coffey geotechnics

Borehole No. **BH106**

Sheet 1 of 1

Project No: **GEOTKPAR01560AA**

Engineering Log - Borehole

Client: ***BROWN CONSULTING (QLD) PTY LTD***

Date started: ***12.5.2009***

Principal:

Date completed: ***12.5.2009***

Project: ***BELLVISTA 2***

Logged by: ***DF***

Borehole Location: ***REFER TO SITE PLAN***

Checked by: ***RFM***

drill model and mounting: EDSON CPI | Easting: 508847.031 | slope: -90° | R.L. Surface: 3.365

hole diameter: 100 mm | Northing 7035109.224 | bearing: | datum: GDA94

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa (100 200 300 400)	structure and additional observations
ADT		N	▶		3			SM	**SILTY SAND:** fine to medium grained, dark grey, trace of organics.	M	L		
								SP	**SAND:** fine to medium grained, pasle grey and brown. ...trace of silt.	M/W	MD		
						1		SC	**CLAYEY SAND:** fine to medium grained, pale grey, medium plasticity fines.	M			
					2			CH	**SANDY CLAY:** medium to high plasticity, pale grey and red, fine to medium grained sand.		St	×	DIST PP-150kPa
											VSt	×	DIST PP=260kPa
					1							×	DIST PP=300kPa
						3			Borehole BH106 terminated at 3m				LIMIT OF INVESTIGATION
					0								
						4							
					-1								
						5							
					-2								
						6							
					-3								
						7							
					-4								
						8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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Borehole No. **BH107**

Sheet 1 of 1

Project No: **GEOTKPAR01560AA**

Engineering Log - Borehole

Client: ***BROWN CONSULTING (QLD) PTY LTD***

Date started: ***12.5.2009***

Principal:

Date completed: ***12.5.2009***

Project: ***BELLVISTA 2***

Logged by: ***DF***

Borehole Location: ***REFER TO SITE PLAN***

Checked by: ***RFM***

drill model and mounting: EDSON CPI | Easting: 508715.242 | slope: -90° | R.L. Surface: 3.513

hole diameter: 100 mm | Northing 7034897.495 | bearing: | datum: GDA94

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
ADT		N			3			SM	**SILTY SAND:** fine to medium grained, dark grey, trace of organics.	M	MD		
						1		SP	**SAND:** fine to medium grained, pale brown, trace of silt.	M/W			
			▼					SP	**SAND:** fine to medium grained, pale brown and orange, with clay fines.	W			
				ASS	2			SC	**CLAYEY SAND:** fine to medium grained, pale brown and red, low plasticity fines, trace of fine grained gravel.	M/W			
								CH		M	St		
						2		CH	**SANDY CLAY:** medium to high plasticity, pale grey and pale brown, fine to medium grained sand, trace of gravel.		VSt	×	DIST PP=300kPa
					1				**SANDY SILTY CLAY:** high plasticity, pale grey, fine to medium grained sand.			×	DIST PP=290kPa
						3			Borehole BH107 terminated at 3m				LIMIT OF INVESTIGATION
					0	4							
					-1	5							
					-2	6							
					-3	7							
					-4	8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

▼ 10/1/98 water level on date shown

► water inflow

◄ water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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Engineering Log - Borehole

Borehole No.	***BH108***
Sheet	1 of 1
Project No:	***GEOTKPAR01560AA***
Client:	***BROWN CONSULTING (QLD) PTY LTD***
Date started:	***12.5.2009***
Principal:	
Date completed:	***12.5.2009***
Project:	***BELLVISTA 2***
Logged by:	***DF***
Borehole Location:	***REFER TO SITE PLAN***
Checked by:	***RFM***

drill model and mounting:	EDSON CPI		Easting:	508803.648	slope:	-90°	R.L. Surface: 3.421
hole diameter:	100 mm		Northing	7034985.015	bearing:		datum: GDA94

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
ADT		N	▶	ASS	3	1		SM	**SILTY SAND:** fine to medium grained, dark grey, trace of organics.	M	L		
								SP	**SAND:** fine to medium grained, grey/brown, trace of silt. ...colour changing to grey/brown. ...colour changing to pale grey and pale brown.	M/W	MD		
					2	2		CL	**SANDY CLAY:** medium plasticity, pale grey and orange/red, fine to medium grained sand.	M	St	×	DIST PP=150kPa
								SP	**SAND:<<B> fine to medium grained, pale grey.** ...colour changing to dark grey/dark brown.	W	MD D		
					1	3		CL	**SANDY CLAY:** medium plasticity, pale grey, fine to medium grained sand.	M	St		
								SP	**SAND:** fine to medium grained, pale grey, trace of silt and clay fines.	W	MD		
					0	4			Borehole BH108 terminated at 3m				LIMIT OF INVESTIGATION
					-1	5							
					-2	6							
					-3	7							
					-4	8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description
based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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Engineering Log - Borehole

Borehole No. **BH109**

Sheet 1 of 1

Project No: **GEOTKPAR01560AA**

Client: **BROWN CONSULTING (QLD) PTY LTD**

Date started: **12.5.2009**

Principal:

Date completed: **12.5.2009**

Project: **BELLVISTA 2**

Logged by: **DF**

Borehole Location: **REFER TO SITE PLAN**

Checked by: **RFM**

drill model and mounting: EDSON CPI | Easting: 508797.886 | slope: -90° | R.L. Surface: 3.413

hole diameter: 100 mm | Northing 7034805.5 | bearing: | datum: GDA94

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
ADT		N	SEEPAGE	ASS	3	1		SM	**SILTY SAND:** fine to medium grained, dark grey, trace of organics.	M	L		
								SP	**SAND:** fine to medium grained, pale brown, trace of silt.	W	MD		
								SP	**SAND:** fine to medium grained, brown, trace of silt and clay.	M/W			
								SC	**CLAYEY SAND:** fine to medium grained, pale brown/grey and red, medium plasticity fines.	M			
					2	2		CL	**SANDY CLAY:** medium plasticity, pale grey, fine to medium grained sand.		St	×	DIST PP=150kPa
								CH	**SANDY CLAY:** medium to high plasticity, pale grey, fine to medium grained sand.		VSt	×	DIST PP=220kPa
					1							×	DIST PP=260kPa
						3						×	DIST PP=280kPa
					0	4			Borehole BH109 terminated at 3m				LIMIT OF INVESTIGATION
					-1	5							
					-2	6							
					-3	7							
					-4	8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

PROJECT FILE: GK01560AA.GPJ. LIBRARY FILE: COFGEOTECHVER7REV1.GLB. TEMPLATE FILE: COFFEY.GDT FRAME TITLE: BOREHOLE. DATE: 25.6.09

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Borehole No. **BH110**

Sheet 1 of 1

Project No: **GEOTKPAR01560AA**

Engineering Log - Borehole

Client: ***BROWN CONSULTING (QLD) PTY LTD***

Date started: ***16.5.2009***

Principal:

Date completed: ***16.5.2009***

Project: ***BELLVISTA 2***

Logged by: ***DF***

Borehole Location: ***REFER TO SITE PLAN***

Checked by: ***RFM***

drill model and mounting: EDSON CPI | Easting: 508949.336 | slope: -90° | R.L. Surface: 2.719

hole diameter: 100 mm | Northing 7034852.051 | bearing: | datum: GDA94

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa (100 200 300 400)	structure and additional observations
ADT		N	▼		2	1		SM	**SILTY SAND:** fine to medium grained, dark grey, trace of organics.	M/W	L		
			►					SP	**SAND:** fine to medium grained, dark grey, trace of silt.	W	MD		
				ASS	1	2		SP	**SAND:** fine to medium grained, pale grey.				
								SC	**CLAYEY SAND:** fine to medium grained, pale grey, medium plasticity fines.	M			
					0	3		CH	**SANDY CLAY:** high plasticity, pale grey, fine to medium grained sand.		VSt	×	DIST PP=250kPa
									...medium to high plasticity.		St	×	DIST PP=180kPa
								SC	**CLAYEY SAND:** fine to medium grained, pale grey, medium plasticity fines.		MD		
					-1	4			Borehole BH110 terminated at 3m				LIMIT OF INVESTIGATION
					-2	5							
					-3	6							
					-4	7							
					-5	8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

PROJECT FILE: GK01560AA.GPJ. LIBRARY FILE: COFGEOTECHVER7REV1.GLB. TEMPLATE FILE: COFFEY.GDT FRAME TITLE: BOREHOLE. DATE: 25.6.09

Form GEO 5.3 Issue 3 Rev.2

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Borehole No. **BH111**

Sheet 1 of 1

Project No: **GEOTKPAR01560AA**

Engineering Log - Borehole

Client: ***BROWN CONSULTING (QLD) PTY LTD***

Date started: ***15.5.2009***

Principal:

Date completed: ***15.5.2009***

Project: ***BELLVISTA 2***

Logged by: ***DF***

Borehole Location: ***REFER TO SITE PLAN***

Checked by: ***RFM***

drill model and mounting: EDSON CPI | Easting: 509087.238 | slope: -90° | R.L. Surface: 1.913

hole diameter: 100 mm | Northing 7034820.414 | bearing: | datum: GDA94

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa (100 200 300 400)	structure and additional observations
ADT		N	▶	ASS	1	1		SM	**SILTY SAND:** fine to medium grained, dark grey, trace of organics.	W	L		
								SP	**SAND:** fine to medium grained, pale grey and pale brown, trace of silt. ...colour changing to pale grey.		MD		
					0	2		SC	**CLAYEY SAND:** fine to medium grained, pale grey, medium plasticity fines.		D		
					-1	3		CH	**SANDY CLAY:** high plasticity, pale grey, fine to medium grained sand. ...medium to high plasticity.	M	VSt	×	DIST PP=350kPa
					-2	4			Borehole BH111 terminated at 3m				LIMIT OF INVESTIGATION
					-3	5							
					-4	6							
					-5	7							
					-6	8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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Soil Description Explanation Sheet (1 of 2)

DEFINITION:

In engineering terms soil includes every type of uncemented or partially cemented inorganic or organic material found in the ground. In practice, if the material can be remoulded or disintegrated by hand in its field condition or in water it is described as a soil. Other materials are described using rock description terms.

CLASSIFICATION SYMBOL & SOIL NAME

Soils are described in accordance with the Unified Soil Classification (UCS) as shown in the table on Sheet 2.

PARTICLE SIZE DESCRIPTIVE TERMS

NAME	SUBDIVISION	SIZE
Boulders		>200 mm
Cobbles		63 mm to 200 mm
Gravel	coarse	20 mm to 63 mm
	medium	6 mm to 20 mm
	fine	2.36 mm to 6 mm
Sand	coarse	600 μm to 2.36 mm
	medium	200 μm to 600 μm
	fine	75 μm to 200 μm

MOISTURE CONDITION

Dry Looks and feels dry. Cohesive and cemented soils are hard, friable or powdery. Uncemented granular soils run freely through hands.

Moist Soil feels cool and darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.

Wet As for moist but with free water forming on hands when handled.

CONSISTENCY OF COHESIVE SOILS

TERM	UNDRAINED STRENGTH s_u (kPa)	FIELD GUIDE
Very Soft	<12	A finger can be pushed well into the soil with little effort.
Soft	12 - 25	A finger can be pushed into the soil to about 25mm depth.
Firm	25 - 50	The soil can be indented about 5mm with the thumb, but not penetrated.
Stiff	50 - 100	The surface of the soil can be indented with the thumb, but not penetrated.
Very Stiff	100 - 200	The surface of the soil can be marked, but not indented with thumb pressure.
Hard	>200	The surface of the soil can be marked only with the thumbnail.
Friable	–	Crumbles or powders when scraped by thumbnail.

DENSITY OF GRANULAR SOILS

TERM	DENSITY INDEX (%)
Very loose	Less than 15
Loose	15 - 35
Medium Dense	35 - 65
Dense	65 - 85
Very Dense	Greater than 85

MINOR COMPONENTS

TERM	ASSESSMENT GUIDE	PROPORTION OF MINOR COMPONENT IN:
Trace of	Presence just detectable by feel or eye, but soil properties little or no different to general properties of primary component.	Coarse grained soils: <5% Fine grained soils: <15%
With some	Presence easily detected by feel or eye, soil properties little different to general properties of primary component.	Coarse grained soils: 5 - 12% Fine grained soils: 15 - 30%

SOIL STRUCTURE

ZONING		CEMENTING	
Layers	Continuous across exposure or sample.	Weakly cemented	Easily broken up by hand in air or water.
Lenses	Discontinuous layers of lenticular shape.	Moderately cemented	Effort is required to break up the soil by hand in air or water.
Pockets	Irregular inclusions of different material.		

GEOLOGICAL ORIGIN

WEATHERED IN PLACE SOILS

Extremely weathered material — Structure and fabric of parent rock visible.

Residual soil — Structure and fabric of parent rock not visible.

TRANSPORTED SOILS

Aeolian soil — Deposited by wind.

Alluvial soil — Deposited by streams and rivers.

Colluvial soil — Deposited on slopes (transported downslope by gravity).

Fill — Man made deposit. Fill may be significantly more variable between tested locations than naturally occurring soils.

Lacustrine soil — Deposited by lakes.

Marine soil — Deposited in ocean basins, bays, beaches and estuaries.

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Soil Description Explanation Sheet (2 of 2)

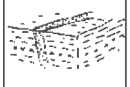
SOIL CLASSIFICATION INCLUDING IDENTIFICATION AND DESCRIPTION

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 60 mm and basing fractions on estimated mass)							USC	PRIMARY NAME
COARSE GRAIINED SOILS More than 50% of materials less than 63 mm is larger than 0.075 mm	(A 0.075 mm particle is about the smallest particle visible to the naked eye)	GRAVELS More than half of coarse fraction is larger than 2.0 mm	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.			GW	GRAVEL
				Predominantly one size or a range of sizes with more intermediate sizes missing.			GP	GRAVEL
			GRAVELS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below)			GM	SILTY GRAVEL
				Plastic fines (for identification procedures see CL below)			GC	CLAYEY GRAVEL
		SANDS More than half of coarse fraction is smaller than 2.0 mm	CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate sizes			SW	SAND
				Predominantly one size or a range of sizes with some intermediate sizes missing.			SP	SAND
			SANDS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below).			SM	SILTY SAND
				Plastic fines (for identification procedures see CL below).			SC	CLAYEY SAND
FINE GRAINED SOILS More than 50% of material less than 63 mm is smaller than 0.075 mm			IDENTIFICATION PROCEDURES ON FRACTIONS <0.2 mm.					
		SILTS & CLAYS Liquid limit less than 50	**DRY STRENGTH**	**DILATANCY**	**TOUGHNESS**			
			None to Low	Quick to slow	None		ML	SILT
			Medium to High	None	Medium		CL	CLAY
			Low to medium	Slow to very slow	Low		OL	ORGANIC SILT
		SILTS & CLAYS Liquid limit greater than 50	Low to medium	Slow to very slow	Low to medium		MH	SILT
			High	None	High		CH	CLAY
			Medium to High	None	Low to medium		OH	ORGANIC CLAY
HIGHLY ORGANIC SOILS			Readily identified by colour, odour, spongy feel and frequently by fibrous texture.				Pt	PEAT

• Low plasticity – Liquid Limit W_L less than 35%. • Medium plasticity – W_L between 35% and 50%.

COMMON DEFECTS IN SOIL

TERM	DEFINITION	DIAGRAM
PARTING	A surface or crack across which the soil has little or no tensile strength. Parallel or sub parallel to layering (eg bedding). May be open or closed.	
JOINT	A surface or crack across which the soil has little or no tensile strength but which is not parallel or sub parallel to layering. May be open or closed. The term 'fissure' may be used for irregular joints <0.2 m in length.	
SHEARED ZONE	Zone in clayey soil with roughly parallel near planar, curved or undulating boundaries containing closely spaced, smooth or slickensided, curved intersecting joints which divide the mass into lenticular or wedge shaped blocks.	
SHEARED SURFACE	A near planar curved or undulating, smooth, polished or slickensided surface in clayey soil. The polished or slickensided surface indicates that movement (in many cases very little) has occurred along the defect.	

TERM	DEFINITION	DIAGRAM
SOFTENED ZONE	A zone in clayey soil, usually adjacent to a defect in which the soil has a higher moisture content than elsewhere.	
TUBE	Tubular cavity. May occur singly or as one of a large number of separate or inter-connected tubes. Walls often coated with clay or strengthened by denser packing of grains. May contain organic matter	
TUBE CAST	Roughly cylindrical elongated body of soil different from the soil mass in which it occurs. In some cases the soil which makes up the tube cast is cemented.	
INFILLED SEAM	Sheet or wall like body of soil substance or mass with roughly planar to irregular near parallel boundaries which cuts through a soil mass. Formed by infilling of open joints.	

Appendix D

Laboratory Test Certificates

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

1/36 Kerryl Street, Kunda Park, QLD,4556
Ph: (07) 5445 4952 Fax: (07) 5445 3764

determination of emerson class number

client : ***Brown Consulting (Qld) Pty Ltd***
job no : ***GEOTKPAR01560AA***
principal :
laboratory : ***KUNDA PARK***
project : ***Bellvista 2***
date : ***20/05/09***
location : ***Area 1***
test report no. : ***GEOTKPAR01560AA***

test procedure : ***AS 1289.3.8.1***
date sampled:
material source: ***Topsoil BH84***
sample number:
sample identification:

test data

air dried crumbs

time start of test:

time dispersion commences:

time dispersion completed:

remoulded material

time start of test:

time dispersion commences:

time dispersion completed:

material description

type of water used: ***distilled***

water temperature: ***20.5*** ° ***C***

immersion of air dried crumbs

- does not slake ☒
- slakes ☐
  - swell ☐ (7)
  - does not swell ☒ (8)
- complete dispersion ☐ (1)
- partial dispersion ☐ (2)
- no dispersion ☐

immersion of remoulded material

- disperses ☐ (3)
- does not disperse ☐
  - calcite or gypsum
    - present ☐ (4)
    - absent ☐
      - vigorous shaking
        - disperses ☐ (5)
        - flocculates ☐ (6)

Emerson class number ***8***

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

1/36 Kerryl Street, Kunda Park, QLD,4556
Ph: (07) 5445 4952 Fax: (07) 5445 3764

determination of emerson class number

client : ***Brown Consulting (Qld) Pty Ltd***
job no : ***GEOTKPAR01560AA***
principal :
laboratory : ***KUNDA PARK***
project : ***Bellvista 2***
date : ***20/05/09***
location : ***Area 1***
test report no. : ***GEOTKPAR01560AA***

test procedure : ***AS 1289.3.8.1***
date sampled:
material source: ***Subsoil BH84***
sample number:
sample identification: ***Depth 1.5 - 1.75m***

test data

air dried crumbs

time start of test:

time dispersion commences:

time dispersion completed:

remoulded material

time start of test:

time dispersion commences:

time dispersion completed:

material description

type of water used: ***distilled***

water temperature: ***20.5*** ° ***C***

immersion of air dried crumbs

- does not slake ☒
- slakes ☐
  - swell ☐ (7)
  - does not swell ☒ (8)
  - complete dispersion ☐ (1)
  - partial dispersion ☐ (2)
  - no dispersion ☐

immersion of remoulded material

- disperses ☐ (3)
- does not disperse ☐
  - calcite or gypsum
    - present ☐ (4)
    - absent ☐
      - vigorous shaking
        - disperses ☐ (5)
        - flocculates ☐ (6)

Emerson class number ***8***

Form Number L4.8R1 Version 6.1

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

1/36 Kerryl Street, Kunda Park, QLD,4556
Ph: (07) 5445 4952 Fax: (07) 5445 3764

determination of emerson class number

client : ***Brown Consulting (Qld) Pty Ltd***
job no : ***GEOTKPAR01560AA***
principal :
laboratory : ***KUNDA PARK***
project : ***Bellvista 2***
date : ***20/05/09***
location : ***Area 1***
test report no. : ***GEOTKPAR01560AA***

test procedure : ***AS 1289.3.8.1***
date sampled:
material source: ***Topsoil BH107***
sample number:
sample identification:

test data

air dried crumbs

time start of test:

time dispersion commences:

time dispersion completed:

remoulded material

time start of test:

time dispersion commences:

time dispersion completed:

material description

type of water used: ***distilled***

water temperature: ***20.5*** ° ***C***

immersion of air dried crumbs

- does not slake ☒
- slakes ☐
  - swell ☐ (7)
  - does not swell ☒ (8)
  - complete dispersion ☐ (1)
  - partial dispersion ☐ (2)
  - no dispersion ☐

immersion of remoulded material

- disperses ☐ (3)
- does not disperse ☐
  - calcite or gypsum
    - present ☐ (4)
    - absent ☐
      - vigorous shaking
        - disperses ☐ (5)
        - flocculates ☐ (6)

