

TABLE 300-A: SUMMARY OF STRUCTURES

| ID | SITUATION | STRUCTURE | | | | | KEY REFERENCES |
|----|---|-----------|----|----|----|----|--------------------------------|
| | | MAIN | IS | MS | MC | MH | |
| A | PROPERTY CONNECTS TO THE NETWORK | ✓ | ✓ | ✓ | ✓ | ✓ | TABLE 104-A, MRWA-S-300 to 306 |
| B | TWO DN150 SEWER MAIN INFLOWS INTERSECT | NA | | ✓ | ✓ | ✓ | TABLE 300-C |
| C | TWO DN225 SEWER MAIN INFLOWS INTERSECT | NA | | | ✓ | ✓ | TABLE 300-C |
| D | TWO ≥DN300 SEWER MAIN INFLOWS INTERSECT | NA | | | | ✓ | TABLE 300-C |
| E | DROP OF A SEWER ≥DN225 | ✓ | | | | ✓ | STANDARD MRWA-S-104B |
| F | DROP OF A SEWER ≥DN300 | | | | | ✓ | TABLE 307-C & D |
| G | CHANGE IN GRADE OF SEWER MAIN ≤DN225 | ✓ | | ✓ | ✓ | ✓ | TABLE 104-C, FIGURE 307-A |
| H | CHANGE IN GRADE OF SEWER MAIN DN300 | | | | ✓ | ✓ | TABLE 104-C, FIGURE 307-A |
| I | CHANGE IN GRADE OF SEWER MAIN ≥DN375 | | | | | ✓ | FIGURE 307-A |
| J | CHANGE IN DIRECTION OF A SEWER MAIN | ✓ | | ✓ | ✓ | ✓ | TABLE 104-C |
| K | TWO SEWERS OF DIFFERENT MATERIAL INTERSECT | | | ✓ | ✓ | ✓ | |
| L | DISCHARGE POINT OF WATER AGENCY PRESSURE MAIN | | | | | ✓ | DRAWING SPS-1405 |
| M | DISCHARGE OF PRESSURE PROPERTY CONNECTION | | | | ✓ | ✓ | |
| N | BOTH SIDES OF A MAJOR CROSSING | | | ✓ | ✓ | ✓ | MRWA-S-207 |
| O | TEMPORARY DEAD END | | | ✓ | ✓ | ✓ | |
| P | PERMANENT DEAD END | | ✓ | ✓ | ✓ | ✓ | TABLE 105-C, MRWA-302 to 304 |

• **Limitations** apply in each case. Refer to Table 300-C and the standard for each structure for details.

- IS refers to inspection shafts.
- MS refers to maintenance shafts.
- MC refers to maintenance chambers.
- MH refers to maintenance holes.

• All of them are collectively referred to as maintenance structures.

* These structures may be used where there are base connections or larger shaft connections (as per Table 104-A) into a permanent dead end.

TABLE 300-B: MAINTENANCE STRUCTURE MAX SPACING

| UPSTREAM STRUCTURE | DOWNSTREAM STRUCTURE | LAND TYPE / SEWER TYPE | MAX SPACING |
|--------------------|-------------------------------|------------------------|-------------|
| IS | MS, MC or MH | PRIVATE PROPERTY | 80m |
| IS | MS, MC or MH | PUBLIC LAND | 100m |
| MS or MC | MS, MC or MH | PRIVATE PROPERTY | 100m |
| MS or MC | MS, MC or MH | PUBLIC LAND | 150m |
| MH | MS or MC | PRIVATE PROPERTY | 100m |
| MH | MS or MC | PUBLIC LAND | 150m |
| IS or MH | MH (+INTERMEDIATE STRUCTURES) | ≤DN300 SEWERS | 300m |
| MH | MH | ≥DN375 SEWERS | 300m |

MHs are not allowed in private property for CWW or YVW

Maintenance Structure Location And Selection Guide:

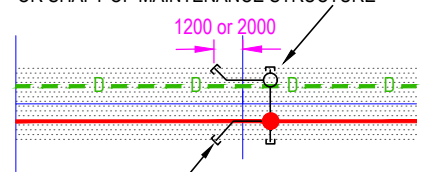
When selecting the location and type of maintenance structures, utilize the following process:

1. Select all the locations where a maintenance structure will be required.
2. Select the **smallest possible** maintenance structure for each location in accordance with Table 300-A and C.
3. Check compliance to the maximum spacing limits as per Table 300-B.
4. Add in extra structures as required to meet maximum spacings. Locate to remove bends and locate centrally if practical.
5. Check that there are no MHs in private property if CWW or YVW. Change the maintenance structure type or location if required.
6. Alter maintenance structure type to meet the max MH spacing limit. Change structures to MHs with the following order of preference:
 - 6.1. Largest number of sewer main inflows.
 - 6.2. Largest number of inflows (property service or retic).

- 6.3. Larger inflow mains.
- 6.4. Deeper structures.
- 6.5. Greater inflow angles.
- 6.6. Future Retic or property connections are likely.
- 6.7. Where greater network storage might be required (rather than building SPS storage downstream).
7. Where possible, shallow structures should be MSs or MCs to avoid the need for squat or truncated maintenance holes.
8. Maintenance structures larger than the minimum (which is typically specified in the design) are allowed provided:
 - 8.1. There is no interference with other assets, adequate clearances are obtained and the structure will be entirely contained within the easement or allocated space.
 - 8.2. Concrete corrosion risks are assessed and covered by the designer (where concrete maintenance holes are to be used) as per MRWA-S-401 and Table 307-E.

FIGURE 300-A: MAINTENANCE STRUCTURE CONNECTION ARRANGEMENTS

TYPE S OR B JUMP UP CONNECTIONS TO BASE OR SHAFT OF MAINTENANCE STRUCTURE



PROPERTY CONNECTION TO MAINTENANCE STRUCTURE WHERE JUMP UP WOULD HAVE BEEN > 2000 TALL

FIGURE 300-A1: ALIGNED BACKYARD LOTS WITH DRAIN CROSSING

PROPERTY CONNECTION TO SEWER WHERE JUMP UP < 2000 TALL

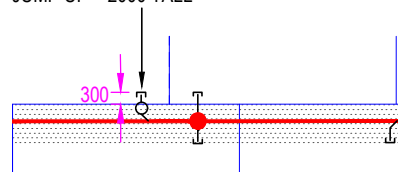


FIGURE 300-A2: STAGGERED BACKYARD LOTS WITH SHALLOWER CONNECTIONS

PROPERTY CONNECTION TO MAINTENANCE STRUCTURE WHERE JUMP UP WOULD HAVE BEEN > 2000 TALL

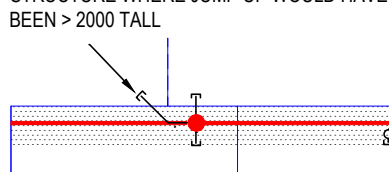


FIGURE 300-A3: STAGGERED BACKYARD LOTS WITH DEEPER CONNECTIONS

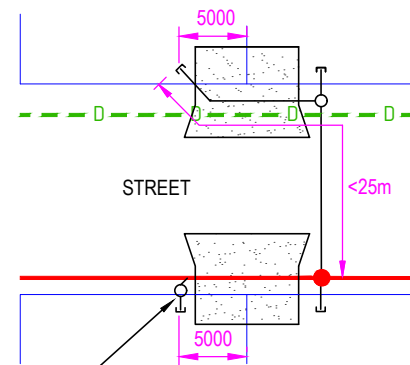


FIGURE 300-A4: LOTS ALIGNED ACROSS STREET WITH SPUR BRANCH CONNECTION INTO BASE

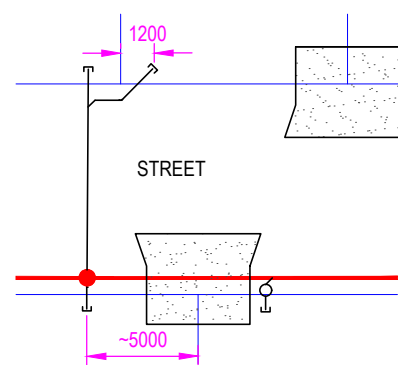


FIGURE 300-A5: LOTS STAGGERED ACROSS STREET WITH SPUR BRANCH CONNECTION INTO SHAFT

LEGEND

- ≥DN150 SEWERAGE PIPE
- MAINTENANCE STRUCTURE
- PROPERTY CONNECTION RISER ("JUMP UP") - BURIED.
- PROPERTY CONNECTION PIPE
- OBSTRUCTION
- ... EASEMENT AREA

TABLE 300-C MAINTENANCE STRUCTURE LIMITATIONS

| PARAMETER | INSPECTION SHAFT | MAINTENANCE SHAFTS | MAINTENANCE CHAMBER | PLASTIC M.HOLE | CONCRETE M.HOLE | CONCRETE M.HOLE | CONCRETE M.HOLE |
|------------------------|-----------------------------|--------------------|----------------------------------|----------------------------------|--------------------------------|--------------------------------|--------------------------------|
| RELEVANT DRAWINGS | MRWA-S-301 TO 304 | MRWA-S-305 | MRWA-S-306 | NA | MRWA-S-307 TO 314 | MRWA-S-307 TO 314 | MRWA-S-307 TO 314 |
| SHAFT SIZE | 150 OR 225 | 300 TO 450 | >450 & <1000 | ≥1000 | ~1050 | 1200 | 1500 |
| MAX DEPTH TO LOWEST IL | 6m | 3m | 6m | 6m ^f | UNLIMITED ^g | UNLIMITED ^g | UNLIMITED ^g |
| MAX SIZE OUTFLOW PIPE | DN150 OR DN225 ^h | DN225 | DN300 | DN300 | DN300 | DN450 | DN750 |
| MAX NO. TOTAL INFLOWS | 2 | 3 | 5 | 3 | 3 | 3 | 3 |
| MAX NO. SHAFT INFLOWS | DN100 | 2 ^a | 2 ^b | 3 ^b | 3 | 3 ^d | 3 ^d |
| | DN150 | 2 ^a | NOT ALLOWED | NOT ALLOWED | (MAX OF 2 x DN150 + 1 x DN225) | (MAX OF 1 x DN150 + 2 x DN225) | (MAX OF 2 x DN375 + 1 x DN450) |
| | DN225 | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED |
| | DN300 | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED |
| MAX NO. BASE INFLOWS | DN100 | NOT ALLOWED | 3 (MAX OF 1 x DN100 + 2 x DN150) | 3 (MAX OF 1 x DN150 + 2 x DN225) | 3 | 3 | 3 |
| | DN150 | NOT ALLOWED | 1 (STRAIGHT THRU ONLY) | 1 (STRAIGHT THRU ONLY) | 1 | 1 | 1 |
| | DN225 | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED |
| | DN300 | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED |
| | DN375 | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED |
| | DN400 / DN450 | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED | 1 | 1 |
| | DN500 / DN525 | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED | 1 |
| | DN600 | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED | 1 (STRAIGHT THRU ONLY) |
| | DN700 / DN750 | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED | NOT ALLOWED | 1 (STRAIGHT THRU ONLY) |

NOTES Regarding Table 300-C:

- a. Only property service connections may connect into the shafts of ISs.
- b. There is a risk that shaft inflows may deposit solids on to the base that will not be removed by base inflows (which will eventually block the sewer). Shaft inflows shall therefore only be installed where there is a base inflow with ≥3 equivalent lots connected.
- c. No two adjoining MSs or MCs shall **both** contain internal bends ≥60° (as the line in between would not be able to be CCTV'd). Instead, install a straight base MS / MC at one of the MS/MCs and fix to it an external long radius bend.

Connections to Existing Maintenance Structures

- Where a reticulation connection is to be made to an existing MS, MC or plastic MH, the designer must verify by as-constructed records that the base arrangement is able to receive a connection. Where as-constructed details are unavailable, the structure must be inspected as part of the design to confirm its suitability. Instructions for connection must be shown on the design drawings.
- If the base arrangement of an existing MS, MC or plastic MH does not allow for a new connection, the structure must be replaced or the connection must be made at a different point along the sewer.
- Refer to MRWA-S-308 for connections to existing concrete MHs.

Property Connections to Maintenance Structures:

- A. Maximise the number of properties connected to maintenance structures, especially where property connection jump ups (the section of riser pipe) would be > 2m tall.
- B. Typically, Maintenance Structures will connect to at least one property.
- C. "where practicable" in the following means that it can be done without the sewer main having to be lowered.
- D. Where a maintenance structure is within a lot or adjacent to a lot, that lot shall connect to the Maintenance Structure where practicable.
- E. Where a lot is within 5m of a Maintenance Structure, the vertical clearance between the property connection pipe and sewer main > 2000 and where practicable, the lot shall connect to the Maintenance Structure. Refer Figures 300-A1 and A3.

- F. Otherwise, the lot may connect to the sewer main. Refer Figures 300-A2, A4 and A5.
- G. Where the property connection pipework is located above the sewerage main, compacted granular backfill / FCR may be used between the two mains. Embedment is not required around the upper property connection.
- H. Both ends of property connections shall be located outside of driveways where practicable.
- I. Locate maintenance structures outside of the driveway where practicable, otherwise, locate in the center of the driveway.
- J. Locate on the side of the driveway which minimises the angle of any road crossing sewerage pipe (where a road crossing is required).

