## TABLE 203-A: EMBEDMENT SYSTEM SELECTION

| SITUATION | DESCRIPTION | WHEN TO USE |
|---|---|---|
| TYPE A | GRADED | NO STRUCTURAL ISSUES OR GROUND WATER |
| TYPE B | CEMENT STABILISED | ASSET PROTECTION REQUIRED. eg: WATER MAINS UNDER MAJOR CROSSINGS |
| TYPE C | CONCRETE ENCASED | HIGH RISK OF THIRD PARTY DAMAGE |
| TYPE D | SINGLE SIZED AGGREGATE | SIGNIFICANT GROUND WATER IS PRESENT OR MAY BE COMMON |
| TYPE E | CEMENT STABILISED BASE | WHERE UNINTENTIONAL OVER EXCAVATION OCCURS DURING TRENCH EXCAVATION |
| TYPE F | CONCRETE BASE | UNSTABLE GROUND AND NO SIGNIFICANT RISK OF THIRD PARTY DAMAGE |

## NOTES Regarding Table 203-A:

1. The designer shall specify the appropriate embedment system(s) for all pipelines.
2. All embedment systems nominated are suitable for all pipe types.
3. Where the contractor finds that the ground conditions are different to that expected by the designer (eg: when ground water is observed and Type A embedment proposed), the designer shall be consulted regarding the embedment system selection.

Type B: Use premixed cement stabilised class 3 FCR in high risk situations, eg:
- where minimum cover cannot be achieved.
- major crossings (rail, tram, river, freeway) where requested by the authority.
- where water main grade > 5%

Type C: Requires Water Agency approval. Pipes may be susceptible to third party damage where excavators will likely operate near the main, eg: the main crosses an open waterway which may be excavated.

Type F: Unstable ground can exist where:
- ground susceptible to land slip.
- highly reactive clays to the depth of the sewer main.
- old refuse sites.
- decomposing soils high in organic content.
- un-compacted ground.

## TABLE 203-B: EMBEDMENT MATERIALS

| ITEM | DESCRIPTION | WSAA PRODUCT SPECIFICATION | PARTICLE SIZE MAX | SIZE DISTRIBUTION | MODULUS (WET) MPa |
|---|---|---|---|---|---|
| a | EMBEDMENT SAND | WSA PS 360 | 10 | GRADED | 5 |
| b | 5mm MINUS CRUSHED ROCK | WSA PS 361 | 5 | GRADED | 3 |
| c | 7mm CRUSHED ROCK | WSA PS 361 SEW | 7 | GRADED | 5 |
| d | NOT CURRENTLY APPROVED FOR WATER SUPPLY | | | | |
| e | 10mm WELL GRADED CRUSHED ROCK | WSA PS 362 | 10 | GRADED | 3 |
| f | 20mm WELL GRADED CRUSHED ROCK | WSA PS 362 | 20 | GRADED | 5 |
| g | 5 / 7mm SINGLE SIZED AGGREGATE | WSA PS 351 | 7 | SINGLE SIZED | 10 |
| h | 10mm SINGLE SIZED AGGREGATE | WSA PS 351 | 10 | SINGLE SIZED | 10 |
| i | 10 / 14mm SINGLE SIZED AGGREGATE | WSA PS 351 | 14 | SINGLE SIZED | 7 |
| j | 14mm SINGLE SIZED AGGREGATE | WSA PS 351 | 14 | SINGLE SIZED | 7 |
| k | 20mm SINGLE SIZED AGGREGATE | WSA PS 351 | 20 | SINGLE SIZED | 7 |
| l | 20mm CEMENT TREATED CLASS 3 FCR | WSA PS 352 | 20 | GRADED | 10 |

## NOTES Regarding Table 203-B:

- Approved embedment materials are listed in the MRWA products portal.
- All material shall be installed with a moisture within 3% of optimum.
- Moisture conditioned embedment material shall be ordered in dry conditions.
- Moisture has a large impact on the ease with which compaction can be achieved and therefore a large impact on the ability of the embedment zone to resist pipe deflection.
- Item g. 5 / 7mm aggregate containing any distribution of particles between 2 and 7mm in size accepted.
- Item l. Shall be plant mixed with 3% cement.