Emerson class number ***8***

Form Number L4.8R1 Version 6.1

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

1/36 Kerryl Street, Kunda Park, QLD,4556
Ph: (07) 5445 4952 Fax: (07) 5445 3764

determination of emerson class number

client : ***Brown Consulting (Qld) Pty Ltd***
job no : ***GEOTKPAR01560AA***
principal :
laboratory : ***KUNDA PARK***
project : ***Bellvista 2***
date : ***20/05/09***
location : ***Area 1***
test report no. : ***GEOTKPAR01560AA***

test procedure : ***AS 1289.3.8.1***
date sampled:
material source: ***Subsoil BH107***
sample number:
sample identification: ***Depth 2.5 - 2.75m***

test data

air dried crumbs

time start of test:

time dispersion commences:

time dispersion completed:

remoulded material

time start of test:

time dispersion commences:

time dispersion completed:

material description

type of water used: ***distilled***

water temperature: ***20.5*** ° ***C***

immersion of air dried crumbs

- does not slake ☐
- slakes ☒
  - swell ☐ (7)
  - does not swell ☐ (8)
  - complete dispersion ☐ (1)
  - partial dispersion ☐ (2)
  - no dispersion ☒

immersion of remoulded material

- disperses ☐ (3)
- does not disperse ☒
  - calcite or gypsum
    - present ☒ (4)
    - absent ☐
      - vigorous shaking
        - disperses ☐ (5)
        - flocculates ☐ (6)

Emerson class number ***4***

Form Number L4.8R1 Version 6.1

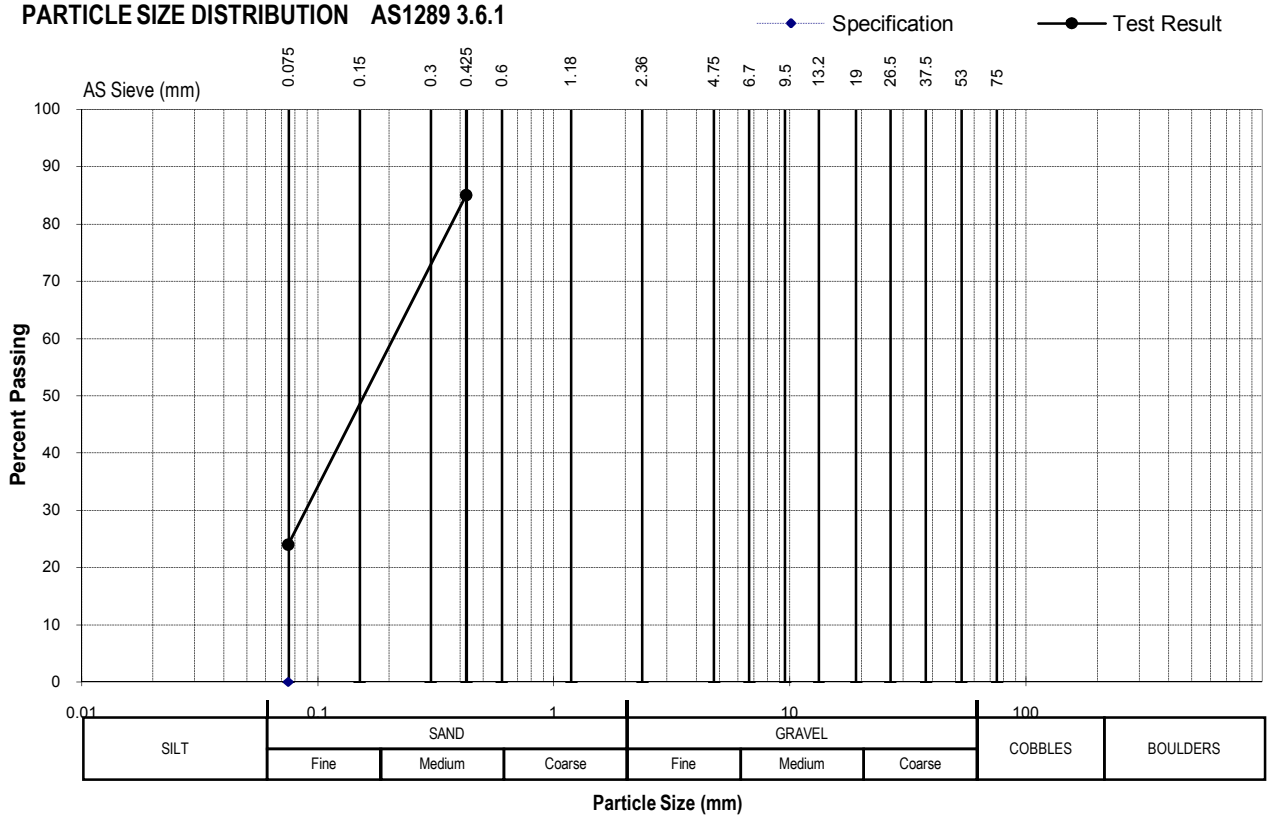
coffey geotechnics
SPECIALISTS MANAGING THE EARTH

Correspondence: PO Box 5537, Maroochydore Qld 4558 Fax (07) 5445 3764
1/36 KERRYL STREET, KUNDA PARK QLD 4556 (07) 5445 4952

Client:	**Brown Consulting (Qld) Pty Ltd**	Job No:	**GEOTKPAR01560AA**	Laboratory:	**Kunda Park**
Principal:		Test Date:	**20-May-2009**	Sampled by:	**MT**
Project:	**Bellvista 2 - Area 1**	Date Sampled:		Report No:	
Location:	**REFER PLAN**	Test No.:	**BH 84**		2 of 3
Sample ID:	**Subsoil 1.5m to 1.75m**	Material Description			

MATERIAL CLASSIFICATION REPORT

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1



Sieve Size mm	% Passing	Specification Upper	Specification Lower
75			
53			
37.5			
26.5			
19			
13.2			
9.5			
6.7			
4.75			
2.36			
1.18			
600µm			
425µm	85		
300µm			
150µm			
75µm	24		

ATTERBERG LIMITS

			Procedures
Liquid Limit	%		A
Plastic Limit	%		B
Plasticity Index	%		C
Linear Shrinkage	%		
Mould Length	mm		
Crumbling &/or Curling			
Sample History		Oven Dried ☐	Air Dried ☐
Sample Preparation		Dry Sieved ☐	Wet Sieved ☐

(A) AS 1289.3.1.1 Liquid Limit – Standard Method
(B) AS 1289.3.2.1 Plastic Limit – Standard Limit
(C) AS 1289.3.3.1 Plasticity Index – Standard Method
(D) AS 1289.C4.1 Linear Shrinkage – Standard Method
(NO) Not obtainable

EMERSON CLASS NUMBER - AS 1289 3.8.1

Emerson Class No.

Water Type: Water Temperature:

REMARKS:

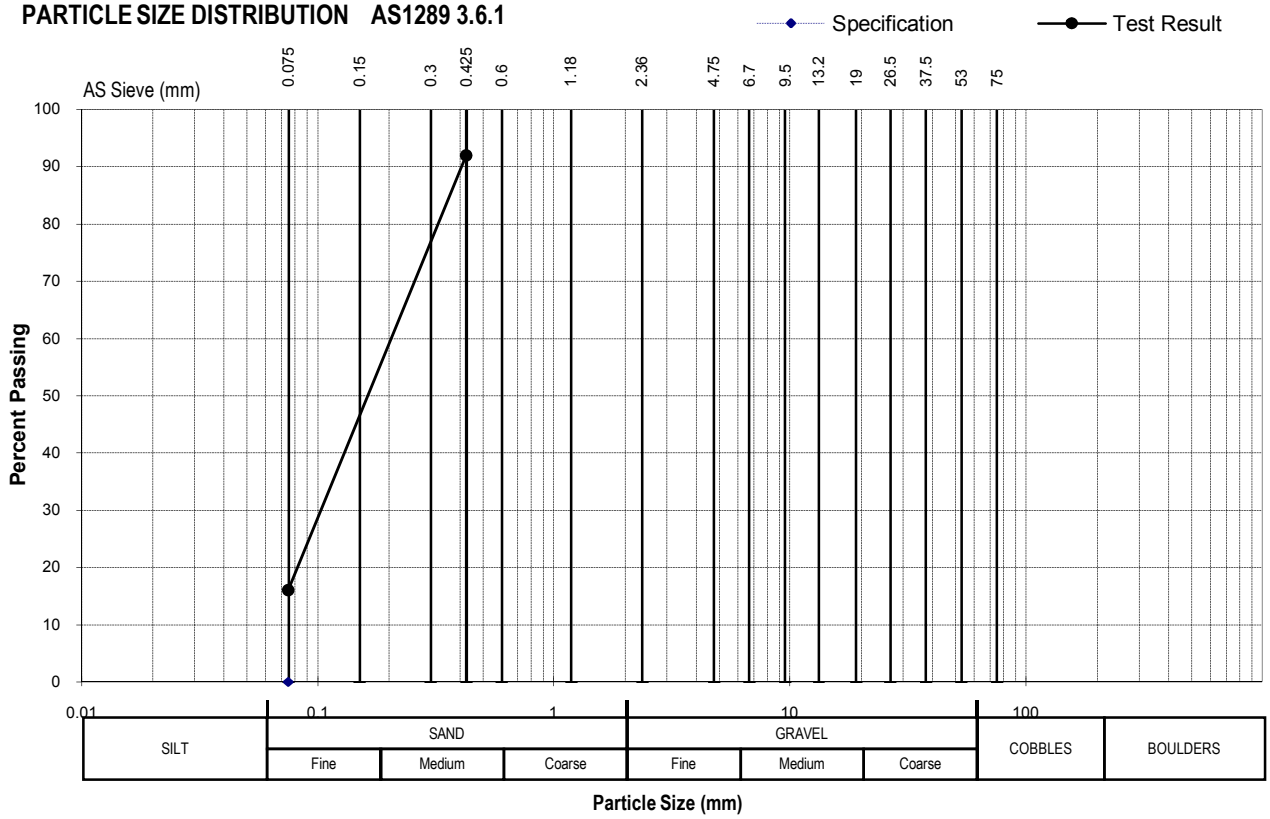
coffey geotechnics
SPECIALISTS MANAGING THE EARTH

Correspondence: PO Box 5537, Maroochydore Qld 4558 Fax (07) 5445 3764
1/36 KERRYL STREET, KUNDA PARK QLD 4556 (07) 5445 4952

Client:	**Brown Consulting (Qld) Pty Ltd**	Job No:	**GEOTKPAR01560AA**	Laboratory:	**Kunda Park**
Principal:		Test Date:	**20-May-2009**	Sampled by:	**MT**
Project:	**Bellvista 2 - Area 1**	Date Sampled:		Report No:	
Location:	**REFER PLAN**	Test No.:	**BH 107**		1 of 3
Sample ID:	**Topsoil**	Material Description			

MATERIAL CLASSIFICATION REPORT

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1



Sieve Size mm	% Passing	Specification Upper	Specification Lower
75			
53			
37.5			
26.5			
19			
13.2			
9.5			
6.7			
4.75			
2.36			
1.18			
600µm			
425µm	92		
300µm			
150µm			
75µm	16		

ATTERBERG LIMITS

			Procedures
Liquid Limit	%		A
Plastic Limit	%		B
Plasticity Index	%		C
Linear Shrinkage	%		
Mould Length	mm		
Crumbling &/or Curling			
Sample History		Oven Dried ☐	Air Dried ☐
Sample Preparation		Dry Sieved ☐	Wet Sieved ☐

(A) AS 1289.3.1.1 Liquid Limit – Standard Method
(B) AS 1289.3.2.1 Plastic Limit – Standard Limit
(C) AS 1289.3.3.1 Plasticity Index – Standard Method
(D) AS 1289.C4.1 Linear Shrinkage – Standard Method
(NO) Not obtainable

EMERSON CLASS NUMBER - AS 1289 3.8.1

Emerson Class No.

Water Type: Water Temperature:

REMARKS:

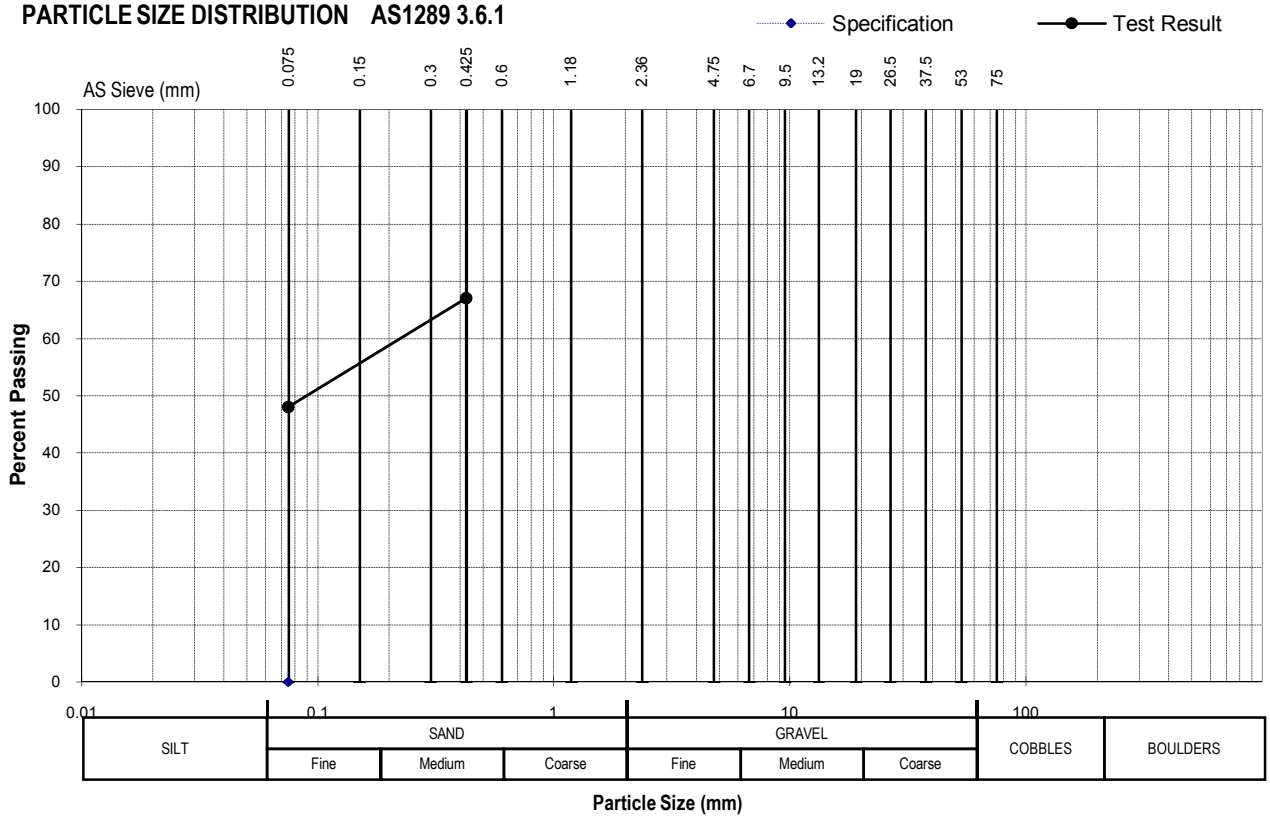
coffey geotechnics
SPECIALISTS MANAGING THE EARTH

Correspondence: PO Box 5537, Maroochydore Qld 4558 Fax (07) 5445 3764
1/36 KERRYL STREET, KUNDA PARK QLD 4556 (07) 5445 4952

Client:	**Brown Consulting (Qld) Pty Ltd**	Job No:	**GEOTKPAR01560AA**	Laboratory:	**Kunda Park**
Principal:		Test Date:	**20-May-2009**	Sampled by:	**MT**
Project:	**Bellvista 2 - Area 1**	Date Sampled:		Report No:	
Location:	**REFER PLAN**	Test No.:	**BH 91**		3 of 3
Sample ID:	**Subsoil 2.5m to 3.0m**	Material Description			

MATERIAL CLASSIFICATION REPORT

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1



Sieve Size mm	% Passing	Specification Upper	Specification Lower
75			
53			
37.5			
26.5			
19			
13.2			
9.5			
6.7			
4.75			
2.36			
1.18			
600µm			
425µm	67		
300µm			
150µm			
75µm	48		

ATTERBERG LIMITS			Procedures
Liquid Limit	%		A
Plastic Limit	%		B
Plasticity Index	%		C
Linear Shrinkage	%		
Mould Length	mm		
Crumbling &/or Curling			
Sample History		Oven Dried ☐	Air Dried ☐
Sample Preparation		Dry Sieved ☐	Wet Sieved ☐

(A) AS 1289.3.1.1 Liquid Limit – Standard Method
(B) AS 1289.3.2.1 Plastic Limit – Standard Limit
(C) AS 1289.3.3.1 Plasticity Index – Standard Method
(D) AS 1289.C4.1 Linear Shrinkage – Standard Method
(NO) Not obtainable

EMERSON CLASS NUMBER - AS 1289 3.8.1
Emerson Class No.
Water Type: Water Temperature:

REMARKS:

Appendix E

Rainer Outputs

********** RAINER **********
DEPARTMENT of CONSERVATION and LAND MANAGEMENT
Date: 25/05/2009

Rainfall Intensity (mm/h) for BELLVISTA 2

1 hour, 2 years	51.00
12 hour, 2 years	10.00
72 hour, 2 years	3.50
1 hour, 50 years	91.00
12 hour, 50 years	20.00
72 hour, 50 years	8.50
Skewness	0.12
Geographical factor F2	4.39
Geographical factor F50	17.50

\DUR	5m	6m	10m	20m	30m	1h	2h	3h	6h	12h	24h	48h	72h	User
ARI														
1	126	118	97	71	58	39.7	25.3	19.3	12.1	7.64	5.14	3.39	2.59	0.00
2	160	150	123	90	74	51	32.4	24.8	15.7	9.92	6.76	4.50	3.46	0.00
5	196	185	152	112	91	63	40.8	31.5	20.2	12.9	9.08	6.24	4.90	0.00
10	217	204	168	124	102	70	45.8	35.5	22.9	14.8	10.5	7.37	5.85	0.00
20	247	232	191	141	116	80	53	40.9	26.5	17.2	12.5	8.83	7.07	0.00
50	285	268	221	164	134	93	62	48.0	31.4	20.5	15.1	10.9	8.78	0.00
100	314	295	244	181	148	103	68	54	35.1	23.1	17.1	12.5	10.2	0.00
User	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Estimated Rainfall Factor (R): 5540 Estimated 1:10 Storm (S10): 3580

	Years						
min	1	2	5	10	20	50	100
7	112	142	175	193	219	254	280
8	106	135	166	184	209	241	266
9	101	129	159	176	199	231	254
10	97	123	152	168	191	221	244
11	93	118	146	162	184	213	235
12	90	114	141	156	177	205	227
13	87	110	136	151	171	198	219
14	84	107	132	146	166	192	212
15	81	103	128	142	161	186	206
16	79	100	124	138	156	181	200
17	77	98	121	134	152	176	195
18	75	95	117	130	148	172	190
19	73	93	115	127	145	167	185
20	71	90	112	124	141	164	181
21	69	88	109	121	138	160	177
22	68	86	107	119	135	156	173
23	66	84	104	116	132	153	169
24	65	83	102	114	129	150	166
25	64	81	100	111	127	147	162
26	62	79	98	109	124	144	159
27	61	78	96	107	122	141	156
28	60	76	95	105	120	139	154
29	59	75	93	103	118	136	151
30	58	74	91	102	116	134	148
31	57	73	90	100	114	132	146
32	56	71	88	98	112	130	144
33	55	70	87	97	110	128	141
34	54	69	86	95	109	126	139
35	53	68	84	94	107	124	137
36	53	67	83	92	105	122	135
37	52	66	82	91	104	121	133
38	51	65	81	90	102	119	131
39	50	64	80	89	101	117	130
40	49.7	63	79	87	100	116	128
41	49.1	62	78	86	98	114	126
42	48.4	62	77	85	97	113	125
43	47.8	61	76	84	96	111	123
44	47.2	60	75	83	95	110	122
45	46.6	59	74	82	94	109	120
46	46.1	59	73	81	93	107	119
47	45.5	58	72	80	91	106	118
48	45.0	57	71	79	90	105	116
49	44.5	57	70	78	89	104	115
50	44.0	56	70	78	88	103	114
51	43.5	55	69	77	88	102	113
52	43.0	55	68	76	87	101	111
53	42.6	54	68	75	86	100	110
54	42.1	54	67	74	85	99	109
55	41.7	53	66	74	84	98	108
56	41.3	53	65	73	83	97	107
57	40.9	52	65	72	82	96	106
58	40.5	52	64	72	82	95	105
59	40.1	51	64	71	81	94	104

Appendix F

RUSLE Calculations

SWMP Commentary, Detailed Calculations

Note: These "Detailed Calculation" spreadsheets relate only to high erosion hazard lands as identified in figure 4.6 or where the designer chooses to use the RUSLE to size sediment basins. The "Standard Calculation" spreadsheets should be used on low erosion hazard lands as identified by figure 4.6 and where the designer chooses not to run the RUSLE in calculations.

