall include
 - A monitoring plan shall be prepared in accordance with section 7 of AS 4678-2002
 - A response plan to carry out necessary maintenance, repair and replacement of sections of defective wall identified in the monitoring process
 -

2. This section applies to retaining walls or batters in subdivisions that are adjacent to property boundaries to resolve height/level differences between adjacent lots. It includes multiple wall systems.

Unless otherwise directed by Council:

- the whole of the retaining wall(s) or batter is to be located on land belonging to the lower lot and
- An easement for support is to be created over the footprint of the above retaining wall(s) or batters, benefiting the higher lot. The terms of this easement shall include:
 - The owner of the lot burdened shall not interfere with the retaining wall or, batter or the support it offers or use it in a way which may detract from the stability or support provided and
 - The owner of the lot benefited, may at any time the stability of the retaining wall is threatened, enter upon the easement and any carry out repairs required to restore the stability and support provided. and
- A restriction on use is to be created on the lower lot title adjacent to the retaining wall footprint, restricting excavation within the area burdened by the restriction. The width of the area and excavation restrictions within the area shall be determined by

Ownership and easements for support over retaining walls near lot boundaries.

the retaining wall designer and

- A restriction on use is to be created on the higher lot adjacent to the retaining wall footprint, restricting placement of structures or filling within the area burdened. The width and fill/structure restrictions shall be determined by the wall designer.
3. This section applies to retaining walls or batters in subdivisions that are adjacent to property boundaries to resolve height/level differences between private lots and public roads or public space. It includes multiple wall systems.

Unless otherwise directed by Council:

- the whole of the retaining wall(s) or batter is to be located wholly within the private allotment and not within the public area
- The toe of the retaining wall or batter shall be located a minimum of 0.3m horizontally from the boundary
- A restriction on use is to be created on the private lot adjacent to the retaining wall footprint, restricting placement of structures or filling within the area burdened. The width and fill/structure restrictions shall be determined by the wall designer.

D6.07 GENERAL STANDARD OF SUBDIVISION LOT PREPARATION

- | | |
|---|------------------------------|
| <p>1. Special requirements will apply where necessary but generally urban lots are to be cleared of low scrub, fallen timber, debris, stumps, large rocks and any trees which in the opinion of Council are approaching the end of their functional life or are dangerous or will be hazardous to normal use of the development. Reference to Council's Tree Preservation Maps prior to the removal of the trees is required.</p> | <i>Clearing</i> |
| <p>2. All timber and other materials cleared from lots shall be removed from the site. All roots, loose timber, etc which may contribute to drain blockage shall be removed. Such requirements shall be shown on the design plan.</p> | <i>Disposal</i> |
| <p>3. Selected trees shall be preserved by approved means to prevent destruction normally caused by placement of conventional filling or other action within the tree drip zone Council shall be consulted for advice and all specific requirements noted on the design plans.</p> | <i>Preservation of Trees</i> |

D6.08 STANDARD OF FILL FOR LOTS

- | | |
|--|-------------------|
| <p>1. The following notations are to be incorporated in the design plans. "Filling is to be of sound clean material, reasonable standard and free from large rock, stumps, organic matter and other debris." "Placing of filling on the prepared areas shall not commence until the authority to do so has been obtained from the Council".</p> | |
| <p>2. The following material types are not acceptable as fill:</p> <ul style="list-style-type: none"> (a) Vegetation (b) Organic soils (c) Silts (d) Material prone to physical or chemical changes on exposure to moisture (e) demolition material <ul style="list-style-type: none"> (i) Steel (ii) Concrete slabs (iii) Timber (f) Highly reactive clays (g) Material containing large particles (> 150mm) | <i>Unsuitable</i> |

