QRA QUEENSLAND RECONSTRUCTION AUTHORITY

Treatment Guide 2020–21

July 2021

Queensland Government

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Foreword

Prepared by the Queensland Reconstruction Authority (QRA), this *QRA Treatment Guide* provides a common set of treatments for the scoping of road reconstruction works following damage by natural disasters.

The treatment list represents the most commonly used treatments across the state. Detail of each treatment is provided to enable consistency of language and a common understanding of treatment inclusions/exclusions. A consistent treatment set also provides for consistency in the methodology for benchmarking local rates.

The guide will be reviewed from time to time to ensure emerging or common treatments are documented.

Treatment list

Category	Reference	Treatment	Unit
Unsealed pavements	USP_LFG	Light formation grading	m
	USP_MFG	Medium formation grading	m
	USP_HFG	Heavy formation grading	m
	USP_HFG50	Heavy formation grading incorporating 50mm of imported material	m^3
	USP_HFG75	Heavy formation grading incorporating 75mm of imported material	m^3
	USP_GR	Gravel resheeting (excludes supply of material)	m^3
	USP_GR100	Gravel resheeting 100mm	m^3
	USP_GR150	Gravel resheeting 150mm	m^3
	USP_GMS	Gravel/material supply	m^3
	USP_RSTD	Reshape table drain (1 side)	m
Sealed pavement repairs	SPR_STB	In-situ stabilisation - including 50mm corrector. Excludes seal	m^2
	SPR_GO	Granular overlay - overlay with imported material (≤150mm). Excludes seal	m^2
	SPR_FBS	Foamed bitumen stabilisation - including 50mm corrector. Excludes seal	m^2
	SPR_RR	Reconstruct unbound granular pavement. Excludes seal	m^2
	SPR_RB	Reconstruct unbound granular base Excludes seal	m^2
	SPR_PRL	Pavement repair - patch unbound pavement failure (≤20m2). Includes 2 coat bitumen seal	m^2
	SPR_POT	Pothole repair ≤1m2	each
	SPR_SCR	Crack repair	m
	SPR_PER	Edge repair	m
	SPR_USF	Reconstruct unsealed shoulder - repair isolated shoulder failure	m^2
	SPR_HSG	Heavy shoulder grading - incorporating 50mm of imported material	m
	SPR_RSAC	Asphalt surfacing, ≤50mm thickness	m^2
	SPR_RSSR	Bitumen spray seal, 2-coat	m^2
Clearing and earthworks	EXC_HVC	Clear mixed debris and remove from site	m^3
	EXC_RSOS	Bulk excavate surplus material and remove from site	m^3
	EXC_RSS	Bulk excavate surplus material to spoil	m^3
	BKF_IMP	Bulk fill - imported	m^3
	BKF_LOC	Bulk fill - local	m^3
Concrete works	CON_KER	Reconstruct concrete kerb	m
	CON_RCN	Reconstruct reinforced concrete	m^3
	CON_RFC	Repair with flowable concrete	m^3

Treatment list (cont)

Category	Reference	Treatment	Unit
Drainage structures	CUL_RP	Repair drainage structure - excavate, repair and reinstate	m
	CUL_SIL	Desilt drainage structure - removal of silt and debris	m^3
	CUL_RBC<600	Replace RCBC, nominal span ≤600mm.	m
	CUL_RBC<900	Replace RCBC, nominal span ≤900mm.	m
	CUL_RBC<1200	Replace RCBC, nominal span ≤1200mm.	m
	CUL_RBC>1200	Replace RCBC, nominal span >1200mm.	m
	CUL_RCP<375	Replace concrete pipe ≤375mm dia.	m
	CUL_RCP<600	Replace concrete pipe ≤600mm dia.	m
	CUL_RCP<900	Replace concrete pipe ≤900mm dia.	m
	CUL_RCP<1200	Replace concrete pipe ≤1200mm dia.	m
	CUL_RCP>1200	Replace concrete pipe >1200mm dia.	m
	CUL_RHW<375	Replace head/end wall ≤375mm pipe or RCBC	unit
	CUL_RHW<600	Replace head/end wall ≤600mm pipe or RCBC	unit
	CUL_RHW<900	Replace head/end wall ≤900mm pipe or RCBC	unit
	CUL_RHW<1200	Replace head/end wall ≤1200mm pipe or RCBC	unit
	CUL_RHW>1200	Replace head/end wall >1200mm pipe or RCBC	unit
Protection works	RK_RKP	Rock protection	m^3
	RK_STP	Repair stone pitching	m^2
	RK_MAT	Construct rock mattress	m^3
Road furniture and delineation	RFD_RGET	Replace guardrail end treatment	each
	RFD_RG	Replace guardrail	m
	RFD_RP	Replace guide posts or markers	each
	RFD_RRS	Repair road signage	each
	RFD_RSF	Replace sign face only - standard road sign	each
	RFD_RCS	Replace sign (complete) - standard road sign, includes post	each
	RFD_RLN	Reinstate line marking	m
Other	OTHER	Other - including structures, retaining items	lump sum

Unsealed roads overview

Treatment selection for the restoration of unsealed roads should be commensurate with the classification of the asset and its maintained condition prior to the disaster. Unsealed road assets are generally classified as either unformed, formed or gravelled.

Unformed road

An unformed road is a road that has no constructed or maintained formation, or surface drainage.

Figure 1 - Unformed road

Unformed roads may have had vegetation intentionally cleared, or may simply be the result of vehicles travelling the same path over a period of time.

Unless the asset owner is able to demonstrate an appropriate level of maintenance has occurred (bulk-fill or clearing), works to unformed assets are generally ineligible. The treatments applicable to a maintained unformed road are bulk fill of scours using local material (BKF_LOC), clearing of mixed debris (EXC_HVC) and bulk excavation to spoil (EXC_RSS).

Formed road

A formed road is a road that has a constructed formation and, in most cases, table drains. A formed road is often constructed through grading of materials from the road reserve onto the road, resulting in the creation of table drains and a shaped formation.

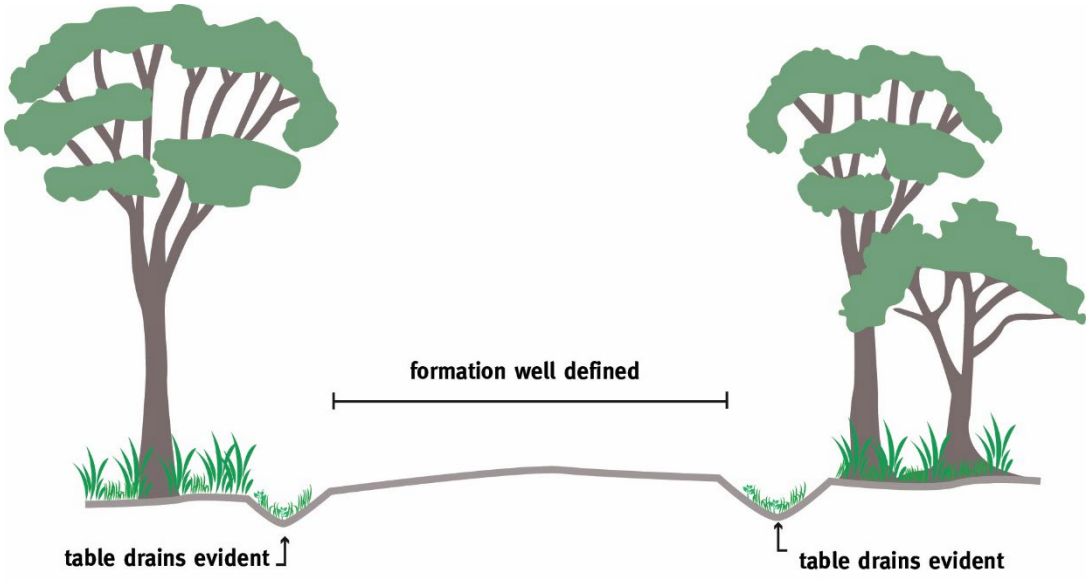

Figure 2 - Formed road

As no gravel is generally imported for this road classification, the import of gravel is generally not eligible. Where scouring or loss of material has occurred, bulk fill using local material (BKF_LOC) from within the road corridor should be used.