1. Site Data Sheet

Site Name: **Bellvista 2**

Site Location: **Caloundra**

Precinct: **Area 1**

Description of Site:

Site area	Sub-catchments						Remarks
	Area 1						
Total catchment area (ha)	16						
Disturbed catchment area (ha)	16						

Soil analysis (enter sediment type if known, or laboratory particle size data)

Sediment Type (C, F or D) if known:	D	D					
% sand (fraction 0.02 to 2.00 mm)							
% silt (fraction 0.002 to 0.02 mm)							
% clay (fraction finer than 0.002 mm)							
Dispersion percentage							
% of whole soil dispersible							
Soil Texture Group	D	D					

Rainfall data

Design rainfall depth (days)	5						
Design rainfall depth (percentile)	85						
x-day, y-percentile rainfall event	57.7						
Rainfall R-factor (if known)	5540						
IFD: 2-year, 6-hour storm (if known)	15.7						

RUSLE Factors

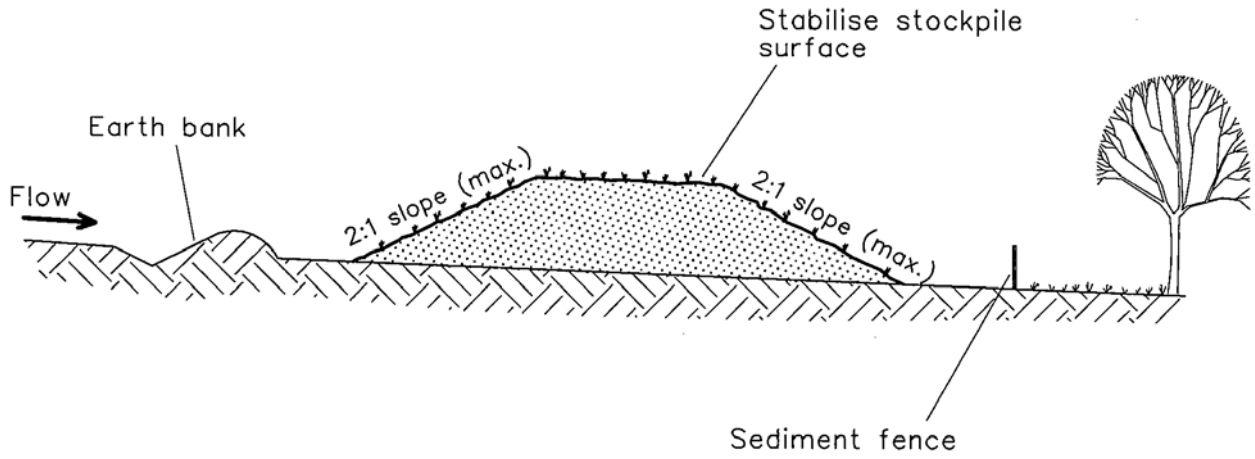
Rainfall erosivity (*R*-factor)	5540						Auto-filled from above
Soil erodibility (*K*-factor)	0.05						
Slope length (m)	80						
Slope gradient (%)	1						
Length/gradient (*LS*-factor)	0.19						
Erosion control practice (*P*-factor)	1.3		1.3	1.3	1.3	1.3	
Ground cover (*C*-factor)	1		1	1	1	1	

Calculations

Soil loss (t/ha/yr)	69						
Soil Loss Class	1						See Section 4.3 and Table 4-2.
Soil loss (m^3/ha/yr)	53						
Sediment basin storage volume, m^3	145						See Sections 6.5.3 and 6.6.3

Appendix G

Standard Drawings

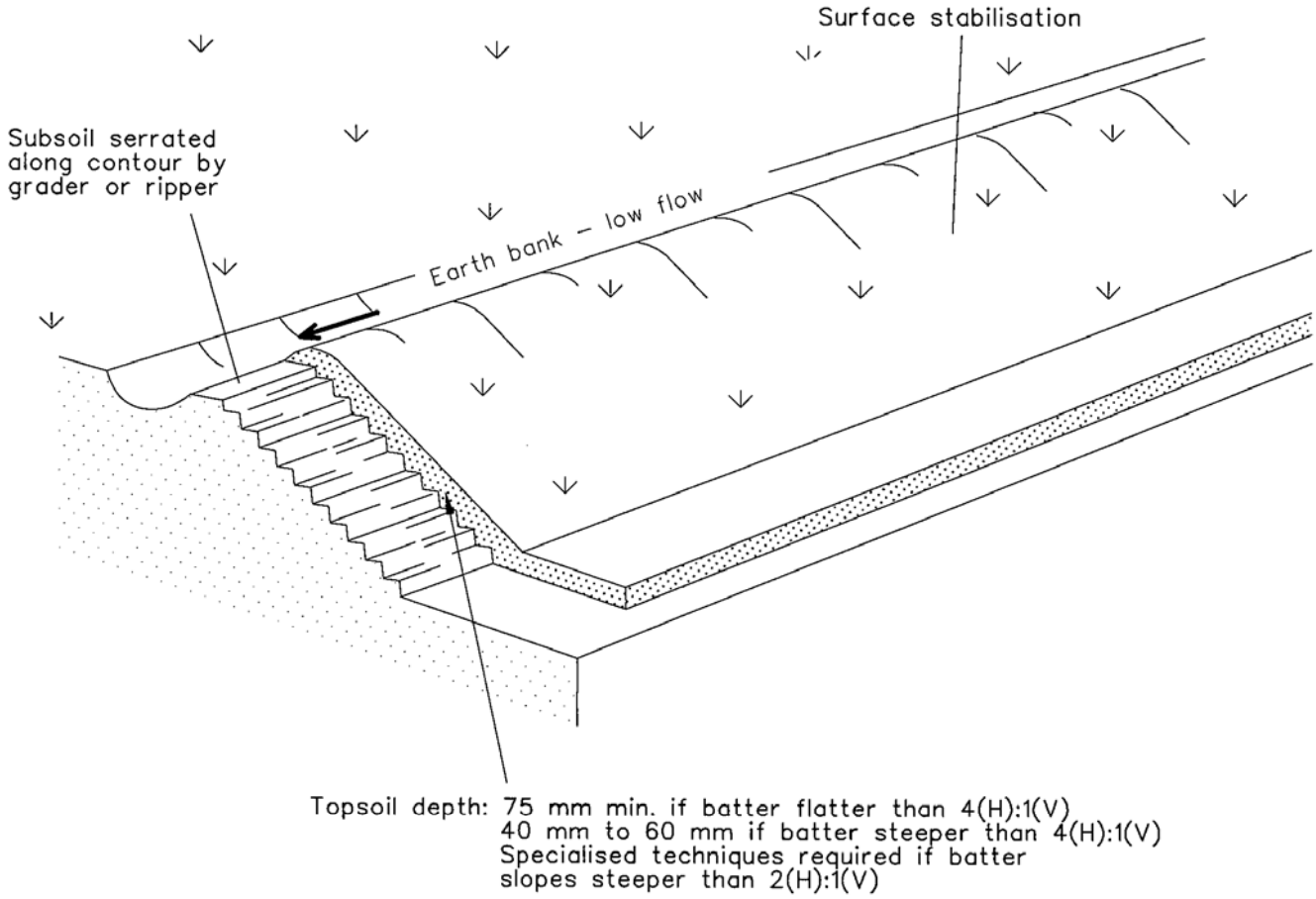


Construction Notes

1. Place stockpiles more than 2 (preferably 5) metres from existing vegetation, concentrated water flow, roads and hazard areas.
2. Construct on the contour as low, flat, elongated mounds.
3. Where there is sufficient area, topsoil stockpiles shall be less than 2 metres in height.
4. Where they are to be in place for more than 10 days, stabilise following the approved ESCP or SWMP to reduce the C-factor to less than 0.10.
5. Construct earth banks (Standard Drawing 5-5) on the upslope side to divert water around stockpiles and sediment fences (Standard Drawing 6-8) 1 to 2 metres downslope.

STOCKPILES

SD 4-1

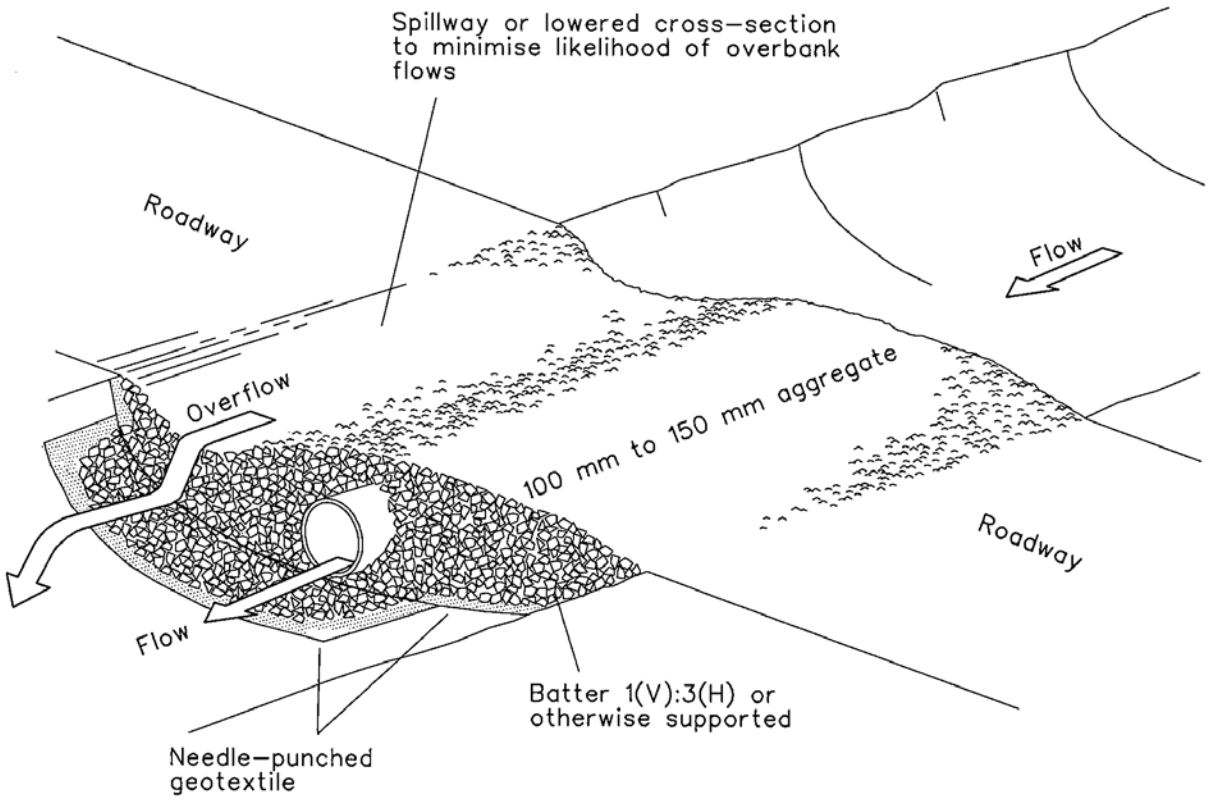


Construction Notes

1. Scarify the ground surface along the line of the contour to a depth of 50 mm to 100 mm to break up any hardsetting surfaces and to provide a good bond between the respread material and subsoil.
2. Add soil ameliorants as required by the ESCP or SWMP.
3. Rip to a depth of 300 mm if compacted layers occur.
4. Where possible, replace topsoil to a depth of 40 to 60 mm on lands where the slope exceeds 4(H):1(V) and to at least 75 mm on lower gradients.

REPLACING TOPSOIL

SD 4-2

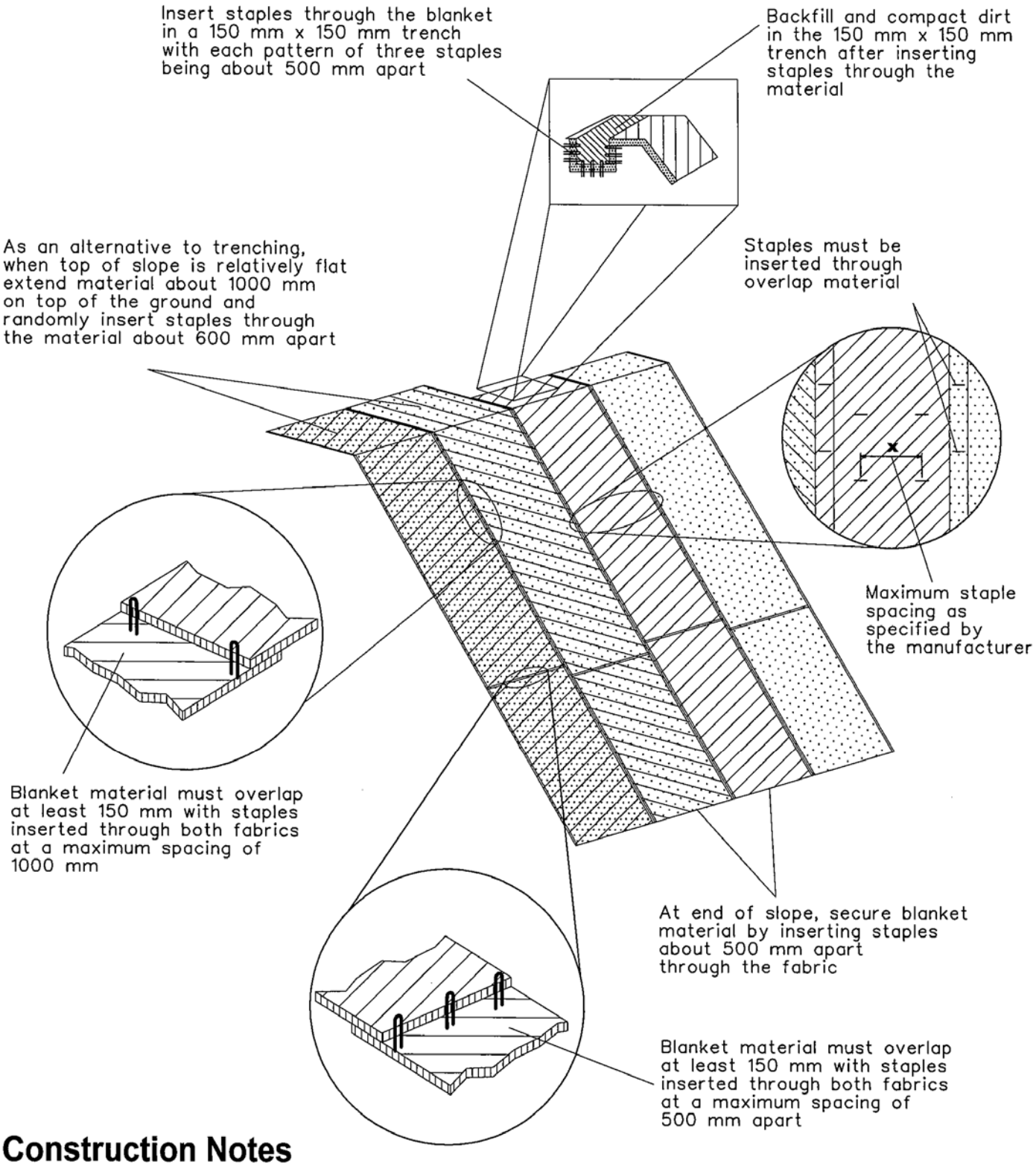


Construction Notes

1. Prohibit all traffic until the access way is constructed.
2. Strip any topsoil and place a needle-punched textile over the base of the crossing.
3. Place clean, rigid, non polluting aggregate or gravel in the 100 mm to 150 mm size class over the fabric to a minimum depth of 200 mm.
4. Provide a 3-metre wide carriageway with sufficient length of culvert pipe to allow less than a 3(H): 1 (V) slope on side batters.
5. Install a lower section to act as an emergency spillway in greater than design storm events.
6. Ensure that culvert outlets extend beyond the toe of fill embankments.

TEMPORARY WATERWAY CROSSING

SD 5-1

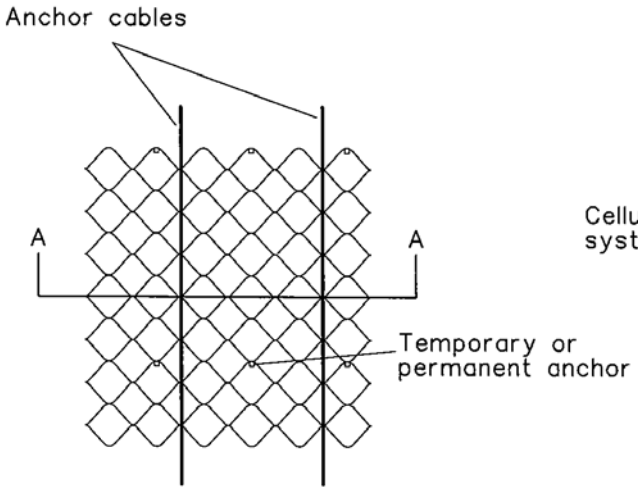


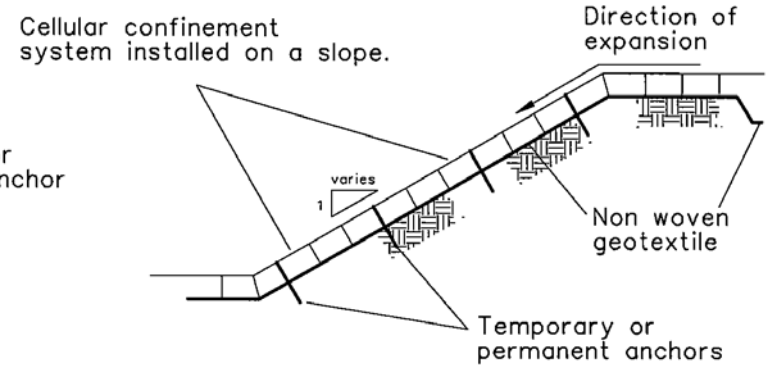
Construction Notes

1. Remove any rocks, clods, sticks or grass from the ground surface before laying the matting.
2. Spread topsoil to at least 75 mm depth.
3. Where appropriate, complete fertilising and seeding on a properly prepared seedbed (Standard Drawing 7-1) before laying the matting.
4. Ensure the fabric can be continuously in contact with the soil by grading the surface carefully first.
5. Lay the matting in "shingle-fashion" with the ends of each upstream roll overlapping the next roll downslope.
6. Ensure sufficient staples are used to maintain a good contact between the soil and the matting.

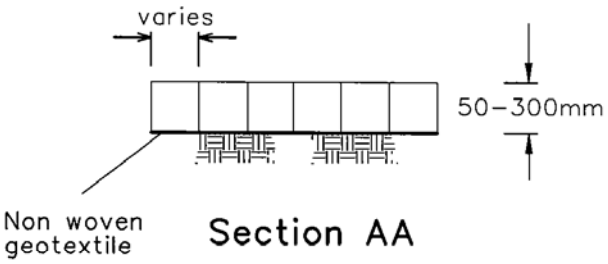
RECP : SHEET FLOW

SD 5-2

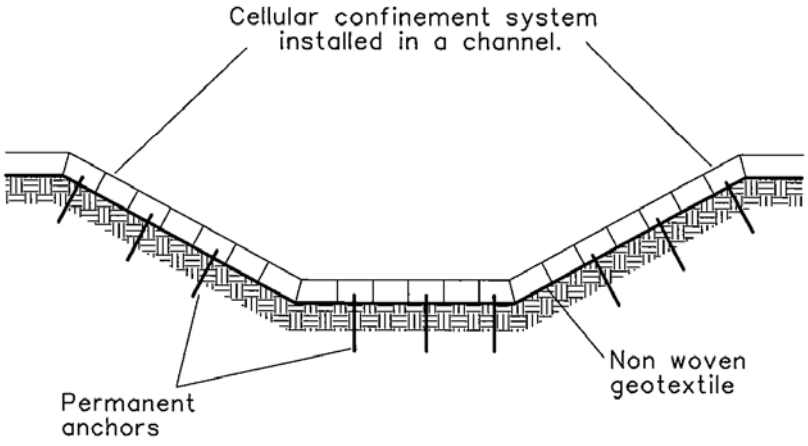




Slope Protection System



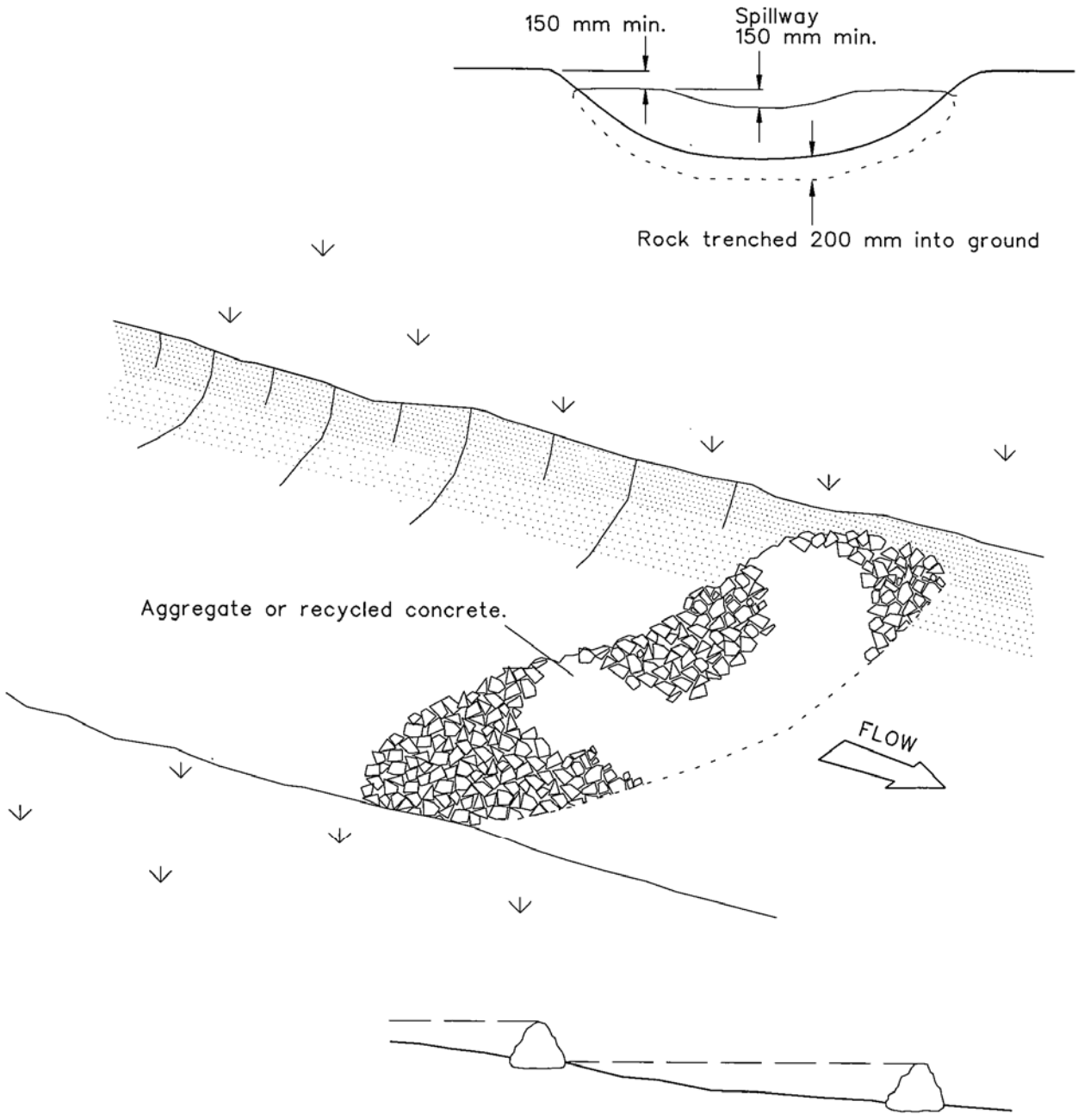
Section AA



Channel Protection System

Construction Notes

1. Undertake design only with the help of a suitably qualified geotechnical engineer.
2. Anchor systems on steep slopes to prevent sliding or movement under gravitational forces. This might include the use of high tensile, low creep cables made of polyester (not polypropylene), rope or steel wire.
3. Place thick, non woven geotextiles under the cellular confinement system to allow for lateral drainage.
4. Fill the cells with soil, rock or concrete depending on the application.



