

Specification (Measurement)

**Transport and Main Roads Specifications
MRS03 Drainage, Retaining Structures and Protective
Treatments**

January 2019

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1 Introduction

This Specification applies to the construction of drainage structures, retaining structures and protective treatments in roadworks.

The requirements for reinforced soil retaining structures are specified in MRS06 *Reinforced Soil Structures*.

This Specification shall be read in conjunction with MRS01 *Introduction to Specifications* and other Specifications as appropriate.

This Specification forms part of the Transport and Main Roads Specifications Manual.

2 Measurement of work

2.1 Standard Work Items

In accordance with the provisions of Clause 2.1.3 of MRS01 *Introduction to Specifications*, the Standard Work Items incorporated in this Specification are listed in Table 2.1.

Table 2.1 – Standard Work Items

Standard Item No.	Description	Unit of measurement
Drainage removal / demolition		
30001	Removal or demolition of culverts, complete	lump sum
30002	Removal or demolition of culvert end structures	lump sum
30003	Removal or demolition of culverts, excluding end structures	lump sum
30004	Removal or demolition of concrete kerb including kerb crossings	m
30005	Removal or demolition of concrete channel	m
30006	Removal or demolition of concrete kerb and channel including kerb crossings	m
30007	Removal or demolition of concrete slabs	m ²
30008	Removal or demolition of gullies	each
30009	Removal or demolition of access chambers	each
Supply of culverts		
30051	Supply of steel-reinforced concrete pipe culvert components, Class [class], [diameter] mm diameter, [environment] environment	m
30052	Supply of fibre reinforced concrete pipe culverts, Class [class], [diameter] mm diameter	m
30053	Supply of concrete box culvert components, [size]	m
30054	Supply of concrete spanning slabs, [size]	m
30055	Supply of helical lock-seam corrugated steel pipe culvert components, [size]	m
30056	Supply of helical lock-seam corrugated aluminium pipe culvert components, [size]	m

Standard Item No.	Description	Unit of measurement
30057	Supply of nestable corrugated steel pipe culvert components, [size]	m
30058	Supply of multiple plate corrugated steel pipe culvert components, [size]	m
30059	Supply of multiple plate corrugated steel pipe-arch culvert components, [size]	m
30060	Supply of multiple plate corrugated steel arch culvert components, [size]	m
30061	Supply of concrete pipe drainage trough components, [size]	m
30062	Supply of concrete box trough components, [size]	m
30063	Supply of nestable corrugated steel pipe drainage trough components, [size]	m
Installation of culverts		
30151	Installation of concrete pipe culvert components, [diameter] mm diameter	m
30152	Installation of fibre reinforced concrete pipe culvert components, [diameter] mm diameter	m
30153	Installation of concrete box culvert components, [size]	m
30154	Installation of concrete spanning slabs, [size]	m
30155	Installation of helical lock-seam corrugated steel pipe culvert components, [size]	m
30156	Installation of helical lock-seam corrugated aluminium pipe culvert components, [size]	m
30157	Installation of nestable corrugated steel pipe culvert components, [size]	m
30158	Installation of multiple plate corrugated steel pipe culvert components, [size]	m
30159	Installation of multiple plate corrugated steel pipe-arch culvert components, [size]	m
30160	Installation of multiple plate corrugated steel arch culvert components, [size]	m
30161	Installation of concrete pipe drainage trough components, [size]	m
30162	Installation of concrete box trough components, [size]	m
30163	Installation of nestable corrugated steel pipe drainage trough components, [size]	m
30164	Installation of pipe culvert components using jacking methods, [diameter] mm diameter	m
Supply and installation of culverts		
30251	Supply and installation of steel-reinforced concrete pipe culvert components, Class [class], [diameter] mm diameter, [environment] environment	m

Standard Item No.	Description	Unit of measurement
30252	Supply and installation of fibre reinforced concrete pipe culvert components, Class [<i>class</i>], [<i>diameter</i>] mm diameter	m
30253	Supply and installation of concrete box culvert components, [<i>size</i>]	m
30254	Supply and installation of concrete spanning slabs, [<i>size</i>]	m
30255	Supply and installation of helical lock-seam corrugated steel pipe culvert components, [<i>size</i>]	m
30256	Supply and installation of helical lock-seam corrugated aluminium pipe culvert components, [<i>size</i>]	m
30257	Supply and installation of nestable corrugated steel pipe culvert components, [<i>size</i>]	m
30258	Supply and installation of multiple plate corrugated steel pipe culvert components, [<i>size</i>]	m
30259	Supply and installation of multiple plate corrugated steel pipe-arch culvert components, [<i>size</i>]	m
30260	Supply and installation of multiple plate corrugated steel arch culvert components, [<i>size</i>]	m
30261	Supply and installation of concrete pipe drainage trough components, [<i>size</i>]	m
30262	Supply and installation of concrete box trough components, [<i>size</i>]	m
30263	Supply and installation of nestable corrugated steel pipe drainage trough components, [<i>size</i>]	m
30264	Supply and installation of pipe culvert components using jacking methods, Class [<i>class</i>], [<i>diameter</i>] mm diameter	m
Concrete in culverts and end structures		
30351	Concrete end plugs for culverts	m ³
30352	Concrete bases in culverts	m ³
30353	Concrete footings in culverts	m ³
30354	Concrete infill floors in culverts	m ³
30355	Concrete abutments and piers in culverts	m ³
30356	Concrete slab decks and kerbs in culverts	m ³
30357	Concrete unitary box culverts	m ³
30358	End structures to culverts, reinforced concrete	m ³
30359	End structures to culverts, unreinforced concrete	m ³
30360	End structures to culverts, rock masonry	m ³
30361	End structures to culverts, concrete masonry	m ³
30362	Aprons to culverts, reinforced concrete	m ³
30363	Aprons to culverts, unreinforced concrete	m ³
30364	Aprons to culverts, grouted rock pitching	m ³
30365	Aprons to culverts, steel wire mattresses	m ³