Where sufficient material remains on the road, but loss of shape has occurred, the treatment should be limited to a **Medium formation grading (USP_MFG)**.

Where rutting and loss of shape is extensive, **Heavy formation grading (USP_HFG)** may be considered. The displaced formation material should be recovered from the table drains or within the road corridor.

Gravel road

A gravel road is a road that has had a layer of gravel imported, compacted and maintained atop the formation. Gravel may vary from a material won from borrow pits, nearby ridges or quarries.

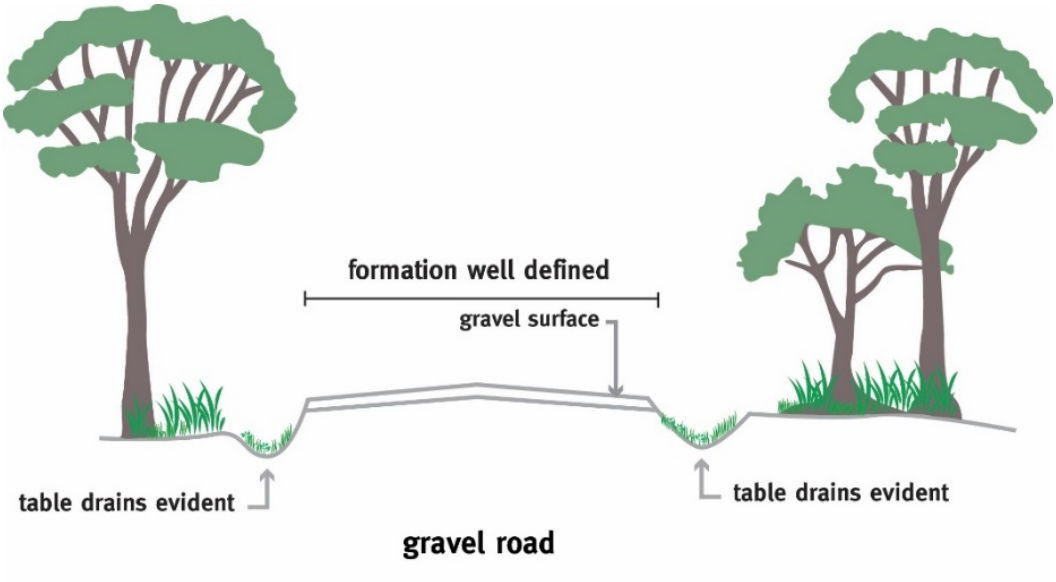

Figure 3 – Gravel road

Where rutting, loss of shape and gravel displacement has resulted, a **Medium formation grading (USP_MFG)** should be nominated. Where displaced gravel is suitable and recoverable from drainage lines, it should be used as a component of the Medium formation grading.

Where the displaced gravel is non-recoverable/heavily contaminated and extensive damage to the roadway has resulted, import of material will likely be required. Considerations of the use of Heavy Formation Grade and Gravel resheet treatments is provided below:

- Where gravel remains on the roadway (i.e. ≥25mm thickness), but gravel displacement and loss of shape is evident, a **Heavy formation grading (USP_HFG)** + **Gravel/material supply (USP_GMS)** should be nominated. The gravel supply volume should be commensurate with the volume of material lost as a result of the event. A minimum gravel thickness of 75mm (inclusive of gravel remaining on roadway) is generally required for constructability purposes
  - to achieve this, where ≥25mm thickness remains on the roadway, a **Heavy formation grading incorporating 50mm of imported material (USP_HFG50)** should be nominated
  - where loss of gravel as a result of the event exceeded 50mm, a Heavy formation grading incorporating 75mm of imported material **(USP_HFG75)** may be nominated
  - where loss of gravel as a result of the event exceeded 75mm, a Gravel Re-sheet should be nominated
- Where loss of both shape and gravel is evident, and no useable gravel remains on the roadway (i.e. <25mm depth), a **100mm Gravel resheet (USP_GR100)** should be nominated. A **150mm Gravel resheet (USP_GR150)** may be nominated only where supported by asset registers and maintenance records. Imported material should be consistent with material in-place pre-disaster or material currently utilised by the asset owner in maintaining the asset.
- Where loss of shape has occurred, but no loss of gravel is evident as a result of the event, a **Heavy formation grading (USP_HFG)** should be nominated. As gravel loss is not evident, Gravel/material supply is not eligible.
- Where road subgrade is exposed, loss of shape is general only (wear and tear), and no loss of gravel is evident as a result of the event, works would be considered ineligible.

Unsealed road treatments

All grading and resheet treatments include the following work operations:

- site establishment and disestablishment of all plant, labour and materials
- establishment and disestablishment of traffic control
- determination of work area
- removal and re-instatement of roadside furniture (e.g. guide posts, signs etc.) as required
- clean up of site and disposal of any waste/removed material in accordance with applicable State Government legislation or Local Government by-laws

Reference	Treatment	Unit
USP_LFG	Light formation grading	m
USP_MFG	Medium formation grading	m
USP_HFG	Heavy formation grading	m
USP_HFG50	Heavy formation grading incorporating 50mm of imported material	m^3
USP_HFG75	Heavy formation grading incorporating 75mm of imported material	m^3
USP_GR	Gravel resheeting (excludes supply of material)	m^3
USP_GR100	Gravel resheeting 100mm	m^3
USP_GR150	Gravel resheeting 150mm	m^3
USP_GMS	Gravel/material supply	m^3
USP_RSTD	Reshape table drain (1 side)	m

Light formation grading

For gravel roads damage as a result of an activated event, a **Light formation grading** is often undertaken during the emergency works period to restore rideability prior to restoration works. Where the road is formed only (not gravelled), and loss of shape and material is minor only, a **Light formation grading** may be appropriate for restoration works to restore shape.