ALL DIMENSIONS IN mm UNLESS STATED OTHERWISE

| | | | |
|-----------|-----------|----------|---------------------|
| DESIGNED: | R. JAGGER | DATE: | 1 JULY 2015 |
| DRAWN: | R. JAGGER | DATE: | 1 JULY 2015 |
| CHECKED: | NAME | DATE | APPROVED: NAME |
| ✓ CWW | D. MOORE | 01/09/15 | ✓ CWW R. CARRUTHERS |
| ✓ SEW | C. PAXMAN | 01/09/15 | ✓ SEW D. O'DONOVAN |
| ✓ YVW | K. DAWSON | 01/09/15 | ✓ YVW J. TOMASI |
| ISSUED | 2015 | VERSION | 1 |

MELBOURNE RETAIL WATER AGENCIES



MRWA SEWERAGE STANDARDS

MAINTENANCE STRUCTURE
SELECTION, PLACEMENT AND
CONNECTION TO PROPERTIES

NOT TO SCALE

MRWA-S-300

| Planning | Design | Construction |
|----------|--------|--------------|
| ✓ | ✓ | ✓ |

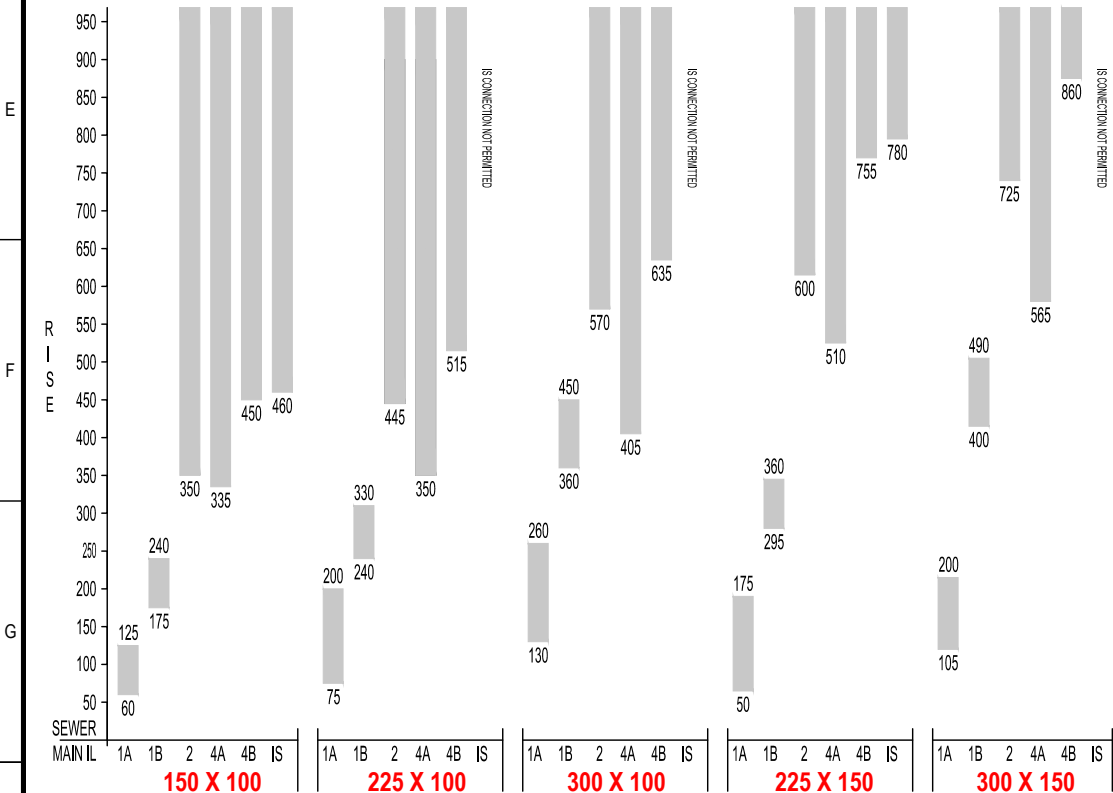
TABLE 301-A: PROPERTY CONNECTION TYPES, LIMITATIONS AND SITUATIONS OF USE

| TYPE | CONFIGURATION | DESCRIPTION | RISE | SITUATIONS OF USE AND COMMENTS |
|---------------------------------|---------------|---|--|---|
| TYPE 1A (Drawing MRWA-S-302) | | ON GRADE CONNECTION WITH 45° BEND AT JUNCTION | 150 X 100 = 60 to 125 225 X 100 = 75 to 200 300 X 100 = 130 to 260 225 X 150 = 50 to 175 300 X 150 = 105 to 200 | Only for connections which control (or almost control) the sewer main's level. Property connection may drown (flood) in wet weather. May or may not be an obstruction above property connection |
| TYPE 1B (Drawing MRWA-S-302) | | ON GRADE CONNECTION WITH 60° BEND AT JUNCTION | 150 X 100 = 175 to 240 225 X 100 = 265 to 330 300 X 100 = 360 to 450 225 X 150 = 295 to 360 300 X 150 = 400 to 490 | For connections where: i) the lot's control level enables a higher connection (to prevent flooding / drowning of the connection). ii) the lot's control level is <u>not</u> high enough for a riser. May or may not be an obstruction above the property connection. |
| TYPE2 (Drawing MRWA-S-303) | | RISER (JUMP UP) CONNECTION | 150 X 100 > 350 225 X 100 > 445 300 X 100 > 570 225 X 150 > 600 300 X 150 > 725 | For connections where the lot's control level permits a riser pipe to be fitted. |
| TYPE 4A (Drawing MRWA-S-304) | | OFFSET RISER (JUMP UP). 45° BEND AT JUNCTION. | 150 X 100 > 335 225 X 100 > 350 300 X 100 > 405 225 X 150 > 510 300 X 150 > 565 | For connections where: i) the connection's point is on the other side of an obstruction from the sewer main. ii) the obstruction controls (or almost controls) the sewer main's level. iii) the lot's control level permits a riser pipe to be fitted on the lot's side of the obstruction. |
| TYPE 4B (Drawing MRWA-S-304) | | OFFSET RISER (JUMP UP). 60° BEND AT JUNCTION. | 150 X 100 > 450 225 X 100 > 515 300 X 100 > 635 225 X 150 > 755 300 X 150 > 860 | For connections where: i) the connection's point is on the other side of an obstruction from the sewer main. ii) the obstruction's level enables a higher connection to the sewer main (to prevent flooding / drowning of the connection). iii) the lot's control level permits a riser pipe on the lot's side of the obstruction. |
| INSPECTION SHAFT CONNECTION | | CONNECTION TO END OF SEWER MAIN'S RISER | 150 X 100 > 460 225 X 100 . NOT PERMITTED 300 X 100 . NOT PERMITTED 225 X 150 > 780 300 X 150 . NOT PERMITTED | For connections where: i) the lot is at the end of the sewer main. ii) the lot's control level permits connection to a riser at the end of the sewer main. |

NOTES Regarding Table 301-A:

- Connection's point shall be < 1500 deep where possible. Maximum depth of connection's point shall be 2500.
- Sewerage main's invert at connection shall be < 4000 deep.
- Notation example: 300 (main size) x 100 (connection size).
- Rises include a provision of 50 for the fall required for up to 3m of property connection pipe work.
- Should the property connection be longer than 3m, an additional fall shall be taken into account.

FIGURE 301-A: RISE OF PROPERTY CONNECTIONS

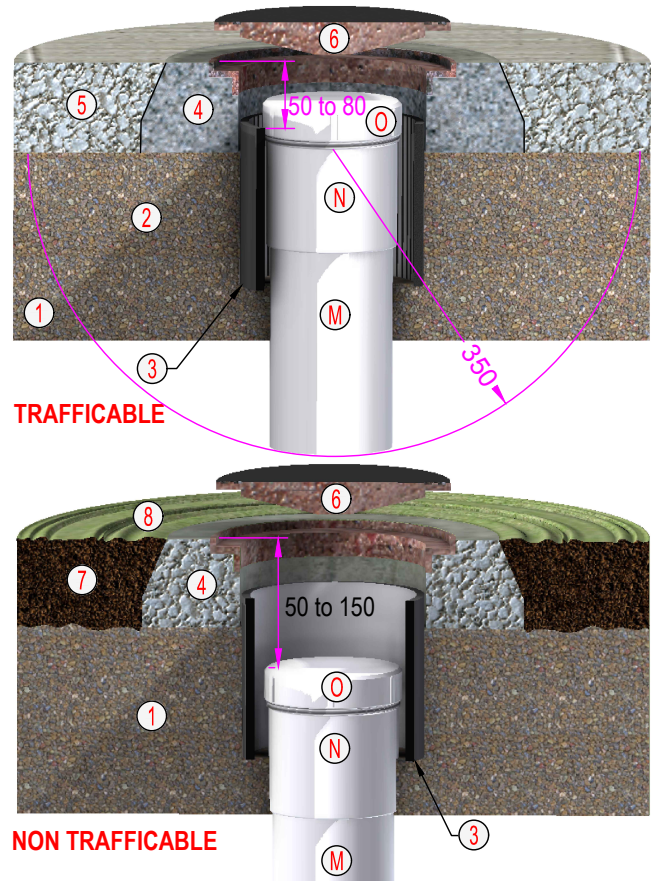


| | | | | | | | | | | |
|---|-----|-----------------------|----------|---|---|-----------|---|---|--------------|----------|
| H | | | | DESIGNED: R. JAGGER | | | | DATE: 1 JULY 2015 | | |
| | | | | DRAWN: R. JAGGER | | | | DATE: 1 JULY 2015 | | |
| | | | | CHECKED: | NAME | DATE | APPROVED: | NAME | DATE | |
| | | | | <input checked="" type="checkbox"/> CWW | D. MOORE | 01/09/15 | <input checked="" type="checkbox"/> CWW | R. CARRUTHERS | 01/09/15 | |
| | 2 | PUBLISHED FIRST ISSUE | 01/10/15 | CP / JT / KD / RJ | <input checked="" type="checkbox"/> SEW | C. PAXMAN | 01/09/15 | <input checked="" type="checkbox"/> SEW | D. O'DONOVAN | 01/09/15 |
| | 1 | PRE-PUBLISHED DRAFT | 01/03/15 | CP / JT / KD / RJ | <input checked="" type="checkbox"/> YVW | K. DAWSON | 01/09/15 | <input checked="" type="checkbox"/> YVW | J. TOMASI | 01/09/15 |
| | REV | DESCRIPTION | DATE | APPROVED | ISSUED 2015 | | | VERSION 1 | | |

MELBOURNE RETAIL WATER AGENCIES



FIGURE 301-B : INSPECTION SHAFT SURFACE ARRANGMENTS (ISOMETRIC VIEW)



NOTES Regarding Figure 301-B items:

- Trafficable refers to all paved areas.
- Item 2. $\frac{1}{4}$ standard bag cement (5kg) to $\frac{1}{2}$ wheel barrow of FCR (0.1m³) required per inspection shaft cover.
Mix thoroughly prior to placement.
No cement shall be visible once mixed.
- Item 3. Locate top of shroud inside surround within 50 to 100 of FSL.
Locate screw cap within shroud / cover within 50 to 150 of FSL.
- Item 4. In nature strips, set cover 25 above surrounding ground.
In backyards and open reserves, set cover 50 above surrounding ground.
In paved areas, set cover flush with pavement.
- Item 6. For DN225 IS, refer to cover for MS as per Figure 305-C.

TABLE 301-B: DETAIL A COMPONENTS

| ITEM ID | DESCRIPTION | MATERIAL | NOTES |
|---------|---------------------|---------------------------------|--|
| 1 | NORMAL BACKFILL | GRANULAR BACKFILL | REFER TO MRWA BACKFILL SPECIFICATION |
| 2 | STABILIZED BACKFILL | 6% CEMENT MIXED CLASS 2 / 4 FCR | ALL BACKFILL WITHIN 500 OF CENTRE OF COVER |
| 3 | SHROUD | PN8 DN225 PE100 PIPE | 300 LONG |
| 4 | FRAME & SURROUND | DI FRAME IN PRECAST CONCRETE | ~230 CLEAR OPENING |
| 5 | PAVEMENT | BITUMEN OR CONCRETE | CONSTRUCTED BY OTHERS |
| 6 | SOLID TOP COVER | DUCTILE IRON | COVER FOR DN150 SHAFT IS SHOWN |
| 7 | TOP SOIL | NATIVE SOIL | IF IN PUBLIC LAND, RE-INSTATE AS PER RESERVE OWNERS' SPECIFICATION |
| 8 | GRASS | PVC DWV. SCJ | |

FIGURE 301-C: SHAFT SUPPORTS (SECTION VIEWS)

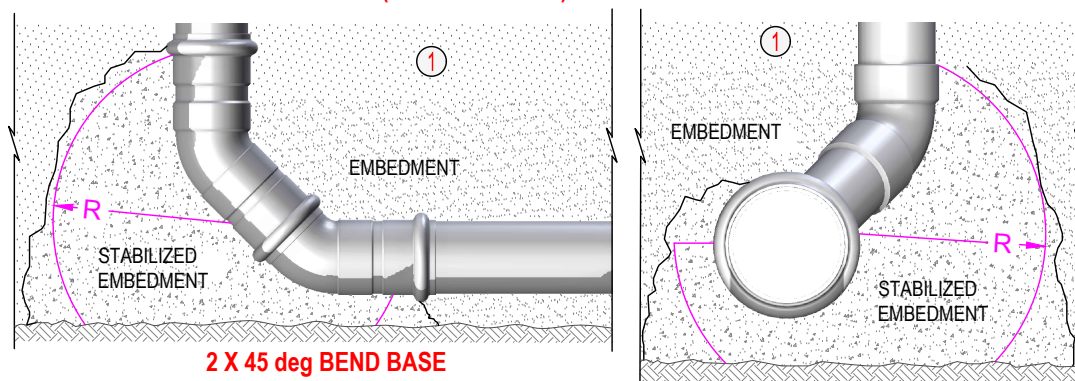


TABLE 301-C: CEMENT STABILIZED EMBEDMENT PARAMETERS

| RISER / SHAFT DIAMETER | R | SUPPORT VOLUME | MASS CEMENT |
|------------------------|-----|---------------------------------------|-----------------|
| 100 | 350 | 0.1 m ³ (1/2 WHEEL BARROW) | 5 kg (1/4 BAG) |
| 150 | 500 | 0.2 m ³ (1 WHEEL BARROW) | 10 kg (1/2 BAG) |
| 225 | 600 | 0.4 m ³ (2 WHEEL BARROWS) | 20 kg (1 BAG) |

NOTES Regarding Figure 301-C:

- Mix 6% cement to embedment material thoroughly prior to placement. No cement shall be visible once mixed.
- Place under and behind bend. Not required above the bend.

H

MELBOURNE RETAIL WATER AGENCIES



MRWA SEWERAGE STANDARDS

PROPERTY CONNECTIONS TO SEWERAGE MAINS

RISER CONSTRUCTION DETAILS

NOT TO SCALE

MRWA-S-301

| Planning | Design | Construction |
|----------|--------|--------------|
| ✓ | ✓ | ✓ |

FIGURE 302-A: TYPICAL PROPERTY CONNECTION SCHEMATIC ARRANGEMENTS AT END OF LINE

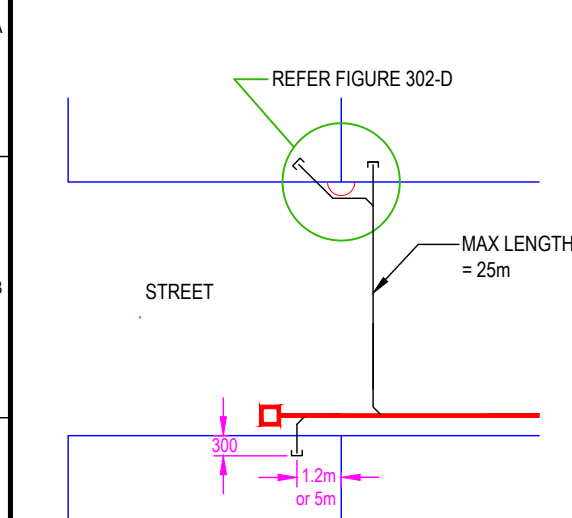


FIGURE 302-A1: LOTS ALIGNED ACROSS STREET

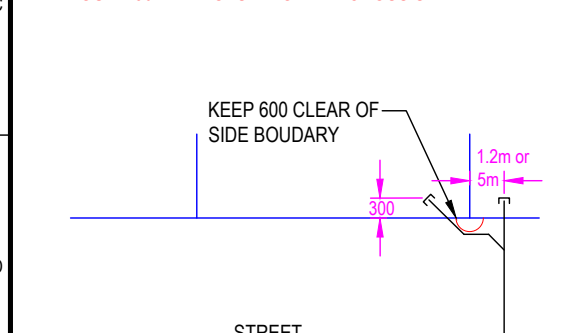


FIGURE 302-A2: LOTS STAGGERED ACROSS STREET

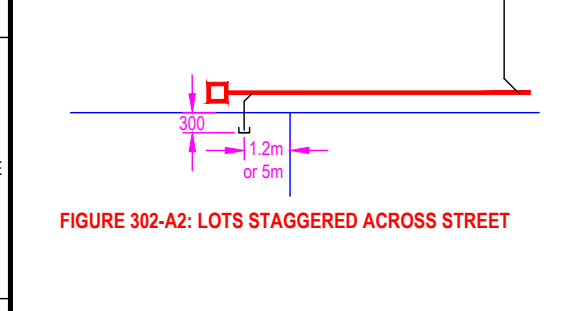


FIGURE 302-A3: ALIGNED BACKYARD LOTS

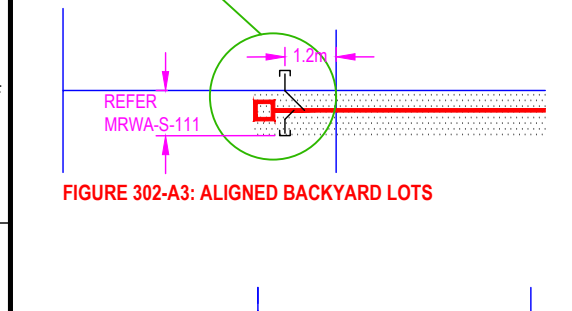


FIGURE 302-A4: STAGGERED BACKYARD LOTS

FIGURE 302-B: TYPICAL TYPE 1 END OF LINE ARRANGEMENT (ISOMETRIC VIEW)