Standard Item No.	Description	Unit of measurement
30366	Precast concrete end structures to culverts, [size]	each
Pavement drainage		
30451	Concrete kerb, [type]	m
30452	Concrete kerb crossings, [type]	m
30453	Concrete channel, [type]	m
30454	Concrete kerb and channel, [type]	m
30455	Concrete kerb and channel crossings, [type]	m
30456	Precast concrete kerb blocks, [type]	m
30457	Precast concrete channel blocks, [type]	m
30458	Precast concrete kerb and channel blocks, [type]	m
30459	Shoulder dykes, concrete	m
30460	Shoulder dykes, asphalt	m
30461	Shoulder dykes, precast concrete blocks	m
30462	Concrete gullies, [size description]	each
30463	Concrete access chambers, [size description]	each
30464	Precast concrete access chambers, [size description]	each
30465	Precast concrete side inlet gullies with precast shaft, [size description]	each
30466	Precast concrete side inlet gullies with cast-in-place pit, [size description]	each
Subsurface drainage		
30551	Subsoil drains, Type B, [size] mm diameter	m
30552	Subsoil drains, Type D	m
30553	Subsoil drain outlet connection, [size] mm diameter, [type]	each
30554	Subsoil drain clean-out, [size] mm diameter, [type]	each
30555	Sheet filter drains	m ²
30556	Strip filter drains	m
30557	Sheet or strip filter drain outlet connection, [type]	each
30558	Vertical wick filter drains, plastic core	m
30559	Vertical sand drains	m
30560	Granular working platform for stone columns	m ³
30561	Supply and installation of reinforcement geosynthetic material for stone columns	m ²
30562	Supply and installation of geotextile, Strength Class [strength class], Filtration Class [filtration class]	m ²
30563	Stone columns	m

Standard Item No.	Description	Unit of measurement
Protective treatments		
30651	Concrete paved inverts in corrugated steel/aluminium culverts, [<i>size</i>]	m
30652	Linings in drains and channels, unreinforced concrete	m ³
30653	Linings in drains and channels, reinforced concrete	m ³
30654	Linings in drains and channels, grouted rock pitching	m ²
30655	Linings in drains and channels, steel wire mattresses	m ³
30656	Berm drain, [<i>width</i>] mm wide	m
30657	Concrete margins	m ³
30658	Concrete batters	m ³
30659	Concrete rail track crossings	m ³
30660	Concrete machinery crossings	m ³
30661	Hand placed concrete paving, [<i>thickness</i>] mm thick	m ²
30662	Sprayed concrete paving, [<i>thickness</i>] mm thick	m ²
30663	Block paving, [<i>thickness</i>] mm thick	m ²
30664	Rock masonry	m ³
30665	Grouted rock pitching	m ²
30666	Rock protection	m ³
30667	Steel wire gabion protection work	m ³
30668	Steel wire mattress protection work	m ²
30669	Fabric encased concrete batter protection on batter faces	m ²
30670	Fabric encased concrete batter protection in cut-off walls	m ²
30671	Bridge abutment protection Type 1 – rock spillthrough, [<i>location</i>] abutment	each
30672	Bridge abutment protection Type 2 – reinforced concrete over road embankment spillthrough, [<i>location</i>] abutment	each
30673	Bridge abutment protection Type 4 – rockwork over road embankment spillthrough, [<i>location</i>] abutment	each
30674	Bridge abutment protection Type 6 – interlocking blockwork over road embankment spillthrough, [<i>location</i>] abutment	each
30675	Shotcreting	m ³
30676	Bridge abutment protection Type 7 – Rock-filled gabion protection over road embankment, [<i>location</i>] abutment	each
Retaining walls		
30801	Concrete retaining wall, concrete in footing, [<i>wall location</i> / <i>wall number</i>]	m ³
30802	Concrete retaining wall, concrete in wall, [<i>wall location</i> / <i>wall number</i>]	m ³
30803	Concrete retaining wall, steel reinforcing bar, [<i>wall location</i> / <i>wall number</i>]	tonne