## TABLE 203-C: EMBEDMENT MATERIAL SELECTION

| EMBEDMENT SYSTEM | PIPE DIAMETER | | |
|---|---|---|---|
| | 100 & 150 | 225 to 450 | > 450 |
| TYPE A, E & F | a, b, c | a, b, c, e | a, b, c, e, f |
| TYPE B | l | l | l |
| TYPE D | g | g, h, i | g, h, i, j, k |

## NOTES Regarding Table 203-B & C:

- Embedment material does not need to be specified as part of the design.
- Unless particular embedment materials are specified in the design, the Contractor may choose any of the materials nominated in Table 203-C which are suitable for the embedment system(s) specified.

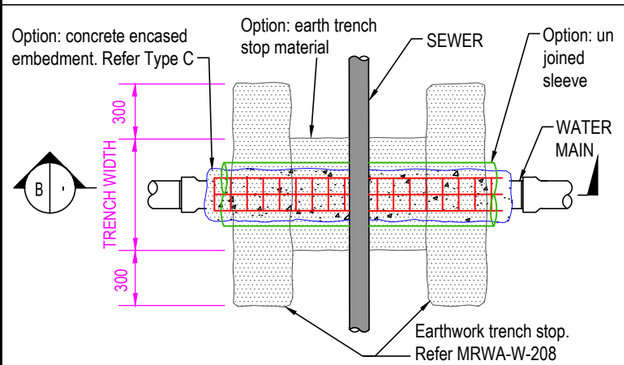



FIGURE 203A: WATER MAIN UNDER SEWER CROSSING (PLAN)

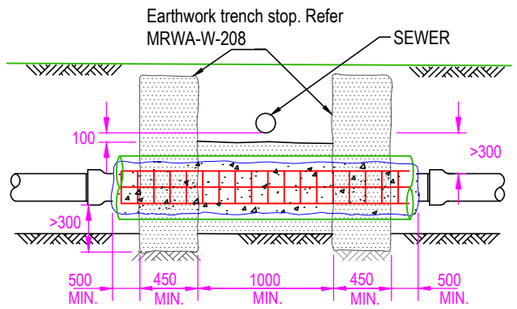
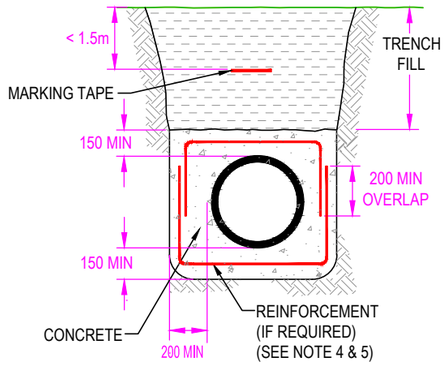



FIGURE 203B: WATER MAIN UNDER SEWER CROSSING (SECTION)

## NOTES Regarding Figures 203-A & B:

1. The principle applied to water main crossings under sewers is that any sewage leakage is to be contained and remain separate from the water main.
2. Water main joints must be outside of the trench stop protected zone.
3. Between the trench stops, there shall be a barrier between the sewer and water mains consisting of one of the following:
   - 3.1. an unjoined sleeve as described in MRWA-W-210, or
   - 3.2. concrete encasement as per Type C, or
   - 3.3. earth trench stop material as described in MRWA-W-209.