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- (h) Over-wet material
 - (i) Single sized or gap graded gravels
 - (j) Saline, chemically aggressive, polluted or acid producing soils
 - (k) Contaminated material
3. All work shall be in accordance with AS 3798 and supervised to a level 2 standard (minimum) in accordance with section 7 of AS3798. Fill is to be placed in layers not exceeding 150 millimetres compacted thickness. All fill is to be compacted to 95% standard maximum dry density. Maximum particle size shall be 2/3 of the layer thickness. **Fill Quality**
4. Fill comprising natural sands will be accepted by Council only in approved locations and will be subject to specific requirements determined by prevailing conditions. **Restricted Fill**
5. It is essential that prior advice be given of intended use of any contaminated or non-uniform materials. It should be noted that failure to obtain Council's approval may lead to an order for removal of any material considered by Council or other relevant authorities as unsuitable or in any way unfit for filling. **Prior Approval**
6. All areas where filling has been placed are to be dressed with clean arable topsoil, fertilised and sown with suitable grasses. **Top Dressing**

D6.09 EROSION AND SEDIMENT CONTROL

1. Erosion and sediment control shall be in accordance with the Erosion and Sediment Control Plan (ESCP) prepared in accordance with the requirements of specification D7 – Stormwater Quality. **Erosion and sediment control**

D6.10 CUT AND FILL BATTERS

1. Where cut and fill batters are required to produce a landform that is satisfactory for development purposes, such batters shall conform to the requirements of this section.
2. Table D6.2. provides advisory maximum slopes for cutting batters. If there is evidence of geotechnical instability, batter slope and design is to be in accordance with a geotechnical engineers certified recommendation. A geotechnical expert investigation and report is required for all cuttings deeper than 5m. **Cut batters**

Material	Weathering	Maximum Slope H:V
Massive, unjointed, hard rock	fresh	0.25:1
As above	Fresh - slight	0.5:1
Strong igneous or metamorphic rock with some jointing or discolouration, but, exposed rock not noticeably weaker than fresh rock.	Fresh - slight	0.75:1
Shale, siltstone, sandstone with not more than two joint sets, unaltered joint walls, surface staining only	Fresh - slight	1:1
Moderately weathered rock with no obvious seepage	Slight - moderate	1.5:1
Sandy soil or gravel with minor seepage		2:1
Cohesive soil or completely weathered rock with minor seepage	Extreme	2.5:1
Weathered rock where joint fillings have eroded out	Moderate - high	3:1
Sand		3:1
Cohesive soil or highly weathered rock with obvious seepage problems		4:1
Weathered rock or soil with boulders		4:1

Table D6.2 Cutting Batter Slopes

3. Table D6.3. provides advisory maximum slopes for fill batters.

Fill batters

Material	Maximum Slope H:V
Shale, soft limestone, foliated metamorphic rock	2:1
Other rock	1.5:1
Gravel, gravel with silt or sand, well graded sand	1.5:1
Clayey gravel, silty sand, clayey sand, silty soils	2:1
Fatty clays, elastic silty clays	3:1

Table D6.3 Fill Batter Slopes

4. Notwithstanding 1 and 2 above, batter slope length, berm drain locations and gradient relationships are not to exceed those in Chapter 4 of NSW Department of Housing - *Managing Urban Stormwater - Soils and Construction*, March 2004.

Maximum slope length on batters

5. Catch drains are to be provided on the high side of cuttings. Berm drains are required on cut and fill batters to keep slope lengths within the maximum permitted in Table D6.3 above. Catch drains and berm drains are to be sized to accommodate Q100 flows and are to be constructed in reinforced concrete with doweled expansion joints where grades are less than 0.5% or more than 5%. If culvert outlets, catch drain, berm drain or other drainage outlets discharge down embankments, corrugated galvanised half round flumes or full pipe flumes are required to convey runoff to natural surface or to a drainage system. Energy dissipaters are required at flume exits.

Catch drains and flume drains

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6. Cut and fill batters, catch drains, berm drains and relief flumes shall be provided on private land. Where other properties gain benefit from these drainage facilities they shall be located in easements benefiting these other properties. The location of these facilities and the provision of appropriate easements shall be such that the ongoing cleaning, repair and maintenance of these facilities shall be the responsibility of benefited properties and shall not be the responsibility of Council.

Benefited properties to pay cleaning, repair and maintenance costs

D6.11 WORK AS EXECUTED PLANS

1. "Work-as-executed plans are required in accordance with Development Design Specification D13.