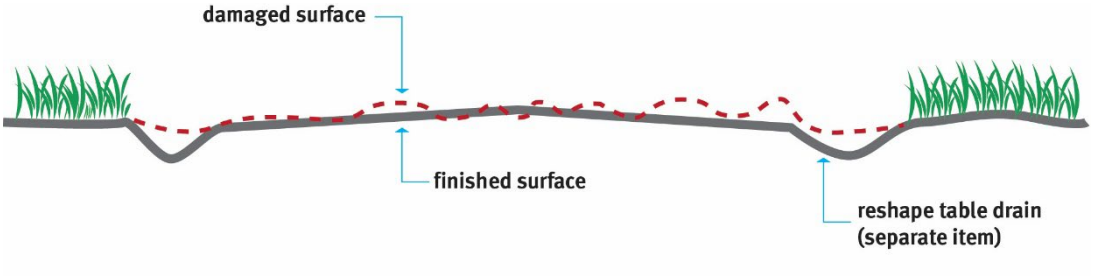

Figure 4 – Light formation grading

Treatment:	**USP_LFG**
Unit of measurement:	m
Summary:	Light trimming by grader of unsealed road surface to restore rideability
Description:	Light trimming by grader of the existing roadway to fill holes and other depressions.
Exclusions:	Scarifying, compaction, import of water or material, table drain works (separate item)
Indicative plant:	Grader

Medium formation grading

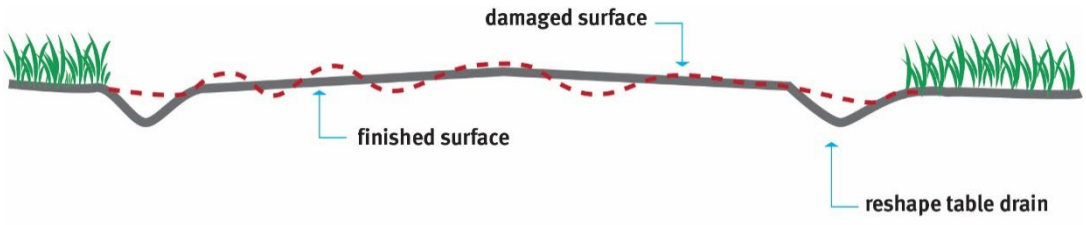

Figure 5 – Medium formation grading

Treatment:	**USP_MFG**
Unit of measurement:	m
Summary:	Grading of unsealed roadway to reinstate the pre-disaster profile.
Description:	Grading to restore the road surface to pre-disaster profile and condition. Includes roughening of up to 50mm of roadway top (by grader), clearing and grubbing to remove light vegetation and grass, recovery of suitable material from table drains (by grader), incorporation of water and compaction.
Exclusions:	No import of material
Indicative plant:	Grader, water truck, rollers

Heavy formation grading

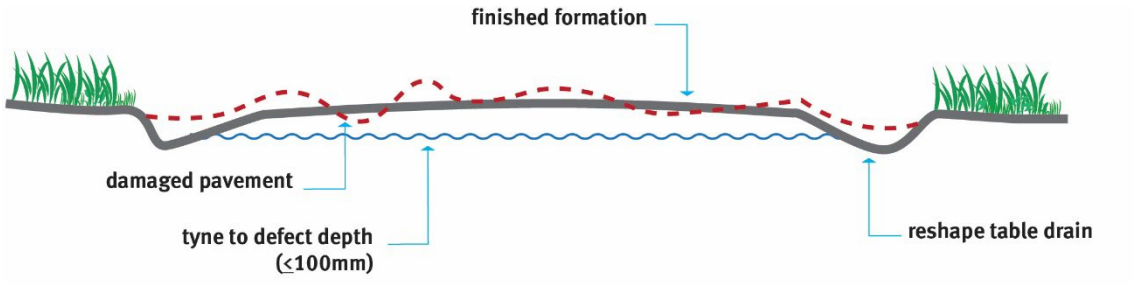

Figure 6 – Heavy formation grading

Treatment:	**USP_HFG** **USP_HFG50** **USP_HFG75**
Unit of measurement:	m
Summary:	Reinstatement of formation and profile.
Description:	Clearing and grubbing and recovery of suitable material from table drains (by grader), tyne ≤100mm depth (150mm if supported by depth of rutting), incorporation of additional gravel/material (excluding USP_HFG), trimming, and compaction.
Exclusions:	USP_HFG (only) – No gravel/material supply
Indicative plant:	Grader, water truck, roller, front end loader and truck (for disposal of unsuitable)

Gravel/material supply

Treatment:	**USP_GMS**
Unit of measurement:	m^3
Summary:	Supply of gravel/material to the work site.
Description:	Supply of gravel/material to the work site for inclusion with material reclaimed through grading operations. Top up gravel/material only. Imported gravel/material should be consistent with material in-place pre-disaster or material which the asset owner currently uses for maintenance in the area.
Exclusions:	Excludes all operations for placement, trimming and rolling
Indicative plant:	Gravel truck, front end loader/excavator

Gravel resheeting

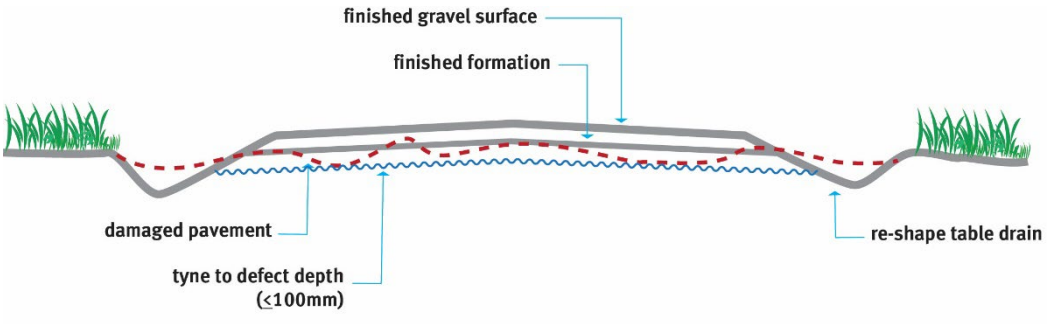

Figure 7 – Gravel resheeting

Treatment:	**USP_GR** **USP_GR100** **USP_GR150**
Unit of measurement:	m^3
Summary:	Addition of imported gravel/material to the roadway to reinstate the running surface and correct profile.
Description:	Preparation of the formation through Heavy Formation Grading. Supply and spreading of imported gravel/material. Imported material should be consistent with material in-place pre-disaster or material which the asset owner currently uses for maintenance in the area.
Exclusions:	Additional material required for incorporation in **the Heavy Formation Grading** (prior to resheet) is not included. Any additional volume should be included as **Gravel/material supply or Bulk Fill** **USP_GR** (only) relates to the work operations of resheeting and excludes import of gravel/material. **USP_GR** should be used in conjunction with **USP_GMS** (Gravel/material supply) where works are being undertaken by Council day labour (**USP_GR** item estimate based on benchmark rate) and a commercial supply for material is required (**USP_GMS** rate based on market pricing)
Indicative plant:	Grader, truck, water truck, roller, front end loader and truck (for disposal of unsuitable)

Reshape table drain

Consequential re-shaping of existing table drains/vee drains, through recovery of displaced material, will occur when carrying out **Medium Formation Grade, Heavy Formation Grading** or **Gravel Resheet** operations. In these instances, no separate item is required for the inclusion of re-shaping existing table drains.

In the absence of, or where not included in the adjacent pavement work item, a separate treatment item, and evidence of event related damage demonstrating silting, scour or blockage of the table drains is required for inclusion.