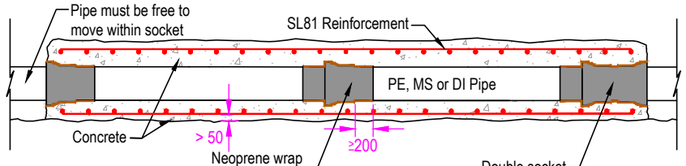



TYPE C: CONCRETE ENCASED EMBEDMENT

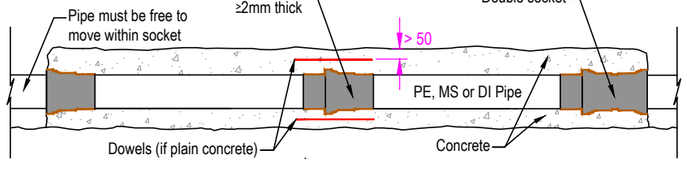
## NOTES Regarding Type C:

1. Use this support where authorised by the Water Agency.
2. Use minimum grade N20 concrete.
3. Plain concrete acceptable means of asset protection.
4. Steel reinforcement required if ground also unstable.
   - 4.1. Reinforcement to consist of min SL81 grade mesh (AS/NZS 4671).
   - 4.2. Steel reinforcement shall have >50 clear cover of concrete.
5. Where concrete is not reinforced, provide 300 long N10 dowel pins at 150 spacing around joints (to prevent the pipe shearing at joints).
6. Wrap each joint (to 200 either side) in a ≥2mm thick neoprene).
7. Pipes will require a restraint system to prevent movement and/or floatation during encasing process.
8. Metal pipe shall have fusion bonded Polyurethane or PE external coating.
9. PVC pipe shall not be used (can be affected by high curing temperatures).
10. Use RRJ pipe where practical (to help the pipe cope with concrete shrinkage).
11. Finish concrete at edge of RRJ at both ends (if RRJ pipe). Double socket connector required at one end.

TYPE C1: CONCRETE ENCASED EMBEDMENT (REINFORCED)

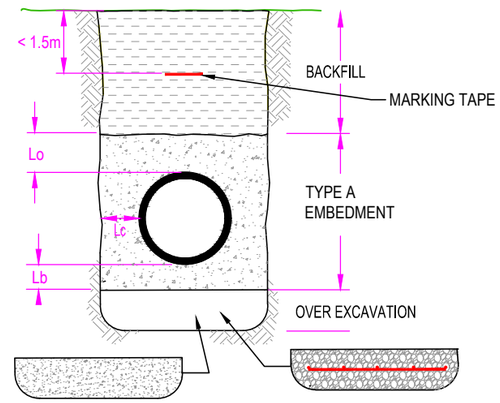



TYPE C2: CONCRETE ENCASED EMBEDMENT (DOWELLED)




## NOTES Regarding Type D:

1. Where ground water volumes are substantial, use 20mm aggregate as embedment under the pipe.
2. Where ground water volumes are extreme, install AGI drain as shown.
3. Where the trench floor is soft (ie: boots sink into the floor under a person's weight ), press 100 ballast into the trench floor until it is solid and can take a persons weight without significant movement.
4. Provide trench stops / bulkheads and trench drainage (if required) as per MRWA-W-208 & 209.




TYPE E: OVEREXCAVATION. CEMENT STABILISED

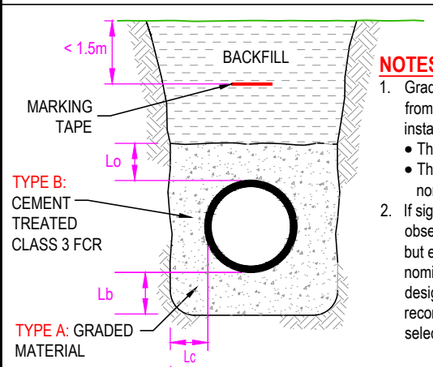
TYPE F: OVEREXCAVATION. CONCRETE

## NOTES Regarding Type E:

a. Use where there is little or no ground water.
A. Appropriate when unintentional over excavation occurs.
B. Cement stabilised material to consist of Item l from Table 203-B.
C. Place dry.