Spacing of check dams along centreline and scour protection below each check dam to be specified on SWMP/ESCP

Construction Notes

1. Check dams can be built with various materials, including rocks, logs, sandbags and straw bales. The maintenance program should ensure their integrity is retained, especially where constructed with straw bales. In the case of bales, this might require their replacement each two to four months.

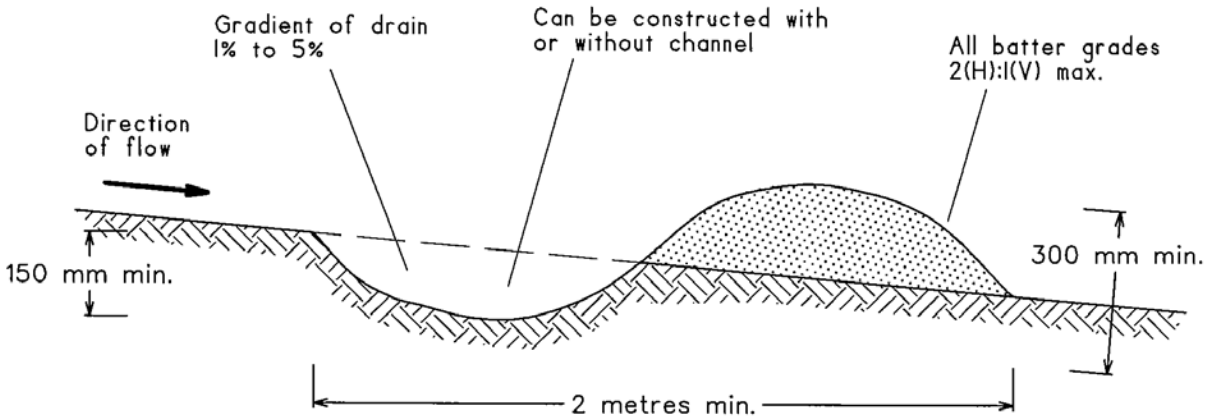
2. Trench the check dam 200 mm into the ground across its whole width. Where rock is used, fill the trenches to at least 100 mm above the ground surface to reduce the risk of undercutting.

3. Normally, their maximum height should not exceed 600 mm above the gully floor. The centre should act as a spillway, being at least 150 mm lower than the outer edges.

4. Space the dams so the toe of the upstream dam is level with the spillway of the next downstream dam.

ROCK CHECK DAM

SD 5-4



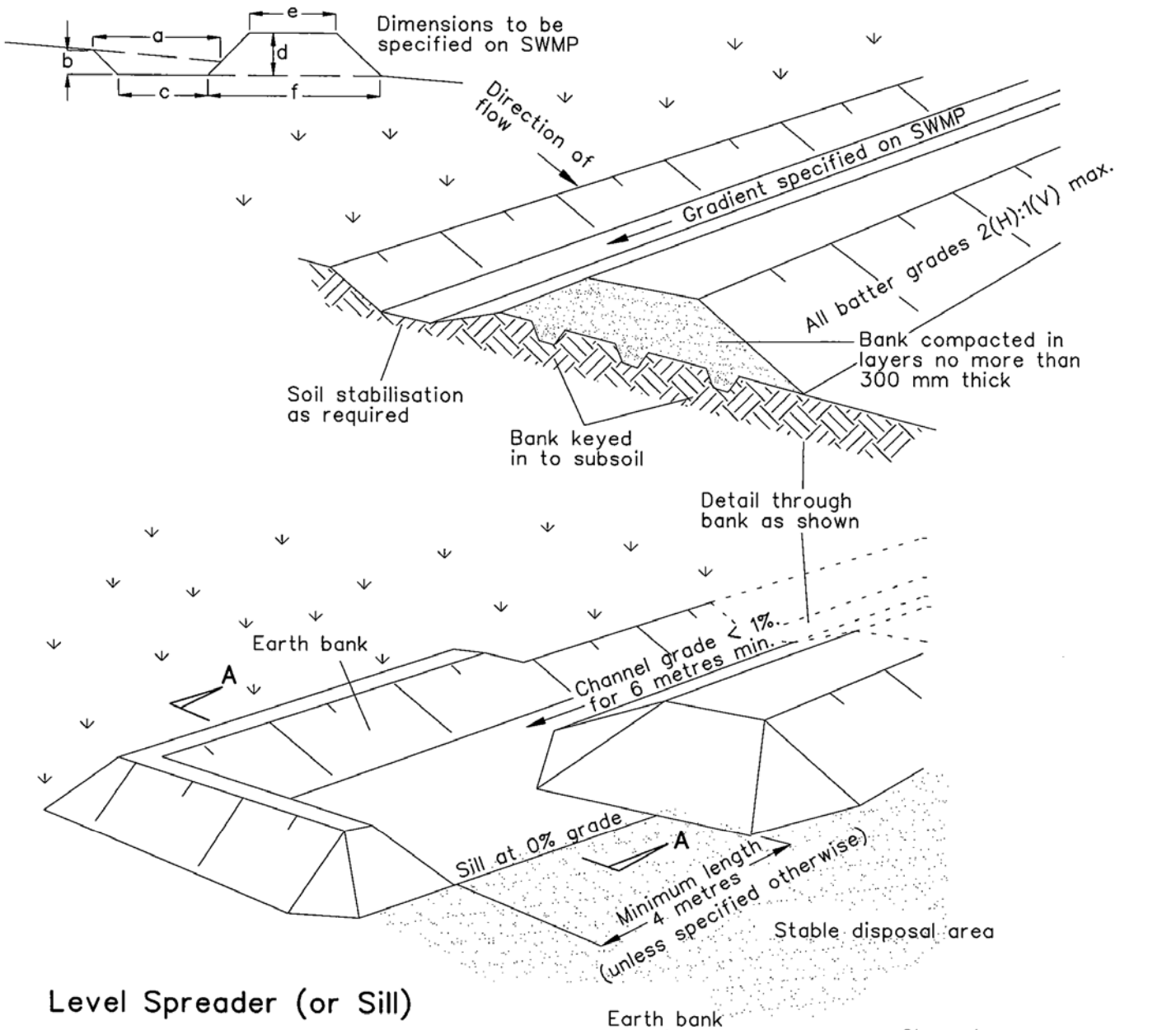
NOTE: Only to be used as temporary bank where maximum upslope length is 80 metres.

Construction Notes

1. Build with gradients between 1 percent and 5 percent.
2. Avoid removing trees and shrubs if possible - work around them.
3. Ensure the structures are free of projections or other irregularities that could impede water flow.
4. Build the drains with circular, parabolic or trapezoidal cross sections, not V shaped.
5. Ensure the banks are properly compacted to prevent failure.
6. Complete permanent or temporary stabilisation within 10 days of construction.

EARTH BANK (LOW FLOW)

SD 5-5

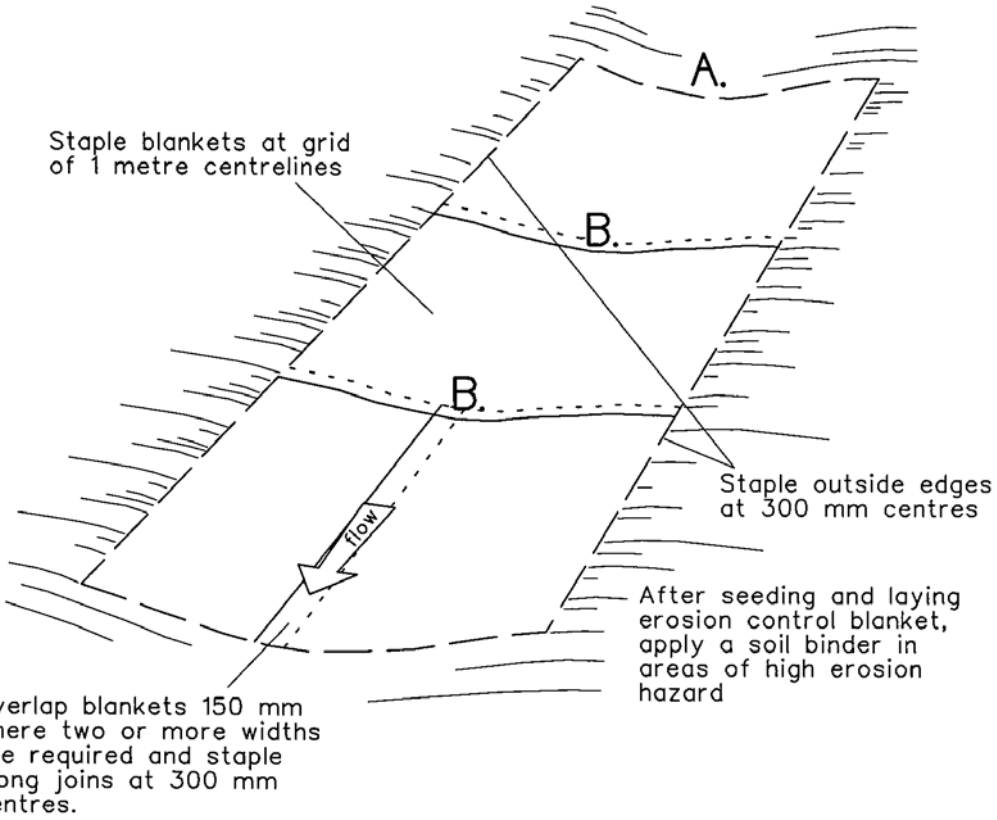


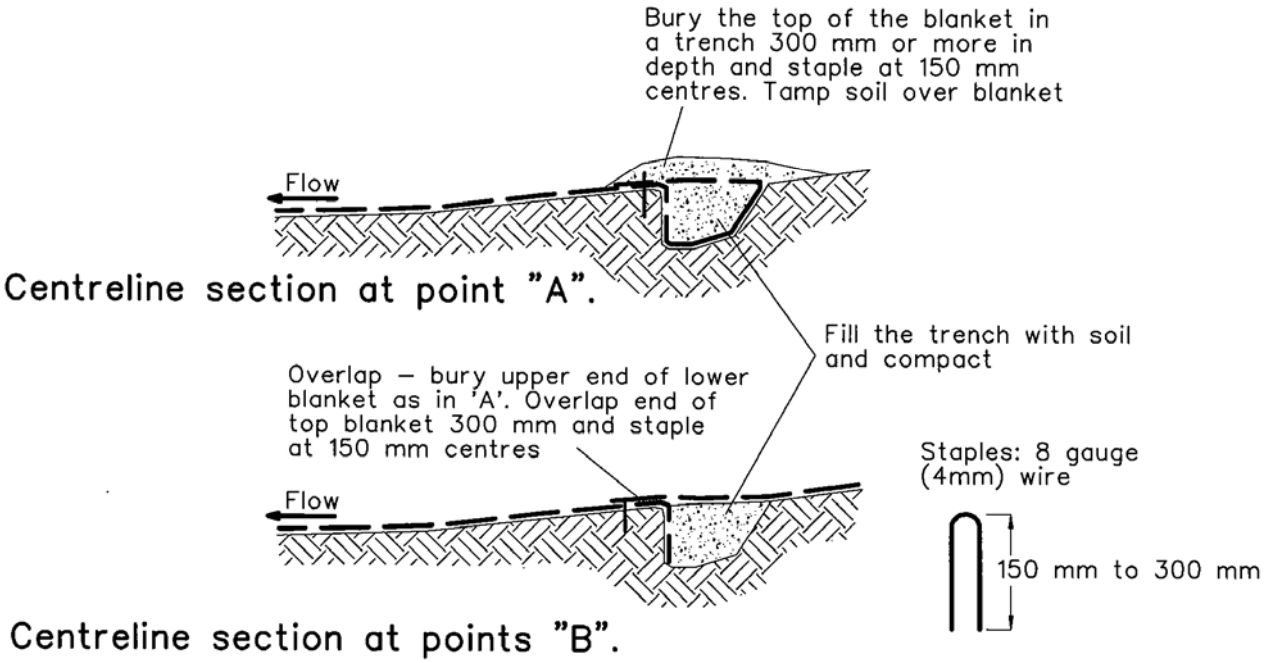
Construction Notes

1. Construct at the gradient specified on the ESCP or SWMP, normally between 1 and 5 percent
2. Avoid removing trees and shrubs if possible - work around them.
3. Ensure the structures are free of projections or other irregularities that could impede water flow.
4. Build the drains with circular, parabolic or trapezoidal cross sections, not V-shaped, at the dimensions shown on the SWMP.
5. Ensure the banks are properly compacted to prevent failure.
6. Complete permanent or temporary stabilisation within 10 days of construction following Table 5.2 in Landcom (2004).
7. Where discharging to erodible lands, ensure they outlet through a properly constructed level spreader.
8. Construct the level spreader at the gradient specified on the ESCP or SWMP, normally less than 1 percent or level.
9. Where possible, ensure they discharge waters onto either stabilised or undisturbed disposal sites within the same subcatchment area from which the water originated. Approval might be required to discharge into other subcatchments.

EARTH BANK (HIGH FLOWS)

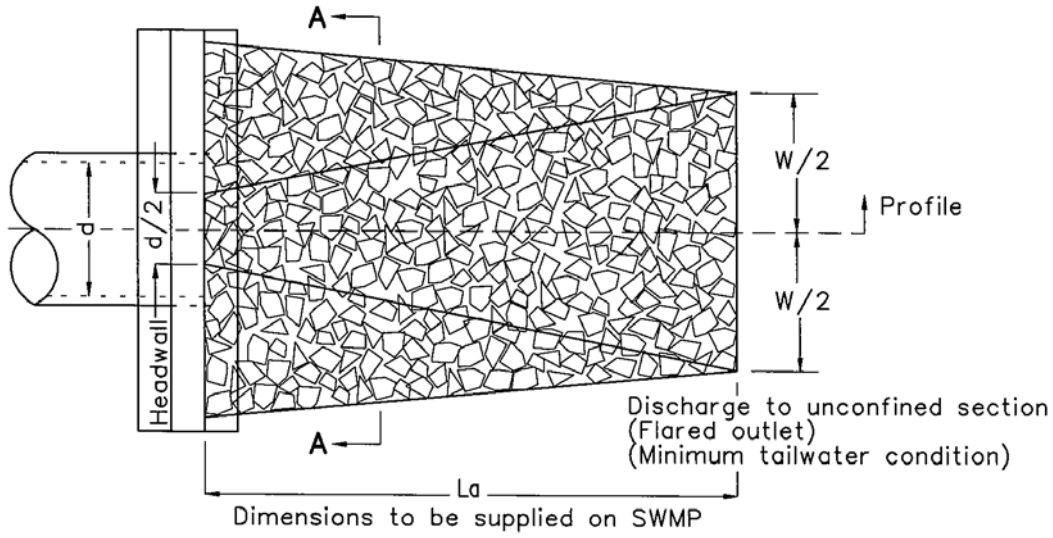
SD 5-6



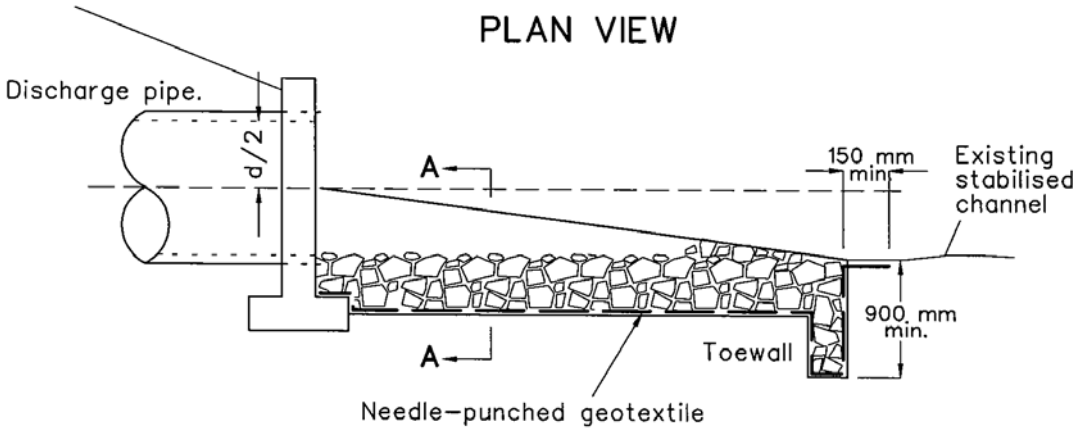


Construction Notes

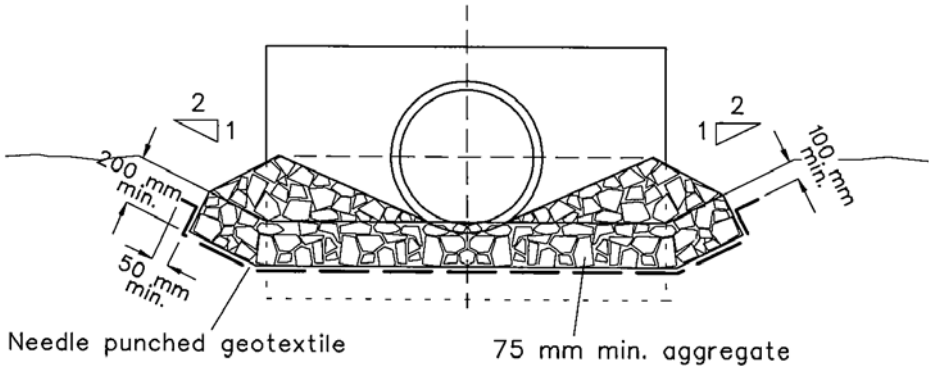
1. Remove any rocks, clods, sticks or grass from the surface before laying matting
2. Ensure that topsoil is at least 75 mm deep.
3. Complete fertilising and seeding before laying the matting.
4. Ensure fabric will be continuously in contact with the soil by grading the surface carefully first.
5. Lay the fabric in "shingle-fashion", with the end of each upstream roll overlapping those downstream. Ensure each roll is anchored properly at its upslope end (Standard Drawing 5-7b).
6. Ensure that the full width of flow in the channel is covered by the matting up to the design storm event, usually in the 10-year ARI time of concentration storm event.
7. Divert water from the structure until vegetation is stabilised properly.