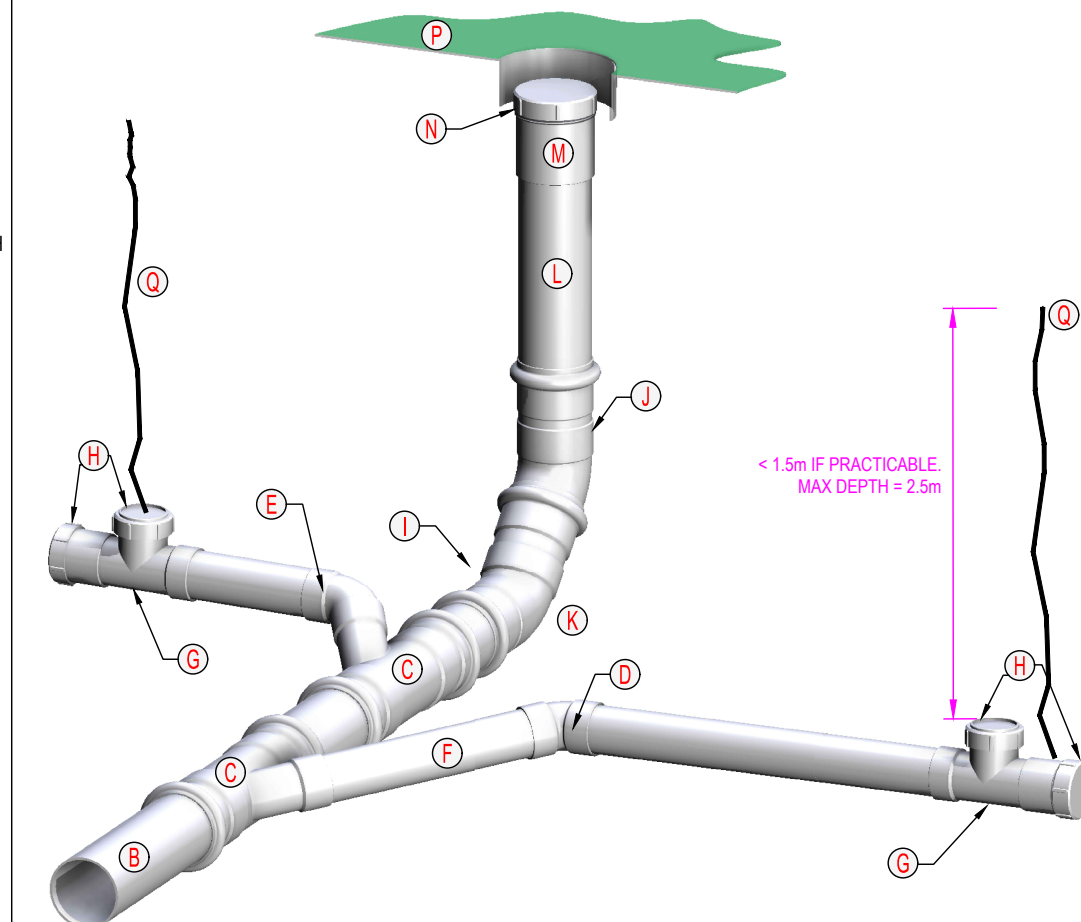


TABLE 302-A: COMPONENTS (in Approximate Order of Construction)

| ITEM | DESCRIPTION | MATERIAL | |
|------|--------------------------|---------------------------|--|
| A | EMBEDMENT | APPROVED MATERIAL | REFER MRWA-S-202 |
| B | RETICULATION PIPE | TYPICALLY PVC DWV OR PP | REFER MRWA-S-103 |
| C | OBLIQUE JUNCTION | PVC DWV / GRP | REFER MRWA-S-104A |
| D | 45 deg BEND | PVC DWV. SCJ | TYPICALLY M-F |
| E | 60 deg BEND | PVC DWV. SCJ | TYPICALLY M-F |
| F | PROPERTY CONNECTION PIPE | PVC DWV. SCJ | LAY AT 1 IN 60 GRADE. FOR SIZE, REFER TO TABLE 104-A |
| G | INSPECTION OPENING (IO) | PVC DWV. SCJ | MARKS END OF WATER AGENCY ASSET |
| H | SCREW CAP | PVC DWV. SCJ | INSTALL ONE AT END OF ACCESS COUPLING AND ONE ON IO |
| I | 45 deg BEND | PVC DWV. RRJ OR SCJ | F-M OR F-F TO SUIT. SIZE TO MATCH RETICULATION PIPE |
| J | 45 deg BEND | PVC DWV. RRJ OR SCJ | TYPICALLY M-F. SIZE TO MATCH RETICULATION PIPE |
| K | RISER PIPE SUPPORT | CEMENT STABILIZED BEDDING | REFER FIGURE 301-C |
| L | RISER PIPE | PVC DWV. SCJ OR RRJ | SIZED TO MATCH RETICULATION PIPE |
| M | ACCESS COUPLING | PVC DWV. SCJ | SIZED TO MATCH RETICULATION PIPE |
| N | SCREW CAP | PVC DWV. SCJ | INSTALL ONE AT END OF ACCESS COUPLING |
| O | COMPACTED BACKFILL | CLASS 2 OR CLASS 4 FCR | REFER MRWA BACKFILL SPEC |
| P | SURFACE ARRANGEMENT | CONCRETE / DUCTILE IRON | REFER FIGURE 301-B |
| Q | MARKER TAPE | AS PER WSA PS 319. CREAM | FROM CENTRE OF CAP. LAY VERTICALLY TO SURFACE |

Additional Notes Regarding Table 302-A items:

Item G. IO ties and Offsets, refer Table 108-B and Table 109-A.

LEGEND

- RETICULATION SEWERAGE PIPE
- INSPECTION SHAFT (TO SURFACE)
- PROPERTY CONNECTION PIPE
- EASEMENT AREA

DETAIL 302-C: PROPERTY CONNECTIONS TO RETICULATION PIPE (SECTION VIEW)

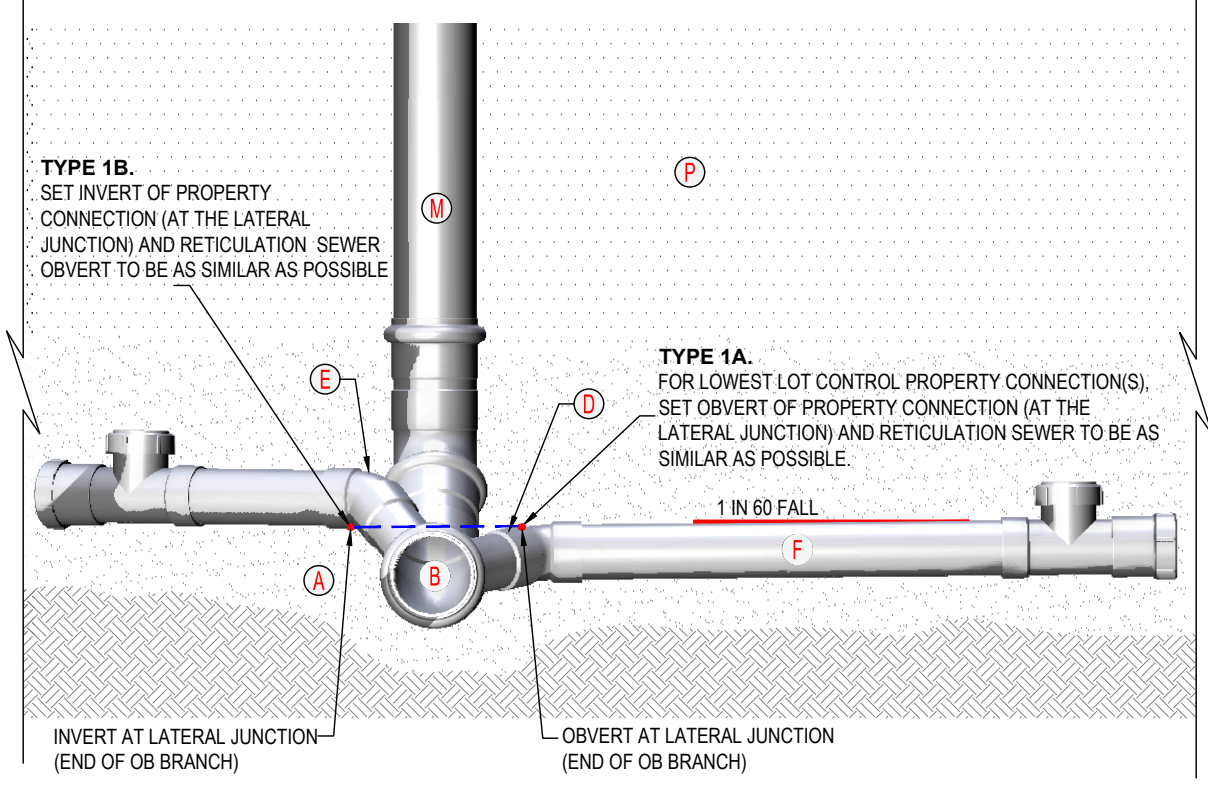
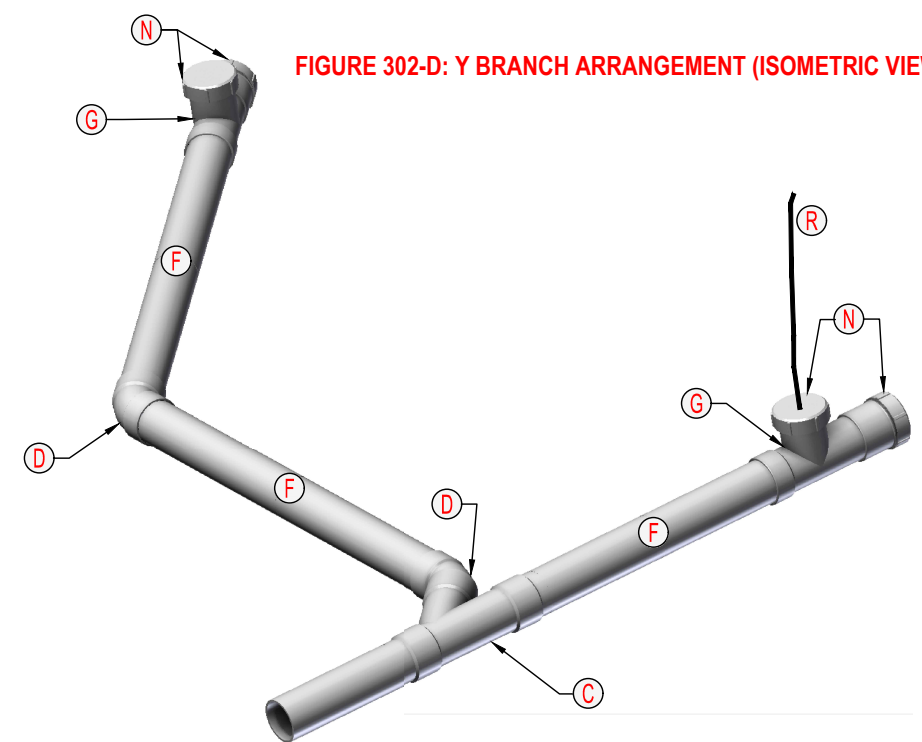


FIGURE 302-D: Y BRANCH ARRANGEMENT (ISOMETRIC VIEW)



| | | | | | | | | | | | | | | | | | | | |
|--|--|--|--|--|--|--|--|---------------------------------|--|--|--|---|--|--|--|------------------------------|--|--|--|
| ALL DIMENSIONS IN mm UNLESS STATED OTHERWISE | | | | DESIGNED: R. JAGGER DATE: 1 JULY 2015 | | | | MELBOURNE RETAIL WATER AGENCIES | | | | MRWA SEWERAGE STANDARDS | | | | NOT TO SCALE | | | |
| DRAWN: R. JAGGER DATE: 1 JULY 2015 | | | | CHECKED: NAME DATE APPROVED: NAME DATE | | | | CityWest Water™ | | | | ON GRADE (TYPE 1) PROPERTY CONNECTIONS TO SEWERAGE MAINS. INSPECTION SHAFTS | | | | MRWA-S-302 | | | |
| 2 PUBLISHED FIRST ISSUE 01/10/15 CP / JT / KD / RJ | | | | 1 PRE-PUBLISHED DRAFT 01/03/15 CP / JT / KD / RJ | | | | SOUTH EAST WATER | | | | Yarra Valley Water | | | | Planning Design Construction | | | |
| REV DESCRIPTION DATE APPROVED | | | | ISSUED 2015 VERSION 1 | | | | | | | | | | | | | | | |