Treatment:	**USP_RSTD**
Unit of measurement:	m
Summary:	Cleaning and reshaping of existing surface drains adjacent the road formation (allowance for one drain only)
Description:	Reshaping of existing table drains by grader.
Exclusions:	No scarify, no import of material, no addition of water, no compaction
Indicative plant:	Grader, front end loader and job truck (for disposal of unsuitable)

Where minor scours or minor deposits of silt exist along a drainage line, repair should be achieved through reshaping of the table drain.

Where drainage lines are filled with large deposits of silt, **Bulk Excavate** (**EXC_RSOS** or **EXC_RSS**) should be nominated to allow for removal of the material.

Where major scours exist along a drainage line, **Bulk Fill** (**BKF_IMP** or **BKF_LOC**) should be nominated to allow for filling of the scours.

Sealed pavement repairs

All sealed pavement repair treatments include the following work operations:

- site establishment and disestablishment of all plant, labour and materials
- establishment and disestablishment of traffic control
- determination of work area
- removal and re-instatement of roadside furniture (e.g. guide posts, signs etc.) as required
- clean up of the site and disposal of any waste/removed material in accordance with applicable State Government legislation or Local Government by-laws

Treatment selection for the restoration of sealed pavements should be appropriate to the road type, functionality, pre-disaster condition and Value for Money outcomes with reference to site specific constraints.

Reference	Treatment	Unit
SPR_STB	In-situ stabilisation - including 50mm corrector. Excludes seal	m^2
SPR_GO	Granular overlay - overlay with imported material (≤150mm). Excludes seal	m^2
SPR_FBS	Foamed bitumen stabilisation - including 50mm corrector. Excludes seal	m^2
SPR_RR	Reconstruct unbound granular pavement. Excludes seal	m^2
SPR_RB	Reconstruct unbound granular base Excludes seal	m^2
SPR_PRL	Pavement repair - patch unbound pavement failure (≤20m2). Includes 2 coat bitumen seal	m^2
SPR_POT	Pothole repair ≤1m2	each
SPR_PER	Edge repair	m
SPR_SCR	Crack repair	m
SPR_USF	Reconstruct unsealed shoulder - repair isolated shoulder failure	m^2
SPR_HSG	Heavy shoulder grading - incorporating 50mm of imported material	m
SPR_RSAC	Asphalt surfacing, ≤50mm thickness	m^2
SPR_RSSR	Bitumen spray seal, 2-coat	m^2

Localised damage

Pothole repair

Where a small pavement failure in the form of a pothole emerges (generally under a wheel path), a **Pothole repair** may be considered appropriate.

Treatment:	**SPR_POT**
Unit of measurement:	each
Summary:	Repair of localised damage with asphalt or premix
Description:	Removal of water and debris, cut back to sound pavement and squaring of sides. Fill with asphalt-mix and compact to match adjacent road surface.
Exclusions:	Line-marking
Indicative plant:	Work truck, pneumatic hammer, cutting saw, blower, plate compacter

Where multiple potholes appear in close proximity, a **Pavement Repair** may be better suited.

Pavement repair

Where a road is damaged in isolated areas, a **Pavement Repair** is considered the most appropriate treatment.

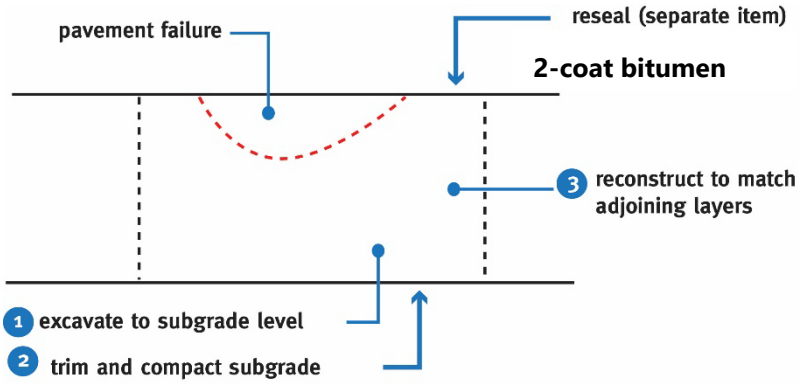

Figure 8 – Pavement repair

Treatment:	**SPR_PRL**
Unit of measurement:	m^2
Summary:	Removal and reconstruction of isolated pavement failures
Description:	Removal of failed pavement material, reasonable allowance for replacement of unsuitable, compaction of subgrade, import and placement of unbound granular material in layers to match adjoining. 2-coat bitumen seal.
Exclusions:	nil
Indicative plant:	Excavator, truck, grader, water truck, rollers

Edge repair

Where damage to the edge of seal and/or pavement has occurred due to trafficking in saturated conditions or excessive volumes or velocities of water, **Edge repair** (**SPR_PER**) should be nominated.

Treatment:	**SPR_PER**
Unit of measurement:	m
Summary:	Repair of pavement edge failures
Description:	Supply and application of tack coat; and supply, application and compaction of asphalt or premix.
Exclusions:	linemarking
Indicative plant:	Roller or manual compaction, truck, flowcon (where required)

Crack repair

Where damage to the road seal has developed as a result of shrink/swell of the underlying material during saturation/inundation, **Crack repair** (**SPR_SCR**) should be nominated.

Treatment:	**SPR_SCR**
Unit of measurement:	m
Summary:	Repair of pavement seal cracking
Description:	Clean out (blow) of loose material, partial filling, application of crack seal to manufacturers specifications, application of cover material.
Exclusions:	linemarking
Indicative plant:	Hand tools and minor compaction equipment

Continuous damage

Where continual or long lengths of damage has occurred across the width of the road, a full-width treatment is likely to be required. Selection of an appropriate full-width treatment requires consideration of the pavement failure mechanism, the usefulness of the in-situ pavement, the surrounding environment and any constructability issues (e.g. plant or material availability).

Where limited damage to the underlying subgrade has occurred, but loss of shape is extensive, excavation of existing pavement material may pose significant risk. Risks include subgrade disturbance and subsequent need for treatment or replacement, or interference with drainage or utilities. In such circumstances, **in-situ stabilisation (SLP_STB)** or reworking of the existing pavement (tyne, shape and compact – select **USP_HFG**) may be suitable. Where additional pavement strength is required, and where still able to represent a value for money option compared to the use of pavement reconstruction, a **Granular Overlay (SPR_GO)** may also be considered.

In-situ stabilisation

Where limited damage to the underlying subgrade has occurred, but loss of shape is extensive, **In-situ stabilisation** may be appropriate**. In-situ Stabilisation** using cement, fly ash or hydrated lime or **Foamed bitumen stabilisation** allow repair of damaged pavement without exposing the subgrade.