PLAN VIEW



PLAN VIEW

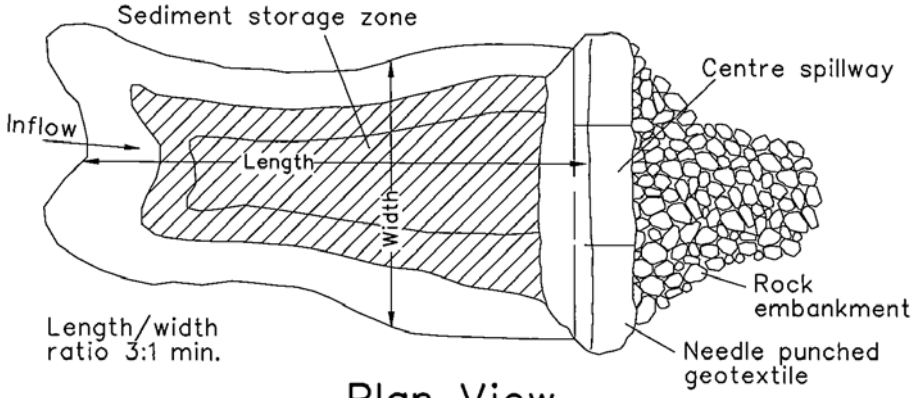


CROSS SECTION AA

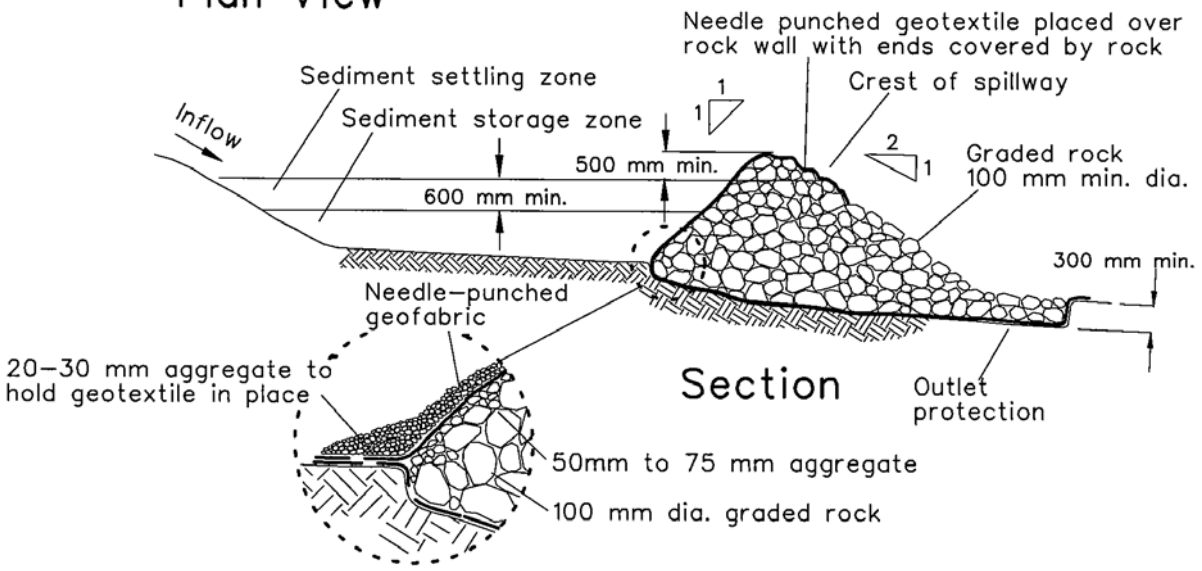
Construction Notes

1. Compact the subgrade fill to the density of the surrounding undisturbed material.
2. Prepare a smooth, even foundation for the structure that will ensure that the needle-punched geotextile does not sustain serious damage when covered with rock.
3. Should any minor damage to the geotextile occur, repair it before spreading any aggregate. For repairs, patch one piece of fabric over the damage, making sure that all joints and patches overlap more than 300 mm.
4. Lay rock following the drawing, according to Table 5.2 of Landcom (2004) and with a minimum diameter of 75 mm.
5. Ensure that any concrete or riprap used for the energy dissipater or the outlet protection conforms to the grading limits specified on the SWMP.

ENERGY DISSIPATER SD 5-8

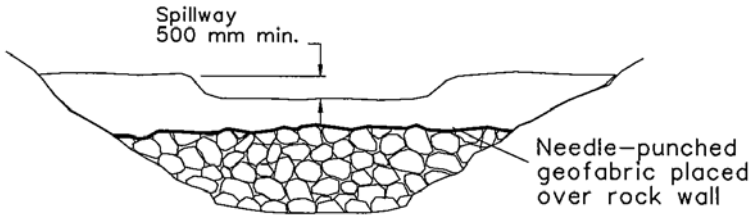


Plan View



Section

NOTE:
Spillway width and depth, wall crest width and downstream outlet protection measures to be specified on SWMP.



Downstream Elevation

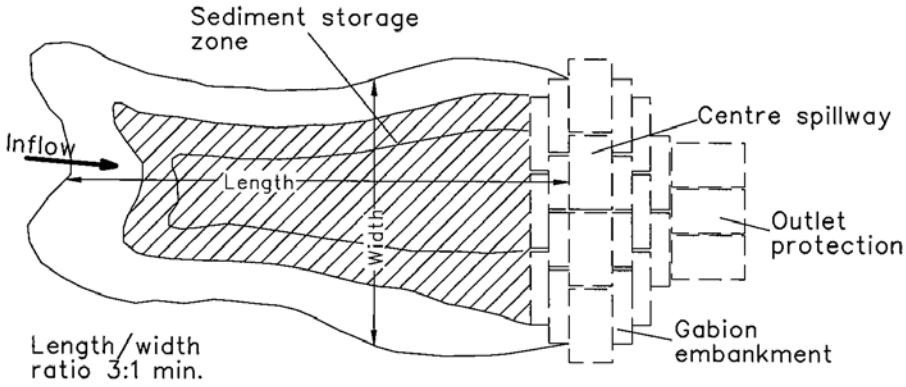
Construction Notes

1. Remove all vegetation and topsoil from under the dam wall and from within the storage area.
2. Excavate to 300 mm depth for base of the dam wall.
3. Line the excavation with a needle-punched geotextile allowing sufficient to line below the wall, and over the upstream rock and the spillway to 500 mm below the spillway exit on the downstream face.
4. Make up the wall profile and outlet protection with100 mm (min.) diameter graded rock. Spread a layer of 50 mm to 75 mm diameter aggregate over the upstream batter for a more even surface, and add 100 mm to 150 mm of 20 mm to 30 mm gravel over the 50 mm to 75 mm diameter aggregate.
5. Lay geotextile over the upstream batter and through the spillway, fixing in place with 100 mm rock.
6. Place a "Full of Sediment" marker to show when less than design capacity occurs and sediment removal is required.
7. Replace the upstream geotextile layer each time sediment is removed

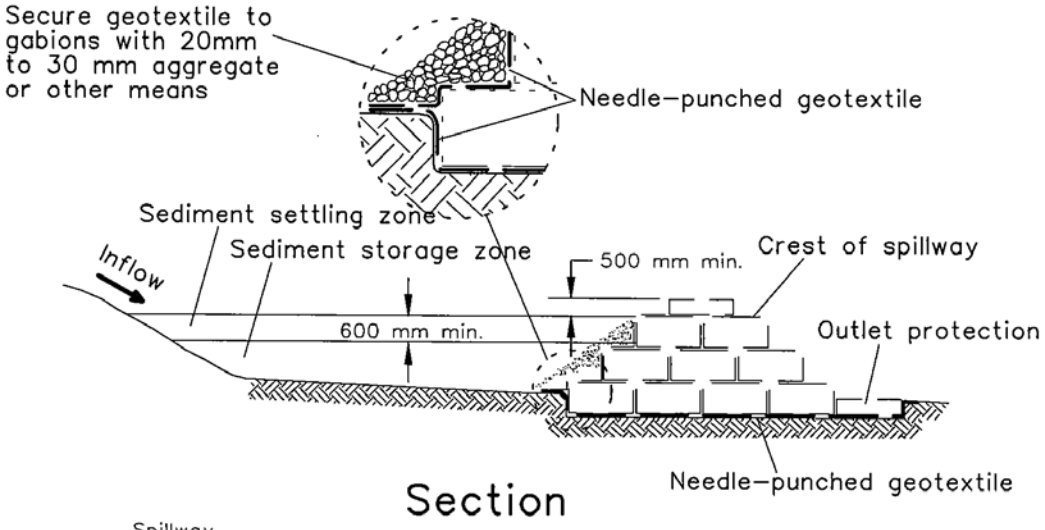
ROCK SEDIMENT BASIN

(APPLIES TO 'TYPE C' SOILS ONLY)

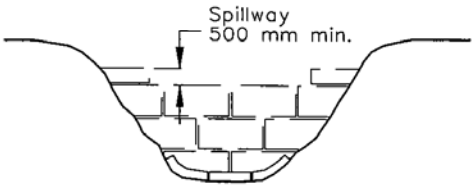
SD 6-1



Plan View



Section



NOTE: Spillway width and depth, wall crest width and downstream outlet protection measures to be specified on SWMP.

Downstream Elevation

Construction Notes

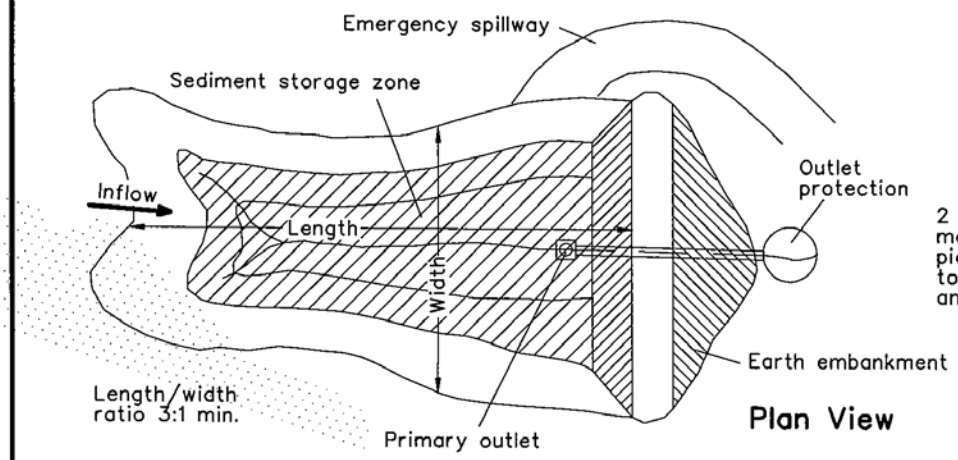
(Applies to Type C soils only)

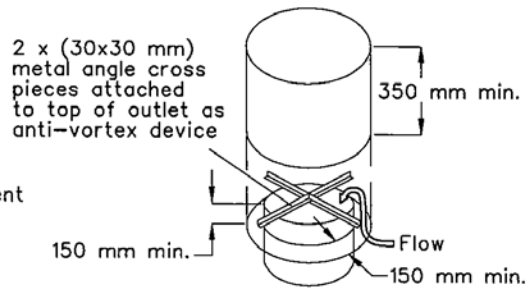
1. Remove all vegetation and topsoil from under the dam wall and from within the storage area.
2. Excavate to 300 mm depth for the base of the dam wall and form a level platform for the gabions.
3. Line the excavation with a needle-punched geotextile allowing sufficient to line below the wall, and over the upstream gabions and spillway to 500 mm below the spillway exit on the downstream face.
4. Make up the wall profile and outlet protection with gabion units filled with graded rock as specified on the SWMP.
5. Construct a spillway 500 mm below the crest of the dam and for the width specified on the SWMP.
6. Lap the geotextile over the upstream face and through the spillway and fix it in place with the top row of gabions.
7. Cover the upstream face of the wall with 20 mm to 30 mm gravel and geotextile (Standard Drawing 6-2b)
8. Place a "Full of Sediment' marker to show when less than design capacity occurs and sediment removal is required.
9. Replace the upstream geotextile layer when sediment is removed if a dry basin is required.

GABION SEDIMENT BASIN

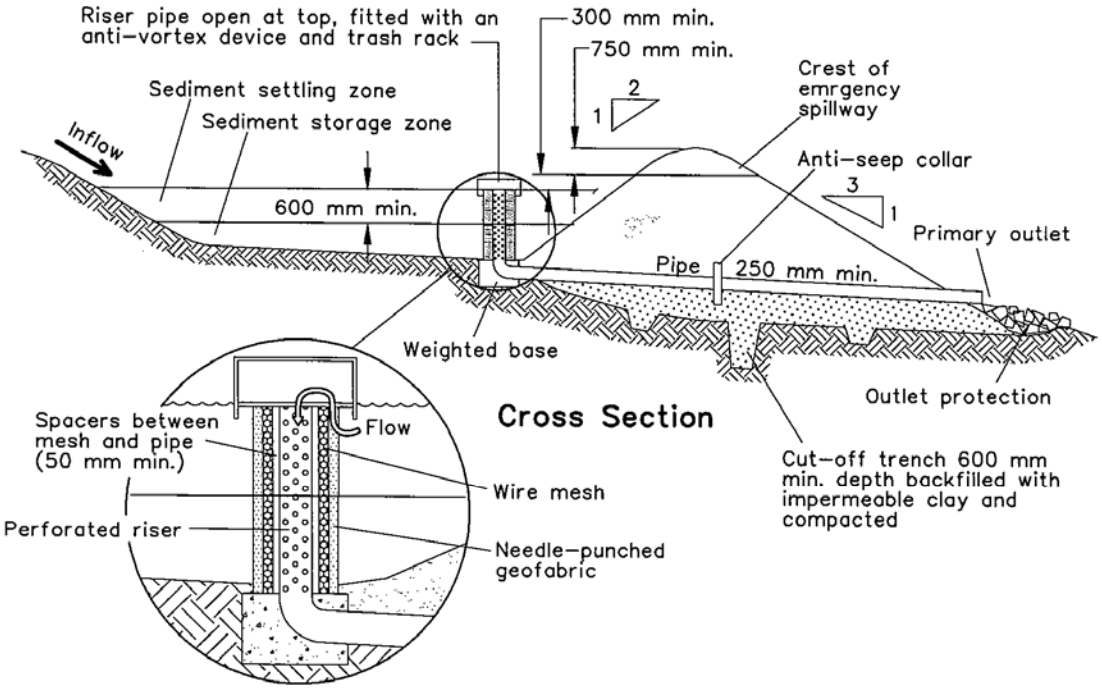
(APPLIES TO 'TYPE C' SOILS ONLY)

SD 6-2





Trash Rack/
Anti-vortex Device



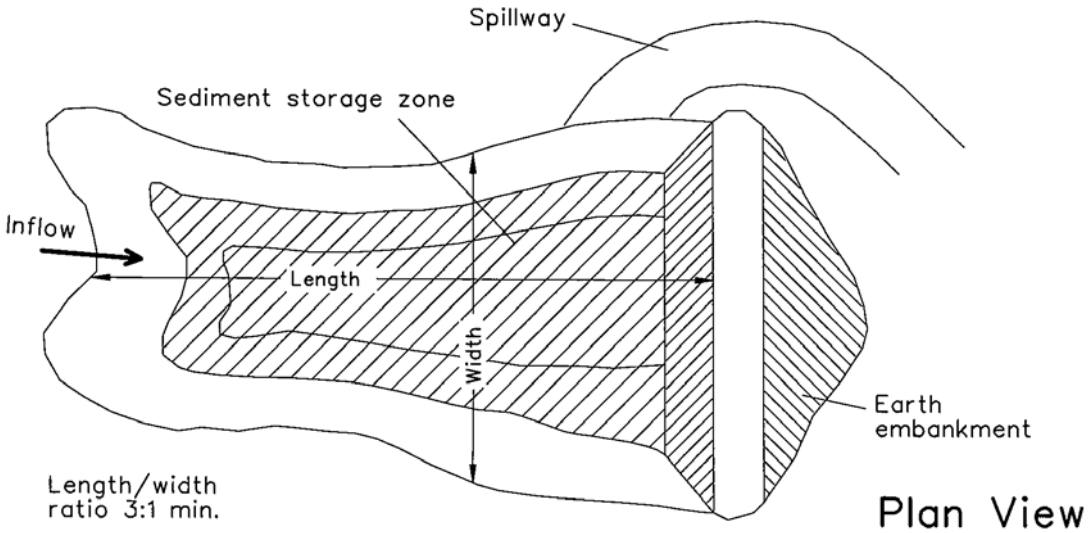
Construction Notes

1. Remove all vegetation and topsoil from under the dam wall and from within the storage area.
2. Form a cut off trench under the centreline of the embankment 600 mm deep and 1,200 mm wide, extending to a point on the watercourse wall above the riser sill level.
3. Maintain the trench free of water and recompact the materials with equipment as specified In the SWMP to 95 per cent Standard Proctor Density.
4. Select fill according to the SWMP that is free from roots, wood, rock, large stone or foreign material.
5. Prepare the site under the embankment by ripping to at least 100 mm to help bond the compacted fill to the existing substrate.
6. Spread the fill in 100 mm to 150 mm layers and compact it at optimum moisture content following the SWMP.
7. Install the pipe outlet with seepage collars as specified in the SWMP and Standard Drawing 6-3b.
8. Form batter grades at 2(H):1(V) upstream and 3(H):1(V) downstream or as specified in the SWMP

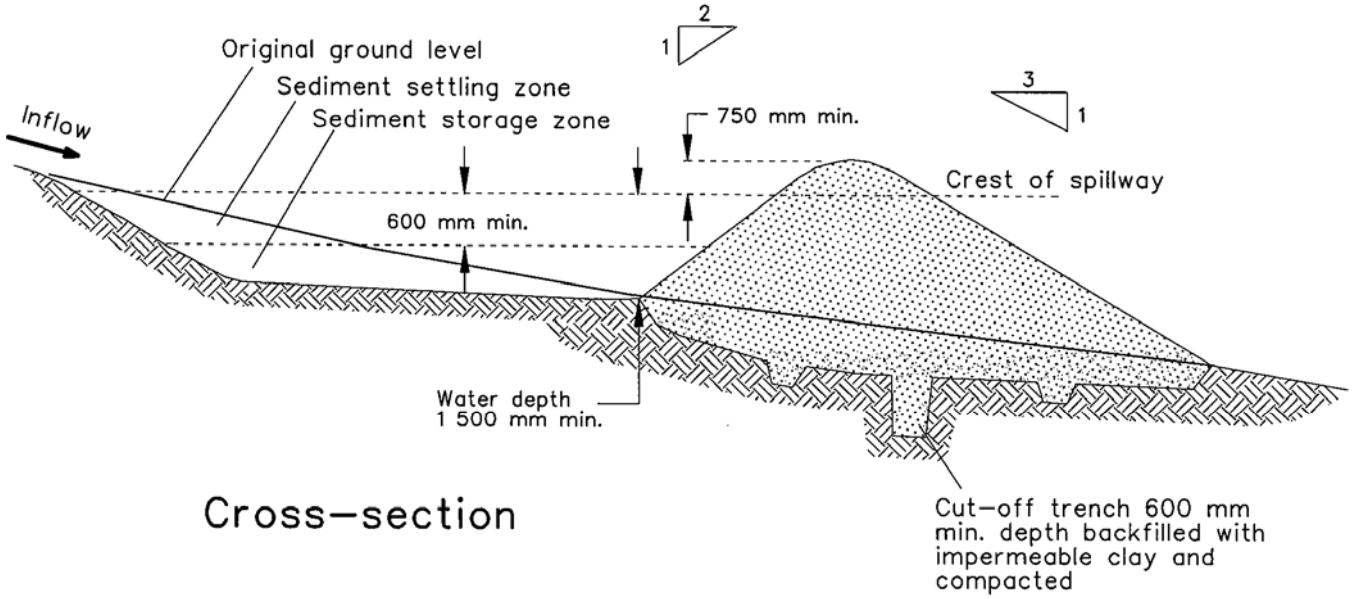
EARTH BASIN - DRY

(APPLIES TO 'TYPE C' SOILS ONLY)

SD 6-3



Plan View



Cross–section

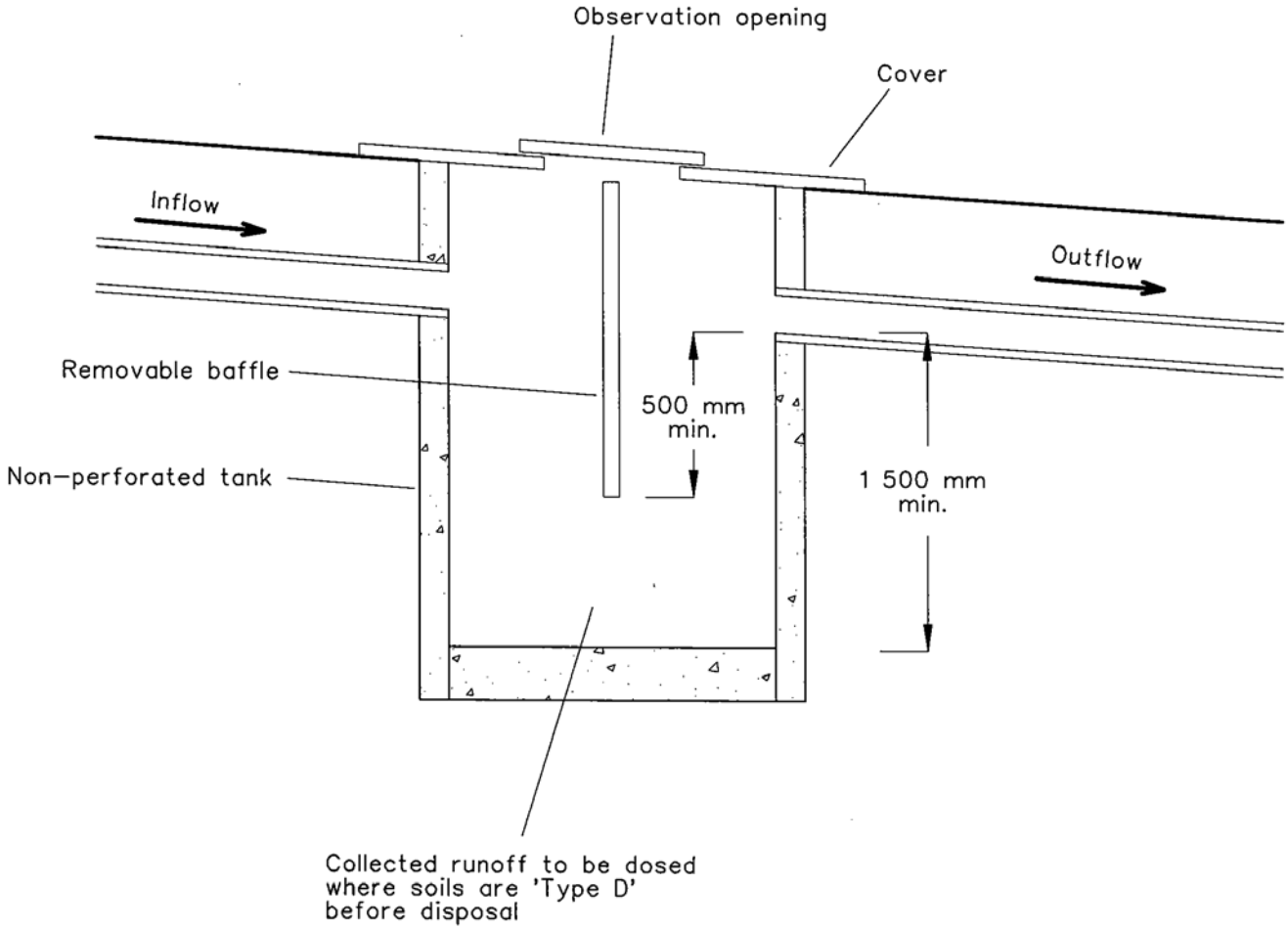
Construction Notes

1. Remove all vegetation and topsoil from under the dam wall and from within the storage area.
2. Construct a cut-off trench 500 mm deep and 1,200 mm wide along the centreline of the embankment extending to a point on the gully wall level with the riser crest.
3. Maintain the trench free of water and recompact the materials with equipment as specified in the SWMP to 95 per cent Standard Proctor Density.
4. Select fill following the SWMP that is free of roots, wood, rock, large stone or foreign material.
5. Prepare the site under the embankment by ripping to at least 100 mm to help bond compacted fill to the existing substrate.
6. Spread the fill in 100 mm to 150 mm layers and compact it at optimum moisture content following the SWMP.
7. Construct the emergency spillway.
8. Rehabilitate the structure following the SWMP.