FIGURE 303-A: TYPICAL PROPERTY CONNECTION SCHEMATIC ARRANGEMENTS AT END OF LINE

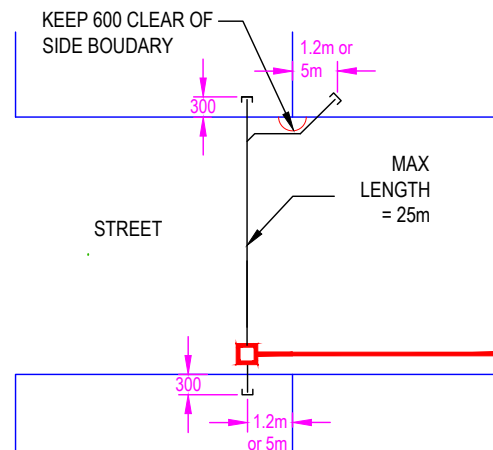


FIGURE 303-A1: LOTS ALIGNED ACROSS STREET

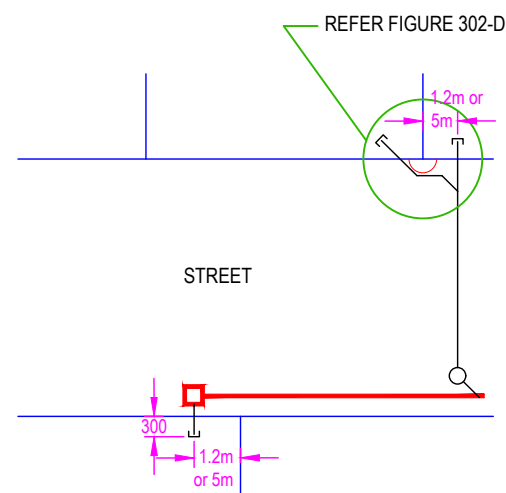


FIGURE 303-A2: LOTS STAGGERED ACROSS STREET

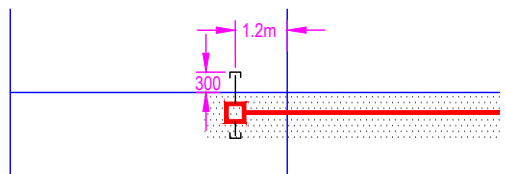


FIGURE 303-A3: ALIGNED BACKYARD LOTS

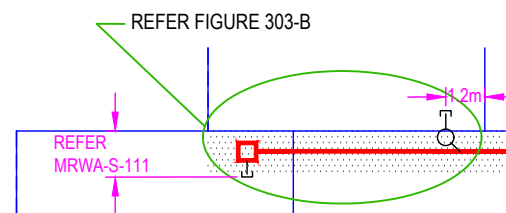
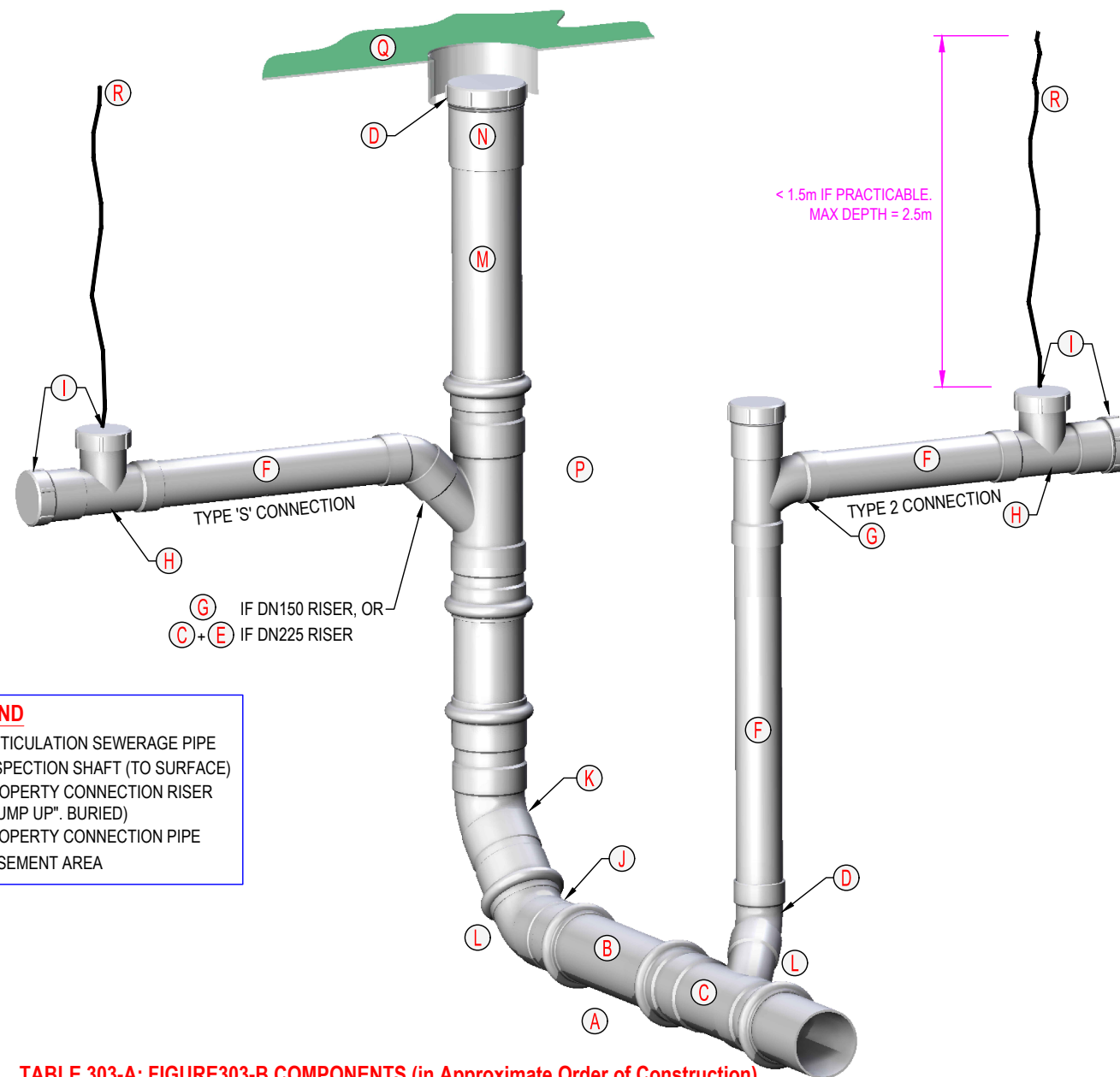


FIGURE 303-A4: STAGGERED BACKYARD LOTS

FIGURE 303-B: TYPICAL TYPE 1 END OF LINE ARRANGEMENT (ISOMETRIC VIEW)



LEGEND

- RETICULATION SEWERAGE PIPE
- INSPECTION SHAFT (TO SURFACE)
- PROPERTY CONNECTION RISER ("JUMP UP", BURIED)
- PROPERTY CONNECTION PIPE
- EASEMENT AREA

TABLE 303-A: FIGURE 303-B COMPONENTS (in Approximate Order of Construction)

| ITEM | DESCRIPTION | MATERIAL | NOTES |
|------|-----------------------------|---------------------------|--|
| A | EMBEDMENT | APPROVED MATERIAL | REFER MRWA-S-202 |
| B | RETICULATION PIPE | TYPICALLY PVC DWV OR PP | REFER MRWA-S-103 |
| C | OBLIQUE JUNCTION | PVC DWV / GRP | REFER MRWA-S-104A |
| D | 60 deg BEND | PVC DWV, SCJ | TYPICALLY M-F. SIZE TO MATCH PROPERTY CONNECTION PIPE |
| E | 45 deg BEND | PVC DWV / GRP | M-F. SIZE TO MATCH PROPERTY CONNECTION PIPE |
| F | PROPERTY CONNECTION PIPE | PVC DWV, SCJ | LAY IN A VERTICAL ALIGNMENT OR 1 IN 60 GRADE (FOR LATERAL) |
| G | 88 deg SWEEP TEE | PVC DWV, SCJ | |
| H | INSPECTION OPENING | PVC DWV, SCJ | MARKS END OF WATER AGENCY ASSET |
| I | SCREW CAP | PVC DWV, SCJ | |
| J | 45 deg BEND | PVC DWV, RRJ OR SCJ | F-M OR F-F TO SUIT. SIZE TO MATCH RETICULATION PIPE |
| K | 45 deg BEND | PVC DWV, RRJ OR SCJ | TYPICALLY M-F. SIZE TO MATCH RETICULATION PIPE |
| L | RISER PIPE SUPPORT | CEMENT STABILIZED BEDDING | BELOW SHAFT AND JUMP UP. REFER FIGURE 301-C |
| M | INSPECTION SHAFT RISER PIPE | PVC DWV, SCJ | SIZED TO MATCH RETICULATION PIPE |
| N | ACCESS COUPLING | PVC DWV, SCJ | SIZED TO MATCH RETICULATION PIPE |
| O | SCREW CAP | PVC DWV, SCJ | INSTALL ONE AT END OF ACCESS COUPLING |
| P | COMPACTED BACKFILL | CLASS 2 / CLASS 4 FCR | REFER MRWA BACKFILL SPEC |
| Q | SURFACE ARRANGEMENT | CONCRETE / DUCTILE IRON | REFER FIGURE 301-B |
| R | MARKER TAPE | AS PER WSA PS 319. CREAM | FROM CENTRE OF CAP. LAY VERTICALLY TO SURFACE |

Type 2 Property Connection Options:

- New connections to existing IS or jump up shafts are permitted provided:
 - There are no more than 2 connections to the shaft in total.
 - The new connection's length is extended by less than 5m to get to the shaft (compared to the length it could be if it were to connect to a sewer).
 - Connection to the shaft is as per MRWA-S-104A.
- Property connections may cross over an obstruction only when:
 - The obvert of the obstruction is low enough, and
 - The obstruction is or will be too low to enable a connection below the obstruction (while achieving minimum clearance), or
 - The property connection is to cross over an existing obstruction to connect to an existing sewer.

FIGURE 303-C : JUMP UP FLEXIBLE COUPLINGS (ISOMETRIC VIEW)

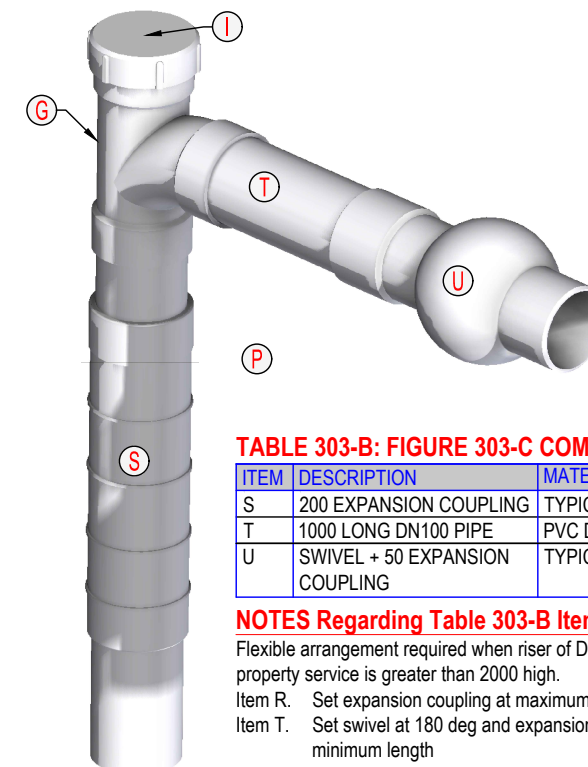


TABLE 303-B: FIGURE 303-C COMPONENTS

| ITEM | DESCRIPTION | MATERIAL |
|------|--------------------------------|--------------------|
| S | 200 EXPANSION COUPLING | TYPICALLY PVC, SCJ |
| T | 1000 LONG DN100 PIPE | PVC DWV SCJ |
| U | SWIVEL + 50 EXPANSION COUPLING | TYPICALLY PVC, SCJ |

NOTES Regarding Table 303-B Items:

- Flexible arrangement required when riser of DN100 property service is greater than 2000 high.
- Item R. Set expansion coupling at maximum length
- Item T. Set swivel at 180 deg and expansion at minimum length

NOTES Regarding Figure 303-D:

- No pipework required in the vertical jump up, ie: fittings directly connect.
- Item D. Use a M-M 60° bend instead of the M-F bend typically required when pipe is installed in the jump up.

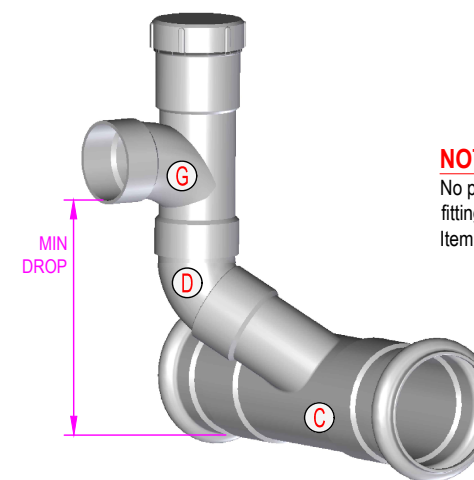


FIGURE 303-D : MINIMUM DROP ARRANGEMENT

Additional Notes Regarding Table 303-A items:

- Item C. Size as per Table 104-A.
- Item H. IO ties and offsets as per Table 108-B and 109-A

ALL DIMENSIONS IN mm UNLESS STATED OTHERWISE

DESIGNED: R. JAGGER DATE: 1 JULY 2015

DRAWN: R. JAGGER DATE: 1 JULY 2015

CHECKED: NAME DATE APPROVED: NAME DATE

✓ CWW D. MOORE 01/09/15 ✓ CWW R. CARRUTHERS 01/09/15

✓ SEW C. PAXMAN 01/09/15 ✓ SEW D. O'DONOVAN 01/09/15

✓ YVW K. DAWSON 01/09/15 ✓ YVW J. TOMASI 01/09/15

ISSUED 2015 VERSION 1

MELBOURNE RETAIL WATER AGENCIES



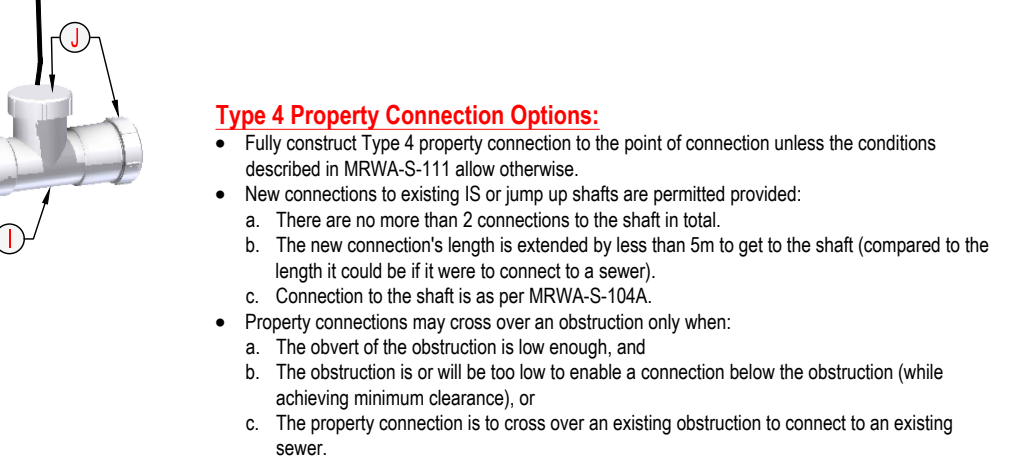
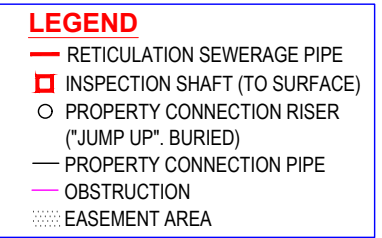
MRWA SEWERAGE STANDARDS

"JUMP UP" (TYPE 2)
PROPERTY CONNECTIONS TO SEWERAGE
MAINS & INSPECTION SHAFTS

NOT TO SCALE

MRWA-S-303

| Planning | Design | Construction |
|----------|--------|--------------|
| | | ✓✓✓✓ |



- Fully construct Type 4 property connection to the point of connection unless the conditions described in MRWA-S-111 allow otherwise.
- New connections to existing IS or jump up shafts are permitted provided:
 - a. There are no more than 2 connections to the shaft in total.
 - b. The new connection's length is extended by less than 5m to get to the shaft (compared to the length it could be if it were to connect to a sewer).
 - c. Connection to the shaft is as per MRWA-S-104A.
- Property connections may cross over an obstruction only when:
 - a. The obvert of the obstruction is low enough, and
 - b. The obstruction is or will be too low to enable a connection below the obstruction (while achieving minimum clearance), or
 - c. The property connection is to cross over an existing obstruction to connect to an existing sewer.

| ITEM | DESCRIPTION | MATERIAL | NOTES |
|------|--------------------------|----------------------------|--|
| A | EMBEDMENT | APPROVED MATERIAL | REFER MRWA-S-202 |
| B | RETICULATION PIPE | TYPICALLY PVC DWV, PP, GRP | REFER MRWA-S-103 |
| C | OBLIQUE JUNCTION | PVC DWV / GRP | REFER MRWA-S-104 |
| D | 45° BEND | PVC DWV. SCJ | TYPICALLY M-F. TYPE 4A USES 45° BEND AFTER O.B. |
| E | 60° BEND | PVC DWV. SCJ | TYPICALLY M-F. TYPE 4B USES 60° BEND AFTER O.B. |
| F | 45° BEND | PVC DWV. SCJ | TYPICALLY F-F. SIZE TO MATCH PROPERTY CONNECTION PIPE |
| G | PROPERTY CONNECTION PIPE | PVC DWV. SCJ | LAY IN A VERTICAL ALIGNMENT OR 1 IN 60 GRADE (FOR LATERAL) |
| H | 88 deg SWEEP TEE | PVC DWV. SCJ | ORIENTATE AT 90 deg FROM RETICULATION PIPE |
| I | INSPECTION OPENING | PVC DWV. SCJ | SIZED TO MATCH PROPERTY CONNECTION PIPE |
| J | SCREW CAP | PVC DWV. SCJ | SIZED TO MATCH PROPERTY INSPECTION OPENING |
| K | 45 deg BEND | PVC DWV. RRJ OR SCJ | F-M OR F-F TO SUIT. SIZE TO MATCH RETICULATION PIPE |
| L | 45 deg BEND | PVC DWV. RRJ OR SCJ | TYPICALLY M-F. SIZE TO MATCH RETICULATION PIPE |
| M | RISER PIPE SUPPORT | CEMENT STABILIZED BEDDING | REFER FIGURE 301-C |
| N | ACCESS COUPLING | PVC DWV. SCJ | SIZED TO MATCH RETICULATION PIPE |
| O | SCREW CAP | PVC DWV. SCJ | INSTALL ONE AT END OF ACCESS COUPLING |
| P | COMPACTED BACKFILL | CLASS 2 OR CLASS 4 FCR | REFER MRWA BACKFILL SPEC |
| Q | SURFACE ARRANGEMENT | CONCRETE / DUCTILE IRON | REFER FIGURE 301-B |
| R | OTHER ASSET | eg: DRAIN, GAS, WATER MAIN | REFER TO OTHER AUTHORITIES REQUIREMENTS |
| S | MARKER TAPE | AS PER WSA PS 319. CREAM | FROM CENTRE OF CAP. LAY VERTICALLY TO SURFACE |

Item D/ E. Use Item E and orientate as per Figure 302-C, unless the lot is setting the level of the sewer main, in which case use Item D.