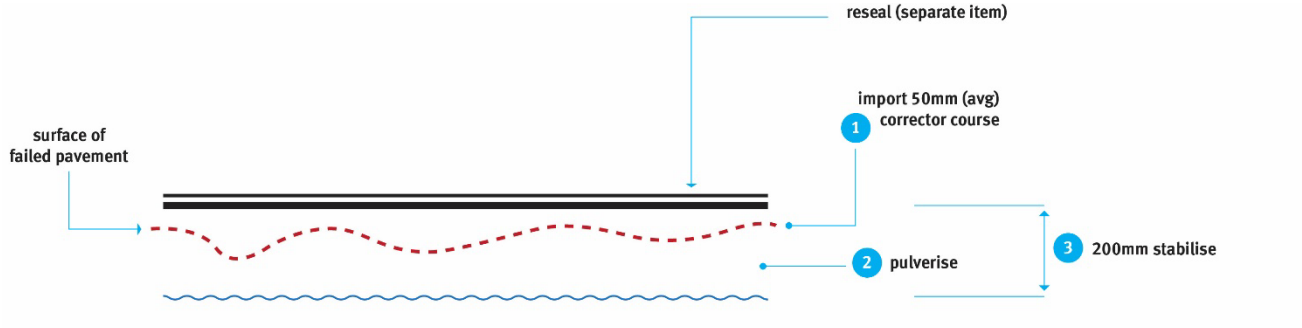

Figure 9 – In-situ stabilisation

Treatment:	**SPR_STB** (in-situ stabilisation), **SPR_FBS** (Foamed bitumen stabilisation)
Unit of measurement:	m^2
Summary:	In-situ stabilisation of base course material
Description:	Removal of material not suitable for stabilisation, import and spreading of unbound granular material to replace unsuitable and for shape-correction (50mm), pulverisation, supply and spreading of stabilising agents, stabilisation, compaction and curing
Exclusions:	Excludes all seal items
Indicative plant:	Gravel truck, grader, stabiliser, water truck and roller, cement spreader/ prime spreader (for prime or foam bitumen stabilisation)

The selection of an appropriate stabilisation type requires consideration of plant availability, suitability of work force, environmental conditions and constitution of the existing pavement.

In some cases, the condition and composition of the existing pavement may preclude in-situ stabilisation treatments. The availability of plant, size of the site and future performance of the stabilised pavement in the context of the surrounding pavement should also be considered when selecting insitu-stabilisation and the stabilisation type.

Granular overlay

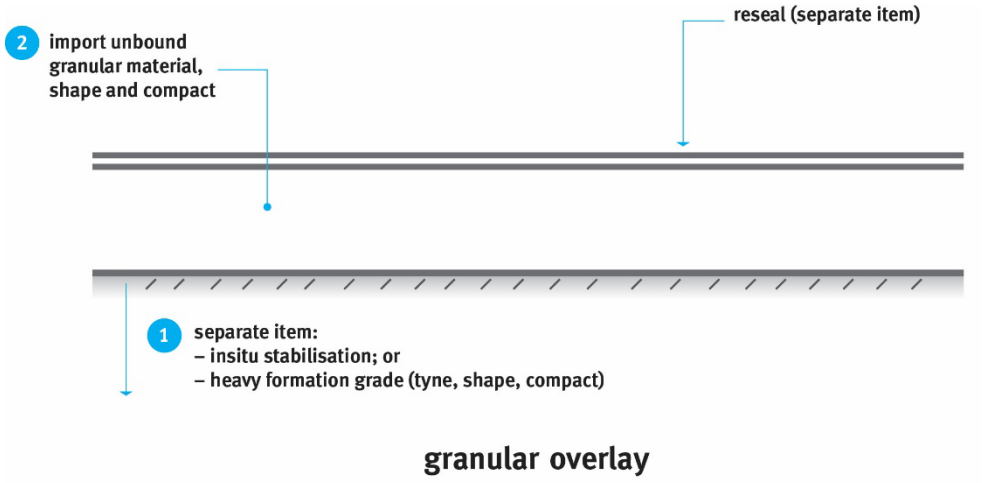

Figure 10 – Granular overlay

Treatment:	**SPR_GO**
Unit of measurement:	m^2
Summary:	Overlay of treated pavement with unbound granular material
Description:	Import and spreading unbound granular material, shaping and compaction, ≤150mm thickness
Exclusions:	Excludes treatment of in-situ material/preparation of subbase (refer alternative treatments)
	Excludes formation work in accommodation of extra pavement height
	Excludes all seal items
Indicative plant:	Gravel truck, grader, water truck, roller

The use of an overlay can reduce material spoilage, reduce risks of exposing unsuitable subgrade and reduce the duration of construction. However, the use of a granular overlay may not be appropriate in the event of vertical constraints (e.g. afflux/flow issues, short site, tie-in to structures, kerb and channel or property accesses) or horizontal constraints, for example insufficient formation width to accommodate overlay. In these circumstances, a treatment maintaining existing levels may need to be adopted.

The overall cost of the pavement treatment, including the treatment of the in-situ material, and formation works to accommodate the overlay, as well as the granular overlay itself needs to be considered in comparison to the likely cost of the alternative, Reconstruct Road treatment.

Reconstruct unbound granular pavement

Where extensive subgrade failure or material contamination has occurred, and the use of an overlay or stabilised layer cannot economically or suitably bridge the failure, reconstruction of the road will likely be required.

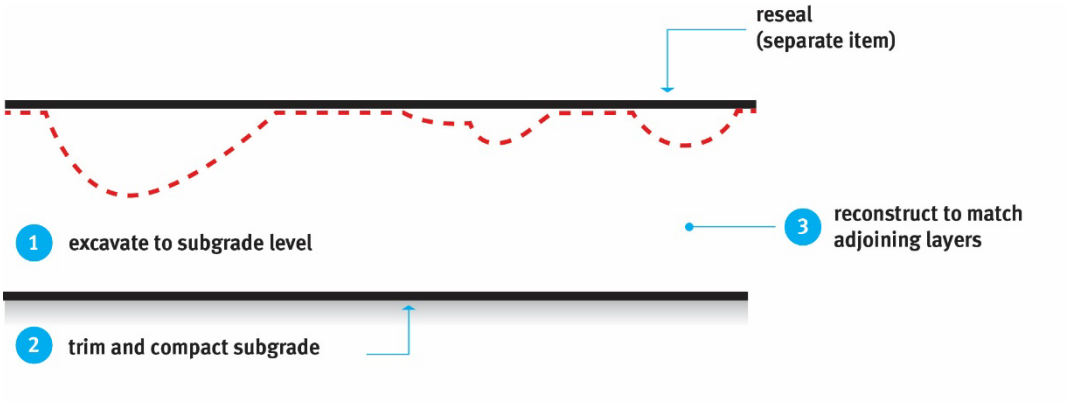

Figure 11 – Reconstruct unbound granular pavement. Excludes seal

Treatment:	**SPR_RR**
Unit of measurement:	m^2
Summary:	Removal and reconstruction of failed pavement
Description:	Removal of failed pavement material, reasonable allowance for replacement of unsuitable, compaction of subgrade, import and placement of unbound granular material in layers to match adjoining
Exclusions:	Excludes all seal items (separate item)
Indicative plant:	Excavator, truck, grader, water truck, roller

Reconstruct unbound granular base

Where road pavement damage such as peeling/stripping of seal (due to overland flow) or shallow pavement failures (i.e. above subgrade) have occurred, **Reconstruct unbound granular base** should be nominated. This treatment allows for repair/replacement of the top 150mm of unbound pavement ready for sealing.

