TABLE 1
EMBEDMENT AND NATIVE SOIL - MATERIALS AND MODULI FOR DESIGN OF BURIED FLEXIBLE PIPES*

MATERIALS				MODULI E'_e (EMBANKMENT MATERIAL) AND E'_n (NATIVE MATERIAL) MPa			
DESCRIPTION	CLASSIFICATION		UNCOMPACTED	R_D (%) (DRY DENSITY RATIO)			
	AS 1726 †	AS 2758.1		85	90	95	100
				I_D (%) (DENSITY INDEX)			
				50	60	70	80
			STANDARD PENETRATION TEST ‡ NUMBER OF BLOWS				
			≤4	>4 ≤14	>14 ≤24	>24 ≤50	>50
GRAVEL - SINGLE SIZE	-	COARSE AGGREGATE	5§	7§	7§	10§	14
GRAVEL - GRADED	-		3§	5§	7§	10§	20
SAND AND COARSE-GRAINED SOIL WITH LESS THAN 12% FINES	GP, SW, SP AND GM-GL, GC-SC etc.	-	1	3§	5§	7§	14
COARSE-GRAINED SOIL WITH MORE THAN 12% FINES	GM, GC, SC, SM AND GM-SC, GC-SC	-	NR	1§	3§	5§	10
FINE-GRAINED SOIL (LL<50%) WITH MEDIUM TO NO PLASTICITY AND CONTAINING MORE THAN 25% COARSE-GRAINED PARTICLES	CL, ML, MIXTURES ML-CL, AND ML-MH	-	NR	1§	3§	5§	10
FINE-GRAINED SOIL (LL<50%) WITH MEDIUM TO NO PLASTICITY AND CONTAINING LESS THAN 25% COARSE-GRAINED PARTICLES	CI, CL, ML, MIXTURES ML-CL, CL-CH AND ML-MH	-	NR	NR	1	3	7
FINE-GRAINED SOIL (LL>50%) WITH MEDIUM TO HIGH PLASTICITY	CH, MH AND CH-MH	-	NR	NR	NR	NR	NR

* VALUES APPLY FOR COVERS TO 10.0 m AND ARE CONSERVATIVE FOR GREATER COVERS.

† SEE APPENDIX A OF AS/NZS 2566.1 SUPP 1.

‡ FOR NATIVE SOILS ONLY. SEE AS 1289.6.3.2.

§ THESE VALUES ARE THE MORE COMMONLY USED AND ACHIEVED IN PRACTICE.

NR = NO RELIABLE MODULUS VALUES FOR THESE MATERIALS. SPECIALIST GEOTECHNICAL ASSESSMENT AND STRUCTURAL DESIGN IS REQUIRED.

NOTES:

1. FOR DESIGN OF BURIED FLEXIBLE PIPES ONLY. FOR RC PIPES REFER TO AS 3725 AND FOR VC PIPES REFER TO AS 4060.
2. VALUES ARE CONSERVATIVE AS THEY CONTAIN A REDUCTION IN MODULUS WHICH OCCURS WHEN GROUND WATER IS ABOVE THE PIPE. ALLOWANCE CAN BE MADE FOR DRY GROUND CONDITIONS. (SEE AS/NZS 2566.1 SUPP 1.)
3. WHERE APPROPRIATE, GEOTEXTILE IS TO BE PLACED BETWEEN NATIVE SOIL AND EMBEDMENT MATERIAL TO PREVENT MIGRATION OF FINES.
4. WHERE STABILISED MATERIALS ARE USED, THE DESIGNER SHALL DETERMINE VALUES FOR E'_e FOR THE SPECIFIED MATERIAL.

TABLE 2
MINIMUM COMPACTION OF EMBEDMENT

MATERIAL TYPE	TEST METHOD	MINIMUM VALUE (%)			
		TRAFFICABLE AREAS		NON-TRAFFICABLE AREAS	
		EMBEDMENT	TRENCH / EMBANKMENT FILL	EMBEDMENT	TRENCH / EMBANKMENT FILL
COHESIONLESS [3]	DENSITY INDEX (I_D) AS 1289.5.6.1	FLEXIBLE PIPES: 70[1] RIGID PIPES: 70[1,4]	70[2]	60	60
COHESION	DRY DENSITY RATIO (R_D) TO AS 1289.5.4.1 & Hilf DENSITY[3] TO AS 1289.5.7.1	FLEXIBLE PIPES: 95 RIGID PIPES: 95	95	90	90

NOTES:

1. SINGLE SIZE COARSE AGGREGATES OF SIZES 7, 10 AND 14 mm ARE DEEMED "SELF COMPACTING" AND DO NOT REQUIRE COMPACTION TESTING WHEN USED FOR PIPE EMBEDMENT.
2. THE ROAD OWNER (e.g. TCCS) MAY SPECIFY ALTERNATIVE VALUES.
3. GRADED GRAVELS AND SANDS HAVING FINES (SILTS AND CLAYS) GREATER THAN 5% TO HAVE THEIR COMPACTION DETERMINED BY THE DRY DENSITY RATIO TEST METHOD.
4. INCREASE PIPE CLASS (STIFFNESS) TO AVOID USING SUPPORT TYPE BETTER THAN HS2 FOR GREATER BURIED DEPTH/COVER.

No.	ISSUE	DATE	DRAWN	CHECKED	AUTHORISED
A	INITIAL ISSUE	15/06/2018	M. Matusiak	K. Danenbergsons	D. Eager
B	APPLICABILITY CHART UPDATED	18/06/2019	S. Essery	K. Danenbergsons	C. Patrick

ICON WATER ACKNOWLEDGES THE USE OF AS/NZS 2566 IN THE DEVELOPMENT OF THIS DRAWING.

DAM	X	RES	X	SPS	X
BWS	X	WAT	X	STP	X
WTP	X	SEW	X		
WPS	X	REC			

ASSET AREA APPLICABILITY

STANDARD DRAWING
SEWERAGE AND WATER NETWORKS
PIPE EMBEDMENT AND TRENCH FILL MATERIALS

DRAWING STATUS: Current

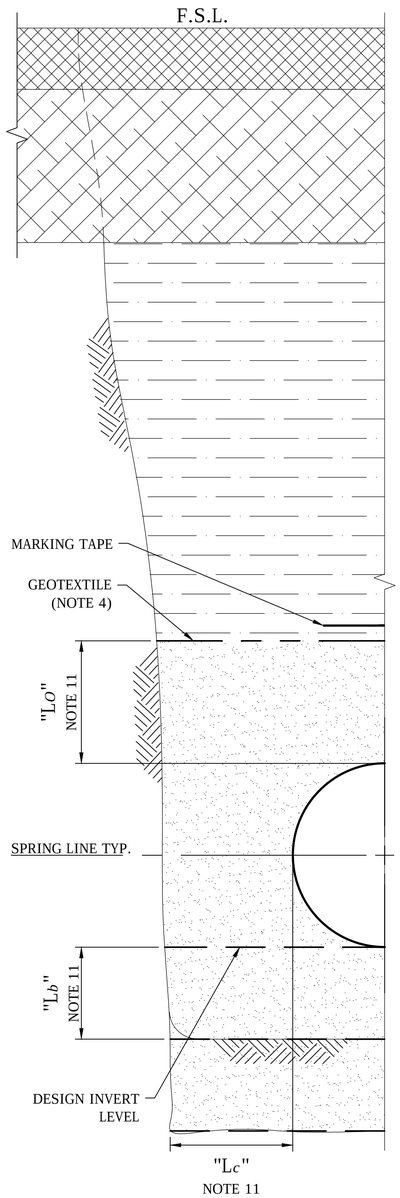
SD-2100-C

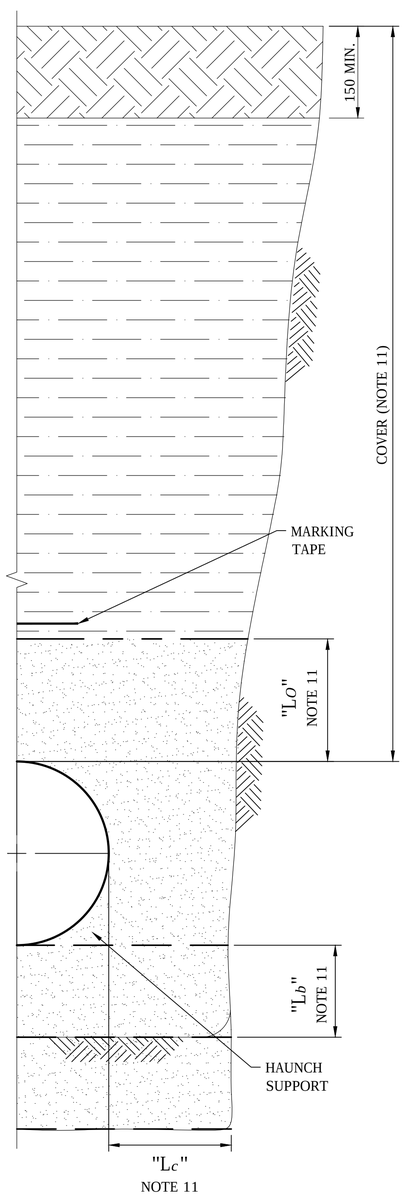
A1

ISSUE B

MATERIAL		ZONE		
ROAD SURFACE	VERGE & TRACK			
ROAD SURFACE LAYER	TO MATCH EXISTING	SURFACE COURSE		
TO MATCH EXISTING ROAD BASE OR TO ROAD OWNERS REQUIREMENTS	ROAD SUB BASE MATERIAL DGS20, DGS40 OR GMS40 (REFER TO TCCS STANDARD SPECIFICATION)	ROAD BASE		
ROAD SUB BASE MATERIAL DGS20, DGS40 OR GMS40 (REFER TO TCCS STANDARD SPECIFICATION)		TRENCH FILL		
EMBEDMENT MATERIAL IN ACCORDANCE WITH DESIGN DRAWINGS AND ICON WATER REQUIREMENTS (NOTE 3) BEDDING MAY BE OMITTED IF TRENCH BASE IS GRANULAR SAND OR GRAVEL OF SUITABLE GRADING.		OVERLAY	EMBEDMENT	
		SIDE SUPPORT		
		BEDDING		
		OVER-EXCAVATION		