Item G. Size as per Table 104-A.

Item H. For IO ties and offsets, refer Table 108-B and 109-A.

| | | | | | | | | | | |
|---|--|-----------------------|----------|-------------------|---|-----------|----------|---|---------------|----------|
| H | ALL DIMENSIONS IN mm UNLESS STATED OTHERWISE | | | | DESIGNED: R. JAGGER | | | DATE: 1 JULY 2015 | | |
| | | | | | DRAWN: R. JAGGER | | | DATE: 1 JULY 2015 | | |
| | | | | | CHECKED: | NAME | DATE | APPROVED: | NAME | DATE |
| | | | | | <input checked="" type="checkbox"/> CWW | D. MOORE | 01/09/15 | <input checked="" type="checkbox"/> CWW | R. CARRUTHERS | 01/09/15 |
| | 2 | PUBLISHED FIRST ISSUE | 01/10/15 | CP / JT / KD / RJ | <input checked="" type="checkbox"/> SEW | C. PAXMAN | 01/09/15 | <input checked="" type="checkbox"/> SEW | D. O'DONOVAN | 01/09/15 |
| | 1 | PRE-PUBLISHED DRAFT | 01/03/15 | CP / JT / KD / RJ | <input checked="" type="checkbox"/> YVW | K. DAWSON | 01/09/15 | <input checked="" type="checkbox"/> YVW | J. TOMASI | 01/09/15 |
| | REV | DESCRIPTION | DATE | APPROVED | ISSUED 2015 | | | VERSION 1 | | |

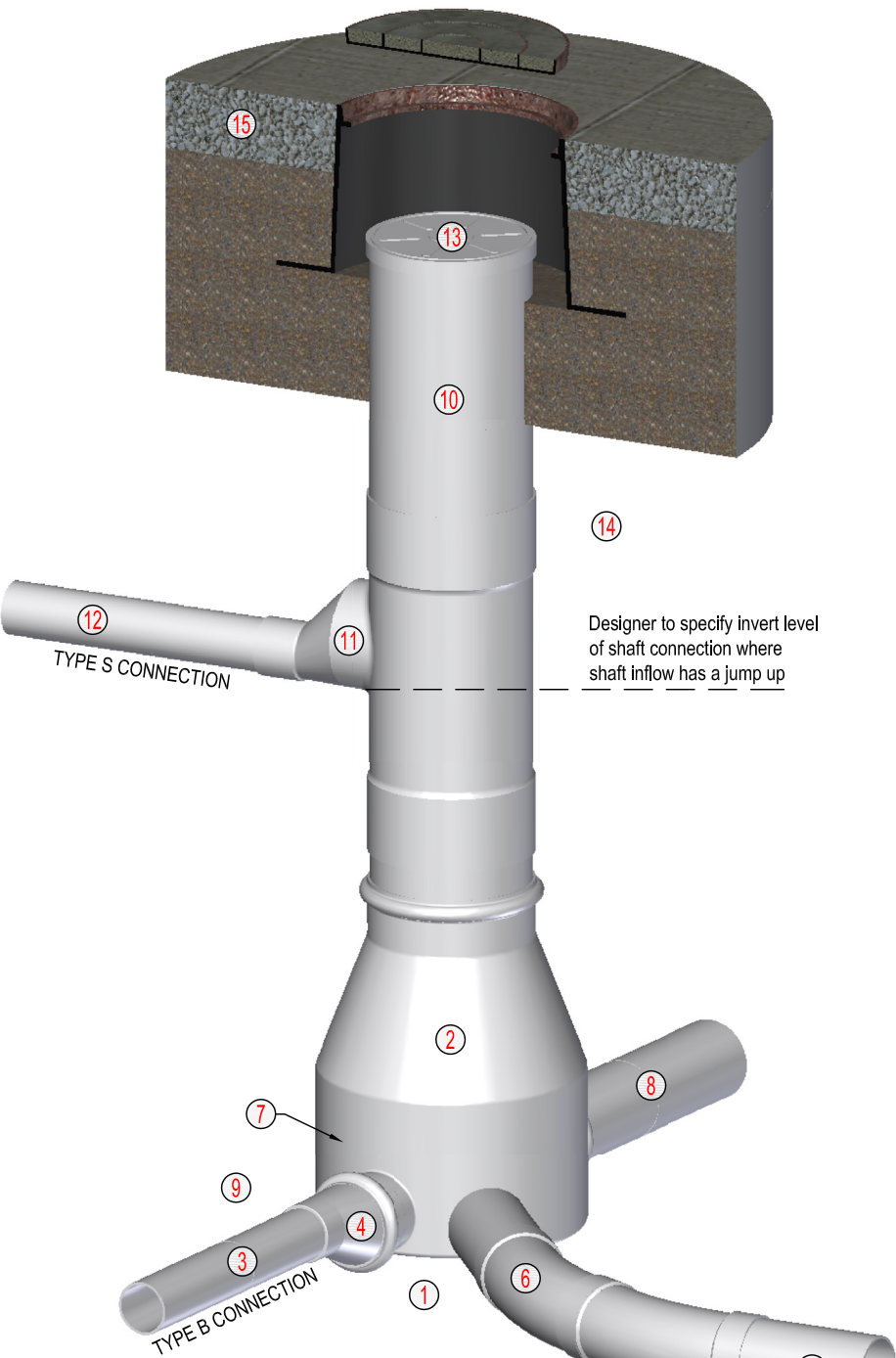


OFFSET "JUMP UP" (TYPE 4)
PROPERTY CONNECTIONS TO SEWERAGE
MAINS & INSPECTION SHAFTS

MRWA-S-304

| Planning | Design | | | Construction | | | |
|----------|--------|--|--|--------------|---|---|---|
| | | | | ✓ | ✓ | ✓ | ✓ |

FIGURE 305-A: MAINTENANCE SHAFT (ISOMETRIC VIEW)



GENERAL NOTES Regarding Maintenance Shafts:

1. Maintenance shafts (MS) shall have:

1.1. A depth to lowest invert < 3m.

1.2. ≤3 total (shaft & base) inflows.

1.3. Shaft connections only where there are base inflows collecting 3 or more lots.

1.4. ≤2 x DN100 connections into the shaft.

1.5. ≤3 inflow connections into the base.

1.5.1. Only two of which may be DN150, or

1.5.2. One DN225 straight through.

1.6. Outflow of DN150 or 225.

1.7. A shaft ≥300 & < 450 in diameter.

1.8. An allowance in the design for a 30mm drop in level between the outflow and all inflows.
2. No two adjoining MSs can both contain internal bends ≥60° (as the line would not be able to be CCTV'd). Instead, install a straight chase MS at one of the MSs and fix to it an external long radius bend.

3. The limitations mentioned on this drawing apply to all MSs.

There may be further limitations on MSs depending on the make and model purchased. Refer to the Product Portal for details.

One of the most common product limitations is that significant retic inflows (>3 lots) cannot enter into a base directly opposite a property service connection (solids may block the property connection).

TABLE 305-A: MAINTENANCE SHAFT COMPONENTS (In Approximate Order of Construction):

| ITEM | DESCRIPTION | MATERIAL | NOTES |
|------|---------------------------------|-------------------------|---|
| 1 | BASE FOUNDATION | EMBEDMENT | REFER MRWA-S-202. LEVEL, FLATTEN AND COMPACT |
| 2 | BASE | TYPICALLY PP / PVC | INSTALL FLAT & AS PER MANUFACTURER'S INSTRUCTIONS. CLEAN AND LUBRICATE RRJs (INC SHAFT RRJ) |
| 3 | PROPERTY CONNECTION BASE INFLOW | PVC DWV. SCJ | SIZE AS PER TABLE 104-A |
| 4 | PROPERTY CONNECTION REDUCER | PVC DWV. SCJ | IF REQUIRED, INSTALL WITHIN 1m OF BASE OR NEXT TO LONG RADIUS BEND. ORIENTATE TO MAINTAIN COMMON OBVERT |
| 5 | RETICULATION SEWER INFLOW | PVC DWV. RRJ OR SCJ | DN150 OR DN225. ENSURE ALIGNMENT IS WITHIN MAXIMUM DEFLECTION LIMIT OF MAINTENANCE SHAFT'S SOCKETS |
| 6 | LONG RADIUS BEND | PVC DWV. SCJ | INSTALL AS PER MRWA-S-104B. MAXIMUM DEFLECTION OF 45° |
| 7 | PLUGGED INLET (NOT VISIBLE) | PVC CAP & SUPPORT | PLUG UNUSED BASE CONNECTIONS AS PER MANUFACTURERS INSTRUCTIONS. PLUG FUTURE USE STUBS EXTERNALLY. |
| 8 | OUTFLOW SEWER | PVC DWV. RRJ OR SCJ | DN150 OR DN225. ENSURE ALIGNMENT IS WITHIN MAXIMUM DEFLECTION LIMIT OF THE MAINTENANCE SHAFT'S SOCKETS |
| 9 | EMBEDMENT | GRANULAR MATERIAL | REFER MRWA-S-202. PLACE MIN 100 COVER OVER BASE. COMPACT TO ACHIEVE REQUIRED DENSITY |
| 10 | SHAFT | TYPICALLY PP / PVC | 300 TO 450Ø. USE CORRUGATED UNLINED SHAFT WHERE AVAILABLE OPTION FOR SELECTED PRODUCT |
| 11 | SHAFT CONNECTOR | PVC (SCJ) / PP | CONNECT > 100 ABOVE BASE. MIN DROP = 750. |
| 12 | SHAFT INFLOW | PVC DWV. SCJ | DN100 PROPERTY OR SPUR BRANCH CONNECTIONS ONLY |
| 13 | SHAFT CAP | PVC DWV. SCJ | PUSH CAP ONTO SHAFT. CAP NOT REQUIRED FOR SOME PP SHAFTS. |
| 14 | COMPACTED BACKFILL | GRANULAR MATERIAL | REFER MRWA BACKFILL SPECIFICATION |
| 15 | SURFACE ARRANGEMENT | CONCRETE / DUCTILE IRON | REFER FIGURE 305-C |

Additional Notes Regarding Table 305-A Components:

- Item 3. Pipework may be RRJ if DN150. Refer MRWA-S-300 for requirements of property connection pipework connected to maintenance shafts.
- Item 6. Where bends are required for DN100 property service, install as per Table 305-B.
- Item 7. Only install base with excess sockets where no more suitable base is available or a future connection is expected.
- Item 10. If RRJ shaft, insert shaft 30 less than shaft socket depth (to allow for settlement of the shaft). Install vertically within 1 in 20 from vertical or with a max offset at surface of 300 (whichever is less).
- Item 11. Where a shaft connection cannot be achieved because the available drop is less than 750, specify a Type B connection and set the connection's level as the base's inflow invert +1 in 60 rise (DN100) or + 1 in 83 (DN150) rise over the length of the property connection.
- Where there are two shaft inflows, they shall be designed to have either the same invert level, or have a difference in invert of > 320 (when two separate shaft connectors would be used). Connect to shafts as per manufacturer's instructions.
- Some maintenance shaft suppliers can provide shaft connectors with 2 inflow stubs at the same invert although they usually need to be fabricated on request.
- For PVC shafts, use a "wide throat" tee & ensure the opening curves upwards for easy insertion of maintenance equipment from above.
- Item 12. Jump ups are permitted on Type S property or spur branch shaft connections provided that the jump up is located at the far side of an obstruction. The location of the jump up shall be specified in the design plans (as a black open circle). The designer shall specify the invert level of all shaft connections where the inflow has a jump up.

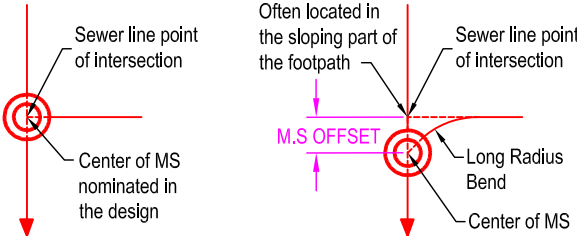
TABLE 305-B: BASE INFLOW CONFIGURATIONS

| BASE INFLOW | BASE SOCKET | REQUIREMENT (UPSTREAM TO DOWNSTREAM) |
|-------------|-------------|--|
| DN100 | DN150 | DN100 SEWER + 100-150 REDUCER + DN150 BEND + DN150 BASE SOCKET |
| DN100 | DN225 | DN100 SEWER + 100-150 REDUCER + DN150 BEND + 150-225 REDUCER + BASE SOCKET |
| DN150 | DN225 | DN150 SEWER + DN150 BEND + 150-225 REDUCER + DN225 BASE SOCKET |

NOTES Regarding Table 305-B:

- Leave out bend where not required.
- MSs may come with either DN150 or DN225 sockets.
- For property connections, match **obvert** of property connection and reducer, bend and base socket.
- For reticulation sewers, match **invert** of sewer and reducer, bend and base socket.