Treatment:	**SPR_RB**
Unit of measurement:	m^2
Summary:	Reconstruction of isolated base course pavement failures
Description:	Removal of failed pavement material (where material cannot be reused), compaction of underlying pavement layer, import and placement of unbound granular base pavement to match adjoining
Exclusions:	Excludes all seal items
Indicative plant:	Excavator/profiler, truck, grader/skid-steer, water truck, roller

Shoulders

Shoulder scour

Where damage to the verge/shoulder (clear of the table drain) has occurred, and no damage sustained to the sealed roadway, a shoulder restoration treatment will likely be appropriate.

Where a pavement failure has occurred and the damage is localised, **Reconstruct unsealed shoulder** should be nominated. Where loss of shoulder material or scour has occurred due to overland or longitudinal flow, a **Heavy shoulder grading** should be nominated.

Reconstruct unsealed shoulder

For treatment of localised areas of severely damaged or contaminated shoulders or verges, **Reconstruct Unsealed Shoulder** should be used. This item is quantified in m² and should be used for localised repairs only.

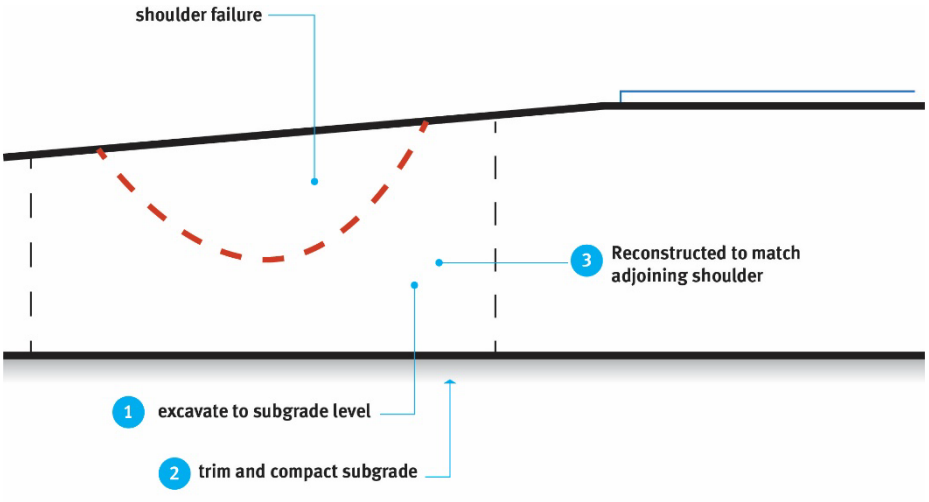

Figure 12 – Reconstruct unsealed shoulder

Treatment:	**SPR_USF**
Unit of measurement:	m²
Summary:	Placement and compaction of gravel into isolated potholes in a gravel shoulder or verge
Description:	Removal of failed material, reasonable allowance for replacement of unsuitable, compaction of subgrade, supply, placement and compaction of granular material
Exclusions:	No reshaping of table drains – refer USP_RSTD
	Brooming of adjacent seal only, no works to sealed pavement
Indicative plant:	Excavator, water truck, roller, truck, grader

Heavy shoulder grading

Where loss of shoulder material or scour has occurred due to overland or longitudinal flow, a **Heavy shoulder grading** should be carried out.

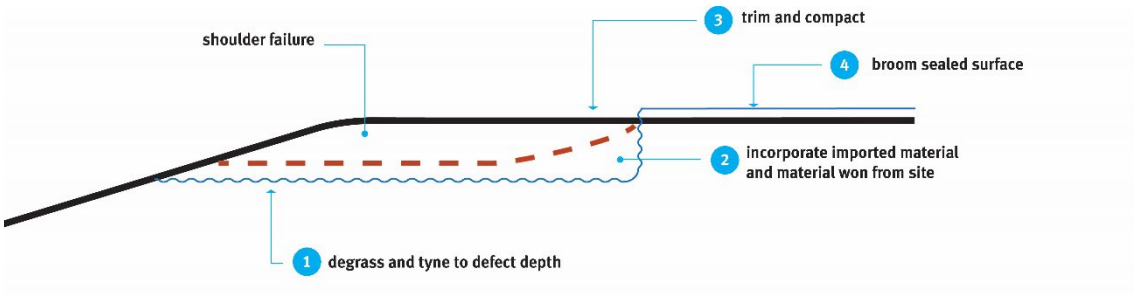

Figure 13 – Heavy shoulder grading

Treatment:	**SPR_HSG**
Unit of measurement:	m
Summary:	Grading of unsealed shoulder to reinstate correct profile
Description:	Reinstatement of formation and profile Includes recovery of material from adjacent table drains where appropriate (by grader), incorporation of additional 50mm top up material, tyne ≤100mm depth, trimming and rolling, and brooming of adjacent sealed surface. Where material additional to the included 50mm is required, include Gravel/material supply
Exclusions:	No works to sealed pavement
Indicative plant:	Grader, water truck, roller

Pavement seals

Where a road reconstruction, granular overlay or stabilisation has occurred as part of the restoration works, a seal will need to be applied. An asphalt surface or bitumen spray seal (2-coat) should be nominated consistent with the pre-disaster road surface.

Asphalt surfacing, ≤50mm thickness

Treatment:	**SPR_RSAC**
Unit of measurement:	m^2
Summary:	Asphalt surfacing ≤50mm
Description:	Preparation of the existing surface, supply and application of tack coat, supply, laying and compaction of asphalt, line spotting as required
Exclusions:	Line-marking
Indicative plant:	Truck, paver, roller

Bitumen spray seal, 2-coat

Treatment:	**SPR_RSSR**
Unit of measurement:	m^2
Summary:	Bitumen spray seal, 2-coat to local applied standard (including prime)
Description:	Preparation of the existing surface, supply, carting, heating and application of prime and spraying of bitumen seal (including cutter and additive), supply, carting, spreading and rolling of pre-coated aggregate, line spotting as required. Includes allowance for lapping of seal with existing.
Exclusions:	Line-marking
Indicative plant:	Truck, bitumen sprayer, roller

Clearing and earthworks

All clearing and earthworks treatments include the following work operations:

- site establishment and disestablishment of all plant, labour and materials
- establishment and disestablishment of traffic control
- determination of work area
- clean up of the site and disposal of any waste/removed material in accordance with applicable State Government legislation or Local Government by-laws

Reference	Treatment	Unit
EXC_HVC	Clear mixed debris and remove from site	m^3
EXC_RSOS	Bulk excavate surplus material and remove from site	m^3
EXC_RSS	Bulk excavate surplus material to spoil	m^3
BKF_IMP	Bulk fill - imported	m^3
BKF_LOC	Bulk fill - local	m^3

Bulk fill

Where scour or loss of road or formation has occurred, a bulk fill item should be selected to reinstate the road to natural surface level (for unformed roads), top of formation (for formed roads) or top of road subgrade (for gravel and sealed roads or table drains).

Where material can be sourced within vicinity of the works, **Bulk fill - local** (**BKF_LOC**) should be selected.

Where material, consistent with that lost, is unable to be won within vicinity of the works, **Bulk fill - imported** (**BKF_IMP**) should be selected, allowing for the purchase of general fill and haulage.