TRAFFICABLE AREAS





ZONE		MATERIAL
TOPSOIL OR PAVEMENT		ORIGINAL OR IMPORTED MATERIAL TO MATCH EXISTING
TRENCH FILL		INORGANIC ENGINEERED FILL MATERIAL WITH 75 MAXIMUM STONE SIZE TO WSA-PS-363 OR DGS20 TO TCCS STANDARD SPECIFICATION
EMBEDMENT	OVERLAY	EMBEDMENT MATERIAL IN ACCORDANCE WITH DESIGN DRAWINGS AND ICON WATER REQUIREMENTS (NOTE 3) BEDDING MAY BE OMITTED IF TRENCH BASE IS GRANULAR SAND OR GRAVEL OF SUITABLE GRADING.
	SIDE SUPPORT	
	BEDDING	
OVER-EXCAVATION		

NON TRAFFICABLE AREAS

INCLUDES LOCATIONS WHERE OCCASIONAL VEHICLE LOADING OCCURS (e.g. RESERVES AND VERGES OUTSIDE THE TRAFFICABLE AREA).

NOTES:

1. SPECIFY SPECIAL BEDDING MATERIAL TO SUIT THE CONDITIONS IF THE TRENCH FLOOR HAS:
   - IRREGULAR OUTCROPS OF ROCK.
   - SOIL MODULUS DENOTED "NR" IN TABLE 1 ON DRAWING SD-2100.
   - BEEN DISTURBED BY UNCONTROLLED GROUND WATER.
2. COMPACT AND EVENLY GRADE TRENCH FLOOR.
3. EMBEDMENT, TRENCH FILL AND COMPACTION TO MEET THE REQUIREMENTS OF DESIGN DRAWINGS AND WSA 02 2014 V3.1 FOR SEWER AND WSA 03 FOR WATER AS AMENDED BY ICON WATER SUPPLEMENTS STD-SPE-G-011 AND 012 RESPECTIVELY.
4. USE GEOTEXTILE FILTER FABRIC WHERE SPECIFIED.
5. SIDES OF EXCAVATION TO BE KEPT VERTICAL TO AT LEAST 150 ABOVE PIPE.
6. MINIMUM COVER SHALL BE SPECIFIED BY THE DESIGNER IN DESIGN DRAWINGS IN ACCORDANCE WITH TABLE 1 OF SD-2106. PROVIDE COVER UNDER FINISHED ROAD LEVEL AS REQUIRED BY ROAD AUTHORITY AND ICON WATER.
7. CROSSINGS UNDER RAILWAYS SHALL BE DESIGNED USING ENGINEERING PRINCIPLES AND IN CONSULTATION WITH THE RAIL AUTHORITY.
8. IN GENERAL THE PIPE DESIGN SHALL ENSURE THAT PIPES ARE NOT LAID DEEPER THAN 5000. DESIGN OF PIPES DEEPER THAN 5000 SHALL BE SUBJECT TO SPECIAL APPROVAL BY ICON WATER. IN THESE CASES, ICON WATER MAY REQUIRE THAT THE PIPES BE LAID AS MAINTENANCE FREE CONDUITS WITH A PLAIN CONCRETE SURROUND (SEE BEDDING TYPE "G" ON SD-2103).
9. TRAFFICABLE AREAS INCLUDE:
   - THE FULL WIDTH OF ANY EXISTING OR PROPOSED ROAD CARRIAGEWAY PLUS SHOULDERS AND EXTENDING TO 1 m BEYOND THE SHOULDERS AND KERBS.
   - THE FULL WIDTH OF ANY PROPERTY ACCESS DRIVEWAY AND EXTENDING 1 m EITHER SIDE.
   - THE FULL LENGTH OF ANY CONSTRUCTED FOOTWAY INCLUDING, BUT NOT LIMITED TO, CONCRETE, ASPHALT AND CRUSHED ROCK PAVEMENTS.
   - THE FULL WIDTH OF ANY MEDIAN STRIP.
   - ANY OTHER AREA SUBJECT TO VEHICULAR TRAFFIC.
10. STANDARD TRENCH DETAILS NOT TO BE USED IN REGIONS OF POTENTIAL SLIP, UNSTABLE OR TALUS GROUND.
11. REFER TO SD-2106 FOR MINIMUM COVER, TRENCH CLEARANCES AND CLEARANCES TO OTHER SERVICES.

No.	ISSUE	DATE	DRAWN	CHECKED	AUTHORISED
A	INITIAL ISSUE	15/06/2018	M. Matusiak	K. Danenbergsons	D. Eager
B	MAJOR DRAWING UPDATE	18/06/2019	S. Essery	K. Danenbergsons	C. Patrick

ICON WATER ACKNOWLEDGES WATER SERVICES ASSOCIATION OF AUSTRALIA IN THE DEVELOPMENT OF THIS DRAWING, IN PARTICULAR, DRAWING :SEW-1201

DAM	X	RES	X	SPS	X
BWS	X	WAT	X	STP	X
WTP	X	SEW	X		
WPS	X	REC			

ASSET AREA APPLICABILITY

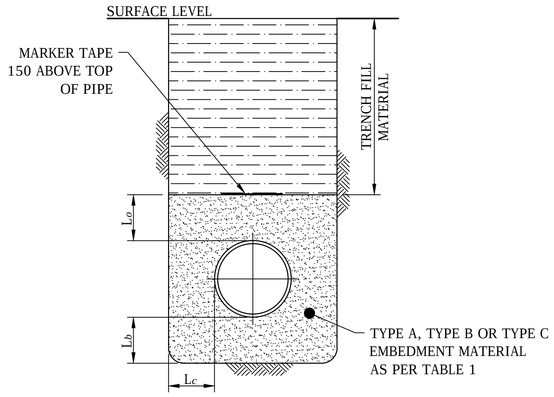
STANDARD DRAWING
SEWERAGE AND WATER NETWORKS
PIPE EMBEDMENT AND TRENCH FILL
TYPICAL ARRANGEMENT