Standard Item No.	Description	Unit of measurement
30804	Concrete masonry retaining wall, concrete in footing, [<i>wall location wall number</i>]	m ³
30805	Concrete masonry retaining wall, masonry in wall, [<i>wall location wall number</i>]	m ²
30806	Concrete masonry retaining wall, steel reinforcing bar, [<i>wall location wall number</i>]	tonne
30807	Crib walls	m ²
30808	Boulder retaining wall	m ³
30809	Soil nailing	m
30810	Passive rock dowels	m
30811	Active rock bolts	m
Surveying requirements		
30901	Conformance and As Constructed survey for culverts	each
30902	Conformance and As Constructed survey for gullies	each
30903	Conformance and As Constructed for insitu concrete access chambers	each
30904	Conformance and As Constructed for precast concrete access chambers	each
30905	Conformance and As Constructed for concrete retaining wall footings	each
30906	Survey information for existing underground assets	lump sum

2.2 Work Operations

2.2.1 General

The listed work operations for the Standard Work Items are given below.

2.2.2 Removal or demolition of culverts and culvert end structures

Item 30001 Removal or demolition of culverts, complete

Item 30002 Removal or demolition of culvert end structures

Item 30003 Removal or demolition of culverts, excluding end structures

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) carrying out any necessary excavations
- c) removing or demolishing complete culverts or end structures or culvert units as relevant
- d) utilising or disposing of excavated and removed or demolished materials
- e) stacking removed culvert or end structure components
- f) backfilling resulting excavations, and
- g) transport of culverts or end structures selected for salvage to the nominated storage site.

2.2.3 Removal/demolition of kerbs and channels and concrete slabs

Item 30004 Removal or demolition of concrete kerb including kerb crossings

Item 30005 Removal or demolition of concrete channel

Item 30006 Removal or demolition of concrete kerb and channel including kerb crossings

Item 30007 Removal or demolition of concrete slabs

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) removing or demolishing concrete kerbs, channels and slabs
- c) utilising or disposing of excavated and removed or demolished material, and
- d) backfilling resulting excavations.

2.2.4 Removal / demolition of gullies and access chambers

Item 30008 Removal or demolition of gullies

Item 30009 Removal or demolition of access chambers

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) carrying out any necessary excavations
- c) removing or demolishing concrete gullies and access chambers
- d) utilising or disposing of excavated and demolished material, and
- e) backfilling resulting excavations.

2.2.5 Supply of precast and preformed culvert and drainage trough components

Item 30051 Supply of steel-reinforced concrete pipe culvert components, Class [class], [diameter] mm diameter, [environment] environment

Item 30052 Supply of fibre reinforced concrete pipe culverts, Class [class], [diameter] mm diameter

Item 30053 Supply of concrete box culvert components, [size]

Item 30054 Supply of concrete spanning slabs, [size]

Item 30055 Supply of helical lock-seam corrugated steel pipe culvert components, [size]

Item 30056 Supply of helical lock-seam corrugated aluminium pipe culvert components, [size]

Item 30057 Supply of nestable corrugated steel pipe culvert components, [size]

Item 30058 Supply of multiple plate corrugated steel pipe culvert components, [size]

Item 30059 Supply of multiple plate corrugated steel pipe-arch culvert components, [size]

Item 30060 Supply of multiple plate corrugated steel arch culvert components, [size]

Item 30061 Supply of concrete pipe drainage trough components, [size]

Item 30062 **Supply of concrete box trough components, [size]**

Item 30063 **Supply of nestable corrugated steel pipe drainage trough components, [size]**

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supply of all materials
- c) delivery to the site, and
- d) storage on the site.

2.2.6 Installation of precast and preformed culvert components

Item 30151 **Installation of concrete pipe culvert components, [diameter] mm diameter**

Item 30152 **Installation of fibre reinforced concrete pipe culvert components, [diameter] mm diameter**

Item 30153 **Installation of concrete box culvert components, [size]**

Item 30154 **Installation of concrete spanning slabs, [size]**

Item 30155 **Installation of helical lock-seam corrugated steel pipe culvert components, [size]**

Item 30156 **Installation of helical lock-seam corrugated aluminium pipe culvert components, [size]**

Item 30157 **Installation of nestable corrugated steel pipe culvert components, [size]**

Item 30158 **Installation of multiple plate corrugated steel pipe culvert components, [size]**

Item 30159 **Installation of multiple plate corrugated steel pipe-arch culvert components, [size]**

Item 30160 **Installation of multiple plate corrugated steel arch culvert components, [size]**

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials excluding culvert components
- c) carrying out excavations (†)
- d) utilising or disposing of excavated material (†)
- e) placing and compacting foundation bedding material and haunch zone material (†)
- f) cartage of culvert components from the storage site
- g) laying and jointing or placing and assembling culvert components
- h) cutting culvert components where necessary
- i) installing dowel bars and holding down anchors
- j) constructing concrete end blocks
- k) placing and compacting concrete infill material

- l) constructing thrust blocks and ring beams
- m) finishing and curing concrete
- n) supply, placing and compacting backfill material (including side zone and overlay zones) (†), and
- o) labelling drainage structures.