For a gravel or sealed road, bulk fill items should be used to reinstate material to subgrade level, and an appropriate pavement treatment selected to reinstate the road to the pre-disaster condition.

Treatment:	varies (**BKF_LOC**; **BKF_IMP**)
Unit of measurement:	m^3
Summary:	Bulk fill to localised scours
Description:	Sourcing and cartage of bulk fill material (varies as per below), preparation of underlying material, placement, incorporation (where required) and compaction
Exclusions:	Bulk fill material should be selected consistent with the displaced/scoured material.
Indicative plant:	Excavator (or backhoe or loader), grader (where dispersed over large areas), truck, water cart, roller

Excavation

Where mixed debris (including rocks, gravel, sand or silt mixed with vegetation or rubbish) has been deposited on a roadway or drainage lines, **Clear mixed debris and remove from site** (**EXC_HVC**) should be nominated.

Treatment:	**EXC_HVC**
Unit of measurement:	m^3
Summary:	Clear mixed debris and remove from site
Description:	Clearing of mixed debris material, loading and removal from site.
Exclusions:	Reshaping of roadway or drainage lines
Indicative plant:	Excavator (or backhoe or loader), grader (where dispersed over large areas), truck

Where large deposits of silt have been deposited on the roadway or within drainage lines, **Bulk excavate** (**EXC_RSOS** or **EXC_RSS**) should be nominated.

Treatment:	varies (**EXC_RSOS**, **EXC_RSS**)
Unit of measurement:	m^3
Summary:	Bulk excavation of surplus material
Description:	Excavation of surplus material, loading and removal from site (**ESC_RSOS**) or to spoil (**EXC_RSS**)
Exclusions:	Reshaping of roadway or drainage lines
Indicative plant:	Excavator (or backhoe or loader), truck, grader (where dispersed over large area of roadway)

Concrete works

Damage to concrete may include scouring, undermining, structural cracking, or total loss as a result of large or intense rainfall events.

All concrete works treatments include the following work operations:

- site establishment and disestablishment of all plant, labour and materials
- establishment and disestablishment of traffic control
- determination of work area
- clean up of the site and disposal of any waste/removed material in accordance with applicable State Government legislation or Local Government by-laws

Reference	Treatment	Unit
CON_KER	Reconstruct concrete kerb	m
CON_RCN	Reconstruct reinforced concrete	m^3
CON_RFC	Repair with flowable concrete	m^3

Reconstruct concrete kerb

Where damage to concrete kerb is suffered as a result of scour, or rendered unusable as a result works to underlying pavement, **Reconstruct concrete kerb** should be nominated. The kerb should be consistent with the pre-disaster kerb/adjoining sections.

Treatment:	**CON_KER**
Unit of measurement:	m
Summary:	Reconstruct concrete kerb
Description:	Saw cut and remove existing kerb. Prepare base and extrude/construct kerb. Backfill with suitable material
Exclusions:	Revegetation/turfing, removal/realignment of utilities.
Indicative plant:	Concrete saw, pavement breaker, bobcat/backhoe, kerb & channel machine, concrete agitator

Reconstruct reinforced concrete

Reinforced concrete assets include floodways, concrete batters, margins and footpaths. Damage to reinforced concrete assets including scouring, undermining, debris impact or total loss can occur during large or intense rainfall events. Where the damage suffered necessitates replacement, **Reconstruct reinforced concrete** should be nominated.

Treatment:	**CON_RCN**
Unit of measurement:	m^3
Summary:	Reconstruct reinforced concrete
Description:	Demolish and remove existing concrete. Prepare base, form and position reinforcing. Pour concrete, cure (where required) and finish surface. Backfill adjoining surface (where required).
Exclusions:	Revegetation/turfing, removal/realignment of utilities
Indicative plant:	Job truck, concrete saw, pavement breaker, bobcat/backhoe, and concrete agitator.

Repair with flowable concrete

Damage often results around bridges and drainage structures during disasters as a result of high velocity waters. **Repair with flowable concrete** may be used for filling of undermined reinforced concrete or for repair of grouted rock protection.

Treatment:	**CON_RFC**
Unit of measurement:	m^3
Summary:	Repair with flowable concrete
Description:	Pouring/pumping of flowable concrete to fill voids.
Exclusions:	Rock protection
Indicative plant:	Job truck, concrete truck, concrete pump

Drainage structures

Damage to drainage structures including scouring, undermining, debris impact, separation of units, silting or total loss can occur during large or intense rainfall events.

All drainage structure treatments include the following work operations:

- site establishment and disestablishment of all plant, labour and materials
- establishment and disestablishment of traffic control
- determination of work area
- the removal and re-instatement of roadside furniture (e.g. guide posts, signs etc.) as required
- clean up of the site and disposal of any waste/removed material in accordance with applicable State Government legislation or Local Government by-laws

Reference	Treatment	Unit
CUL_RP	Repair drainage structure - excavate, repair and reinstate	m
CUL_SIL	Desilt drainage structure - removal of silt and debris	m^3
CUL_RBC‹600	Replace RCBC, nominal span ≤600mm.	m
CUL_RBC‹900	Replace RCBC, nominal span ≤900mm.	m
CUL_RBC‹1200	Replace RCBC, nominal span ≤1200mm.	m
CUL_RBC›1200	Replace RCBC, nominal span ›1200mm.	m
CUL_RCP‹375	Replace concrete pipe ≤375mm dia.	m
CUL_RCP‹600	Replace concrete pipe ≤600mm dia.	m
CUL_RCP‹900	Replace concrete pipe ≤900mm dia.	m
CUL_RCP‹1200	Replace concrete pipe ≤1200mm dia.	m
CUL_RCP›1200	Replace concrete pipe ›1200mm dia.	m
CUL_RHW‹375	Replace head/end wall ≤375mm pipe or RCBC	unit
CUL_RHW‹600	Replace head/end wall ≤600mm pipe or RCBC	unit
CUL_RHW‹900	Replace head/end wall ≤900mm pipe or RCBC	unit
CUL_RHW‹1200	Replace head/end wall ≤1200mm pipe or RCBC	unit
CUL_RHW›1200	Replace head/end wall ›1200mm pipe or RCBC	unit

Where access issues exist, or there is uncertainty in quantities or cost of works, a market price may need to be sought to establish an estimate of cost following design.

Repair drainage structure

Where separation of culvert cells has occurred, but no damage to the pipes eventuated, **Repair drainage structure** should be nominated. Repair drainage structure allows for excavation of the drainage structure, resetting of the units, backfill with suitable material (representing value for money) and reinstatement of pavement.

Treatment:	**CUL_RP**
Unit of measurement:	m
Summary:	Repair drainage structure
Description:	Excavate, repair and reinstate drainage structure, backfill with suitable material and reinstatement of pavement.
Exclusions:	Pavement seal, import of rock protection
Indicative plant:	Excavator, lifting equipment, truck, roller

Clearing of culverts, pipes and pits

Where a culvert has been blocked, **Desilt drainage structure** should be selected to remove the silt and debris from the culvert where it is not possible to undertake the clearing by an excavator or small plant.