DRAWING STATUS: Current

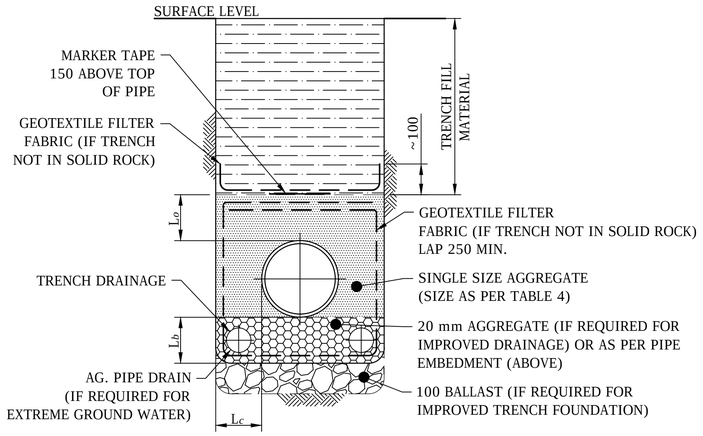
SD-2101-C

A1

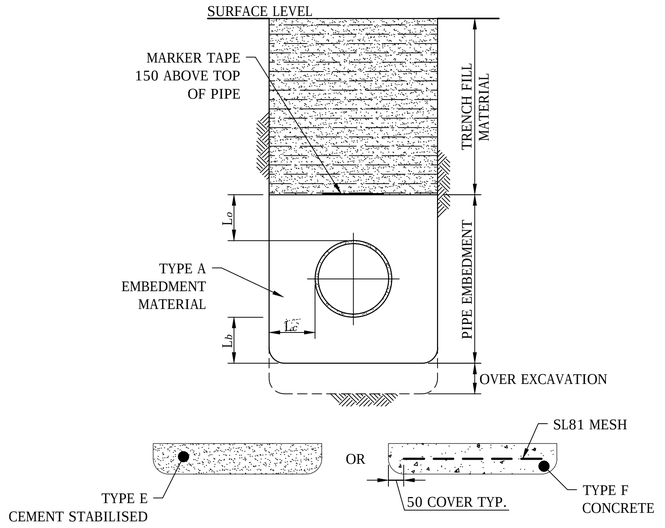
ISSUE B



TYPE A - STANDARD EMBEDMENT
TYPE B - CEMENT STABILISED
AND
TYPE C - CONTROLLED LOW STRENGTH MATERIAL (CLSM)
EMBEDMENT



TYPE D - SINGLE SIZED AGGREGATE
EMBEDMENT



TYPE E - CEMENT STABILISED
AND
TYPE F - CONCRETE
WHERE OVER-EXCAVATION OR LOW BEARING
CAPACITY TRENCH BOTTOM OCCURS

TABLE 1		
EMBEDMENT TYPE	APPLICATION	APPROVED MATERIALS*
TYPE A - STANDARD	FOR USE WHERE THERE ARE NO STRUCTURAL ISSUES OR GROUNDWATER	WSA PS-350, WSA PS-360, WSA PS-361
TYPE B - CEMENT STABILISED SAND	FOR USE WHEN ASSET PROTECTION IS REQUIRED (e.g. WATER MAINS UNDER MAJOR CROSSINGS) OR WHEN MINIMUM COVER CANNOT BE ACHIEVED.	WSA PS-350 (SAND) PLANT MIXED WITH 5% CEMENT PLACED AND COMPACTED DRY
TYPE C - CLSM	FOR USE WHERE COMPACTION IN TRENCH IS DIFFICULT TO ACHIEVE DUE TO TIME OR SPACE CONSTRAINTS OR WHERE NATIVE SOIL CONDITIONS PROVIDE INSUFFICIENT FOUNDATION STRENGTH OR SOIL MODULUS FOR SIDE SUPPORT	WSA PS 352, 28-day COMPRESSIVE STRENGTH 0.7 MPa, SLUMP 180 mm COMPACTION IS NOT REQUIRED

1. IF SIGNIFICANT GROUNDWATER IS OBSERVED DURING EXCAVATION BUT EMBEDMENT TYPE A IS NOMINATED IN THE DESIGN, THE DESIGNER SHOULD BE CONSULTED TO RECONSIDER THE EMBEDMENT SYSTEM SELECTION AND PROVISON OF DRAINAGE.
2. WHEN USING CLSM, MEASURES SHALL BE TAKEN TO PREVENT FLOATATION OF PIPE DURING PLACEMENT.

TABLE 2		
EMBEDMENT TYPE	APPLICATION	APPROVED MATERIALS*
TYPE D - AGGREGATE (SINGLE SIZED)	FOR USE WHERE SIGNIFICANT GROUNDWATER IS PRESENT OR COULD REASONABLY BE EXPECTED	WSA PS-351

1. EMBEDMENT SHALL BE WRAPPED IN GEOTEXTILE TO WSA PS-355, WITH MINIMUM 250 mm LAP AT ALL JOINTS.
2. IF THE TRENCH HAS SOLID ROCK ON BOTH SIDES AND UNDERNEATH THE EMBEDMENT MATERIAL, FILTER FABRIC IS ONLY REQUIRED ON THE TOP SURFACE (AS SHOWN).
3. WHERE THE TRENCH FLOOR IS SOFT (i.e. BOOTS SINK INTO THE FLOOR UNDER A PERSON'S WEIGHT), PRESS 100 BALLAST INTO THE TRENCH FLOOR UNTIL IT CAN TAKE A PERSON'S WEIGHT WITHOUT MOVEMENT.
4. PROVIDE TRENCH STOPS AND/OR BULKHEADS AND TRENCH DRAINAGE (IF REQUIRED) AS PER SD-2104.
5. AGGREGATE TO BE WELL-ROUNDED WITH NO SHARPS.
6. MAXIUMUM PARTICLE SIZE AS PER TABLE 4.

TABLE 4 - MAXIMUM PARTICLE SIZE	
NOMINAL PIPE DIAMETER (DN)	MAXIMUM PARTICLE SIZE (mm)
<100	10
100 ≤ DN ≤ 150	14
>150	20

TABLE 3		
EMBEDMENT TYPE	APPLICATION	APPROVED MATERIALS*
TYPE E - CEMENT STABILISED SAND	FOR USE WHERE OVER EXCAVATION HAS OCCURRED DUE TO POOR SOIL CONDITIONS AND WHEN THERE IS LITTLE OR NO GROUNDWATER	WSA PS-350(SAND) PLANT MIXED WITH 5% CEMENT PLACED AND COMPACTED DRY
TYPE F - CONCRETE	FOR USE IN SHORT SPANS (<1000) OF LOW BEARING CAPACITY GROUND (SOFT CLAYS AND LOOSE SAND.	CONCRETE GRADE N25 TO AS 3600. STRENGTH - 25 MPa MAX AGGREGATE - 20 MAX SLUMP - 80

1. IF SIGNIFICANT GROUNDWATER IS OBSERVED DURING EXCAVATION BUT EMBEDMENT TYPE A IS NOMINATED IN THE DESIGN, THE DESIGNER SHOULD BE CONSULTED TO RECONSIDER THE EMBEDMENT SYSTEM SELECTION AND PROVISION OF DRAINAGE.
2. CONCRETE SHALL BE SULFATE RESISTANT TYPE IF NATIVE SOIL IS CLASSIFIED AS ACID SULFATE SOIL (ASS) WHICH CONTAINS GREATER THAN 0.1% SULFATE AND NET ACID GENERATION POTENTIAL GREATER THAN 0.0.

* DESIGNER SHALL NOMINATE ONLY ONE APPROVED MATERIAL ON THE PROJECT CONSTRUCTION DRAWINGS FOR EACH EMBEDMENT TYPE (FOR EXAMPLE "TYPE A EMBEDMENT, WSA PS-350").

No.	ISSUE	DATE	DRAWN	CHECKED	AUTHORISED
A	INITIAL ISSUE	15/06/2018	M. Matusiak	K. Danenbergsons	D. Eager
B	DIMENSIONS AND APPLICABILITY CHART UPDATES. DRAWING NOW -D	18/06/2019	S. Essery	K. Danenbergsons	C. Patrick

ICON WATER ACKNOWLEDGES MRWA IN THE DEVELOPMENT OF THIS DRAWING, IN PARTICULAR, DRAWING : MRWA-S-202

DAM	X	RES	X	SPS	X
BWS	X	WAT	X	STP	X
WTP	X	SEW	X		
WPS	X	REC			

ASSET AREA APPLICABILITY

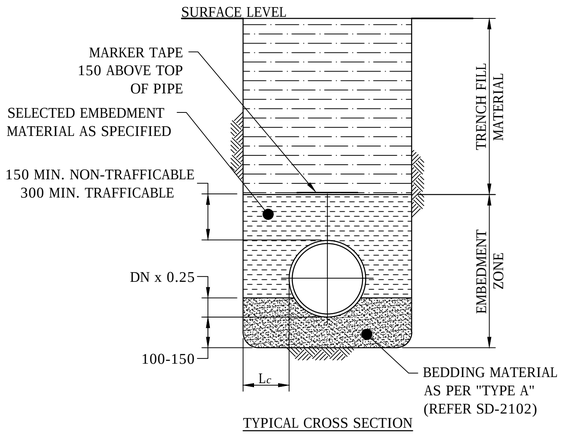
STANDARD DRAWING
SEWERAGE AND WATER NETWORKS
PIPE EMBEDMENT AND TRENCH FILL
GRANULAR AND CEMENT STABILISED EMBEDMENT
DETAILS

DRAWING STATUS: Current

SD-2102-D

A1

ISSUE: B



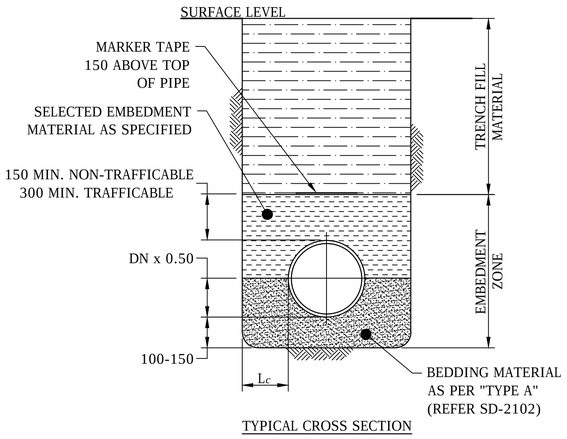
TYPICAL CROSS SECTION

TYPE G - EMBEDMENT

FOR RIGID PIPES (RCP AND VC) ONLY

SCALE: N.T.S.

TABLE 5		
EMBEDMENT TYPE	APPLICATION	APPROVED MATERIALS
TYPE G - EMBEDMENT	FOR USE WITH RCP AND VC PIPES WHERE SPECIFIED BY THE DESIGNER	BEDDING MATERIAL AS PER "TYPE A" (REFER SD-2102), AS SPECIFIED BY THE DESIGNER. REMAINING EMBEDMENT MATERIAL TO BE COMPACTED SELECT FILL TO WSA PS-364



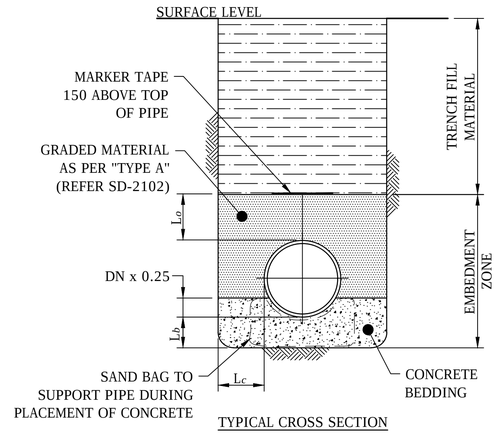
TYPICAL CROSS SECTION

TYPE H - EMBEDMENT

FOR RIGID PIPES (RCP AND VC) ONLY

SCALE: N.T.S.