EARTH BASIN - WET

(APPLIES TO 'TYPE D' AND 'TYPE F' SOILS ONLY)

SD 6-4

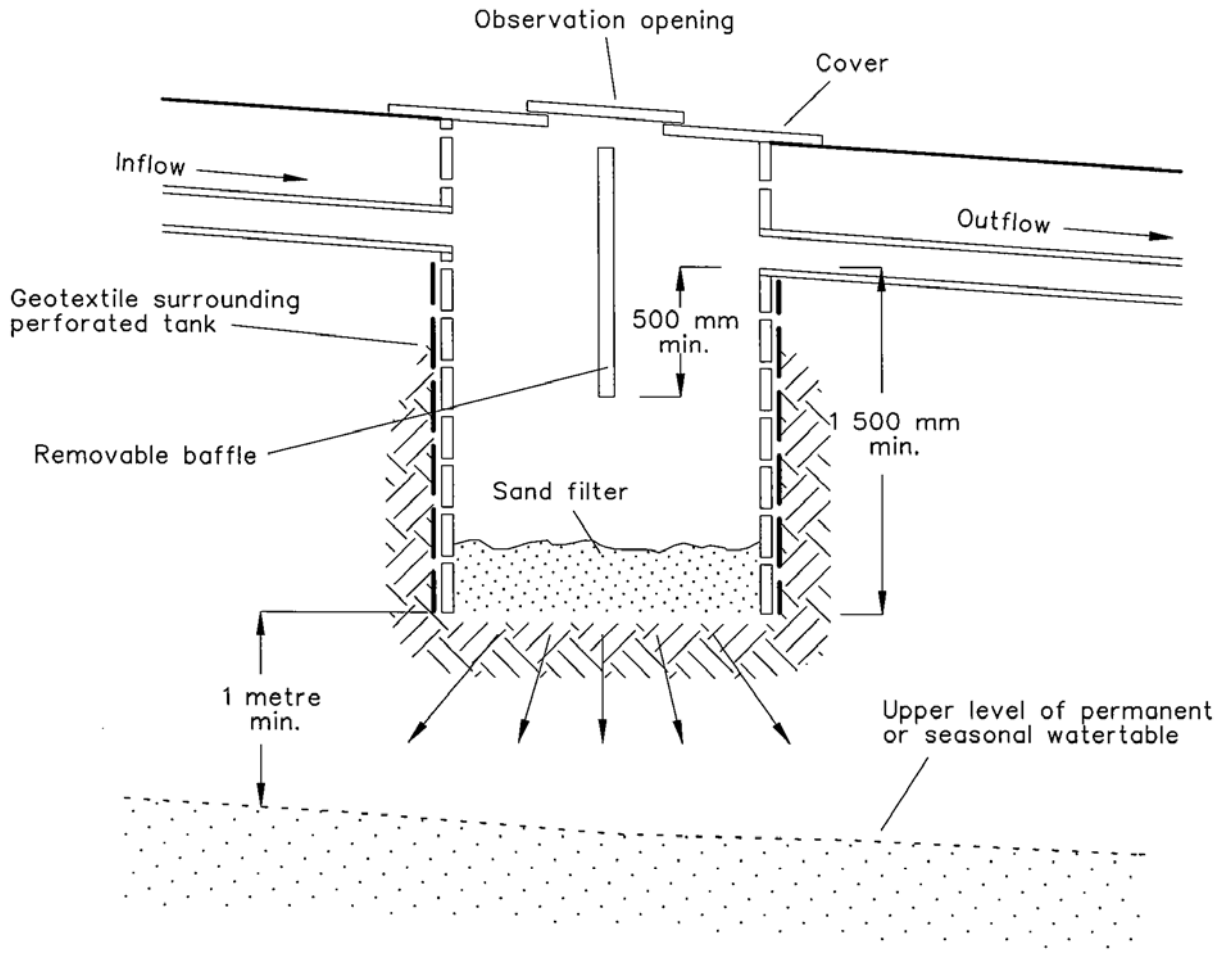


Construction Notes

1. Join the inlet to the stormwater, taking any suitable steps to remove bulky or coarse material before it can enter the tank.
2. Connect the outlet to a safe disposal area following the SWMP.
3. Install a removable baffle, central to the inflow/outflow and normal to the direction of flow, ensuring that it reaches 500 mm below the invert of the outlet pipe.
4. Install a cover over the pit with an observation port and access cover.

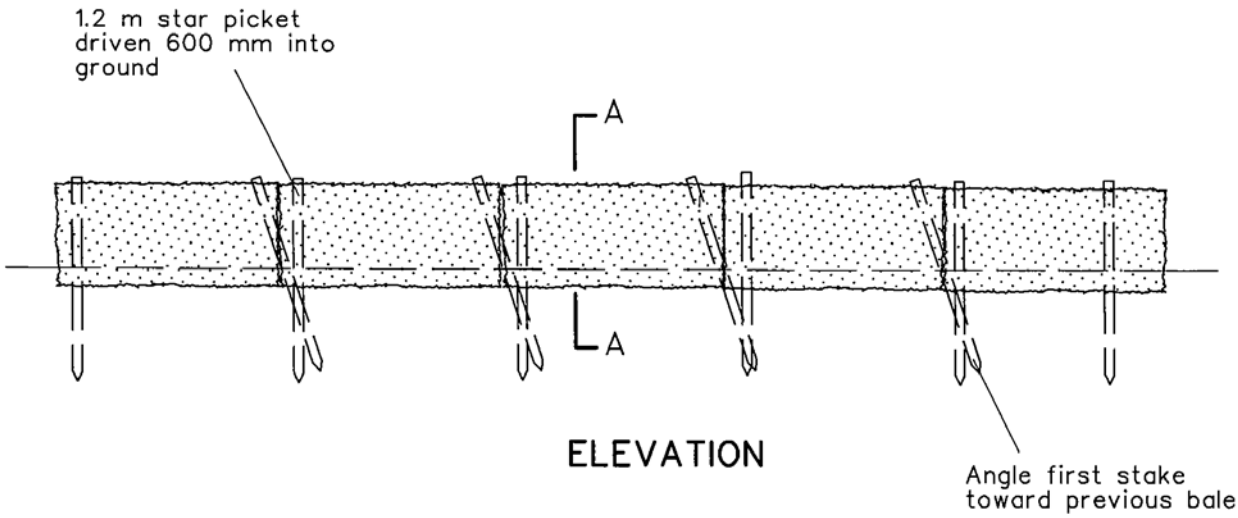
LINED TANK

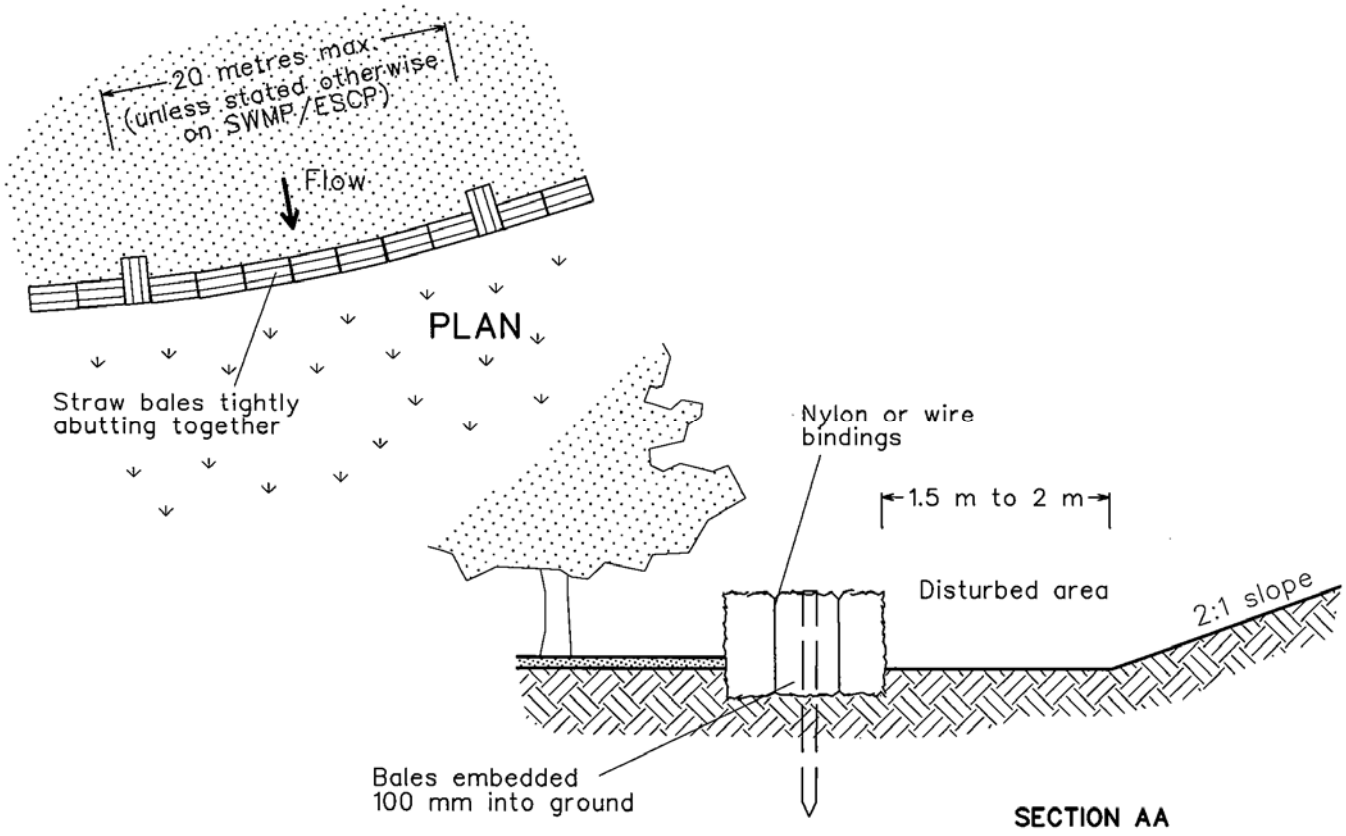
SD 6-5



Construction Notes

1. Join the inlet to the polluted supply taking any suitable step to remove bulky material before it can enter the sump.
2. Connect the outlet to a safe disposal area following the ESCP/SWMP.
3. Place a geotextile liner on the outside of the pit.
4. Install a removable baffle, central to the inflow/outflow and normal to the direction of flow, ensuring that it reaches 500 mm below the invert of the outlet pipe.
5. Install a cover over the pit with an observation port and access cover.



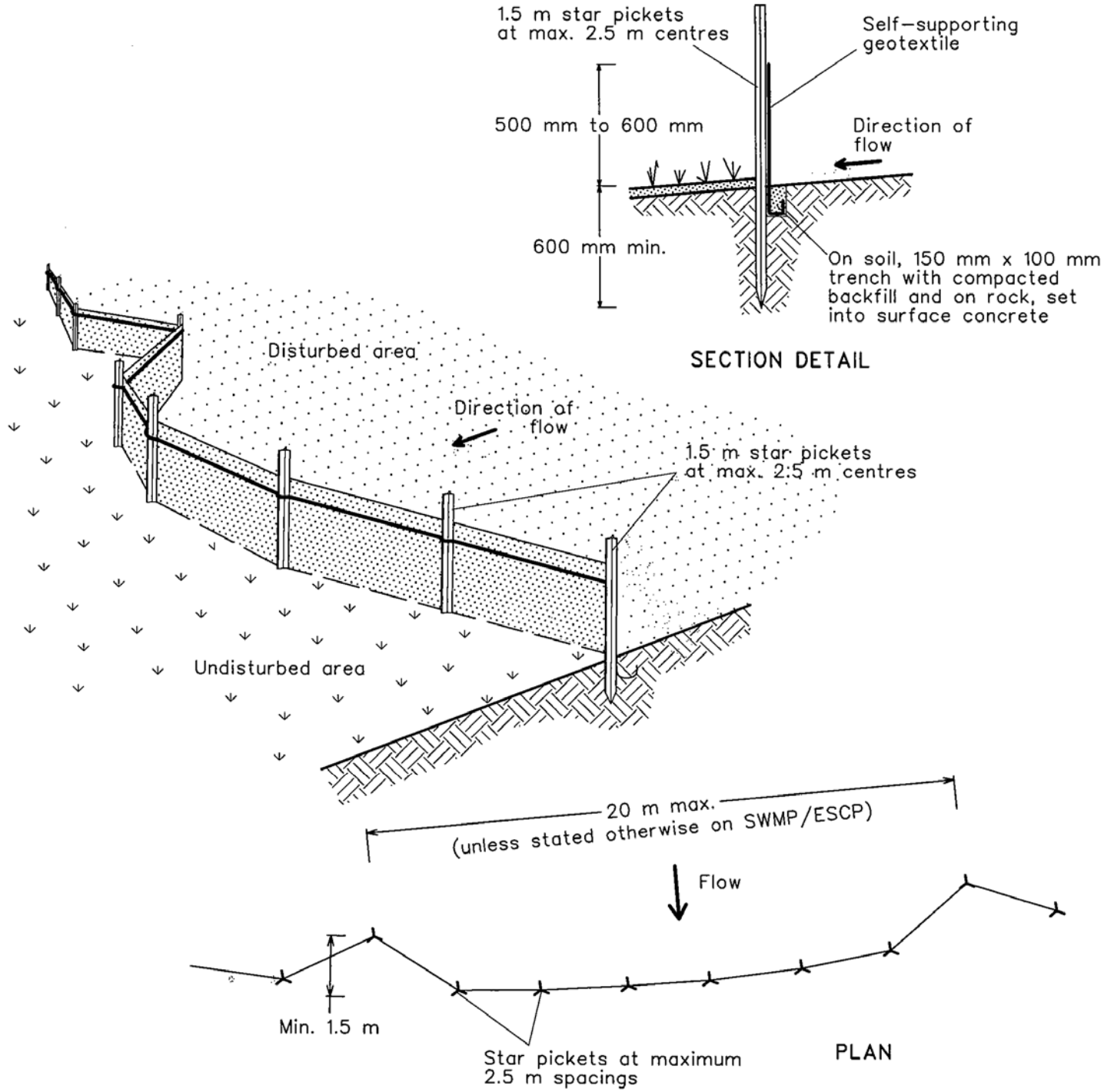


Construction Notes

1. Construct the straw bale filter as close as possible to being parallel to the contours of the site.
2. Place bales lengthwise in a row with ends tightly abutting. Use straw to fill any gaps between bales. Straws are to be placed parallel to ground.
3. Ensure that the maximum height of the filter is one bale.
4. Embed each bale in the ground 75 mm to 100 mm and anchor with two 1.2 metre star pickets or stakes. Angle the first star picket or stake in each bale towards the previously laid bale. Drive them 600 mm into the ground and, if possible, flush with the top of the bales. Where star pickets are used and they protrude above the bales, ensure they are fitted with safety caps.
5. Where a straw bale filter is constructed downslope from a disturbed batter, ensure the bales are placed 1 to 2 metres downslope from the toe.
6. Establish a maintenance program that ensures the integrity of the bales is retained - they could require replacement each two to four months.

STRAW BALE FILTER

SD 6-7



Construction Notes

1. Construct sediment fences as close as possible to being parallel to the contours of the site, but with small returns as shown in the drawing to limit the catchment area of any one section. The catchment area should be small enough to limit water flow if concentrated at one point to 50 litres per second in the design storm event, usually the 10-year event.

2. Cut a 150-mm deep trench along the upslope line of the fence for the bottom of the fabric to be entrenched.

3. Drive 1.5 metre long star pickets into ground at 2.5 metre intervals (max) at the downslope edge of the trench. Ensure any star pickets are fitted with safety caps.

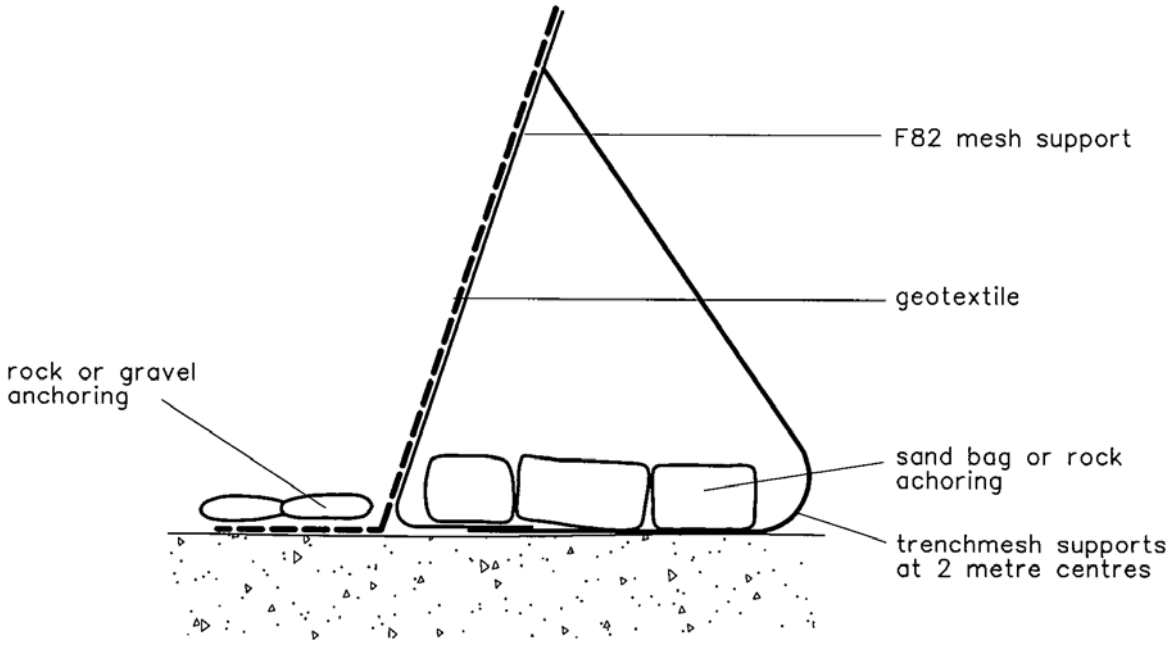
4. Fix self-supporting geotextile to the upslope side of the posts ensuring it goes to the base of the trench. Fix the geotextile with wire ties or as recommended by the manufacturer. Only use geotextile specifically produced for sediment fencing. The use of shade cloth for this purpose is not satisfactory.