FIGURE 305-B: MAINTENANCE SHAFT OFFSETS FROM THE SEWER INTERSECTION

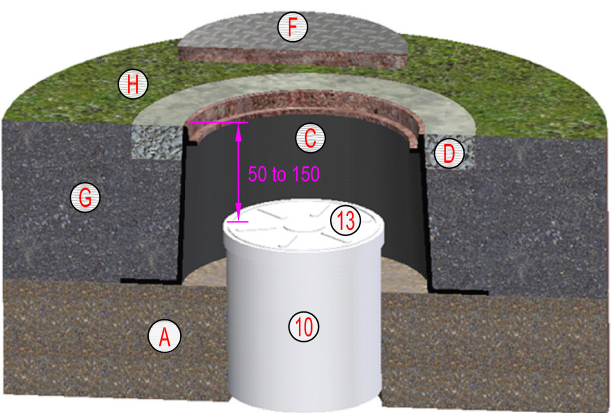


i) AS INDICATED IN THE DESIGN ii) POSSIBLE CONSTRUCTION

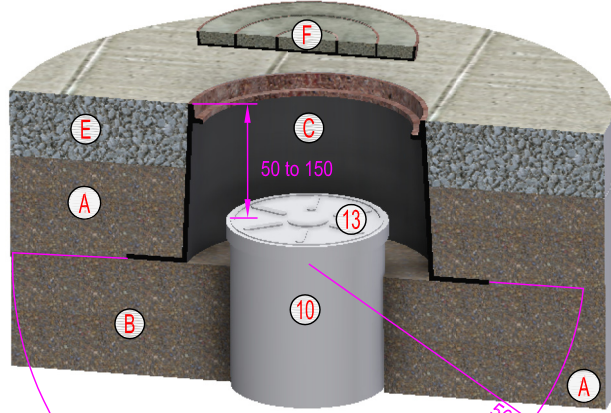
NOTES Regarding Figure 305-B:

- Some MSs come with outlets at 135° to the outlet and require a bend to achieve the correct sewer direction and offset.
- The MS shall be offset from the sewer line point of intersection accordingly.
- The designed sewer offsets shall be maintained.
- The construction method shown in item ii) above is often required where both sewers are in the footpath and the maintenance shaft needs to be kept clear of sloping pavement.

FIGURE 305-C: MAINTENANCE SHAFT SURFACE ARRANGEMENTS (ISOMETRIC VIEW)



(i) NON TRAFFICABLE



(ii) TRAFFICABLE

TABLE 305-C: FIGURE 305-C COMPONENTS

| ITEM | DESCRIPTION | MATERIAL | NOTES |
|------|---------------------|--------------------------|--|
| A | BACKFILL | GRANULAR FILL | REFER TO MRWA BACKFILL SPECIFICATION |
| B | STABILIZED BACKFILL | 6% CEMENT MIXED BACKFILL | INSTALL WITHIN 500 OF COVER CENTRE |
| C | FRAME | DI | 350 TO 450 CLEAR OPENING |
| D | VEGETATION RING | REINFORCED CONCRETE | TAPERED FOR TIGHT FIT TO FRAME |
| E | PAVEMENT | BITUMEN OR CONCRETE | CONSTRUCTED BY OTHERS |
| F | COVER | APPROVED PRODUCT | REFER TABLE 313-B |
| G | TOP SOIL | NATIVE SOIL | IF IN PUBLIC LAND, RE-INSTATE AS PER RESERVE OWNER'S SPECIFICATION |
| H | GRASS | | |

NOTES Regarding Figure 305-C Components:

- Item B. ½ standard bag cement (10kg) to 1 wheel barrow of FCR (0.2m³) required per cover. Mix thoroughly prior to placement. No cement shall be visible once mixed.
- Item C. Where the surface has a slope > 1 in 10, a deep frame may clash with the shaft and not be able to be used. Use a shallow flat concrete encased frame and shroud where necessary. Where the shaft is > 300Ø, a 300mm orifice shall be installed above the shaft (to prevent falls inside).
- Item C & D. Set height of cover in accordance with Table 313-B.
- Item 13. Separate screw cap not required if surround is a tight fit over RRJ shaft (for some models of MS, the frame is designed to fit snugly over the shaft). Refer Figure 306-C, option ii or iii.

ALL DIMENSIONS IN mm UNLESS STATED OTHERWISE

| | | | | | |
|---|-----------|-------------------|---|---------------|----------|
| DESIGNED: R. JAGGER | | DATE: 1 JULY 2015 | | | |
| DRAWN: R. JAGGER | | DATE: 1 JULY 2015 | | | |
| CHECKED: | NAME | DATE | APPROVED: | NAME | DATE |
| <input checked="" type="checkbox"/> CWW | D. MOORE | 01/09/15 | <input checked="" type="checkbox"/> CWW | R. CARRUTHERS | 01/09/15 |
| <input checked="" type="checkbox"/> SEW | C. PAXMAN | 01/09/15 | <input checked="" type="checkbox"/> SEW | D. O'DONOVAN | 01/09/15 |
| <input checked="" type="checkbox"/> YVW | K. DAWSON | 01/09/15 | <input checked="" type="checkbox"/> YVW | J. TOMASI | 01/09/15 |
| ISSUED 2015 | | | VERSION 1 | | |

MELBOURNE RETAIL WATER AGENCIES



MRWA SEWERAGE STANDARDS

MAINTENANCE SHAFTS

NOT TO SCALE

MRWA-S-305

| Planning | Design | Construction |
|----------|--------|--------------|
| | | |

FIGURE 306-A: MAINTENANCE CHAMBERS (ISOMETRIC VIEW)

TABLE 306-A: MAINTENANCE CHAMBER COMPONENTS (In Approximate Order of Construction):

| ITEM | DESCRIPTION | MATERIAL | NOTES |
|------|-------------------------------------|-------------------------|---|
| 1 | BASE FOUNDATION | EMBEDMENT | REFER MRWA-S-202. LEVEL, FLATTEN AND COMPACT |
| 2 | BASE | TYPICALLY PP | INSTALL FLAT & AS PER MANUFACTURER'S INSTRUCTIONS. CLEAN AND LUBRICATE RRJs (INC SHAFT RRJ) |
| 3 | PROPERTY CONNECTION BASE INFLOW | PVC DWV | SIZE AS PER TABLE 104-A |
| 4 | PROPERTY CONNECTION REDUCER | PVC DWV | IF REQUIRED, INSTALL WITHIN 1m OF BASE. ORIENTATE TO MAINTAIN COMMON OBVERT |
| 5 | RETICULATION SEWER INFLOW | PVC DWV, RRJ OR SCJ | DN150 TO DN300. ENSURE ALIGNMENT IS WITHIN MAXIMUM DEFLECTION LIMIT OF MAINTENANCE SHAFT'S SOCKETS |
| 6 | RETIC SEWER MAIN REDUCER (IF REQ'D) | PVC DWV, RRJ OR SCJ | INSTALL WITHIN 1m OF BASE OR NEXT TO LONG RADIUS BEND. ORIENTATE TO MAINTAIN COMMON INVERT |
| 7 | LONG RADIUS BEND | PVC DWV, SCJ | INSTALL WITHIN 1m OF BASE. INSTALL AS PER MRWA-S-104B. MAX DEFLECTION OF 45° |
| 8 | PLUGGED INLET (NOT SHOWN) | PVC CAP & SUPPORT | PLUG UNUSED BASE CONNECTION POINTS AS PER MANUFACTURERS INSTRUCTIONS. PLUG FUTURE USE STUBS EXTERNALLY |
| 9 | OUTFLOW SEWER | PVC DWV, RRJ OR SCJ | DN150 TO DN300. ENSURE ALIGNMENT IS WITHIN MAXIMUM DEFLECTION LIMIT OF THE MC'S SOCKETS |
| 10 | EMBEDMENT | GRANULAR MATERIAL | REFER MRWA-S-202. PLACE MIN 100 COVER OVER BASE. COMPACT TO ACHIEVE REQUIRED DENSITY. |
| 11 | SHAFT | TYPICALLY PP | USE CORRUGATED UNLINED SHAFT WHERE PREFERRED PRODUCT HAS THE OPTION |
| 12 | SHAFT CONNECTOR | TYPICALLY PP RRJ | CONNECT AS PER FIGURE 306-B OR AS PER MANUFACTURER'S INSTRUCTION. CONNECT >100 ABOVE BASE. MIN DROP = 750 |
| 13 | SHAFT INFLOW | PVC DWV | DN100 SPUR BRANCH OR PROPERTY CONNECTIONS ONLY |
| 14 | COMPACTED BACKFILL | GRANULAR MATERIAL | REFER MRWA BACKFILL SPECIFICATION |
| 15 | SURFACE ARRANGEMENT | CONCRETE / DUCTILE IRON | REFER FIGURE 306-C |

ADDITIONAL NOTES Regarding Table 306-A Components:

- Item 2. Select base size according to the size of the outflow sewer pipe.
Any smaller base inflows will require a reducer on the incoming sewer as per Table 306-B.
- Item 3. Pipework as per MRWA-S-103. Refer Table 306-B.
Refer drawing MRWA-S-300 for requirements of property connection pipework arrangements.
- Item 5. Pipework as per MRWA-S-103. Refer Table 306-B.
- Item 7. Long radius bends required when any sewer (property connection or retic) alignment is outside the deflection limit of the base's socket. Minimise the number of long radius bends required.
- Item 8. Only install base with excess sockets where no suitable base is available or a future connection is expected.
- Item 11. If RRJ ring shaft, insert shaft 30 less than the full depth of the socket to allow for settlement of the shaft. Install vertically within 1 in 20 from vertical or with a max offset at surface of 300 (whichever is less).

- Item 12. Where a shaft connection cannot be achieved because the available drop is less than 750, specify a Type 1B connection and set the connection's level at the base's inflow invert +1 in 60 rise (DN100) or +1 in 83 (DN150) rise over the length of the spur branch + property connection. For connections through holes cut into the shaft, ensure min space between holes of 200. Refer Figure 306-B.
- For connections using a shaft connector, where there are two shaft inflows, they shall be designed to have either the same invert level, or have a difference in invert of > 320 (when two separate shaft connectors would be used). Connect to shafts as per manufacturer's instructions. Shaft connectors with 2 or 3 inflow stubs at the same invert typically can be fabricated on request.
- Item 13. Jump ups are permitted on Type S property or spur branch shaft connections provided that the jump up is located on the far side of an obstruction. The location of the jump up shall be specified in the design plans (as a black open circle). The designer shall specify the invert level of all shaft connections where the inflow has a jump up.

FIGURE 306-B: SHAFT CONNECTION DETAILS (Plan & Isometric views)

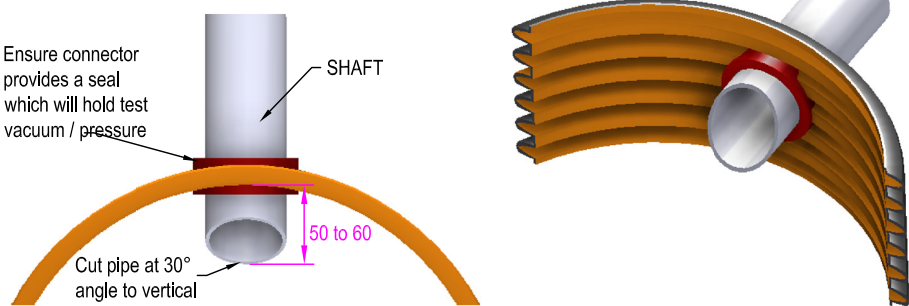


TABLE 306-B: BASE INFLOW CONFIGURATIONS

| BASE INFLOW | BASE SOCKET | REQUIREMENT (UPSTREAM TO DOWNSTREAM) |
|-------------|-------------|--|
| DN100 | DN150 | DN100 SEWER + 100-150 REDUCER + DN150 BEND + BASE SOCKET |
| DN100 | DN225 | DN100 SEWER + 100-150 REDUCER + DN150 BEND + 150-225 REDUCER + BASE SOCKET |
| DN150 | DN225 | DN150 SEWER + DN150 BEND + 150-225 REDUCER + BASE SOCKET |

- Leave out bend where not required.
- MCs may come with either DN150, DN225 or DN300 sockets.
- For property connections, match **obvert** of property connection and reducer, bend and base socket.
- For reticulation sewers, match **invert** of sewer and reducer, bend and base socket.

FIGURE 306-C: MAINTENANCE CHAMBER SURFACE ARRANGEMENTS (ISOMETRIC VIEW)

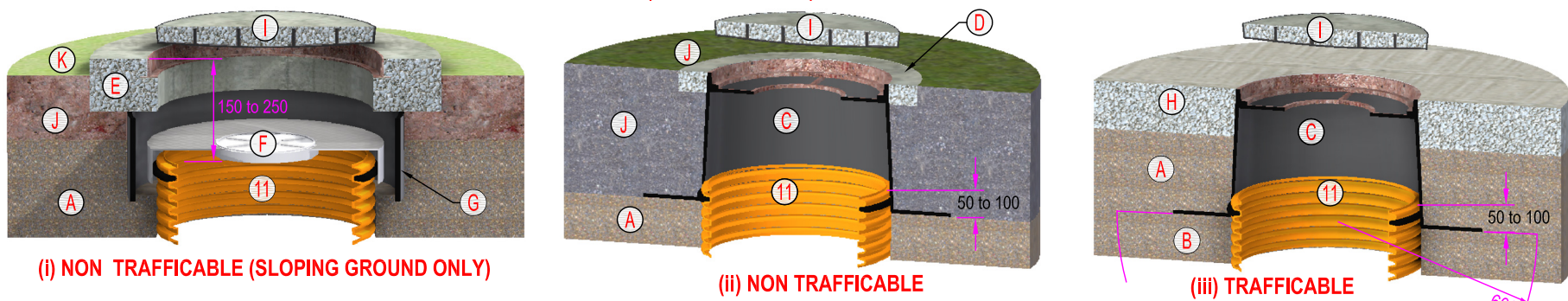


TABLE 306-C: FIGURE 306-C COMPONENTS

| ITEM | DESCRIPTION | MATERIAL | NOTES |
|------|---------------------|------------------------------|--------------------------------------|
| A | BACKFILL | GRANULAR FILL | REFER TO MRWA BACKFILL SPECIFICATION |
| B | STABILIZED BACKFILL | 6% CEMENT MIXED BACKFILL | BACKFILL WITHIN 600 OF CENTRE |
| C | FRAME | DI FRAME | 300 CLEAR OPENING |
| D | VEGETATION RING | REINFORCED CONCRETE | TAPERED FOR TIGHT FIT TO FRAME |
| E | FRAME & SURROUND | DI FRAME IN PRECAST CONCRETE | 600 CLEAR OPENING |
| F | LID AND CAP | GALVANIZED STEEL OR 316 SS | 300 CLEAR OPENING |
| G | SHROUD | DN800PE PIPE | >300 LONG |
| H | PAVEMENT | BITUMEN OR CONCRETE | CONSTRUCTED BY OTHERS |
| I | COVER | APPROVED PRODUCT | REFER TABLE 313-B |
| J | TOP SOIL | NATIVE SOIL | IF IN PUBLIC LAND, RE-INSTATE AS PER |
| K | GRASS / GARDEN | | REFER RESERVE OWNER'S SPECIFICATION |

NOTES Regarding Table 306-C Components:

- Item B. 1 standard bag cement (20kg) to 2 wheel barrows of FCR (0.4m³) required per cover. Mix thoroughly prior to placement. No cement shall be visible once mixed.
- Item C. Where the surface has a slope > 1 in 10, a deep frame may not be able to be inserted over a vertical shaft at such an angle. Use items E and F instead where necessary.
- Item C & D. Set height of cover in accordance with Table 313-B.
- Item I. The cover may be up to 600 in diameter, provided there is a restriction within the frame or upper part of the shaft to 300 (to prevent falls inside).
- Item 11. Separate screw cap not required if frame is a tight fit over RRJ shaft (ie: option ii or iii above).