## NOTES Regarding Type F:

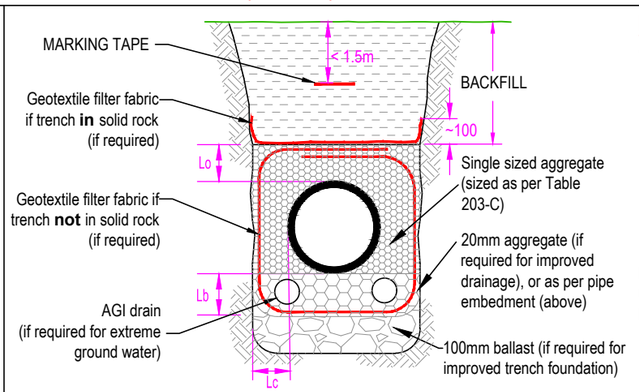
1. Use N20 concrete or better.
2. Steel reinforcement is to consist of min SL81 grade mesh and N10 grade bar (as per AS/NZS 4671).
3. Steel reinforcement shall have >50 clear cover.




## NOTES RegardingType A:

1. Graded material (Items a to e from Table 203-B) may only be installed when:
   - The trench is not wet.
   - The pipe sits above the normal groundwater level.
2. If significant groundwater is observed during excavation but embedment Type A is nominated in the design, the designer shall be consulted to reconsider embedment system selection.

TYPE A: STANDARD EMBEDMENT SYSTEM
TYPE B: CEMENT STABILISED EMBEDMENT
Type B as per Type A but use Item l from Table 203-B only.




TYPE D: AGGREGATE (SINGLE SIZED) EMBEDMENT

## NOTES Regarding Geotextile Wrapping:

A. 5 / 7 mm aggregate shall be geotextile wrapped **unless**:
   - A.A. Water main grade < 1 in 60, **and**
   - A.B. Embedment is not subject to tidal ground water, **and**
   - A.C. Trench sidewall consists of particles which satisfy the conditions of Appendix I of AS2566.2 (ie: coarse sand or gravel), **or**
   - A.D. Trench sidewall consists of non dispersive clay which is not subject to drying out (ie: is generally below the water table). Non dispersive clay shall be:
     - determined by a NATA accredited geotechnical laboratory,
     - be crumb test grade 1 or 2, or
     - emerson test class 4, 5 or 6.

B. The designer shall nominate whether 5 / 7 mm aggregate requires geotextile wrapping.
C. Aggregate > 7mm shall always be wrapped in geotextile fabric.
D. Lay geotextile fabric against the trench floor and wall such that it fully encases the embedment, **unless**:
E. There is solid rock on both sides and underneath, in which case only the top surface requires geotextile filter fabric.
   In this case, fold >100 of fabric up sides of trench prior to backfill placement.
F. Provide min of 250 lap at all filter fabric joints.

| REV | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|
| 2 | FIRST ISSUE REPLACEMENT STANDARD | 1/12/16 | RJ / CP / JT |
| 1 | PRE PUBLISHED DRAFT FOR COMMENT | 1/6/16 | RJ / CP / JT |

| | NAME | DATE | NAME | DATE |
|---|---|---|---|---|
| DESIGNED: | R. JAGGER | 1/06/2016 | | |
| DRAWN: | R. JAGGER | 1/06/2016 | | |
| CHECKED: CWW | R.JAGGER | 1/06/2016 | APPROVED: CWW R.CARRUTHERS | 1/06/2016 |
| CHECKED: SEWL | C.PAXMAN | 1/06/2016 | APPROVED: SEWL D. O'DONOVAN | 1/06/2016 |
| CHECKED: YVW | J. TOMASI | 1/06/2016 | APPROVED: YVW D.ERREY | 1/06/2016 |

MELBOURNE RETAIL WATER AGENCIES
City West Water™
South East Water
Yarra Valley Water

MRWA WATER SUPPLY STANDARDS

EMBEDMENT

NOT TO SCALE

MRWA-W-203

ISSUED 2016 | REVISION NO. 2