D6.12 CARTAGE OF SOIL

1. The applicant shall refer to Council for acceptable haul roads with applicable load limits. This detail shall be required to be shown on the design plan/site regrading plan. The payment of a Heavy Haulage levy will be required from the developer/contractor (see Contribution Plan No 4 TRCP).
2. Unless specific application is made to Council and approval obtained, the plans will be annotated as follows:
- "All topsoil shall be retained on the development site and utilised effectively to encourage appropriate revegetation."

Possible Bond Requirement

Topsoil

D6.13 OVERLAND FLOW PATHS

1. No fill or structure is to be placed on land to cause an overland flow path from any catchment (either within or external or partly external to the subject site) to be blocked or its capacity inhibited for transporting overland flow in a storm up to and including a ARI 100 year event. In the assessment of the runoff from the ARI 100 year event, it shall be assumed that the catchment is fully developed as identified in the strategic plan long term projection.

D6.14 NATURAL WATERCOURSES, AQUATIC ENVIRONMENTS, RIPARIAN VEGETATION

1. Site regrading may involve works that impact on natural watercourses, adjacent riparian vegetation and aquatic environments both on the site and external to the site. Where such works are proposed they must comply with the requirements of this section.
2. Significant natural watercourses, adjacent riparian vegetation and aquatic environments that traverse a land development site are to be preserved and where they are degraded, their environmental values appropriately restored.
3. The approval of NSW Fisheries is required for dredging, reclamation, crossings and roadworks in watercourses and any works which harm marine vegetation (seagrass, mangroves and seaweeds).
4. A permit under the Water Management Act 2000 must be obtained for the excavation of material in or within 40 metres of any river. Land within 20 metres of nominated rivers is "Protected Lands" under the Soil Conservation Act 1938, the approval of the Department of Land and Water Conservation is required for removal of riparian and other trees in "Protected Lands. Development applications are to include plans of the location of natural watercourses, adjacent riparian vegetation and aquatic environments; an assessment of their environmental values; and proposals for their retention and restoration.

Natural watercourses

5. Proposals to convert natural watercourses to artificial drains (or remove riparian vegetation or adversely affect existing aquatic habitats) will only be considered if such proposals are part of a site management plan that will result in an enhanced net environmental outcome.

6. Land development, site regrading and drainage works are not to adversely affect fish and aquatic habitat.

Aquatic environment, NSW Fisheries requirements

Fish and aquatic fauna can be adversely affected by the following:

- (a) Barriers to fish passage
- (b) Road structures, pipes, culverts, causeways that change the stream cross section, increase velocities or insert vertical barriers or other obstacles to upstream fish migration
- (c) Long, dark, narrow or steep culverts
- (d) Works that cause excessive turbulence or cause depths to be too shallow
- (e) Inlets poorly maintained or blocked with debris
- (f) Water pollution
- (g) Sedimentation, turbidity, increased nutrient levels, release of acid sulphate soils, oils and heavy metals runoff pollution from roads
- (h) Loss or changes to fish habitat
- (i) Dredging (excavation in) and reclamation (filling) of streams and waterbodies
- (j) Removal of instream vegetation and snags (or fallen hollow logs), removal of mangroves and seagrass
- (k) Changes to water flow pattern and morphology of streams
- (l) Loss of riparian vegetation

In this regard development is to comply with the *NSW Fisheries (1999) Policy and Guidelines Aquatic Habitat Management and Fish Conservation* and the *Fisheries Management Act 1994* and *Fisheries Management (General) Regulation 1995*.

7. The riparian zone vegetation plays a significant role in providing scenic amenity, provision of wildlife habitat, enhancing aquatic habitat, bank stability, enhancing quality of overland waters entering the stream.

Riparian vegetation

The provision of a strip of undeveloped, revegetated land fringing watercourses will provide a buffer between terrestrial land uses and the stream and assist in maintaining the stream and riparian zone environmental values.

Unless otherwise approved

- (a) Along major streams the minimum riparian buffer shall be 50m, major waterways are Tweed River, Rouse River, Oxley River, Cudgen Ck, Cudgera Ck, Mooball Ck and major tributaries.
- (b) Along minor streams the minimum riparian buffer shall be 10m.

- (c) Riparian buffer zones shall be revegetated and fences or other appropriate barriers provided to prevent transverse crossing of the riparian buffer (except in designated areas).