TABLE 6		
EMBEDMENT TYPE	APPLICATION	APPROVED MATERIALS
TYPE H - EMBEDMENT	FOR USE WITH RCP AND VC PIPES WHERE SPECIFIED BY THE DESIGNER	BEDDING MATERIAL AS PER "TYPE A" (REFER SD-2102), AS SPECIFIED BY THE DESIGNER. REMAINING EMBEDMENT MATERIAL TO BE COMPACTED SELECT FILL TO WSA PS-364



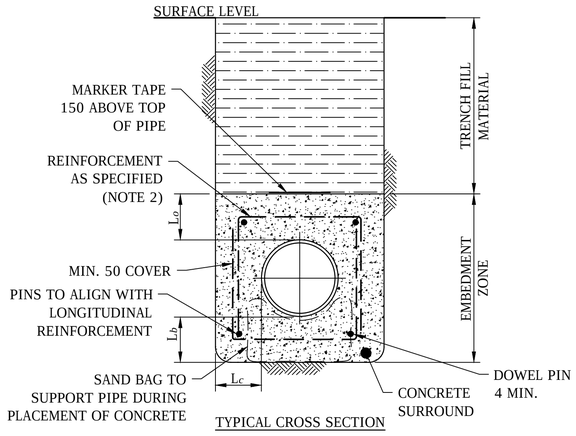
TYPICAL CROSS SECTION

TYPE J - CONCRETE BEDDING

FOR RIGID PIPES (RCP AND VC) ONLY

SCALE: N.T.S.

TABLE 7		
EMBEDMENT TYPE	APPLICATION	APPROVED MATERIALS
TYPE J - CONCRETE BEDDING (SIDE SUPPORT AND OVERLAY AS PER TYPE A)	FOR USE WHERE THERE IS UNSTABLE GROUND AND NO SIGNIFICANT RISK OF THIRD PARTY DAMAGE. UNSTABLE GROUND CAN EXIST WHERE THE PIPE IS LOCATED IN: · DECOMPOSING SOILS HIGH IN ORGANIC CONTENT; · HIGHLY REACTIVE CLAYS; · OLD REFUSE SITES; OR · NON-ENGINEERED FILL	CONCRETE GRADE N25 TO AS 3600. STRENGTH - 25 MPa MAX AGGREGATE - 20 MAX SLUMP - 80 (BEDDING CONCRETE MAY BE PLAIN OR REINFORCED, TO BE SPECIFIED BY THE DESIGNER)



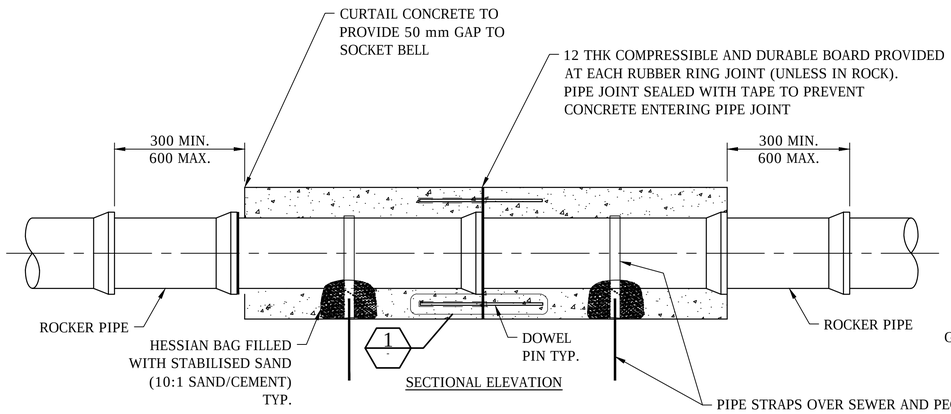
TYPICAL CROSS SECTION

TYPE K - CONCRETE EMBEDMENT

SCALE: N.T.S.

TABLE 8		
EMBEDMENT TYPE	APPLICATION	APPROVED MATERIALS
TYPE K - CONCRETE ENCASEMENT	FOR USE WHERE THERE IS UNSTABLE GROUND AND · THERE IS HIGH RISK OF THIRD PARTY DAMAGE · PIPES ARE LAID ACROSS CREEKS, · AREAS OF INSUFFICIENT FOUNDATION STRENGTH, OR · AREAS WHERE MINIMUM COVER CAN NOT BE OBTAINED.	CONCRETE GRADE N25 TO AS 3600. STRENGTH - 25 MPa MAX AGGREGATE - 20 MAX SLUMP - 80

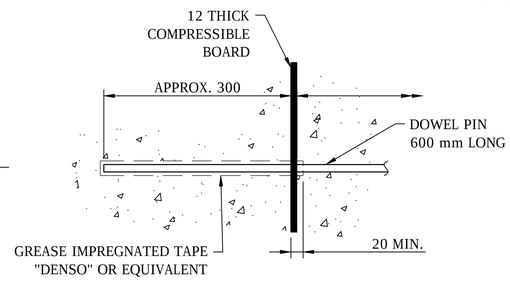
1. FOR DICL, VC, RCP, PE, MS AND GRP PIPES. HOWEVER IT IS PREFERRED THAT DICL BE USED IN THESE AREAS. PVC PIPE SHALL NOT BE USED.
2. MINIMUM STEEL REINFORCEMENT OF 0.4% CONCRETE CROSS SECTION. SPECIFY REINFORCEMENT FOR THE APPLICATION LOADING IN THE DESIGN DRAWINGS.
3. REINFORCED CONCRETE SURROUND SHALL EXTEND 5000 PAST THE POINT WHERE MINIMUM COVER IS RESTORED OR UP TO THE 1:2 ARI FLOODLINE. WHERE MINIMUM COVER CAN NOT BE OBTAINED, PIPE SECTIONS SHALL BE DESIGNED AS STRUCTURAL PIPE BRIDGES TAKING INTO ACCOUNT ALL RELEVANT HYDRAULIC FORCES. THE UNDER SIDE OF A PIPE BRIDGE SHALL BE ABOVE 1:1 ARI.
4. FOR SCOUR PROTECTION AND TRENCH STOP DETAILS SEE STANDARD DRAWING SD-2104.
5. CONCRETE SHALL BE SULFATE RESISTANT TYPE IF NATIVE SOIL IS CLASSIFIED AS ACID SULFATE SOIL (ASS) WHICH CONTAINS GREATER THAN 0.1% SULFATE AND NET ACID GENERATION POTENTIAL GREATER THAN 0.0.



SECTIONAL ELEVATION

TYPE K - CONCRETE EMBEDMENT
JOINT AND END OF ENCASEMENT DETAILS

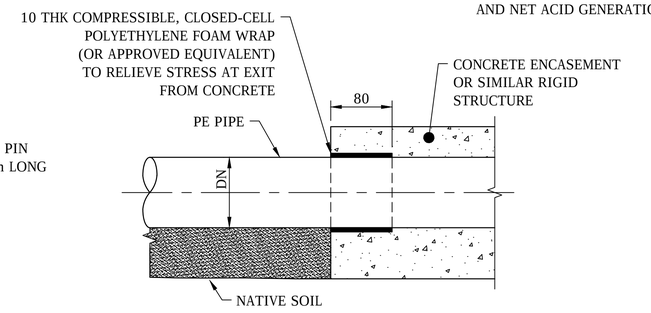
SCALE: N.T.S.



DETAIL 1

DOWEL PIN

SCALE: N.T.S.

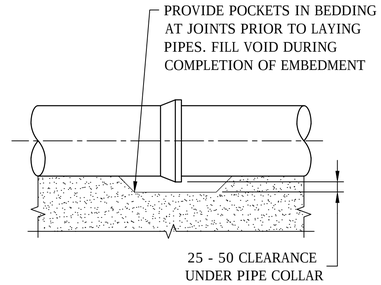


SECTIONAL ELEVATION

TYPE K - CONCRETE EMBEDMENT
PROTECTION OF PE PIPE AT EXIT FROM ENCASEMENT

FOR PE PIPE ONLY

SCALE: N.T.S.



PIPE JOINT BEDDING POCKETS FOR JOINT PROJECTIONS

SCALE: N.T.S.