Treatment:	**CUL_SIL**
Unit of measurement:	m^3
Summary:	Clearing of culverts, pipes and pits
Description:	Cleaning or flushing of blocked culverts from debris or silt by hand tools, water pressure blasting or pull-back/pull-through system.
Exclusions:	Import of materials, import of rock protection, removal of spoil.
Indicative plant:	Watercart, high pressure water blaster, generator

Replace concrete pipe/RCBC

Where replacement of a drainage structure is required, replacement of concrete pipe/RCBC should be to the same size/arrangement as per pre-disaster. Where replacement to pre-disaster size and arrangement is not possible due to current requirements of cover, or not economical (due to obsolete sizes or combination of pipes) a concrete pipe/RCBC arrangement with a cross-sectional area equivalent to the pre-disaster arrangement should be nominated.

Treatment:	various (**CUL_RBC‹600, CUL_RBC‹900, CUL_RBC‹1200, CUL_RBC›1200, CUL_RCP‹600, CUL_RCP‹900, CUL_RCP‹1200, CUL_RCP›1200**)
Unit of measurement:	m
Summary:	Replacement of concrete pipes/RCBC
Description:	Excavate and dispose of existing drainage structure. Prepare base, form and construct base slab (where required) supply and place drainage structure, replace sand band (where required), backfill with suitable material and reinstate pavement.
Exclusions:	Head/end walls (end structures), scour protection, pavement seals
Indicative plant:	Excavator/ backhoe, hydraulic breaker, lifting equipment, truck, roller, concrete truck, concrete agitator. Concrete vibrator, rotary screed & concrete pump (if required)

Replace head/end wall

Where a culvert/RCBC end structure has been dislodged or damaged by an activated event, or rendered unusable as a result of reconstruction work to the adjoining culverts, replacement of the head/end wall should be nominated.

Unless nearby concrete works (floodways, margins etc.) is being undertaken, it is often more economical to use pre-cast units. Where multiple cell arrangements are in-place, this may not be possible or efficient due to manufacturing time etc. It is the responsibility of the asset owner to identify the best value for money solution for replacing the head/end wall.

Treatment:	various (**CUL_RHW‹600, CUL_RHW‹900, CUL_RHW‹1200, CUL_RHW›1200**)
Unit of measurement:	unit
Summary:	Replacement of culvert/RCBC end structures
Description:	Remove and dispose of existing end structure. Prepare base, supply and install OR construct end structure, backfill with suitable material.
Exclusions:	Pavement works, scour protection
Indicative plant:	Excavator, hydraulic breaker, lifting equipment, truck, roller

Protection works

Damage to rock protection (including mass/dumped rock, rock pitching and rock mattress) can occur from result of high velocity flows, undermining or debris impact during large or intense rainfall events.

Subject to the ability to achieve value for money, damaged protection works should be restored commensurate with pre-disaster arrangements. Where reconstruction to pre-disaster arrangements is uneconomical (due to material or labour availability), or not feasible (due to obsolete construction techniques) contemporary techniques may be employed.

All protection works treatments include the following work operations:

- site establishment and disestablishment of all plant, labour and materials
- establishment and disestablishment of traffic control
- determination of work area
- removal and re-instatement of roadside furniture (e.g. guide posts, signs etc.) as required
- preparation of work area
- placement of geotextile (where required)
- construction/placing of protection works
- clean up of the site and disposal of any waste/removed material in accordance with applicable State Government legislation or Local Government by-laws\

Reference	Treatment	Unit
RK_RKP	Rock protection	m^3
RK_STP	Repair stone pitching	m^2
RK_MAT	Construct rock mattress	m^3

Rock protection

Bulk rock for scour protection is commonly affected by large inundation or high intensity events due to its interaction high velocity waters. **Rock protection**, although low-tech, can be effective in mitigating against high velocity waters and requires limited preparation of the underlying surface prior to placement. Rock type should be selected subject to local availability.

Treatment:	**RK_RKP**
Unit of measurement:	m^3
Summary:	Rock protection works (bulk)
Description:	Preparation of work area, placement of geotextile (where required), recovery of displaced rock, placement of bulk rock.
Exclusions:	Pavement works
Indicative plant:	Excavator, truck

Where adequate sized rock in not economically viable, alternative solutions such as rock-mattresses may be considered.

Stone pitching

Stone pitching, whilst not commonly used in modern construction, is commonly encountered in older head-walls, margins, retaining walls and abutments. The extent of damage and the likely cost of repair needs to be considered. Alternatives such as shotcreting, gabions, rock-mattress, reinforced concrete or pre-cast elements may need to be considered where a repair option with stone pitching is not economically viable.

Treatment:	**RK_STP**
Unit of measurement:	m^2
Summary:	Repair stone pitching
Description:	Preparation of work area, cleaning of damaged area, supply and replacement of displaced or damaged stone and pitching.
Exclusions:	Pavement works
Indicative plant:	Truck, excavator, concrete agitator

Rock mattresses

Where bulk rock relies on its mass to withstand scouring waters, **rock mattresses** provide an alternative, able to utilise smaller rock through a caging system. Although more labour intensive, and requiring the purchase/manufacturing of cages, significantly less rock, and more easily sourced rock (due to size) may result in a value for money alternative.

Treatment:	**RK_MAT**
Unit of measurement:	m^3
Summary:	Installation of rock-mattresses
Description:	Preparation of the work area, placement of geotextile (where required), supply and installation cages, recovery of displaced rock, filling and wiring of cages.
Exclusions:	Pavement works
Indicative plant:	Excavator, truck

Note: Environmental conditions leading to corrosion of the cages/wires and estimated flow velocities (with potential to lead to failure of the cage or bunching of the rock) needs to be considered during specification.

Road furniture and delineation

Road furniture is often damaged during natural disasters as a result of flood waters or debris impacts. Where damage has occurred to road furniture, the number of units replaced should be commensurate with the pre-disaster arrangements, however a current standard of the pre-disaster system/item should be used.

All road furniture works include the following work operations:

- site establishment and disestablishment of all plant, labour and materials
- establishment and disestablishment of traffic control
- determination of work area
- removal of damaged road furniture
- re-instatement of roadside furniture
- clean up of the site and disposal of any waste/removed material in accordance with applicable State Government legislation or Local Government by-laws

Following restoration of sealed pavements, line-marking is generally required. Line marking should be consistent with either the adjoining sections of road or the pre-disaster arrangement.

Reinstate line-marking includes the following work operations:

- establishment and disestablishment of traffic control
- determination of work area
- cleaning the pavement in the work area (as required)
- spotting/symbolising
- application of marking material

Reference	Treatment	Unit
RFD_RGET	Replace guardrail end treatment	each
RFD_RG	Replace guardrail	m
RFD_RP	Replace guide posts or markers	each
RFD_RRS	Repair road signage	each
RFD_RSF	Replace sign face only - standard road sign	each
RFD_RCS	Replace sign (complete) - standard road sign, includes post	each
RFD_RLN	Reinstate line marking	m

Where a depth marker or similar has been damaged or destroyed, select **Replace sign (complete**) (**RFD_RCS**).

Other

Where works require engineering investigations/testing or detailed design, **OTHER** should be nominated. This includes landslips, coastal protection, structures, gabions, shotcreting etc.

Reference	Treatment	Unit
OTHER	Other - including structures, retaining items	lump sum

Specifics of the scope should be outlined and priced by the applicant for consideration.