Work operations marked with a (†) above apply unless excavation and backfilling is measured separately in accordance with Clause 2.3 of MRS04 *General Earthworks*.

2.2.7 Installation of precast and preformed drainage trough components

Item 30161 Installation of concrete pipe drainage trough components, [size]

Item 30162 Installation of concrete box trough components, [size]

Item 30163 Installation of nestable corrugated steel pipe drainage trough components, [size]

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials, excluding drainage trough components
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) placing and compacting foundation bedding material
- f) cartage of drainage trough components from the storage site
- g) laying and jointing or placing and assembling culvert components
- h) cutting culvert components where necessary
- i) installing holding down anchors
- j) supply, placing and compacting backfill material, and
- k) labelling drainage structures.

2.2.8 Installation of precast pipe culvert components using jacking methods

Item 30164 Installation of pipe culvert components using jacking methods, [diameter] mm diameter

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials excluding culvert components
- c) establishment of excavating and jacking equipment on the site
- d) carrying out all excavations including jacking and receiving pits where necessary
- e) utilising or disposing of excavated material
- f) cartage of culvert components from the storage site

- g) jacking culvert components
- h) cutting culvert components where necessary
- i) filling pipe joints with mortar
- j) supply, placing and compacting backfill material, and
- k) labelling drainage structures.

2.2.9 Supply and installation of precast and preformed culvert and drainage trough components

Item 30251	Supply and installation of steel-reinforced concrete pipe culvert components, Class [class], [diameter] mm diameter, [environment] environment
Item 30252	Supply and installation of fibre reinforced concrete pipe culvert components, Class [class], [diameter] mm diameter
Item 30253	Supply and installation of concrete box culvert components, [size]
Item 30254	Supply and installation of concrete spanning slabs, [size]
Item 30255	Supply and installation of helical lock-seam corrugated steel pipe culvert components, [size]
Item 30256	Supply and installation of helical lock-seam corrugated aluminium pipe culvert components, [size]
Item 30257	Supply and installation of nestable corrugated steel pipe culvert components, [size]
Item 30258	Supply and installation of multiple plate corrugated steel pipe culvert components, [size]
Item 30259	Supply and installation of multiple plate corrugated steel pipe-arch culvert components, [size]
Item 30260	Supply and installation of multiple plate corrugated steel arch culvert components, [size]
Item 30261	Supply and installation of concrete pipe drainage trough components, [size]
Item 30262	Supply and installation of concrete box trough components, [size]
Item 30263	Supply and installation of nestable corrugated steel pipe drainage trough components, [size]
Item 30264	Supply and installation of pipe culvert components using jacking methods, Class [class], [diameter] mm diameter

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supply of all materials
- c) carrying out excavations (†)
- d) utilising or disposing of excavated material (†)

- e) placing and compacting foundation bedding material and haunch zone material (†)
- f) cartage of culvert components from the storage site
- g) laying and jointing or placing and assembling culvert components
- h) jacking culvert components where appropriate
- i) cutting culvert components where necessary
- j) installing dowel bars and holding down anchors
- k) constructing concrete end blocks
- l) placing and compacting concrete infill material
- m) constructing thrust blocks and ring beams
- n) finishing and curing concrete
- o) supply, placing and compacting backfill material (including side zone and overlay zones) (†),
and
- p) labelling drainage structures.

Work operations marked with a (†) above apply unless excavation and backfilling is measured separately in accordance with Clause 2.3 of MRS04 *General Earthworks*.

2.2.10 Concrete end plugs for existing culverts

Item 30351 Concrete end plugs for culverts

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) placing and compacting concrete, and
- d) finishing and curing concrete.

2.2.11 Insitu concrete culvert components

Item 30352 Concrete bases in culverts

Item 30353 Concrete footings in culverts

Item 30354 Concrete infill floors in culverts

Item 30355 Concrete abutments and piers in culverts

Item 30356 Concrete slab decks and kerbs in culverts

Item 30357 Concrete unitary box culverts

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations (†)
- d) utilising or disposing of excavated material (†)

- e) fabricating and placing steel reinforcement
- f) placing and compacting concrete
- g) supplying and placing embedded dowel bars and galvanised arch channels
- h) finishing and curing concrete, and
- i) supply, placing and compacting backfill material (†).

Work operations marked with a (†) above apply unless excavation and backfilling is measured separately in accordance with Clause 2.3 of MRS04 *General Earthworks*.