No.	ISSUE	DATE	DRAWN	CHECKED	AUTHORISED
A	INITIAL ISSUE	15/06/2018	M. Matusiak	K. Danenbergsons	D. Eager
B	DIMENSIONS AND APPLICABILITY CHART UPDATED. DRAWING NOW -D	18/06/2019	S. Essery	K. Danenbergsons	C. Patrick

DAM	X	RES	X	SPS	X
BWS	X	WAT	X	STP	X
WTP	X	SEW	X		
WPS	X	REC			

ASSET AREA APPLICABILITY

icon WATER

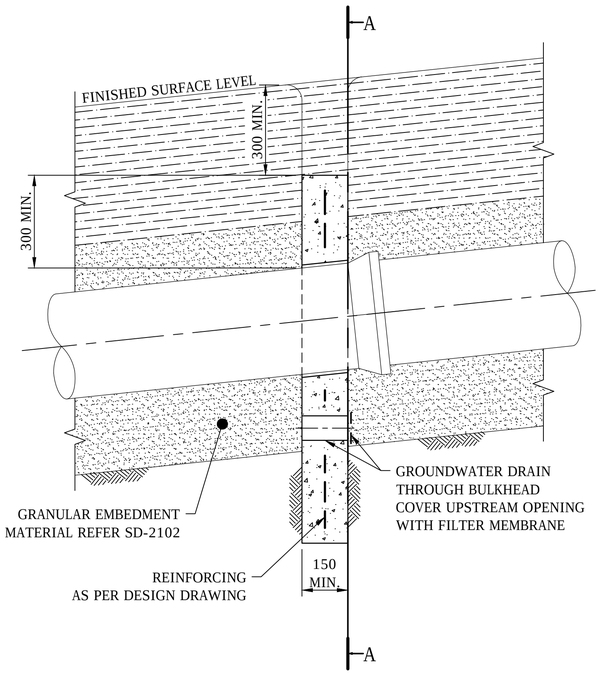
STANDARD DRAWING
SEWERAGE AND WATER NETWORKS
PIPE EMBEDMENT AND TRENCH FILL
CONCRETE BEDDING AND EMBEDMENT
DETAILS

DRAWING STATUS: Current

SD-2103-D

A1

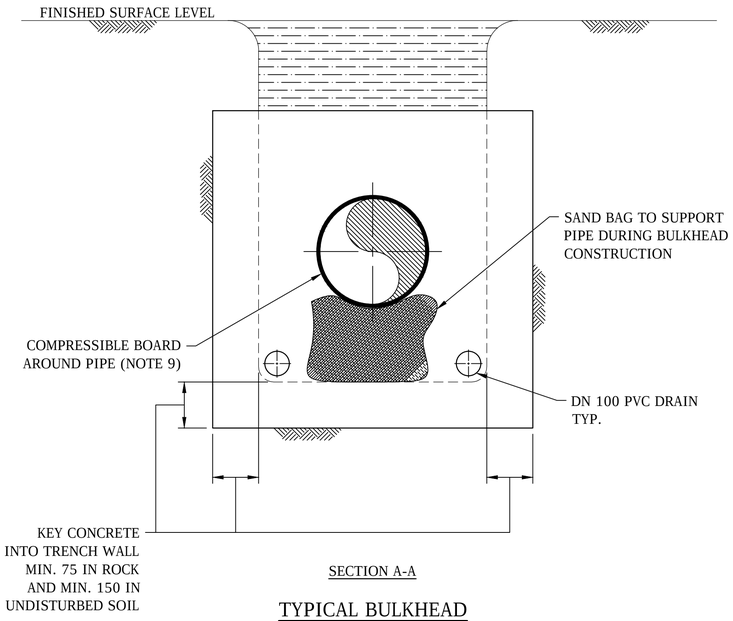
ISSUE: B



SECTIONAL ELEVATION

CONCRETE BULKHEAD

SCALE: N.T.S.



SECTION A-A

TYPICAL BULKHEAD

SCALE: N.T.S.

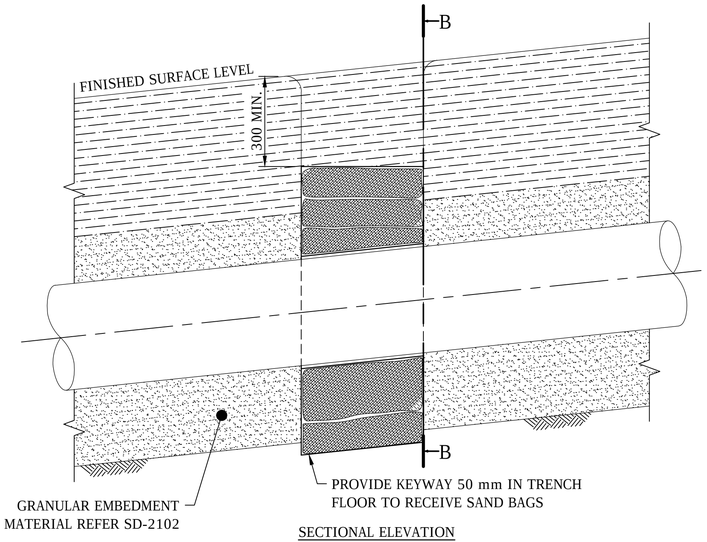
NOTES:

1. CONSTRUCT CONCRETE BULKHEADS AND TRENCH STOPS AT LOCATIONS SPECIFIED ON DESIGN DRAWINGS.
2. BULKHEADS LOCATED UNDER RETAINING WALLS TO BE DIRECTLY UNDER THE WALL.
3. KEY CONCRETE BULKHEADS AND TRENCH STOPS INTO SIDES AND BOTTOM OF TRENCH AGAINST A BEARING SURFACE OF UNDISTURBED SOIL.
4. CONCRETE TO BE CLASS N25.
5. DO NOT DEFORM PIPES DURING PLACEMENT OF CONCRETE.
6. SEAL BAGS TO PREVENT LEAKAGE OF MATERIAL CONTAINED INSIDE.
7. PROVIDE A CONTINUOUS DRAINAGE PATH:
   - THROUGH BULKHEADS AND TRENCH STOPS.
   - AROUND MAINTENANCE HOLES.
   - IN TRENCH EXCAVATIONS ACROSS ROADWAYS.
8. TRENCH DRAINAGE TO BE IN ACCORDANCE WITH SD-2105.
9. COMPRESSIBLE BOARD AROUND PIPE TO BE 3 mm THICK RUBBER FOR BULKHEADS AND TRENCH STOPS.
10. EMBEDMENT AND BACKFILL MATERIAL TO BE PLACED PROGRESSIVELY ON BOTH SIDES OF BULKHEAD / TRENCH STOP.
11. STANDARD TRENCH DETAILS NOT TO BE USED IN REGIONS OF POTENTIAL SLIP, UNSTABLE OR TALUS GROUND.

REQUIREMENTS FOR BULKHEADS AND TRENCH STOPS

TRENCH/PIPE GRADE (%)	REQUIREMENT	SPACING "S" (m)
5-14	TRENCH STOP	S = 100/GRADE(%)
15-29	CONCRETE BULKHEAD	S = L_p/GRADE(%), WHERE L_p = 80 x PIPE LENGTH (m) (450 MAX.) WHERE L_p > 100 m - USE INTERMEDIATE TRENCH STOPS AT SPACING <100/GRADE(%)
30-50	CONTINUOUS CONCRETE ENCASEMENT OF PIPELINE AND CONCRETE BULKHEADS	S= 100/GRADE(%)
>50	SPECIAL DESIGN	

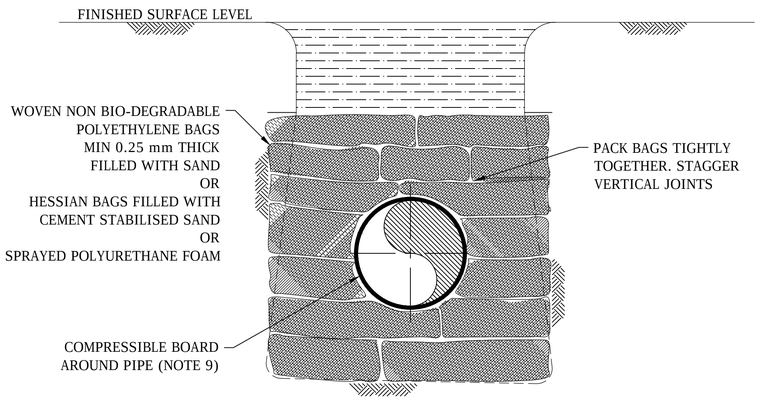
* PIPE LENGTH IS THE STANDARD PIPE LENGTH INSTALLED



SECTIONAL ELEVATION

TRENCH STOP

SCALE: N.T.S.



SECTION B-B

TRENCH STOP

SCALE: N.T.S.