GENERAL NOTES Regarding Maintenance Chambers:

- Maintenance chambers (MC) shall have:
 - 1.1. A depth to lowest invert < 6m.
 - 1.2. ≤5 total (shaft & base) inflows.
 - 1.3. Shaft connections only where there are base inflows collecting 3 or more lots.
 - 1.4. ≤3 x DN100 connections into the shaft.
 - 1.5. ≤3 inflow connections into the base (2 of which may be DN225. Only one permitted if DN300 straight through).
 - 1.6. Outflow ≤DN300.
 - 1.7. A shaft ≥450 & < 1000 in diameter.
 - 1.8. An allowance in the design for a 30mm drop in level between the outflow and all inflows.
- No two adjoining MCs can both contain internal bends ≥60° (as the line would not be able to be CCTV'd). Instead, install a straight chase MC at one of the MCs and fix to it an external long radius bend.
- The limitations mentioned on this drawing apply to all MCs. There may be further limitations on MCs depending on the make and model purchased. Refer to the product portal for details. One of the most common product limitations is that Significant retic inflows (>3 lots) cannot enter into a base directly opposite a property service connection (it may block the property connection).

ALL DIMENSIONS IN mm UNLESS STATED OTHERWISE

| | | | | | |
|---|-----------|-----------|---|-------------------|----------|
| DESIGNED: | | R. JAGGER | | DATE: 1 JULY 2015 | |
| DRAWN: | | R. JAGGER | | DATE: 1 JULY 2015 | |
| CHECKED: | NAME | DATE | APPROVED: | NAME | DATE |
| <input checked="" type="checkbox"/> CWW | D. MOORE | 01/09/15 | <input checked="" type="checkbox"/> CWW | R. CARRUTHERS | 01/09/15 |
| <input checked="" type="checkbox"/> SEW | C. PAXMAN | 01/09/15 | <input checked="" type="checkbox"/> SEW | D. O'DONOVAN | 01/09/15 |
| <input checked="" type="checkbox"/> YVW | K. DAWSON | 01/09/15 | <input checked="" type="checkbox"/> YVW | J. TOMASI | 01/09/15 |
| ISSUED 2015 | | | VERSION 1 | | |

MELBOURNE RETAIL WATER AGENCIES



MRWA SEWERAGE STANDARDS

MAINTENANCE CHAMBERS

NOT TO SCALE

MRWA-S-306

| Planning | Design | Construction |
|----------|--------|--------------|
| | ✓ | ✓✓✓✓ |

TABLE 307-A: CONCRETE MH DETAILS

| DEPTH RANGE | MAINTENANCE HOLE ID | CONCRETE MH SHAFT DETAILS | | |
|------------------|---------------------|---------------------------|----------------------|--------------------------|
| | | MIN WALL THICKNESS | CONCRETE CLASS (MIN) | REINFORCEMENT (IF REQ'D) |
| < 8 m | 1000 / 1050 | 150 (170) ⁴ | N32 | ROLLED SL81 MESH |
| | 1200 | 150 (170) ⁴ | N32 | ROLLED SL81 MESH |
| | 1500 | 225 | N32 | N12 |
| | 1800 | 225 | N32 | N12 |
| | 2100 | 225 | N32 | N12 |
| BETWEEN 8m & 15m | 2400 | 300 | N32 | N16 |
| | 1000 / 1050 | 150 (180) ⁴ | N40 | N12 |
| | 1200 | 150 (180) ⁴ | N40 | N12 |
| | 1500 | 225 | N40 | N16 |
| | 1800 | 225 | N40 | N16 |
| | 2100 | 225 | N40 | N16 |
| | 2400 | 300 | N40 | N20 |

MH Selection and Specification

- All acceptable MH options (ie: GRP, plastic, concrete) which are suitable shall be specified for in the design template.
- Each MH shall be specified in accordance with the MH schedule (standard MRWA-S-100).
- Plan view designs shall be provided in the design in accordance with standard MRWA-S-308.
- Ref column 3 Table 307-A. Wall thickness to be 150 if concrete is not reinforced. Wall thickness to be > than the larger quoted thickness if reinforced concrete (value in brackets). This is to ensure clear cover can be achieved.
- Prefabricated MHs may be subject to depth limitations. Refer to products portal for all limitations of use.
- Situations of use of MHs are described in MRWA-S-300.
- All quoted depths are to outflow pipe invert.

Concrete Reinforcement (if required):

- MHs shall be concrete cast in situ with shaft reinforcement **only** where the Water Agency advises that the MH is subject to surcharge conditions. Otherwise, reinforcement is **not** required.
- Reinforcement shall be specified in the MH schedule of the design template (refer standard MRWA-S-100) and as per Table 307-A.
- Reinforcement shall be placed as per standard MRWA-S-309 (ie: horizontal hoops at 200 spacing, vertical bars at 300 spacing).
- Undertake specialized structural design for MHs deeper than 15m or MHs greater than 2400 in diameter to determine what reinforcement (if any) is required.

TABLE 307-B: CONCRETE MH FLOTATION CONTROL

| MAINTENANCE HOLE ID | MIN WALL THICKNESS | MAX DEPTH ^a | BASE DIAMETER INCREASE ^c |
|---------------------|--------------------|------------------------|-------------------------------------|
| 1000 / 1050 | 150 | 5.5m | 15 mm/ m DEPTH |
| 1200 | 150 | 4m | 25 mm/ m DEPTH |
| 1500 | 225 | 6m | 20 mm/ m DEPTH |
| 1800 | 225 | 4.5m | 35 mm/ m DEPTH |
| 2100 | 225 | 3.5m | 50 mm/ m DEPTH |
| 2400 | 300 | 4.5m | 45 mm/ m DEPTH |

NOTES Regarding Table 307-B: Bouyancy Control

- Flotation mitigation shall be provided when the depth to invert of the outflow pipe exceeds the value specified in column 3 of Table 307-B.
- Flotation shall be mitigated by extending the MH base diameter.
- For every meter in depth below the depth limit, increase the base diameter by the value given in Table 307-B.
- MSs, MCs and prefabricated MHs do not require flotation mitigation unless the manufacturer's installation instructions or the product web portal specifies it.

Bouyancy Control Examples

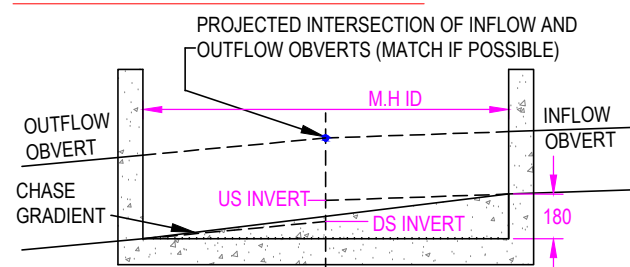
Example a: 6m deep 1500 diameter MH requires no flotation mitigation.

Example b: 12m deep 1500 diameter MH requires a 6 x 20 = 120 addition to the base diameter.

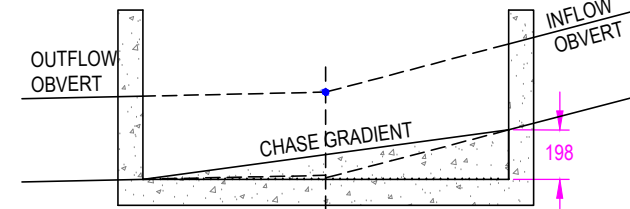
Example c: 3.5m deep 2100 diameter MH requires no flotation mitigation.

Example d: 12.5m deep 2100 diameter MH requires a 9 x 50 = 450 addition to the base diameter.

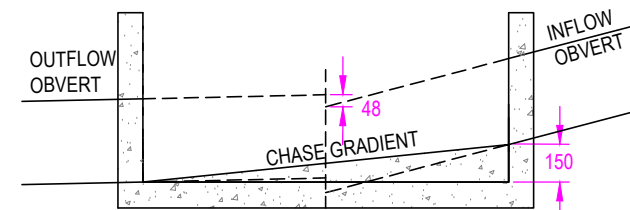
FIGURE 307-A: CONCRETE MH LEVELS

**EXAMPLE A: 225 INFLOW, 300 OUTFLOW.**

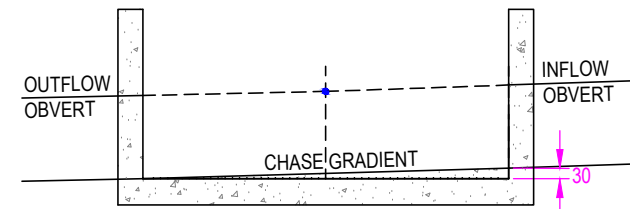
FALL ADEQUATE TO COVER ANY INTERNAL BEND. FALL LIMIT (150) EXCLUDES CHANGE IN PIPE SIZE (ie: 75 (DN1 - DN2) OF ABOVE EXAMPLE SHOULD BE SUBTRACTED FROM 180) - OK

**EXAMPLE B: STEEP 300 INFLOW.**

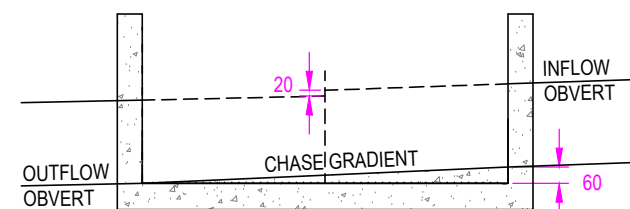
FALL EXCEEDS LIMIT (150) & IS **NOT** ACCEPTABLE

**EXAMPLE C: AS EXAMPLE B, EXCEPT OUTFLOW RAISED TO REDUCE FALL**

FALL NOW WITHIN LIMIT (150) - OK
DS PROJECTED INVERT HIGHER THAN US PROJECTED INVERT - OK

**EXAMPLE D: 300 INFLOW & OUTFLOW.**

FALL ADEQUATE TO COVER INTERNAL BEND < 90°.

**EXAMPLE E: AS EXAMPLE D, EXCEPT DROP INCREASED TO ACCOMMODATE A 90° BEND.**

FALL NOW ADEQUATE TO COVER INTERNAL BEND > 90°

NOTES Regarding Figure 307-A.

- Where possible, projected **obvert** levels of inflow and outflow pipes to match (to restrict flooding of upstream pipes).
- Drop through chase shall be < 150 + (outflow Ø - inflow Ø).
Eg: (from eg 1): 180 drop. 180-(300-225) = 105. Drop OK.
- Where outflow sewers ≤DN300, provide adequate fall through the chase:
Min 30 change in invert for bends ≤ 90° & straight through.
Min 60 change in invert for bends > 90°.
- Where outflow sewer ≥DN375, maintain lowest connecting sewer grade through the chase.

TABLE 307-C: MAINTENANCE HOLE DROP TYPES

| HIGH LEVEL SEWER | TYPICAL REQUIREMENTS | REFERENCE |
|---------------------|---|---------------------------------|
| ≤DN375 | INTERNAL DROP WITH PVC PIPEWORK | REFER MRWA-S-311 |
| ≥DN450 (SEW) | INTERNAL DROP WITH GRP PIPEWORK | REFER WATER AGENCY |
| ≥DN450 (CWW or YVW) | ESTIMATE COST DIFFERENCE BETWEEN INTERNAL AND EXTERNAL DROP | REFER WATER AGENCY. MRWA-S-312. |

NOTES Regarding Table 307-C:

- MH drops are required where the difference in invert level between the incoming and outgoing sewer mains is greater than the minimum height of a drop (refer Table 307-D).
- Where the required drop is less than the minimum, evenly grade the sewer back to the nearest upstream maintenance structure.
If this leads to the maximum grade being exceeded or the line has already been constructed, contact the Water Agency for advice.
- Cost comparison between internal and external drop can be based on the difference in concrete volume between the two different drop types which depends largely on the depth and diameter of the two different MH types.
- The water agency will decide the optimum type based on cost and operational risk factors.

TABLE 307-D: MH DROP OPTIONS, LIMITS & DIMENSIONS

| SEWER SIZE (DN) | DROP SIZE (DN) | MIN DROP (m) | DROP HEIGHT (m) IF OPEN SYSTEM | | | IF CLOSED SYSTEM | | |
|-----------------|----------------|--------------|---------------------------------|-------------------------|---------------------------|-------------------------------|---------------------------|-----------------------------------|
| | | | FREE DROP + BEND ^F | FREE DROP + PLUNGE POOL | VORTEX DROP + PLUNGE POOL | FREE DROP + BEND ^F | VORTEX DROP + PLUNGE POOL | P= PLUNGE POOL DEPTH ^E |
| 100 | 100 | 0.5 | MIN to 10 | 10 to 20 | >20 | MIN to 10 | >10 | 300 + 20mm / m |
| 150 | 100 | 0.6 | MIN to 8.5 | 8.5 to 17.5 | >17.5 | MIN to 8 | >8 | 300 + 20mm / m |
| 225 | 150 | 0.9 | MIN to 7 | 7 to 15 | >15 | MIN to 6 | >6 | 350 + 20mm / m |
| 300 | 225 | 1.1 | MIN to 5.5 | 5.5 to 12.5 | >12.5 | MIN to 4 | >4 | 450 + 30mm / m |
| 375 | 300 | 1.2 | MIN to 4 | 4 to 10 | >10 | MIN to 2 | >2 | 600 + 30mm / m |
| 450 | 300 | 1.3 | MIN to 2.5 | 2.5 to 8 | >8 | NOT | > MIN | 650 + 30mm / m |
| 525 | 375 | 1.4 | NOT | MIN to 6 | >6 | RECOM-MENDED | > MIN | 750 + 30mm / m |
| 600 | 375 | 1.5 | RECOM-MENDED | MIN to 5 | >5 | | > MIN | 800 + 30mm / m |
| 675 | 450 | 1.6 | | MIN to 4 | >4 | | > MIN | CONTACT |
| 750 | 450 | 1.7 | | MIN to 3 | >3 | | > MIN | WATER AGENCY |
| >750 | | | CONSULT WATER AGENCY FOR ADVICE | | | | | |

NOTES Regarding Table 307-D

- Whether a system is open or closed shall be determined in accordance with MRWA-S-401.
 - For an example of a plain drop with bottom bend, refer MRWA-S-311 & Figure 312-D.
 - For an example of a plunge pool, refer Figure 312-A & C. Plunge pools may also be designed with internal drops. Contact the Water Agency for advice on any such structure.
 - Contact the Water Agency for requirements of vortex drops.
 - Plunge pool depth = min + (drop height - min drop required for plunge pool) x rate of depth increase.
- eg: 7m drop of an open incoming DN450 sewer = 650 + ((7-2.5) x 30) = 785
- For drops to bends (rather than to plunge pools), care must be taken to avoid high velocity sewage jumping out of the chase and over the table. This risk is diminished where:
F.A. Bends direct sewage to the MH outlet.
F.B. The drop flow has a minor change in direction within the MH.
F.C. The drop flow intersects a relatively large flow.
 - Plunge pool depth shall be from the ADWF HGL of the outflow sewer.