2.2.12 End structures to culverts

- Item 30358 End structures to culverts, reinforced concrete**
- Item 30359 End structures to culverts, unreinforced concrete**
- Item 30360 End structures to culverts, rock masonry**
- Item 30361 End structures to culverts, concrete masonry**
- Item 30362 Aprons to culverts, reinforced concrete**
- Item 30363 Aprons to culverts, unreinforced concrete**
- Item 30364 Aprons to culverts, grouted rock pitching**
- Item 30365 Aprons to culverts, steel wire mattresses**

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) constructing end structures
- f) constructing aprons
- g) laying and jointing masonry units
- h) installing dowel bars, and
- i) finishing and curing concrete work.

2.2.13 Precast concrete end structures to culverts

- Item 30366 Precast concrete end structures to culverts, [size]**

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all material
- c) carrying out excavations
- d) utilising or disposing of excavated material

- e) placing and compacting foundation bedding material, and
- f) placing and jointing end structures.

2.2.14 Cast-in-place concrete kerb, channel and kerb and channel

Item 30451 Concrete kerb, [type]

Item 30452 Concrete kerb crossings, [type]

Item 30453 Concrete channel, [type]

Item 30454 Concrete kerb and channel, [type]

Item 30455 Concrete kerb and channel crossings, [type]

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) placing and compacting concrete
- f) forming expansion and contraction joints, and
- g) finishing and curing concrete.

2.2.15 Precast concrete kerb, channel and kerb and channel blocks

Item 30456 Precast concrete kerb blocks, [type]

Item 30457 Precast concrete channel blocks, [type]

Item 30458 Precast concrete kerb and channel blocks, [type]

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) placing and compacting bedding material
- f) installing precast concrete kerb blocks, and
- g) installing precast concrete channel blocks.

2.2.16 Shoulder dykes

Item 30459 Shoulder dykes, concrete

Item 30460 Shoulder dykes, asphalt

Item 30461 Shoulder dykes, precast concrete blocks

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) placing and compacting concrete, asphalt or concrete blocks, and
- d) finishing and curing concrete.

2.2.17 Concrete gullies

Item 30462 Concrete gullies, [*size / description*]

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material at bottom of excavations
- f) fabricating and placing steel reinforcement
- g) placing and compacting concrete
- h) finishing and curing concrete
- i) placing cement mortar
- j) placing and compacting backfilling material
- k) fabricating, coating and installing grates and frames, and
- l) installing precast concrete back-units.

2.2.18 Concrete access chambers

Item 30463 Concrete access chambers, [*size | description*]

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material at the bottom of excavations
- f) fabricating and placing steel reinforcement
- g) placing and compacting concrete
- h) finishing and curing concrete
- i) placing cement mortar

- j) placing and compacting backfilling material
- k) shaping concrete benching, and
- l) installing step irons.

2.2.19 Precast concrete access chambers

Item 30464 Precast concrete access chambers, [size | description]

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material at the bottom of excavations
- f) placing and compacting backfilling material
- g) installing precast concrete access chambers
- h) placing cement mortar, and
- i) shaping concrete benching.

2.2.20 Precast concrete side inlet gullies

Item 30465 Precast concrete side inlet gullies with precast shaft, [size / description]

Item 30466 Precast concrete side inlet gullies with cast-in-place pit, [size / description]

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material at the bottom of excavations
- f) placing and compacting foundation bedding material
- g) placing and compacting concrete
- h) finishing and curing concrete
- i) installing precast concrete side inlet gully components
- j) placing cement mortar
- k) placing and compacting backfilling material, and
- l) shaping concrete benching.

2.2.21 Subsoil drains

Item 30551 Subsoil drains, Type B, [size] mm diameter

Item 30552 Subsoil drains, Type D

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) constructing concrete cradles
- f) placing, jointing and fixing geotextiles and textile sleeves
- g) installing, jointing and fixing prefabricated strip filter drains
- h) installing drainage pipes
- i) placing and compacting backfilling material, and
- j) installing marker maintenance posts.

Item 30553 Subsoil drain outlet connection, [size] mm diameter, [type]

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) constructing outlet ends
- d) installing maintenance marker post, and
- e) installing galvanised chicken-wire cones/pest-proof flaps to the outlets of drainage pipes.

Item 30554 Subsoil drain clean-out, [size] mm diameter, [type]

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) installing pipe and fittings
- d) installing concrete surrounds, and
- e) installing maintenance marker post.

2.2.22 Sheet or strip filter drains

Item 30555 Sheet filter drains

Item 30556 Strip filter drains

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) installing, combining, joining and fixing prefabricated sheet filter and strip filter drains
- f) installing collector pipes including all fittings, slitting of pipes and provision of filling around pipes, and
- g) supplying and installing marker maintenance posts.

Item 30557 Sheet or strip filter drain outlet connection, [type]

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) constructing outlet ends
- c) supplying and installing maintenance marker post, and
- d) supplying and installing galvanised chicken-wire cones/pest-proof flaps to the outlets of drainage pipes.