No.	ISSUE	DATE	DRAWN	CHECKED	AUTHORISED
A	INITIAL ISSUE	15/06/2018	M. Matusiak	K. Danenbergsons	D. Eager
B	APPLICABILITY CHART UPDATED. DRAWING NOW -D	18/06/2019	S. Essery	K. Danenbergsons	C. Patrick

ICON WATER ACKNOWLEDGES WATER SERVICES ASSOCIATION OF AUSTRALIA IN THE DEVELOPMENT OF THIS DRAWING, IN PARTICULAR, DRAWING :SEW-1206

DAM	X	RES	X	SPS	X
BWS	X	WAT	X	STP	X
WTP	X	SEW	X		
WPS	X	REC			

ASSET AREA APPLICABILITY

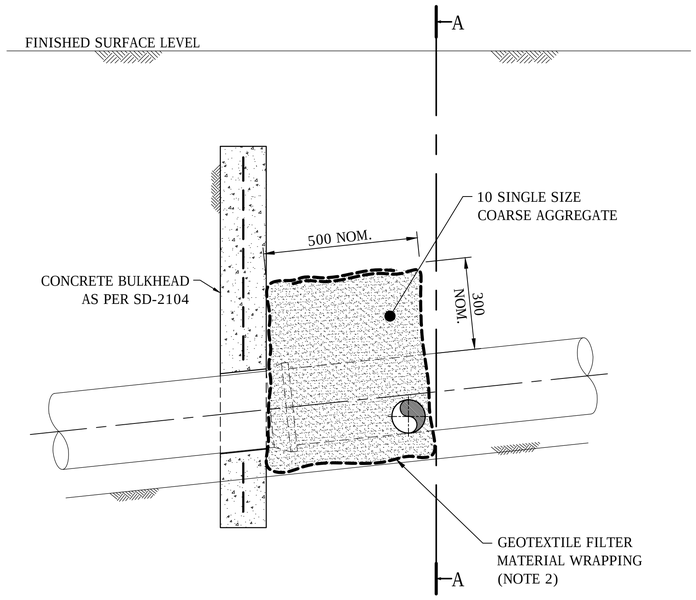
STANDARD DRAWING
SEWERAGE AND WATER NETWORKS
PIPE EMBEDMENT AND TRENCH FILL
BULKHEADS AND TRENCH STOPS
DETAILS

DRAWING STATUS: Current

SD-2104-D

A1

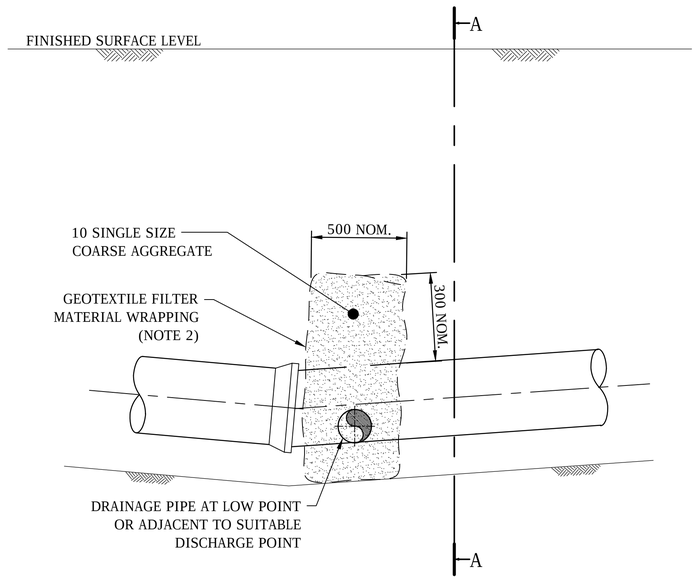
ISSUE B



SECTIONAL ELEVATION

BULKHEAD IN TRENCH

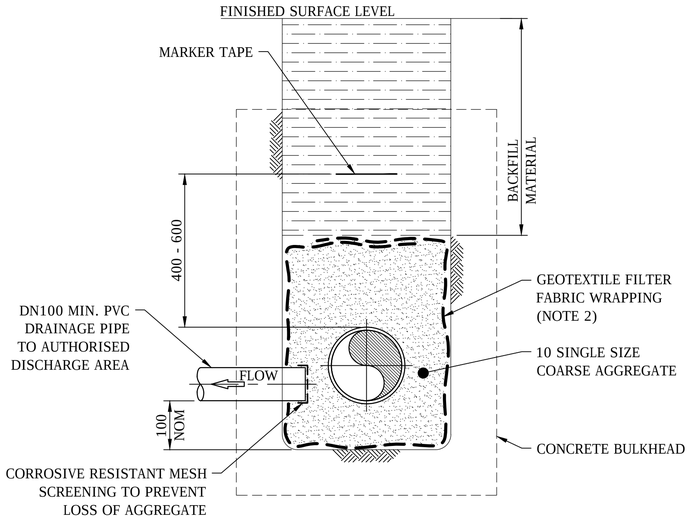
SCALE: N.T.S.



SECTIONAL ELEVATION

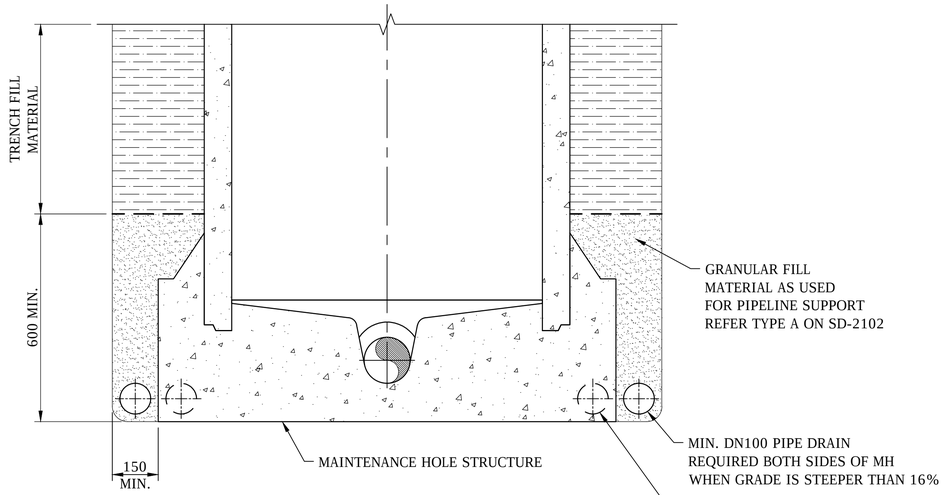
LOW POINT IN TRENCH

SCALE: N.T.S.



SECTION A-A

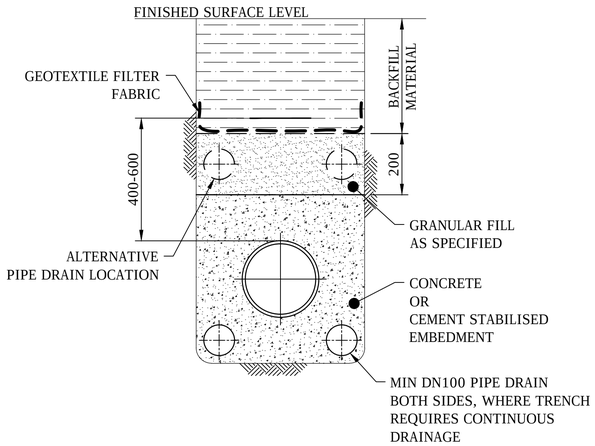
TYPICAL DISCHARGE SYSTEM FOR PIPE TRENCHES



TYPICAL SECTION

DRAINANGE PAST MAINTENANCE HOLES

SCALE: N.T.S.



TYPICAL SECTION

DRAINAGE FOR CONCRETE ENCASEMENT AND CEMENT STABILISATION

SCALE: N.T.S.

NOTES:

1. SHOW ALL DRAINAGE DETAILS INCLUDING TERMINATION POINT(S) ON DESIGN DRAWINGS.
2. LAY GEOTEXTILE FILTER FABRIC IN TRENCH TO FULLY ENCAPSULATE THE DRAINAGE MATERIAL (COARSE AGGREGATE). PROVIDE MINIMUM 250 LAP AT ALL FILTER FABRIC JOINTS.
3. WRAP BOTH ENDS OF DRAINAGE PIPE WITH GEOTEXTILE FILTER FABRIC AND INSTALL SUCH THAT THE PIPE PROTRUDES PAST THE CONCRETE ENCASEMENT INTO THE GRANULAR EMBEDMENT.
4. WHERE ENCASEMENT ENDS WITHIN 1000 OF A MAINTENANCE HOLE, EXTEND ENCASEMENT TO MH AND EXTEND DRAINAGE PIPE BEYOND MH TO ADJOINING PIPELINE EMBEDMENT.
5. PROVIDE A CONTINUOUS DRAINAGE PATH:
   -THROUGH BULKHEADS AND TRENCH STOPS.
   -AROUND MAINTENANCE HOLES.
   -IN TRENCH EXCAVATIONS ACROSS ROADWAYS.