5. Join sections of fabric at a support post with a 150-mm overlap.

6. Backfill the trench over the base of the fabric and compact it thoroughly over the geotextile.

SEDIMENT FENCE

SD 6-8

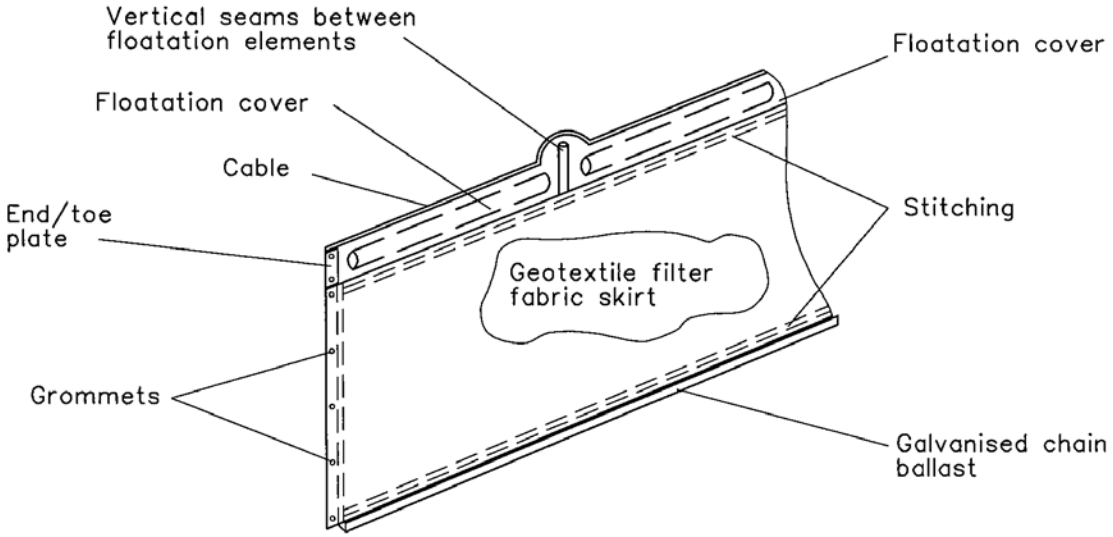


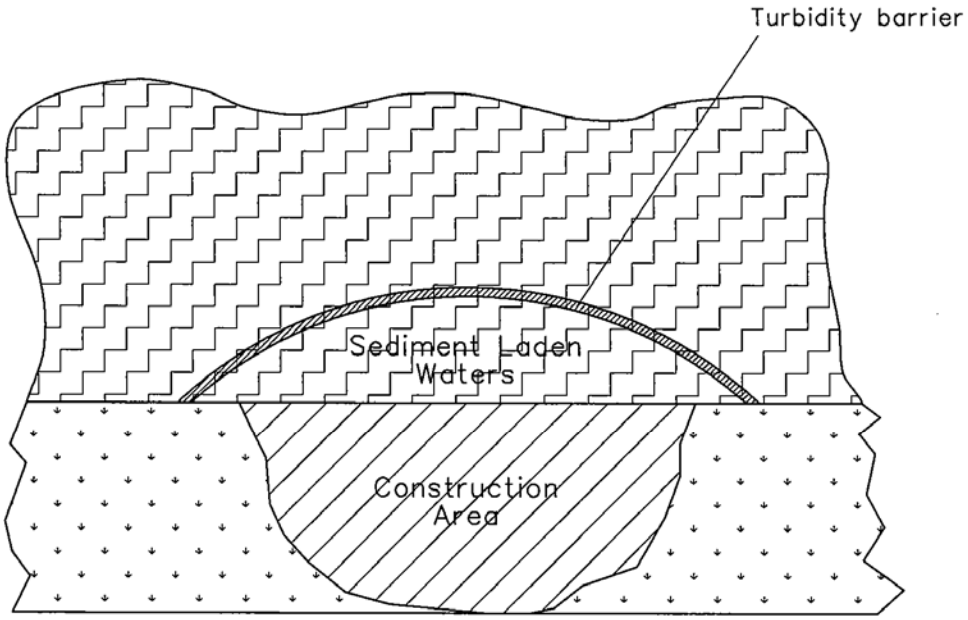
Construction Notes

1. Install this type of sediment fence when use of support posts is not desirable or not possible. Such conditions might apply, for example, where approval is granted from the appropriate authorities to place these fences in highly sensitive estuarine areas.

2. Use bent trench mesh to support the F82 welded mesh facing as shown on the drawing above. Attach the geotextile to the welded mesh facing using UV resistant cable ties.

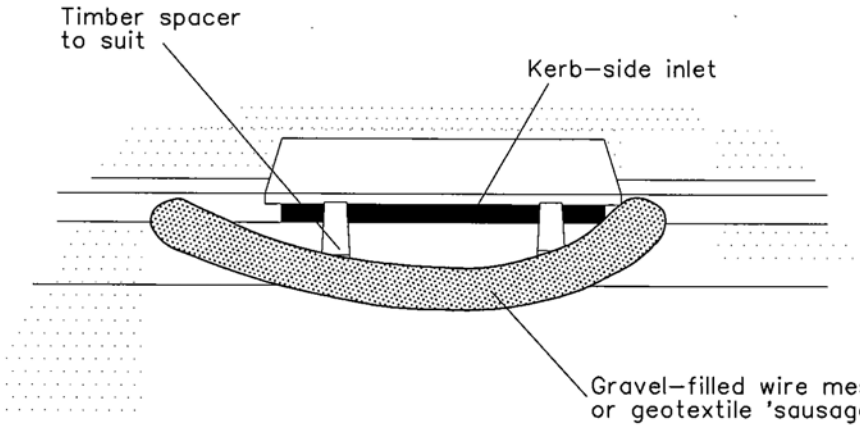
3. Stabilise the whole structure with sandbag or rock anchoring over the trench mesh and the leading edge of the geotextile. The anchoring should be sufficiently large to ensure stability of the structure in the design storm event, usually the 10 year event.

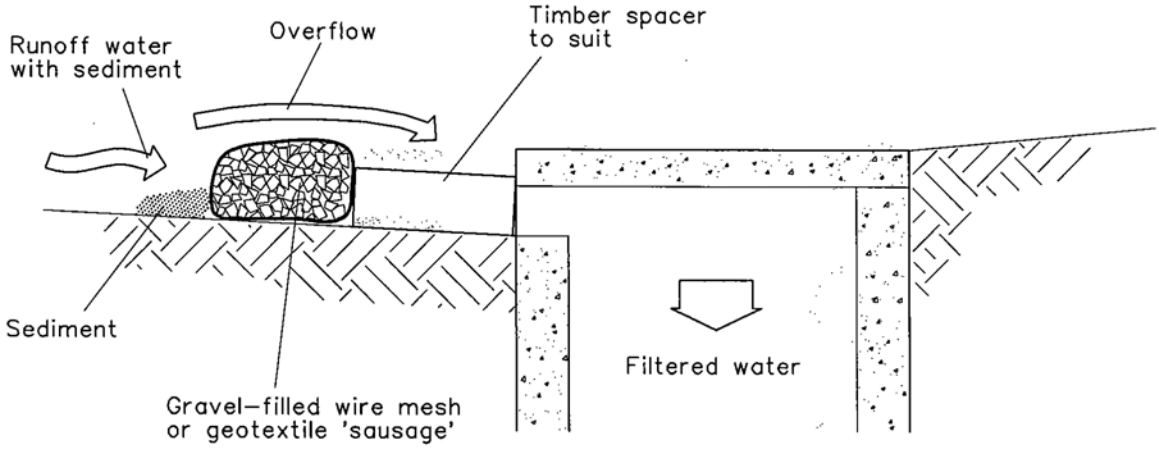




Construction Notes

1. Use turbidity barriers only where high flows are unlikely to remove accumulated sediment and/or move the curtain significantly.
2. Where the barrier is to remain in place for more than one month, ensure the floatation cover is a UV-resistant, durable material.
3. Use only closed cell foam or foam-filled PVC piping as floatation elements. Do not use unfilled pipes.
4. Use only woven or heat-set non woven geotextiles. Needle-punched, non woven geotextiles can become fouled with debris that fray and delaminate them as they move with the waves or currents.
5. Remove captured sediment before the barrier is decommissioned.
6. In tidal areas, ensure the barrier can rise and fall without being moved from its position.





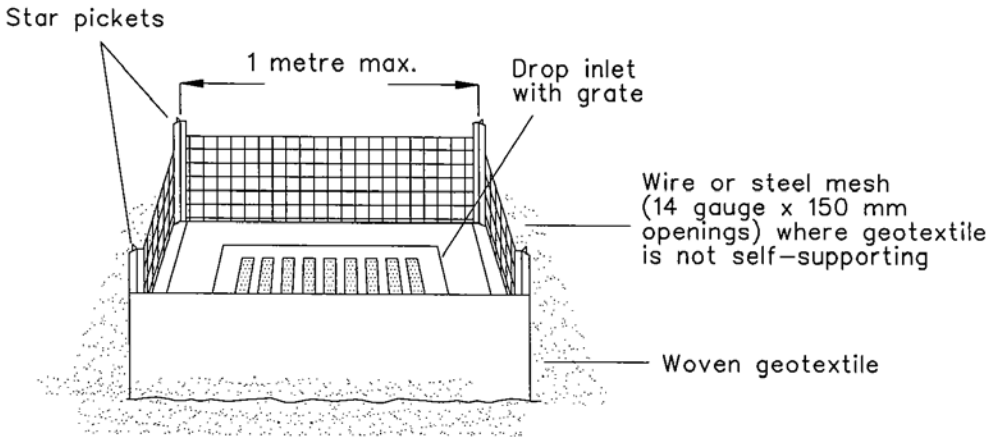
NOTE: This practice only to be used where specified in an approved SWMP/ESCP.

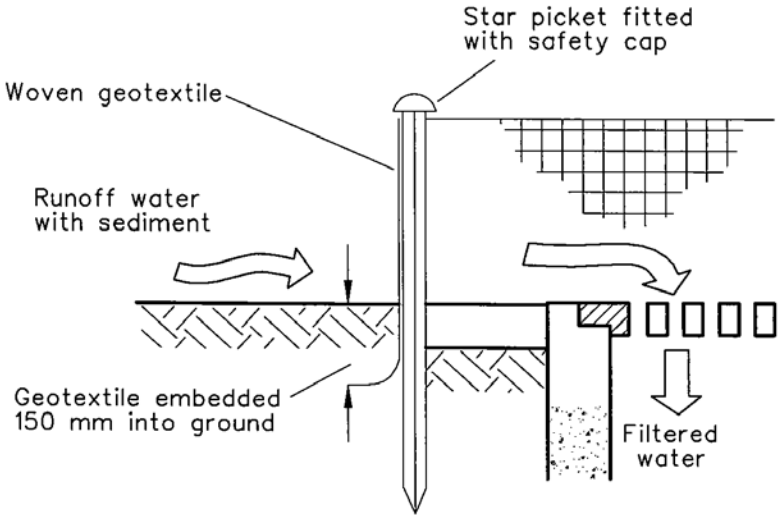
Construction Notes

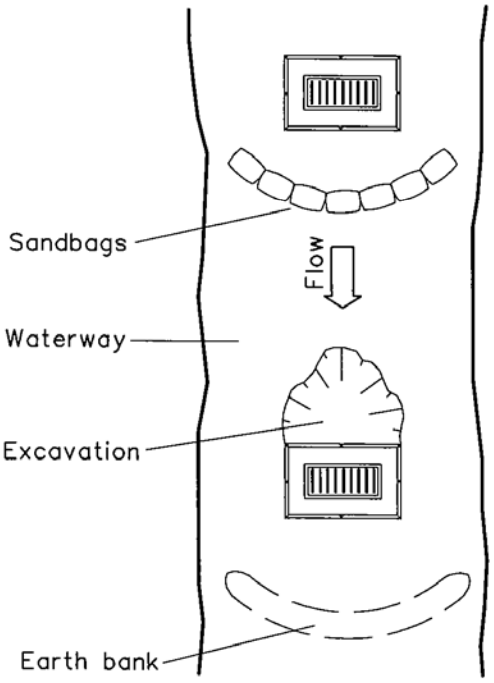
1. Install filters to kerb inlets only at sag points.
2. Fabricate a sleeve made from geotextile or wire mesh longer than the length of the inlet pit and fill it with 25 mm to 50 mm gravel.
3. Form an elliptical cross-section about 150 mm high x 400 mm wide.
4. Place the filter at the opening leaving at least a 100-mm space between it and the kerb inlet. Maintain the opening with spacer blocks.
5. Form a seal with the kerb to prevent sediment bypassing the filter.
6. Sandbags filled with gravel can substitute for the mesh or geotextile providing they are placed so that they firmly abut each other and sediment-laden waters cannot pass between.

MESH AND GRAVEL INLET FILTER

SD 6-11







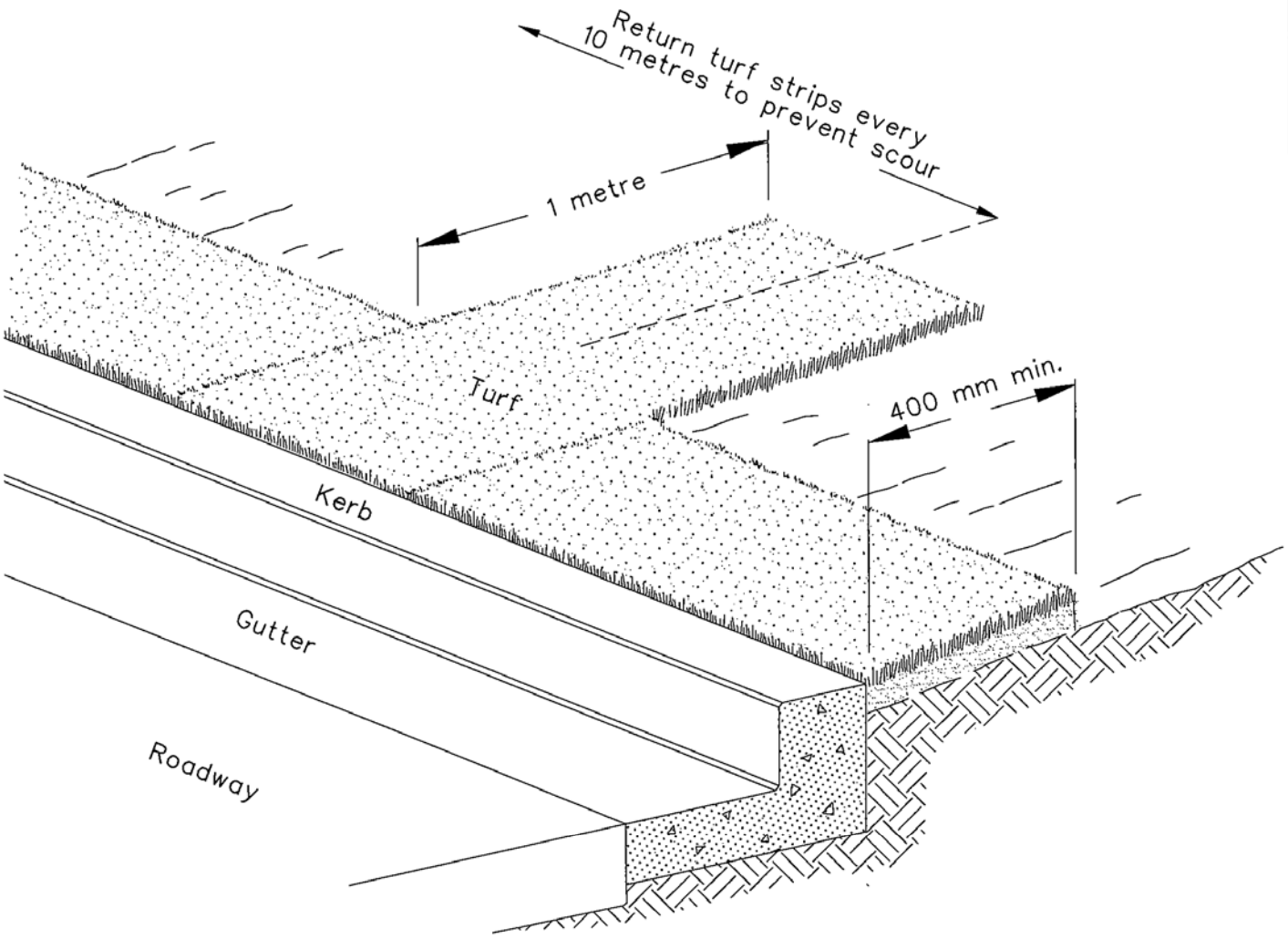
For drop inlets at non–sag points, sandbags, earth bank or excavation used to create artificial sag point

Construction Notes

1. Fabricate a sediment barrier made from geotextile or straw bales.
2. Follow Standard Drawing 6-7 and Standard Drawing 6-8 for installation procedures for the straw bales or geofabric. Reduce the picket spacing to 1 metre centres.
3. In waterways, artificial sag points can be created with sandbags or earth banks as shown in the drawing.
4. Do not cover the inlet with geotextile unless the design is adequate to allow for all waters to bypass it.

GEOTEXTILE INLET FILTER

SD 6-12

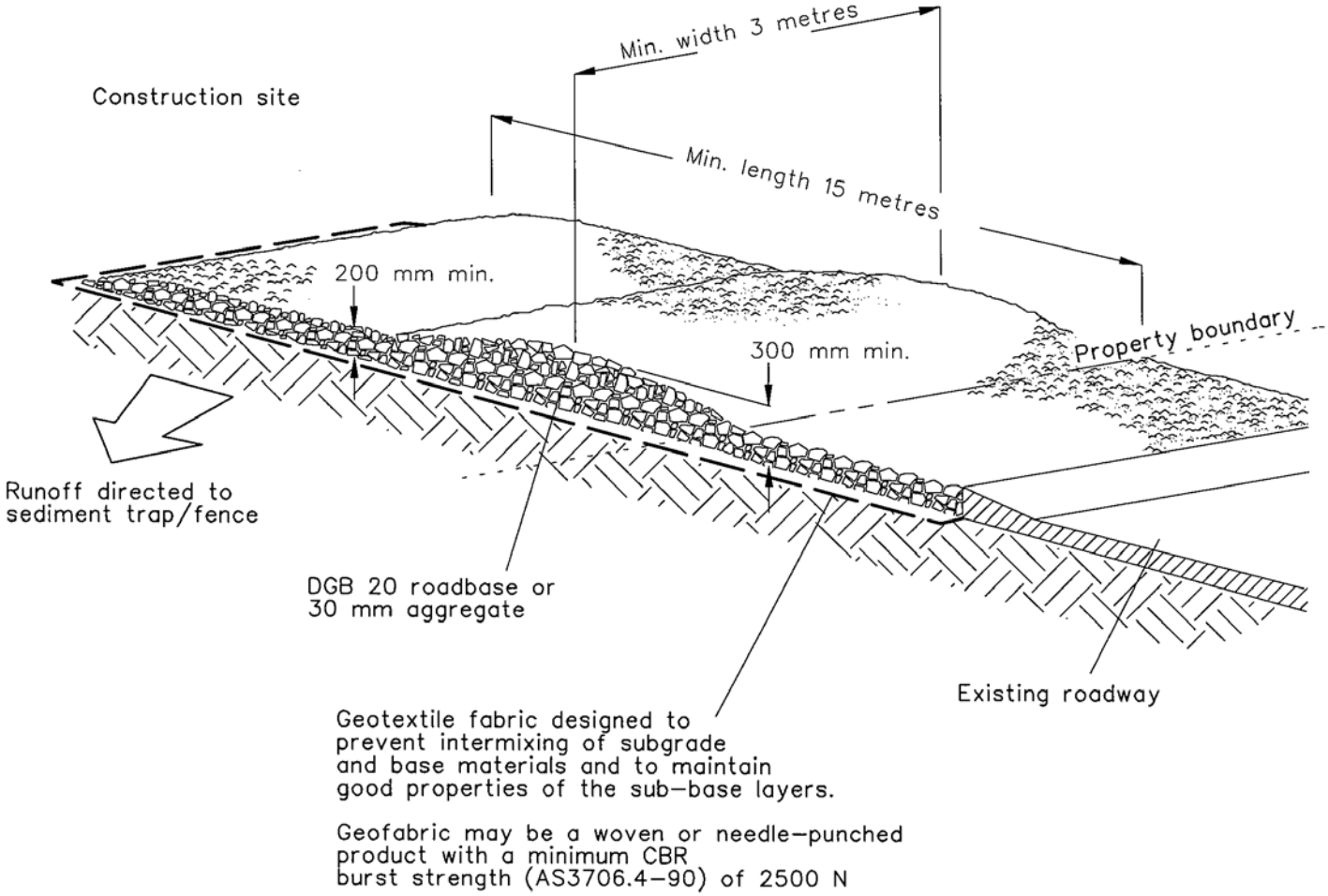


Construction Notes

1. Install a 400-mm minimum wide roll of turf on the footpath next to the kerb and at the same level as the top of the kerb.
2. Lay 1.4 metre long turf strips normal to the kerb every 10 metres.
3. Rehabilitate disturbed soil behind the