2.2.23 Vertical Drains

Item 30558 Vertical wick filter drains, plastic core

Item 30559 Vertical sand drains

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) placing and fixing vertical wick filter drains, and
- f) placing and compacting and monitoring sand drains.

2.2.24 Stone Columns

Item 30560 Granular working platform for stone columns

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) preparation of the existing surface

- c) supply of granular material, and
- d) construction of the granular working platform.

Item 30561 Supply and installation of reinforcement geosynthetic material for stone columns

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and
- b) supply and installation of reinforcement geosynthetic material.

Item 30562 Supply and installation of geotextile, Strength Class [*strength class*], Filtration Class [*filtration class*]

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and
- b) supply and installation of geotextile.

Item 30563 Stone columns

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) installation of stone columns
- d) clearing the Site of spoil, mud and sedimentation ponds, and
- e) reinstatement of disturbed areas.

2.2.25 Concrete paved inverts in corrugated culverts

Item 30651 Concrete paved inverts in corrugated steel/aluminium culverts, [*size*]

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) preparing the surfaces on which paved inverts are to be constructed, and
- d) constructing paved inverts.

2.2.26 Linings in drains and channels

Item 30652 Linings in drains and channels, unreinforced concrete

Item 30653 Linings in drains and channels, reinforced concrete

Item 30654 Linings in drains and channels, grouted rock pitching

Item 30655 Linings in drains and channels, steel wire mattresses

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials

- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material below surfaces to be lined, and
- f) constructing lining.

2.2.27 Berm drains

Item 30656 Berm drain, [*width*] mm wide

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material below surfaces to be lined, and
- f) constructing concrete lining.

2.2.28 Concrete margins and batters

Item 30657 Concrete margins

Item 30658 Concrete batters

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material below surfaces covered by margins and batters
- f) constructing margins (including cut-off walls)
- g) constructing batters (including cut-off walls)
- h) supplying and installing steel sleeves, and
- i) providing weepholes.

2.2.29 Concrete rail track crossings and machinery crossings

Item 30659 Concrete rail track crossings

Item 30660 Concrete machinery crossings

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations

- d) utilising or disposing of excavated material
- e) compacting material at bottom of excavations
- f) placing and compacting foundation bedding material, and
- g) constructing concrete crossings.

2.2.30 Hand placed concrete paving

Item 30661 Hand placed concrete paving, [*thickness*] mm thick

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material at the bottom of excavations
- f) fabricating and placing steel reinforcement
- g) placing and compacting concrete
- h) placing compressible packing, and
- i) finishing and curing concrete.

2.2.31 Sprayed concrete paving

Item 30662 Sprayed concrete paving, [*thickness*] mm thick

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material at the bottom of excavations
- f) fabricating and placing steel reinforcement
- g) spraying concrete
- h) placing compressible packing, and
- i) finishing and curing concrete.

2.2.32 Block paving

Item 30663 Block paving, [*thickness*] mm thick

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials

- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material at the bottom of excavations
- f) placing bedding material
- g) placing paving blocks
- h) compaction of blocks and bedding
- i) cutting paving blocks, and
- j) filling gaps between blocks and edge restraints.

2.2.33 Rock masonry

Item 30664 Rock masonry

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) placing cement mortar
- f) placing compressible filler
- g) placing rock
- h) placing tightly packed rock behind the pile and between blocks of rock masonry, and
- i) placing geotextile, sheet and strip filter drain.

2.2.34 Grouted rock pitching

Item 30665 Grouted rock pitching

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) placing foundation bedding material
- f) placing rock, and
- g) placing cement mortar.

2.2.35 Rock protection

Item 30666 Rock protection

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material, and
- e) dumping or otherwise placing rock.

2.2.36 Steel-wire gabion protection work

Item 30667 Steel wire gabion protection work

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) assembling, positioning and joining gabions
- f) forming shapes
- g) placing rock filling, and
- h) closing gabions.

2.2.37 Steel-wire mattress protection work

Item 30668 Steel wire mattress protection work

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) installing anchor plates, anchor bolts and anchor pickets
- f) assembling, positioning and joining mattresses
- g) forming shapes
- h) placing rock filling, and
- i) closing mattresses.

2.2.38 Fabric encased concrete batter protection

Item 30669 Fabric encased concrete batter protection on batter faces

Item 30670 Fabric encased concrete batter protection in cut-off walls

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations, and
- d) utilising or disposing of excavated material.

2.2.39 Bridge abutment protection Type 1 – rock spill through

Item 30671 Bridge abutment protection Type 1 – rock spillthrough, [location] abutment

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) construction of rock masonry toe wall
- f) constructing rockfill, and
- g) constructing hand-packed rock face and grouting with cement mortar.