No.	ISSUE	DATE	DRAWN	CHECKED	AUTHORISED
A	INITIAL ISSUE	15/06/2018	M. Matusiak	K. Danenbergsons	D. Eager
B	APPLICABILITY CHART UPDATED, DRAWING NOW -D	18/06/2019	S. Essery	K. Danenbergsons	C. Patrick

ICON WATER ACKNOWLEDGES WATER SERVICES ASSOCIATION OF AUSTRALIA IN THE DEVELOPMENT OF THIS DRAWING, IN PARTICULAR DRAWING : SEW-1207

DAM	X	RES	X	SPS	X
BWS	X	WAT	X	STP	X
WTP	X	SEW	X		
WPS	X	REC			

ASSET AREA APPLICABILITY

STANDARD DRAWING
SEWERAGE AND WATER NETWORKS
PIPE EMBEDMENT AND TRENCH FILL
TRENCH DRAINAGE
TYPICAL DETALS

DRAWING STATUS: Current

SD-2105-D

A1

ISSUE: B

TABLE 1 - MINIMUM PIPE COVER			
LOCATION	GRAVITY SEWER	PRESSURISED SEWER	WATER
PUBLIC AND PRIVATE BLOCKS, NOT SUBJECT TO VEHICULAR LOADING.	600 - NEW DEVELOPMENTS 450 - EXISTING DEVELOPMENTS	450 #	450 #
PRIVATE BLOCKS ZONED RESIDENTIAL, SUBJECT TO VEHICULAR LOADING.	750	600 #	450 #
FOOTWAYS, NATURE STRIPS, INDUSTRIAL AND COMMERCIAL BLOCKS, SEALED ROAD PAVEMENTS OTHER THAN MAJOR ROADS SUBJECT TO VEHICULAR LOADING.	900	600	600
UNSEALED ROAD CARRIAGEWAYS	1200	750	750
MAJOR ROAD CARRIAGEWAYS	1200	750	750
FUTURE ROAD, RAIL AND TRAM PAVEMENTS.	1200	1200	1200
EMBANKMENTS	750	750	750
FREEWAYS, STATE & NATIONAL HIGHWAYS	1200	1200	1200

WHERE MINIMUM COVER CANNOT BE ACHIEVED, PROVIDE ALTERNATIVE PROTECTION TO THE PIPELINE IN ACCORDANCE WITH THE PROJECT DESIGN DRAWINGS.

LESSER COVER PERMISSIBLE IN AS 3500 NOT TAKEN INTO ACCOUNT AND SHALL BE ASSESSED AS PER AS 3500 AND SOUND ENGINEERING PRINCIPLES

TABLE 2 - TRENCH CLEARANCE			
NOMINAL DIAMETER (DN)	MINIMUM CLEARANCE		
	CLEARANCE AT SPRING LINE ("L_c")	BED ZONE UNDER PIPE ("L_b")	DEPTH OF OVERLAY ("L_o")
≤150	100	100 - 150	150
>150 - ≤300	150	100 - 200	150
>300 - ≤450	200	100 - 200	150
>450 - ≤900	300	100 - 200	150

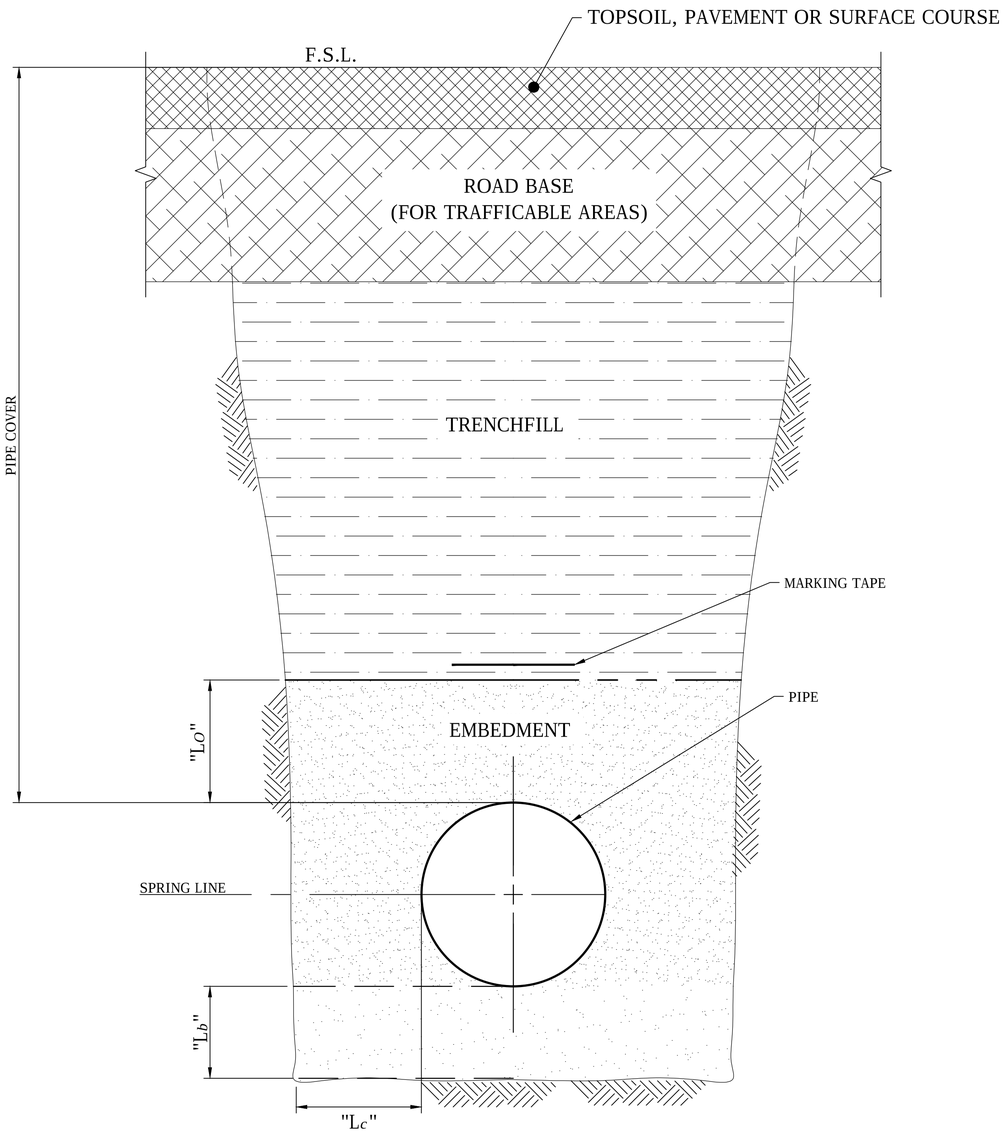
TRENCH WIDTH TO BE SUFFICIENT TO SAFELY LAY PIPE AND COMPACT THE SUPPORT ZONE.

ENSURE BEDDING IS DEEP ENOUGH THAT PIPE JOINT PROJECTIONS (SOCKETS AND FLANGES) DO NOT TOUCH THE TRENCH FLOOR.

TABLE BASED ON FLEXIBLE PIPELINE INSTALL ONLY NOT CONCRETE OR VC

TABLE 3 - CLEARANCES BETWEEN SEWERS AND OTHER UNDERGROUND SERVICES			
UTILITY (EXISTING SERVICES)	MINIMUM HORIZONTAL CLEARANCES (mm) NEW SEWER SIZE		MINIMUM VERTICAL CLEARANCE (mm)
	≤ DN 300	>DN 300	
SEWERS ≤DN 300	300	600	150 / 300
SEWERS >DN 300	600	600	300
GAS MAINS	300	600	150 / 300
COMMS SERVICES	300	600	150 / 300
ELECTRICITY SERVICES	500	1000	225 / 300
STORMWATER DRAINS	300	600	150
WATER MAINS	1000 / 600	1000 / 600	500
KERBS	150	600	N/A

NOTE: REFER TO CLAUSE 5.4.5.2 OF WSA 02 FOR NOTES SPECIFICALLY RELATING TO THIS TABLE.



NOTES:

1. THIS DRAWING SHALL ONLY BE SPECIFIED FOR USE BY THE DESIGNER FOR STANDARD CONDITIONS AND APPLICATIONS. THE DESIGNER SHALL USE THEIR SKILL, KNOWLEDGE AND JUDGEMENT TO DETERMINE IF THE COVER DEPTHS AND CLEARANCES ARE REQUIRED TO BE INCREASED IN NON-STANDARD CONDITIONS AND APPLICATIONS. IF IN ANY DOUBT, SEEK ADVICE FROM ICON WATER.

2. NON-STANDARD CONDITIONS INCLUDE, BUT ARE NOT LIMITED TO: REGIONS OF POTENTIAL SLIP, UNSTABLE OR TALUS GROUND, EXISTING "BROWNFIELDS" DEVELOPMENTS WHERE PIPE DEPTH IS CONSTRAINED AND ALTERNATIVE REMEDIES (e.g. PROTECTION SLABS, PILES) ARE REQUIRED.