D6.15 STAGING

- 1. Where site regrading is to be staged, each stage is required to individually conform with the requirements of this specification. In this regard interfaces with future subdivision stages will be treated as interfaces with adjoining land in different ownership.

D6.16 GEOTECHNICAL INVESTIGATION, DESIGN AND CERTIFICATION

- 1. Complementary geotechnical and structural engineers reports, based on appropriate site investigations and laboratory testing are required to accompany development applications that include earthworks in:
 - subdivisions where there is a risk of landslip or subsidence:
 - within the subdivision area that may adversely impact on the proposed lots or land external to the subdivision or
 - external to the subdivision that may adversely impact on the subdivision
 - subdivisions where proposed earthworks batter slope exceeds 1:2 (v:h).
 - subdivisions where the height of cut or fill will exceed one metre in height

Geotechnical and structural engineers reports with DAs

- 2. The suitability of any cut or fill within these areas will be assessed by the determining authority, taking into account the recommendations contained in the above reports.

Assessment

The geotechnical and structural engineers report shall include

- an assessment of the stability of the proposal (for both the subject land and adjoining land)
 - recommended design criteria for earthworks, retaining walls and associated drainage
 - recommended location and design criteria for underground services in the zone of influence of the earthworks
 - recommended periodic maintenance requirements for earthworks, drainage and retaining structures
- 3. Earthworks, revetments, retaining structures, associated drainage and underground services must be designed and constructed in accordance with this report. The construction certificate application shall include engineering design plans and specifications that implement the recommendations of the report.

Construction certificate

4. Prior to the issue of a subdivision certificate for subdivisions that contain cut or fill or retaining walls in excess of 1m height, a certificate shall be provided by a practising geotechnical engineer certifying that the earthworks and retaining walls, as constructed, will be stable in the long term and that there will be no significant risk of landslip, or retaining wall collapse. In this regard the certificate must address the risk to land and infrastructure both within the subdivision and on land adjacent to the subdivision and must detail maintenance measures required to ensure any risk does not increase over time. The certificate must address both the probability and consequences of any identified risk. Subdivision certificates shall not be issued for subdivisions where risks identified in the above assessment are considered unacceptable by Council. Risk assessment to persons and property, addressing likelihood and consequences shall be in general accordance with the format in "Landslide Risk Management Concepts and Guidelines" – Australian Geomechanics, Vol.35, No.1, 2000.

**Geotechnical
risk
assessment**

SPECIAL REQUIREMENTS

D6.17 INVESTIGATION AND TREATMENT OF INSITU SOILS

1. Prior to the issue of a Construction Certificate, a Detailed Geotechnical Investigation shall be undertaken by an appropriately qualified practising professional Geotechnical Engineer, unless considered unjustified by the Geotechnical Engineer, supported in writing and endorsed by Council.

The investigation shall identify any areas of compressible clay materials, loose sands, landslip, subsidence or reactive soil profiles which may impact on construction or building activities. If unsuitable materials are identified the investigation shall provide recommendations such as a preloading or other forms of treatment necessary to achieve surface movement (y_s) rates consistent with a site classification M as defined by AS 2870 (current version). All consolidation resulting from preloading shall be monitored by settlement plates or detailed survey to determine consolidation / settlement characteristics.

2. All earthworks and filling shall be carried out in accordance with AS 3798 (current version) to a Level 1 inspection regime and testing in accordance with Table 8.1.

The earthworks and filling shall also be undertaken in accordance with the recommendations provided in the Geotechnical Investigation (as required above) and monitored by a Registered Geotechnical Testing Consultant.

3. At the completion of the earthworks/filling and prior to the issue of the Subdivision Certificate an appropriately qualified practising professional geotechnical engineer shall provide an engineering certification that clearly states the following;
 - All earthworks and filling have been inspected to a Level 1 standard in accordance with AS 3798 (current version) and in accordance with the recommendations of the detailed geotechnical investigation
 - All surface movement (y_s) has achieved rates that are consistent with a site classification M as defined by AS 2870 (current version). If expected surface movement (y_s) for the proposed allotments are likely to exceed a site classification of M, all affected allotments shall be burdened by a Restriction on Use pursuant to Section 88B of the Conveyancing Act advising future owners of the site classification.

D6.18 RESERVED