2.2.40 Bridge abutment protection Type 2 – reinforced concrete over earth spillthrough

Item 30672 Bridge abutment protection Type 2 – reinforced concrete over road embankment spillthrough, [location] abutment

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) constructing concrete toe walls, edge walls and capping
- f) constructing reinforced concrete slabs, and
- g) provision of joints, where required.

2.2.41 Bridge abutment protection Type 4 – rockwork over earth spillthrough

Item 30673 Bridge abutment protection Type 4 – rockwork over road embankment spillthrough, [location] abutment

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) constructing rock masonry toe wall
- f) constructing rockwork layer, and
- g) constructing hand-packed rock face and grouting with cement mortar.

2.2.42 Bridge abutment protection Type 6 – interlocking blockwork over earth spillthrough

Item 30674 Bridge abutment protection Type 6 – interlocking blockwork over road embankment spillthrough, [*location*] abutment

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) constructing cement stabilised sand
- f) placing PVC-slotted pipe
- g) placing granular fill
- h) placing, jointing and fixing geotextile
- i) constructing concrete toe walls, edge walls, mid walls and capping, and
- j) installing interlocking blocks.

2.2.43 Shotcreting

Item 30675 Shotcreting

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) fabrication of fixing pins
- d) hot-dipped galvanising of steelwork
- e) fabricating and placing steel reinforcement
- f) provision of weep holes
- g) spraying shotcrete, and
- h) provision of joints where required.

2.2.44 Bridge abutment protection Type 7 – Rock-filled gabion protection

Item 30676 Bridge abutment protection Type 7 - Rock-filled gabion protection over road embankment, [*location*] abutment

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials except eyebolts for safety harness. Note eyebolts are included in Item 7314 of MRS62 *Bridge Substructure*
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) constructing subsoil drainage, applicable to gabion toe only
- f) installing geotextile layer
- g) constructing gabion toe or mass concrete toe
- h) constructing cement stabilised sand layer, rock armour and rock-filled mattress toe protection
- i) constructing rock-filled gabion protection,
- j) installing medium impact polythene sheet separator for capping construction,
- k) constructing concrete capping, and
- l) Dewatering and cofferdam where required.

2.2.45 Concrete retaining walls

Item 30801 Concrete retaining wall, concrete in footing, [*wall location* / *wall number*]

Item 30802 Concrete retaining wall, concrete in wall, [*wall location* / *wall number*]

Item 30803 Concrete retaining wall, steel reinforcing bar, [*wall location* / *wall number*]

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material at bottom of excavations
- f) fabricating and placing steel reinforcing
- g) placing and compacting concrete
- h) finishing and curing of concrete
- i) fabricating and placing inserts
- j) installation of expansion and contraction joints
- k) installing weep holes
- l) installing drainage behind retaining wall, and

- m) backfilling behind retaining wall where required.

2.2.46 Concrete masonry retaining walls

Item 30804 Concrete masonry retaining wall, concrete in footing, [*wall location / wall number*]

Item 30805 Concrete masonry retaining wall, masonry in wall, [*wall location / wall number*]

Work Operations incorporated in the above items include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials, excluding reinforcing
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material at bottom of excavations
- f) constructing concrete footings
- g) finishing and curing of concrete
- h) laying and jointing masonry units
- i) placing and compacting concrete infill
- j) fabricating and placing inserts
- k) installation of expansion and contraction joints
- l) installing weep holes
- m) constructing capping walls
- n) installing drainage behind retaining wall, and
- o) backfilling behind retaining wall where required.

Item 30806 Concrete masonry retaining wall, steel reinforcing bar, [*wall location / wall number*]

Work Operations incorporated in the above item include:

- a) Work Operations incorporated in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials, and
- c) fabricating and placing steel reinforcements.

2.2.47 Crib walls

Item 30807 Crib walls

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material

- e) compacting material at bottom of excavations
- f) constructing concrete footings
- g) installing crib units, and
- h) placing and compacting backfilling material.

2.2.48 Boulder retaining walls

Item 30808 Boulder retaining wall

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) carrying out excavations
- d) utilising or disposing of excavated material
- e) compacting material at bottom of excavations
- f) placing boulders/rockfill
- g) installing drainage blanket behind boulder retaining wall
- h) installing seepage drains
- i) backfilling behind boulder retaining wall
- j) compacting backfill behind or adjacent to boulder retaining wall/drainage bracket
- k) filling voids between boulders with slurry concrete, and
- l) inspections by RPEQ Geotechnical Engineer.

2.2.49 Soil nailing

Item 30809 Soil nailing

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) fabrication of soil nails
- d) hot-dipped galvanising of steelwork
- e) drilling holes for soil nails
- f) installation of nails
- g) grouting soil nails, and
- h) acceptance testing.

2.2.50 Passive rock dowels

Item 30810 Passive rock dowels

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) fabrication of dowels
- d) hot-dipped galvanising of dowels
- e) encapsulating dowels in HDPE sheath
- f) drilling holes for dowels
- g) installing dowels
- h) grouting dowels, and
- i) acceptance testing.