KERBSIDE TURF STRIP

SD 6-13

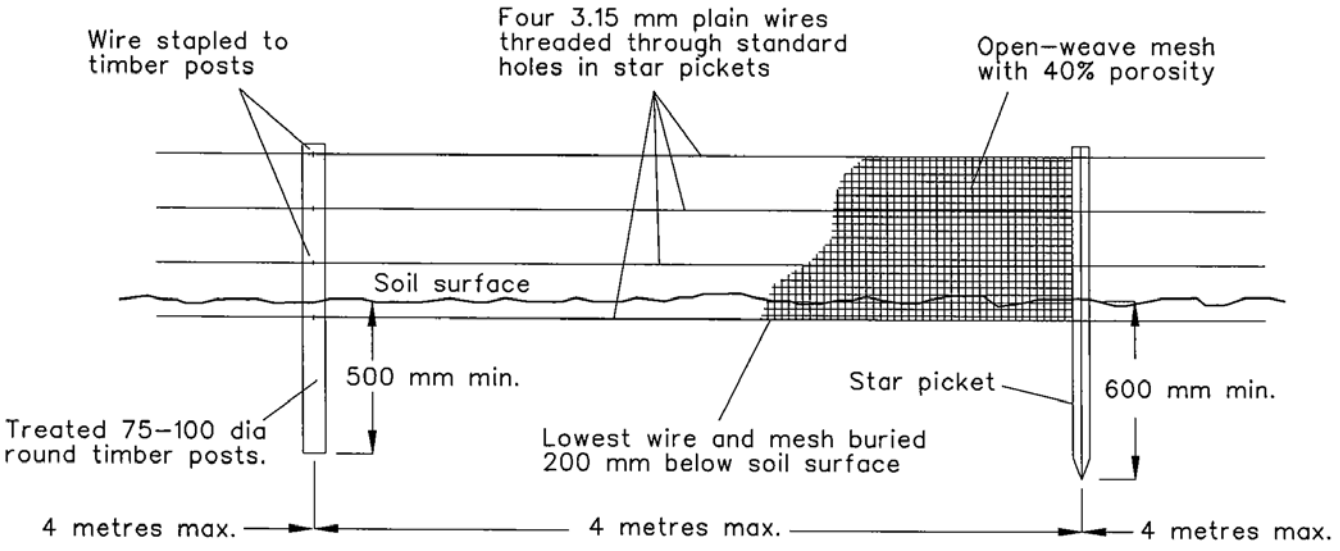


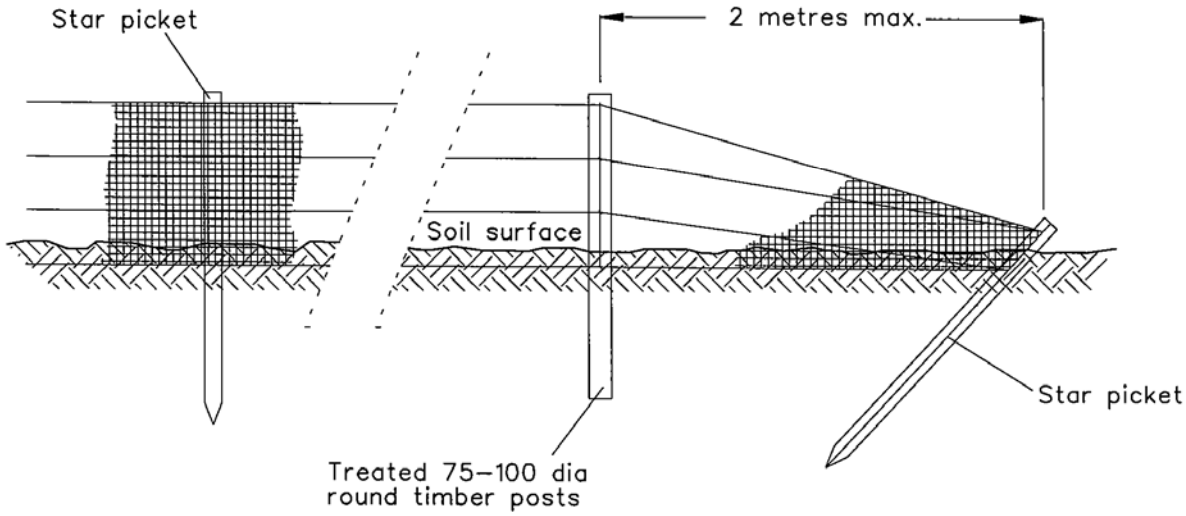
Construction Notes

1. Strip the topsoil, level the site and compact the subgrade.
2. Cover the area with needle-punched geotextile.
3. Construct a 200-mm thick pad over the geotextile using road base or 30-mm aggregate.
4. Ensure the structure is at least 15 metres long or to building alignment and at least 3 metres wide.
5. Where a sediment fence joins onto the stabilised access, construct a hump in the stabilised access to divert water to the sediment fence

STABILISED SITE ACCESS

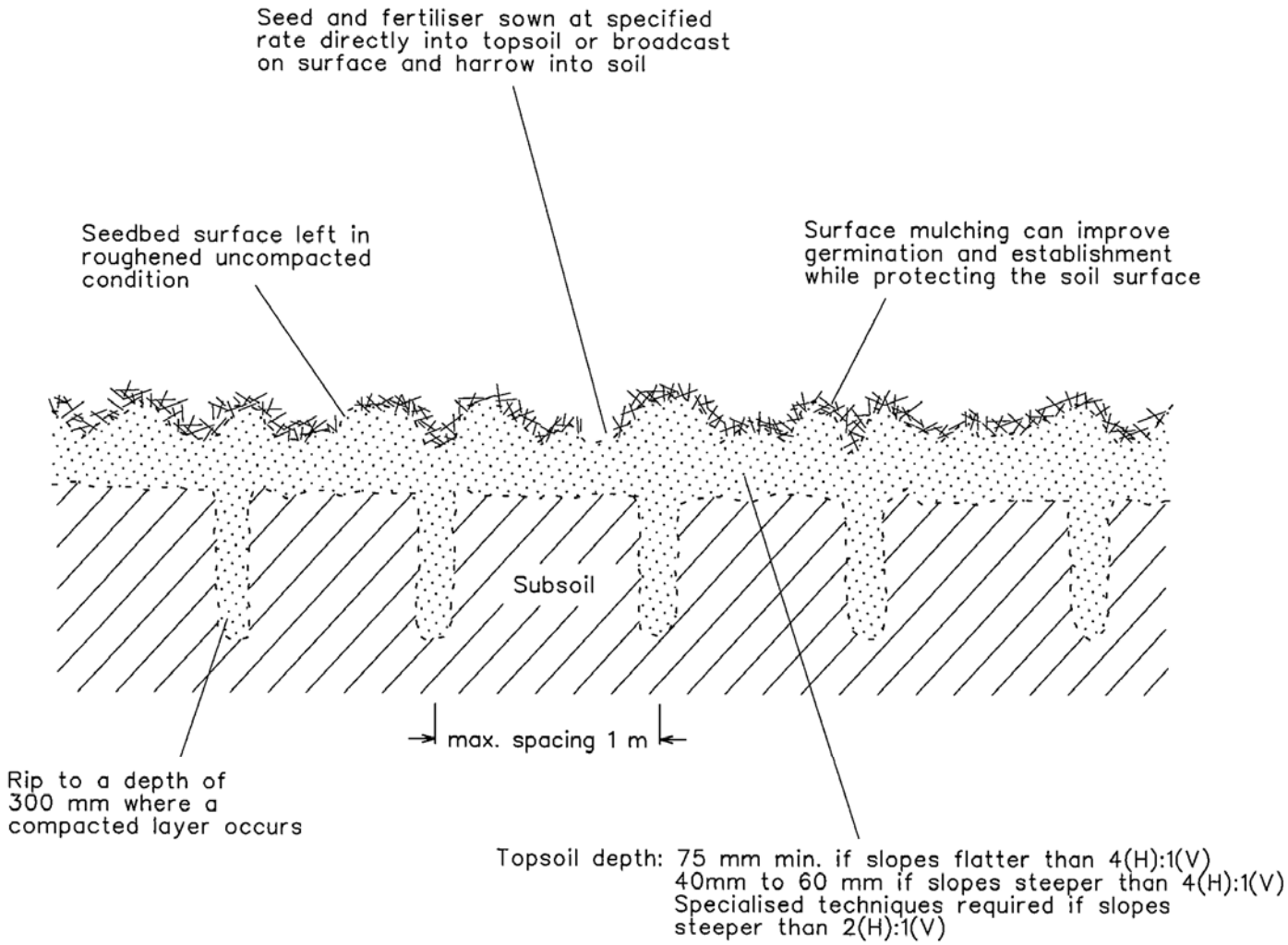
SD 6-14





Construction Notes

1. Install the fence to the height specified in the ESCP/SWMP.
2. Cut a channel 200 mm deep along the fence line.
3. Place wire and light resistant, open-weave polymer mesh with 40 percent porosity on the prevailing wind side of fence.
4. Fasten the mesh to all wires using ring fasteners at 100 mm to 150 mm intervals on top wire and 300 mm intervals on other wires.
5. Use one 75-mm to100-mm diameter treated round timber post every 20 metres.
6. Where star pickets are used, ensure they are fitted with safety caps.



Construction Notes

1. Loosen compacted soil before sowing any seed. If necessary, rip the soil to a depth of 300 mm. Avoid rotary hoe cultivation.
2. Work the ground only as much as necessary to achieve the desired tilth and prepare a good seedbed.
3. Avoid cultivation in very wet or very dry conditions.
4. Cultivate on or close to the contour where possible, not up and down the slope.

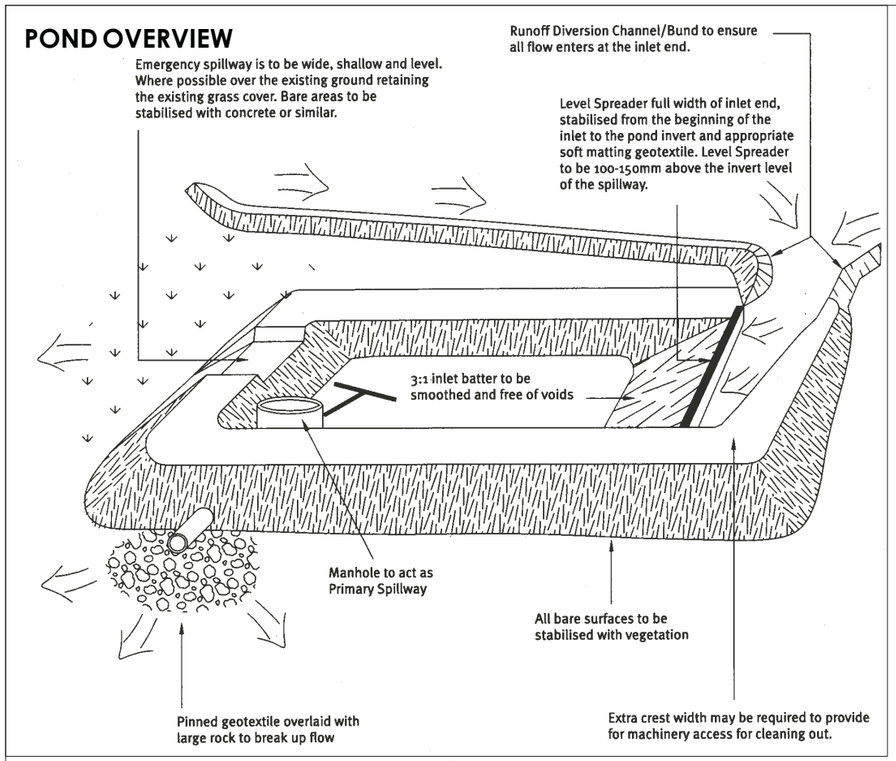
SEEDBED PREPARATION

SD 7-1

Appendix H

High Efficiency Basin

POND OVERVIEW



GENERAL POND DETAIL

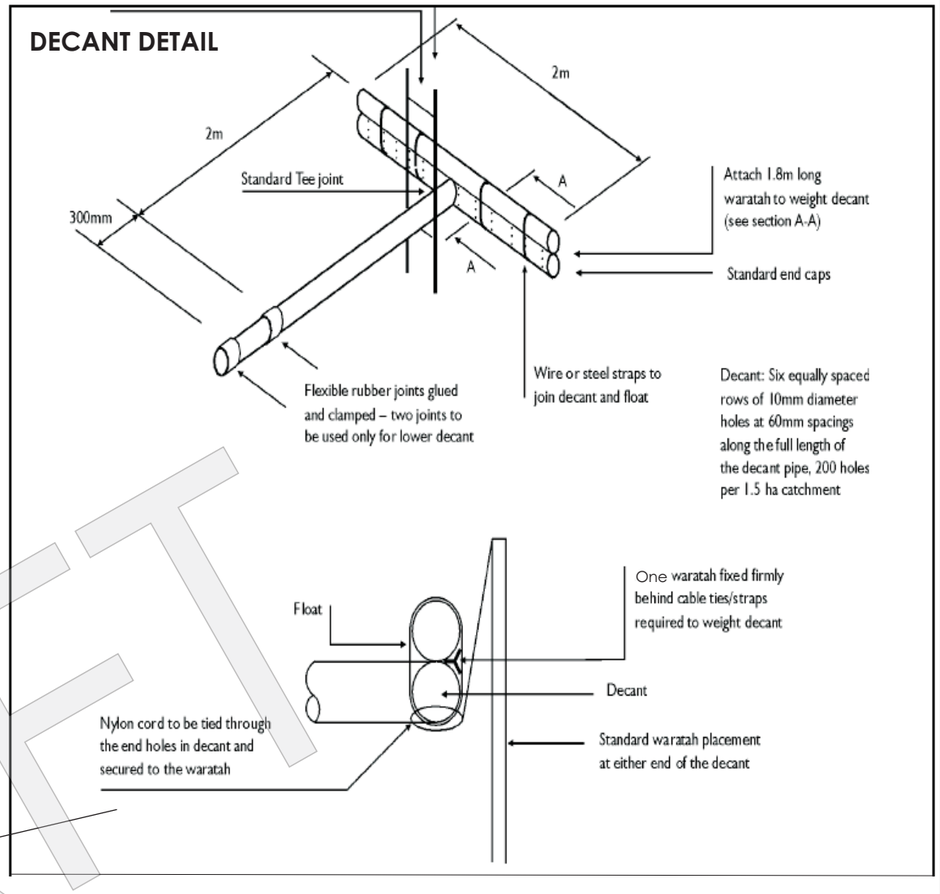
Catchment	2.0 ha
Minimum required capacity	600 m3 (to top of primary spillway)
Inside pond slopes	3h:1v
Bottom pond size	24 x 4 m
Depth to top of primary spillway	2.0 m
No's of decants	2
Holes/decant	200 bottom one; 66 top

1. Remove all organic soil, use approved fill only and ensure thorough compaction.
2. Clean pond out when 20% full of sediment
3. Position chemical dose point upstream of the level spreader for better mixing (ensure all site runoff is treated)

PIPE WORK

Install a 225 mm diameter pipe to the outside of the pond. Place fabric or rock at the outlet for erosion control.
Construct a minimum of two anti-seep collars around the outlet pipe. Record this with a photo and file. Compact the soil thoroughly around the pipe to avoid seepage.
Install a concrete manhole at the outlet end to the pond with the invert or top 250 mm below the emergency spillway invert. Weigh manhole (e.g concrete) to stop potential floating.
Decants are to drain at equal depths through the live storage volume i.e set at 800 and 1400 mm above the pond floor for the 2 decant ponds @ 2m depth. Elevate the stubs to the manhole slightly to the vertical to help decant movement. Fasten two rubber couplings (available from drainage outlets) to the bottom fitting -one coupling only is needed for the top one. Construct the decants as shown opposite and securely clamp and PK screw all connections to make watertight seals. Install waratahs (steel posts) at the end of each decant and fasten cord so the decants are at the correct heights off the pond. Strap (wire) a waratah on to each float for weight. Decants are to have 10 mm diameter holes - 200 for the bottom one and 66 for the top one.

DECANT DETAIL



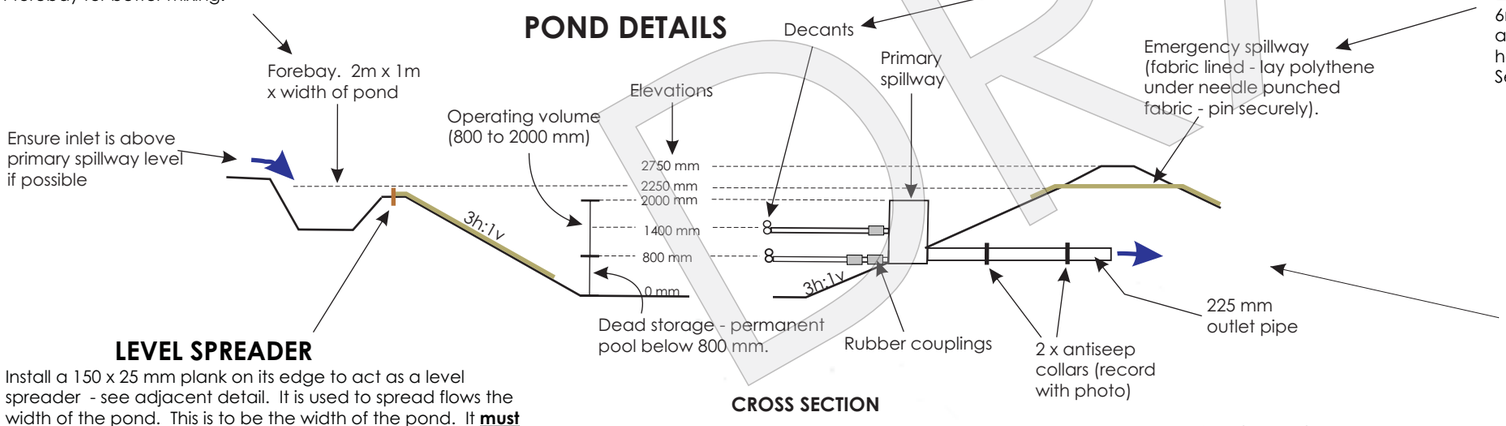
FOREBAY/INLET

Construct a forebay at the pond inlet as shown - this will reduce future cleaning of the pond. Make it the same width of the pond (see below) and position it where it can be easily cleaned out by machine. The inlet slope should be a minimum of 3h:1v, smooth & level, and lined with polythene overlaid with needle punched fabric down to the permanent pool level. Ensure chemical dose point is upstream of forebay for better mixing.

EMERGENCY SPILLWAY

6m wide emergency spillway. Invert of spillway to be 250 mm above the invert of the primary spillway (riser). It needs to be horizontal and lined with polythene overlaid with fabric. Securely pin e.g. 0.5m centres.

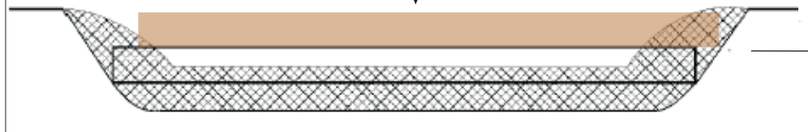
POND DETAILS

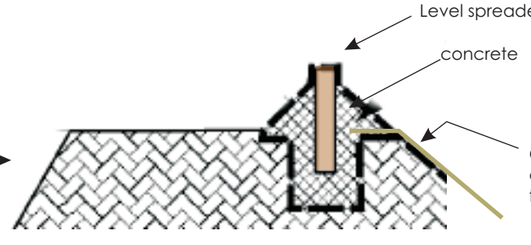


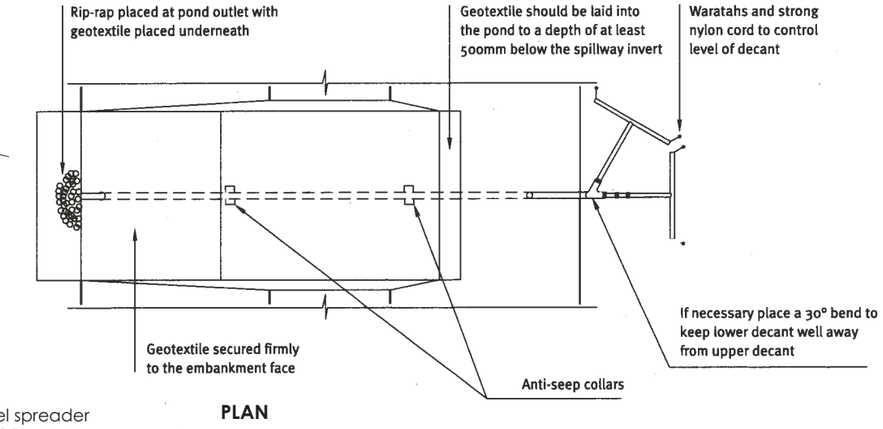
CROSS SECTION

LEVEL SPREADER

Install a 150 x 25 mm plank on its edge to act as a level spreader - see adjacent detail. It is used to spread flows the width of the pond. This is to be the width of the pond. It **must** be level & secured well with concrete. [Take care with the compaction of this area as level spreaders can be difficult to 're-level' once concrete has been laid.







PLAN

Plan

Reference
TP 90: Auckland Regional Council. 1999 *"Erosion and sediment control guidelines for land disturbing activities in the Auckland Region"*.

SUNSHINE COAST REGIONAL COUNCIL		High Efficiency Basin SEDIMENT RETENTION POND DETAILS	Date: February 2009 Scale: Not to scale Drwg No. PF/1

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