No.	ISSUE	DATE	DRAWN	CHECKED	AUTHORISED
A	INITIAL ISSUE	26/06/2019	S. Essery	K. Danenbergsons	C. Patrick

DAM		RES		SPS	
BWS		WAT	X	STP	
WTP		SEW	X		
WPS		REC			

ASSET AREA APPLICABILITY

STANDARD DRAWING
SEWERAGE AND WATER NETWORKS
MINIMUM PIPE COVER AND CLEARANCES
STANDARD CONDITIONS AND APPLICATIONS

DRAWING STATUS: Current

SD-2106-D

A1

ISSUE: A

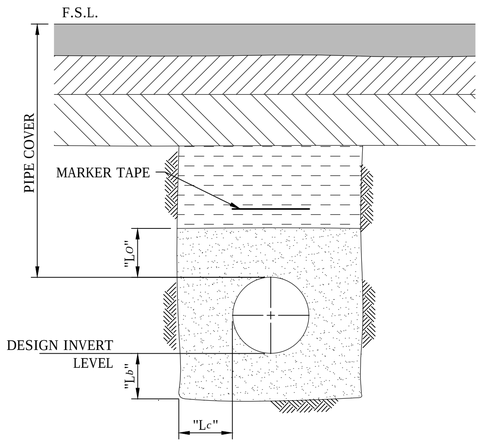


TABLE 1 - TRAFFICABLE AREAS	
ZONE	MATERIAL AND COMPACTION DETAILS
ROAD WEARING COURSE	ROAD WEARING COURSE, BASE AND SUB BASE MATERIALS SHALL BE TO TCCS STANDARDS WITH A MINIMUM COMPACTION OF 95% MAXIMUM MODIFIED DRY DENSITY (MMDD) TO AS 1289.5.2.1.
ROAD BASE	
ROAD SUB BASE	
TRENCH FILL	TCCS DGS20 COMPACTED TO AT LEAST 95% MAXIMUM MODIFIED DRY DENSITY (MMDD) TO AS 1289.5.2.1.
EMBEDMENT	TYPE A STANDARD EMBEDMENT CHOOSE FROM EITHER: 1. SAND TO WSA PS-350, OR 2. SAND TO WSA PS-360, OR 3. 5 mm CRUSHED ROCK TO WSA PS-361 COMPACTION TO AT LEAST 70% DENSITY INDEX. (AS 1289.5.6.1).

TRENCH DETAILS - TRAFFICABLE AREAS

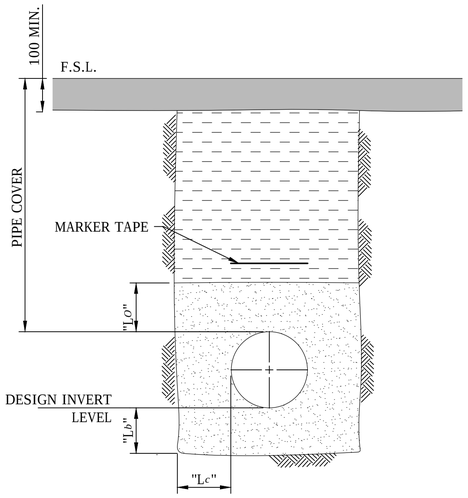


TABLE 2 - NON-TRAFFICABLE AREAS	
ZONE	MATERIAL AND COMPACTION DETAILS
TOP SOIL	TOP SOIL (AND GRASS SEEDING IF REQUIRED) TO TCCS STANDARDS.
TRENCH FILL	CHOOSE FROM EITHER: 1. INORGANIC GENERAL FILL, OR 2. TCCS DGS20 COMPACTED TO AT LEAST 90% MAXIMUM MODIFIED DRY DENSITY (MMDD) TO AS 1289.5.2.1. REFER TO GENERAL NOTE G.3 FOR INORGANIC FILL REQUIREMENTS (INCLUDING COMPACTION REQUIREMENTS).
EMBEDMENT	TYPE A STANDARD EMBEDMENT CHOOSE FROM EITHER: 1. SAND TO WSA PS-350, OR 2. SAND TO WSA PS-360, OR 3. 5 mm CRUSHED ROCK TO WSA PS-361 COMPACTION TO AT LEAST 60% DENSITY INDEX. (AS 1289.5.6.1).

TRENCH DETAILS - NON-TRAFFICABLE AREAS

GENERAL NOTES:

G1. THIS DRAWING HAS BEEN PRIMARILY DEVELOPED FOR "WATER SUPPLY MAINS-TO METER" AND "SEWER MAINS-TO-TIE" APPLICATIONS WITHIN THE LIMITS OF USE STATED ELSEWHERE ON THIS DRAWING. THIS DRAWING MAY ALSO BE USED FOR BOTH SEWER AND WATER MAIN PROJECTS (SUBJECT TO THE SAME LIMITS OF USE) WHERE APPROPRIATE.

G2. IF (i) SIGNIFICANT GROUNDWATER IS OBSERVED DURING EXCAVATION, OR (ii) THE NATIVE SOIL CONDITION IS DEEMED TO BE "POOR" IN ACCORDANCE WITH SD-9302, OR (iii) OVER-EXCAVATION OCCURS, THEN ICON WATER SHALL BE CONSULTED FOR THE PURPOSES OF DIRECTING THE DESIGNER TO RECONSIDER THE EMBEDMENT MATERIAL AND DRAINAGE DETAILS SPECIFIED FOR THE PROJECT.

G3. INORGANIC FILL (e.g. EXCAVATED MATERIAL) MUST MEET ALL OF THE FOLLOWING MANDATORY REQUIREMENTS:

A. FREE FROM ORGANIC MATTER.

B. CONTAINS NO ROCK OR HARD CLAY GREATER THAN 75 mm AND NOT MORE THAN 20% BY MASS.

C. IF IT IS COHESIONLESS SOIL (e.g. CLEAN SAND, SILTY SAND AND POORLY GRADED SAND AND GRAVEL MIXTURES) IT CAN ONLY BE USED IN AREAS WHERE THE NATURAL SOILS WITHIN WHICH WORKS ARE BEING UNDERTAKEN ARE ALSO COHESIONLESS (i.e. NOT CLAYEY). COMPACT TO AT LEAST 60% DENSITY INDEX (AS 1289.5.6.1) IN LIFTS NOT EXCEEDING 300 mm.

D. IF IT IS A COHESIVE SOIL (e.g. CLAYEY IN NATURE) COMPACT TO AT LEAST 90% MAXIMUM MODIFIED DRY DENSITY (MMDD) TO AS 1289.5.2.1 IN LIFTS NOT EXCEEDING 300 mm.

G4. GRADED MATERIALS (e.g. SAND, CRUSHED ROCK OR TCCS DGS20) CANNOT BE INSTALLED WHILST THE TRENCH IS WET.

G5. THE SIDES OF THE EXCAVTION SHALL BE KEPT VERTICAL TO AT LEAST 150 mm ABOVE THE PIPE.

G6. TRACER WIRE HAS NOT BEEN SHOWN FOR CLARITY. REFER TO TO STD-SPE-M-006 FOR DETAILS.

G7. SHOULD THE CONTRACTOR BE IN ANY DOUBT AS TO WHETHER THE TRENCH FILL OR EMBEDMENT MATERIAL FROM A GIVEN SUPPLIER MEETS THE REQUIRED WSAA PRODUCT SPECIFICATION (e.g. WSA PS-360) OR INORGANIC FILL PROPERTIES, CONTACT ICON WATER BEFORE PURCHASE (OR IN THE CASE OF EXCAVATED MATERIAL, BEFORE INSTALLATION).

G8. THIS DRAWING SHALL BE READ IN-CONJUNCTION WITH SD-2106. FOR DEFINITIONS OF "TRAFFICABLE" AND "NON-TRAFFICABLE" AREAS, REFER TO SD-2101.

G9. FOR THE TRENCH FILL ZONE AND ALL ZONES ABOVE FOR BOTH TRAFFICABLE AND NON-TRAFFICABLE AREAS, TCCS REQUIREMENTS TAKE PRECEDENCE OVER THE ICON WATER REQUIREMENTS STATED ON THIS DRAWING. HOWEVER, IN THE PIPE EMBEDMENT ZONE, ICON WATER REQUIREMENTS ARE MANDATORY REQUIREMENTS AND TAKE PRECEDENCE OVER ANY OTHER AGENCY'S REQUIREMENTS.

LIMITS OF USE:

THIS DRAWING SHALL ONLY BE USED FOR DETAILED DESIGN AND CONSTRUCTION PURPOSES IF THE SPECIFIC APPLICATION AND LOCATION DETAILS COMPLY WITH ALL OF THE FOLLOWING LIMITS OF USE:

L1. THE APPLICATION INVOLVES THE LAYING OF EITHER A WATER MAINS-TO-METER PIPE RUN, A SEWER MAINS-TO-TIE PIPE RUN, A POTABLE WATER MAIN, A GRAVITY SEWER MAIN OR A SEWER RISING MAIN.

L2. THERE ARE NO STRUCTURAL ISSUES. FOR EXAMPLE, THE SOIL "QUALITY DESCRIPTOR" IS "MEDIUM" OR "SOUND" IN ACCORDANCE WITH SD-9302.

L3. THERE IS NO GROUNDWATER.

L4. THE MINIMUM DEPTHS OF COVER SHOWN ON SD-2106 CAN BE ACHIEVED.

L5. TRENCH OVER-EXCAVATION DOES NOT REQUIRE ICON WATER TO DIRECT AN ALTERNATIVE EMBEDMENT TYPE.

L6. THE PIPE GRADE IS NO GREATER THAN 15%.

L7. ASSET PROTECTION IS NOT REQUIRED.

No.	ISSUE	DATE	DRAWN	CHECKED	AUTHORISED
A	INITIAL ISSUE	27/06/2019	S. Essery	K. Danenbergsons	C. Patrick

ASSET AREA APPLICABILITY					
DAM		RES		SPS	
BWS		WAT	X	STP	
WTP		SEW	X		
WPS		REC			

STANDARD DRAWING
SEWERAGE AND WATER NETWORKS
WATER MAINS-TO-METER AND SEWER TIE APPLICATIONS
TRENCH EMBEDMENT AND BACKFILL DETAILS

DRAWING STATUS: Current

SD-2107-D

A1

ISSUE: A