2.2.51 Active rock bolts

Item 30811 Active rock bolts

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*
- b) supplying all materials
- c) fabrication of rock bolts
- d) hot-dipped galvanising of steelwork
- e) drilling holes for rock bolts
- f) installing rock bolts
- g) grouting rock bolts
- h) stressing the rock bolts, and
- i) acceptance testing.

2.2.52 Surveying requirements

Item 30901 Conformance and As Constructed survey for culverts

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 59 of MRS03 *Drainage, Retaining Structures and Protective Treatments*.

Item 30902 Conformance and As Constructed for gullies

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 59 Surveying requirements of MRS03 *Drainage, Retaining Structures and Protective Treatments*.

Item 30903 Conformance and As Constructed for insitu concrete access chambers

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 59 of MRS03 *Drainage, Retaining Structures and Protective Treatments*.

Item 30904 Conformance and As Constructed survey for precast concrete access chambers

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 59 of MRS03 *Drainage, Retaining Structures and Protective Treatments*.

Item 30905 Conformance and As Constructed for concrete retaining wall footings

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 59 of MRS03 *Drainage, Retaining Structures and Protective Treatments*.

Item 30906 Survey information for existing underground assets

Work Operations incorporated in the above item include:

- a) Work Operations listed in Clause 60 of MRS03 *Drainage, Retaining Structures and Protective Treatments*.

2.3 Measurement

2.3.1 Measurement of removal/demolition

Where any of Items 2104–2109 are not scheduled separately, demolition and/or removal of existing infrastructure shall be included in Item 3101 in MRS04 *General Earthworks*.

2.3.2 Measurement of excavation and backfilling

In general, any excavation and backfilling required to be carried out in order to construct the work described by this Specification shall not be measured separately. Payment for excavation and backfilling shall be deemed to be included in the rate for the appropriate Standard Work Item for the particular work.

However, where specifically provided for under Clause 2.3 of MRS04 *General Earthworks*, excavation and backfilling for particular components of the work under the Contract may be measured separately. Where this is the case, appropriate Standard Work Items from MRS04 *General Earthworks* shall be included in the Schedule of Rates.

2.3.3 Measurement of precast culverts

This Specification provides Standard Work Items for:

- a) supply only
- b) installation only, and
- c) supply and installation

of precast culvert components.

Any combination of Standard Work Items relating to these methods of measurement may be used in the Schedule of Rates. However, where a Standard Work Item for supply and installation of a particular culvert structure is included in the Schedule of Rates, no supply only nor installation only Standard Work Item shall also apply to that structure.

2.4 Calculation of quantities

2.4.1 General

Unless specified otherwise in Clause 2.4, quantities shall be calculated in accordance with the provisions of Clause 2.1.1 of MRS01 *Introduction to Specifications*.

2.4.2 Precast culverts

Where precast culvert components are supplied only under the Contract (i.e., not installed), the quantity shall be the exact length supplied and quantities shall not be rounded in accordance with Clause 2.1.1 of MRS01 *Introduction to Specifications*.

Where precast culvert components are installed only or are supplied and installed under the Contract, the quantity shall be measured in accordance with the remainder of this Clause and normal rounding of the final quantity shall apply.

Where culverts are installed by other than jacking methods:

a) Single cell culverts

The quantity shall be the invert length along the centreline of the cell as shown on or calculated from the Drawings, or

b) Multiple cell culverts

Where the cells are of equal length, the quantity shall be the invert length along the centreline of one cell only as shown on or calculated from the Drawings.

Where the cells are of variable length, the quantity shall be the average of the invert lengths along the centreline of all cells as shown on or calculated from the Drawings.

Where culverts are installed using jacking methods:

a) Whole length of culvert is installed as a jacking operation

The quantity shall be the invert length along the centreline of the culvert for the complete installation as shown on or calculated from the Drawings, or

b) Part of the length of culvert only is jacked

The quantity shall be the invert length along the centreline of that section of culvert which is actually required to be jacked as shown on or calculated from the Drawings, plus an allowance of 2.4 m for end stubs. The remainder of the culvert shall be measured as for installation other than using jacking methods.

2.4.2.1 Stone columns

The quantity of stone columns shall be the length of stone column in place and shall be the sum of the individual lengths of each column, calculated as the difference between the height of the ground surface and the founding level as shown on the Drawings or otherwise accepted by the Superintendent.

The quantity of the working platform shall be the volume calculated from the dimensions shown on the Drawings.

Embankment fill above stone columns shall be measured in accordance with the relevant Standard Work Items in MRS04 *General Earthworks*.

2.4.2.2 Soil nails, passive rock dowels and active rock bolts

The quantity of soil nails, passive rock dowels and active rock bolts shall be calculated as the sum of the lengths of soil nails, passive rock dowels or active rock bolts installed, grouted, stressed (where applicable) and load tested successfully.