TABLE 307-E: CONCRETE CORROSION RISK CONTROLS

| LOW RISK (<3 POINTS) | MEDIUM RISK (3 TO 6 POINTS) | HIGH RISK (> 6 POINTS) |
|----------------------|--|---|
| NO CONTROL REQUIRED | POLYUREA (MORE FLEXIBLE & EASIER TO APPLY), or EPOXY NOVALAC OR VINYL ESTER (HIGHER CHEMICAL RESISTANCE). CONSULT WATER AGENCY ON WHICH IS MORE APPROPRIATE UNDER THE CIRCUMSTANCES. | CAST IN SITU THERMOPLASTIC SHEET LINER OR PLASTIC / GRP SHAFT |

NOTES Regarding Table 307-E:

- The Water Agency will indicate the risk level to be applied to concrete MHs.
- Hydrogen sulphide risk assessments may be calculated in accordance with MRWA-S-401.
- Natural ventilation shall be implemented as per drawings MRWA-S-401 & 402.
- Coatings and linings shall be prepared, applied and tested as per the WSA 201- Selection and Application of Protective Coatings Manual.
- Calcium Aluminate cement mortar, whilst an effective rehabilitation system, is not suitable on new concrete surfaces (which are too smooth).

| | | | | | | | | | |
|--|-----------------------|----------|-------------------|---|-----------|----------|---|---------------|----------|
| ALL DIMENSIONS IN mm UNLESS STATED OTHERWISE | | | | DESIGNED: R. JAGGER | | | DATE: 1 JULY 2015 | | |
| | | | | DRAWN: R. JAGGER | | | DATE: 1 JULY 2015 | | |
| | | | | CHECKED: | NAME | DATE | APPROVED: | NAME | DATE |
| | | | | <input checked="" type="checkbox"/> CWW | D. MOORE | 01/09/15 | <input checked="" type="checkbox"/> CWW | R. CARRUTHERS | 01/09/15 |
| 2 | PUBLISHED FIRST ISSUE | 01/10/15 | CP / JT / KD / RJ | <input checked="" type="checkbox"/> SEW | C. PAXMAN | 01/09/15 | <input checked="" type="checkbox"/> SEW | D. O'DONOVAN | 01/09/15 |
| 1 | PRE-PUBLISHED DRAFT | 01/03/15 | CP / JT / KD / RJ | <input checked="" type="checkbox"/> YVW | K. DAWSON | 01/09/15 | <input checked="" type="checkbox"/> YVW | J. TOMASI | 01/09/15 |
| REV | DESCRIPTION | DATE | APPROVED | ISSUED 2015 | | | VERSION 1 | | |

MELBOURNE RETAIL WATER AGENCIES



MRWA SEWERAGE STANDARDS

MAINTENANCE HOLES
GENERAL DESIGN REQUIREMENTS

NOT TO SCALE

MRWA-S-307

| Planning | Design | Construction |
|----------|--------|--------------|
| | ✓✓✓✓ | |

Detailed Maintenance Hole Designs Required When:

The designer is required to produce a scale plan view drawing for concrete MHs with the following:

1. Diameter ≥ 1500 , or
2. 3 or more incoming sewers, or
3. 2 or more drops, or
4. A drop $\geq DN300$, or
5. Sewer intersection offset from MH centre, or
6. A landing, or

7. New connections are being made to an existing MH.
- In the case of 7, the scale plan shall show existing details and the proposed modifications necessary to ensure structural integrity while achieving the requirements outlined below.
- Existing MHs should be inspected as part of the design process to ensure that they are suitable for connection.

LEGEND:
+ SHAFT CENTRE POINT
• PROJECTED SEWERAGE PIPE INTERSECTION

TABLE 308-A: CONCRETE MAINTENANCE HOLE PLAN VIEW DESIGN REQUIREMENTS:

| REQUIREMENT ID | REQUIREMENT | REQUIREMENT DETAILS |
|----------------------------|-------------|--|
| A | GRID NORTH | |
| B | SCALE | NOMINATE SCALE (RECOMMENDED 1:25 AT A3 SIZE) |
| GROUND LEVEL | C | FOOTWAY OR ROAD PAVEMENT EDGE |
| | D | OPENING |
| | E | NECK INSIDE AND OUTSIDE DIAMETER |
| SHAFT & BASE | F | SHAFT CENTER |
| | G | SHAFT INSIDE DIAMETER |
| | H | SHAFT OUTSIDE DIAMETER |
| | I | BASE DIAMETER |
| | J | VENT PENETRATIONS AND PIPEWORK |
| OPERATIONS AND MAINTENANCE | K | 2 X 250 DIAMETER STANDING AREAS |
| | L | 1 X 750 DIAMETER WORK AREA |
| | M | LADDER / STEP IRONS |
| | N | LANDING |
| | O | STANDING PLANK |
| PIPEWORK AND CHASE | P | STANDING PLANK STEP IRON |
| | Q | PIPE CENTER LINES (EXTENDED) |
| | R | PIPE CENTER LINE INTERSECTIONS |
| | S | SEWER INVERTS |
| | T | ANGLE OF SEWERS |
| | U | INTERSECTION OFFSETS FROM SHAFT CENTER |
| | V | CHASE OUTLINE (ON GRADE SEWERS) |
| | W | CHASE OUTLINE (DROP PIPE) |
| | X | OUTLINE OF EXTERNAL BENDS |
| | Y | DROP PIPE LOCATIONS |
| | Z | EXTERNAL DROP PIPE ENCASEMENT |

ADDITIONAL NOTES Regarding Table 308-A items:

- Item E. Where practicable, ensure that neck of MH lies either completely inside or completely outside of a paved surface. Maintain min 100 clearance between outline of neck and any pavement edge. Locate ladder / step irons where neck and shaft internal diameters intersect.
- Item I. Refer Table 307-B for details.
- Item K. One standing area shall be directly in front of the ladder / step irons.
- Item M. Where possible, ladder shall be located to allow standing plank access to all high level sewers. standing plank spans a ladder's rung to a step iron on the other side of shaft. Refer mrwa-s-314.
- Item N. Nominate level & position. Refer standard MRWA-S-314 for details.
- Item O. Locate 1200 below centre line of high level entry into shaft. Standing plank position shall be indicated. 350 wide. Not a permanent fixture. Brought on site as required. Spans from a ladder / step iron rung to a step iron on the other side of the MH.
- Item P. Locate opposite and at the same level as a ladder / step iron rung.
- Item T. Max angular deflection within a chase is 90°. Maximum angle of incidence of a high level sewer to the MH shaft wall shall be 25° from perpendicular. Any greater angular deflection shall be accommodated using a bend external to the MH.
- Item V. Outer radius shall be inner radius + inflow pipe ID.
- All curves shall be tangential to both the inflow and outflow sewers.
 - Tangent curves shall be contained within the inner shaft circumference.
 - Angular deflection of a chase is limited to 90°.
 - External bends are preferred to increasing a MH's size to provide for more angular deflection within the MH.
- Item W. Preferred that a chase from a drop pipe be at $\geq 135^\circ$ to the outflow.
- Item X. External bends shall be as per MRWA-S-104B.
- Item Y. Clearance equal to the diameter of the drop pipe is required from a drop pipe to any ladder, other drop pipe or other fixture.

FIGURE 308-A: EXAMPLE 1. DEEP MH DESIGN WITH INTERNAL DROPS

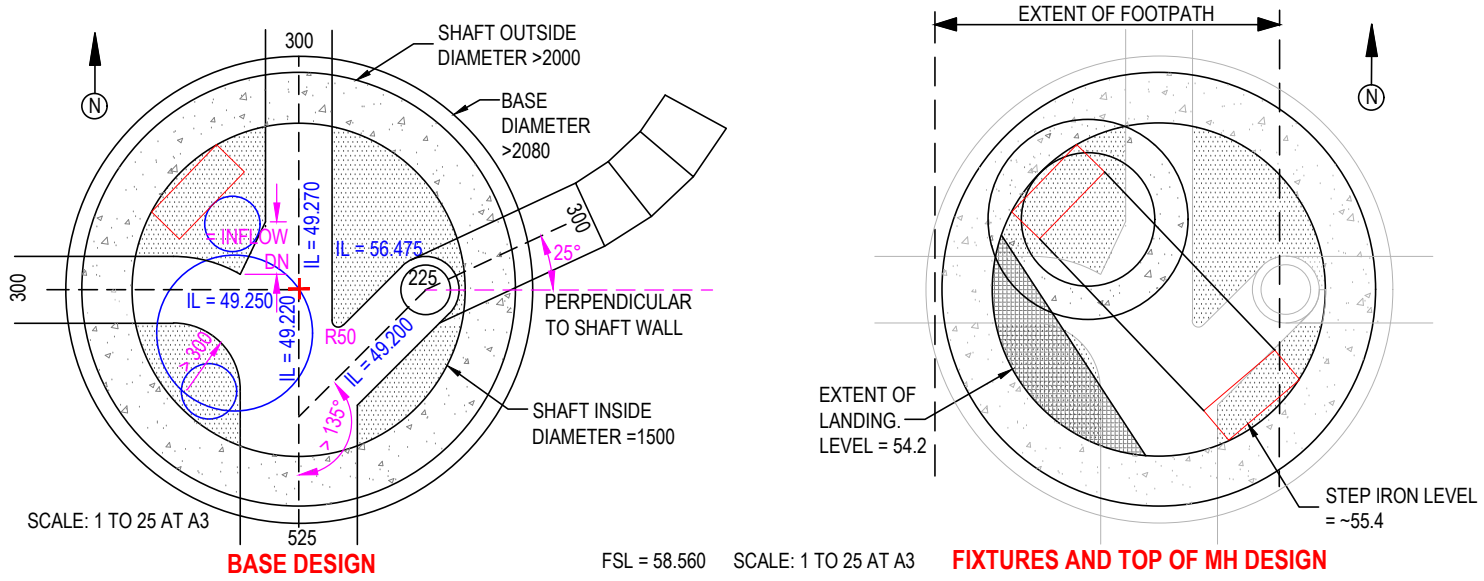


FIGURE 308-B: EXAMPLE 2. MH DESIGN WITH HIGH ANGULAR DEFLECTION

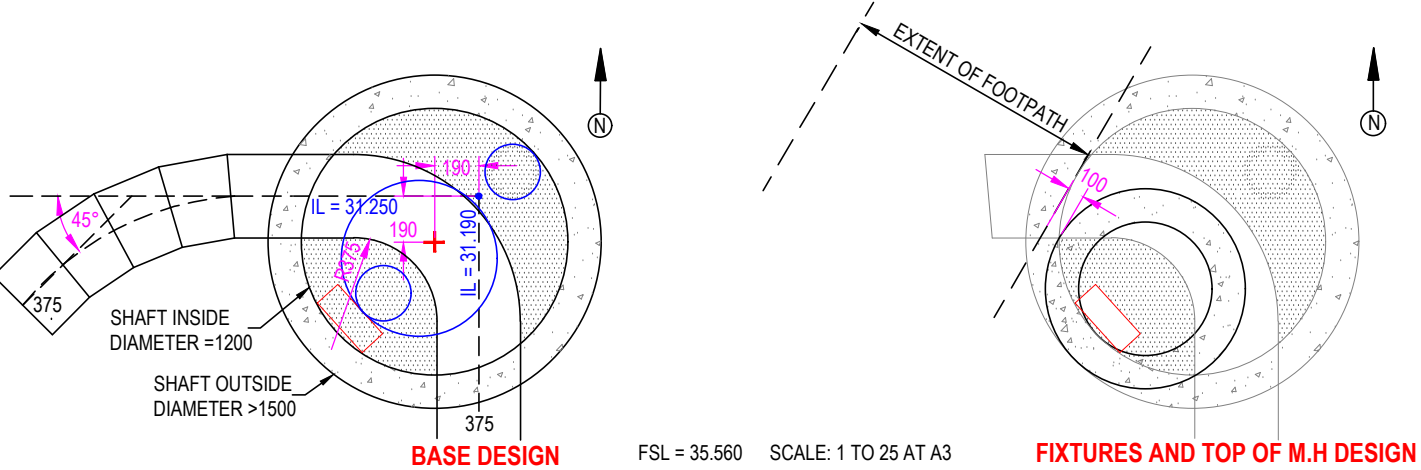
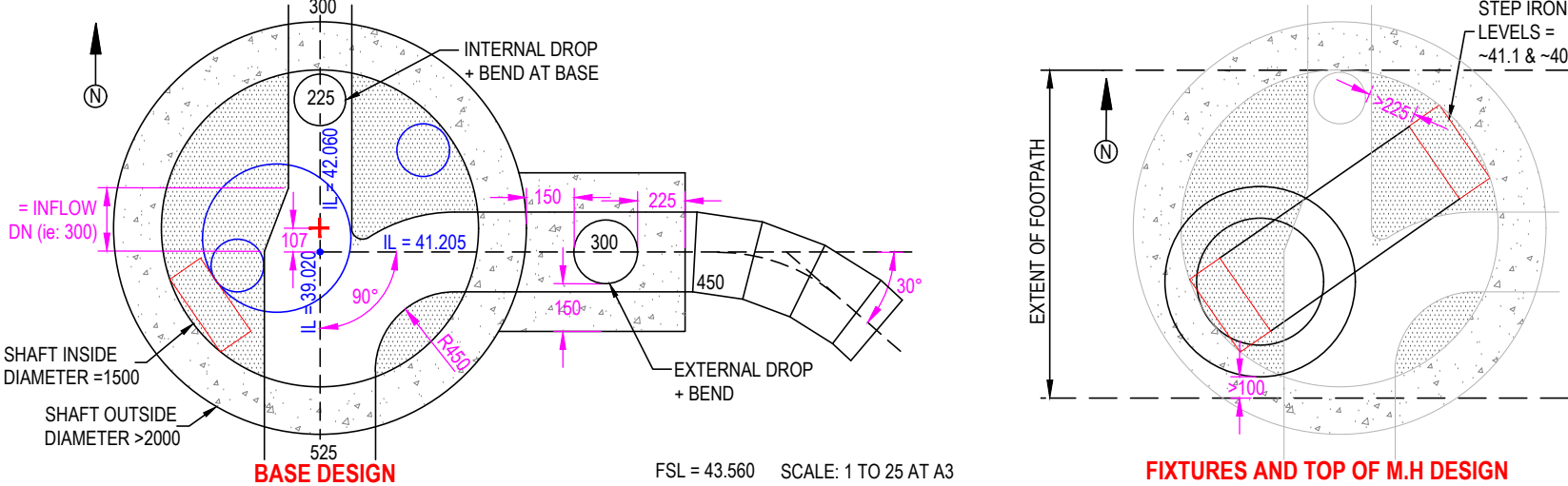


FIGURE 308-C: EXAMPLE 3. MH DESIGN WITH EXTERNAL DROP
EXTERNAL DROPS NOT PERMITTED BY SEW



| | | | | | | | |
|--|--|--|--|---|------|-------------------|-----------|
| ALL DIMENSIONS IN mm UNLESS STATED OTHERWISE | | | | DESIGNED: R. JAGGER | | DATE: 1 JULY 2015 | |
| | | | | DRAWN: R. JAGGER | | DATE: 1 JULY 2015 | |
| | | | | CHECKED: | NAME | DATE | APPROVED: |
| | | | | <input checked="" type="checkbox"/> CWW | | D. MOORE | 01/09/15 |
| | | | | <input checked="" type="checkbox"/> SEW | | C. PAXMAN | 01/09/15 |
| | | | | <input checked="" type="checkbox"/> YVW | | K. DAWSON | 01/09/15 |
| | | | | <input checked="" type="checkbox"/> CWW | | R. CARRUTHERS | 01/09/15 |
| | | | | <input checked="" type="checkbox"/> SEW | | D. O'DONOVAN | 01/09/15 |
| | | | | <input checked="" type="checkbox"/> YVW | | J. TOMASI | 01/09/15 |
| | | | | ISSUED 2015 | | VERSION 1 | |

MELBOURNE RETAIL WATER AGENCIES



MRWA SEWERAGE STANDARDS

CONCRETE MAINTENANCE HOLE
DETAILED DESIGNS

NOT TO SCALE

MRWA-S-308

| | | |
|----------|--------|--------------|
| Planning | Design | Construction |
| | | ✓✓✓✓ |

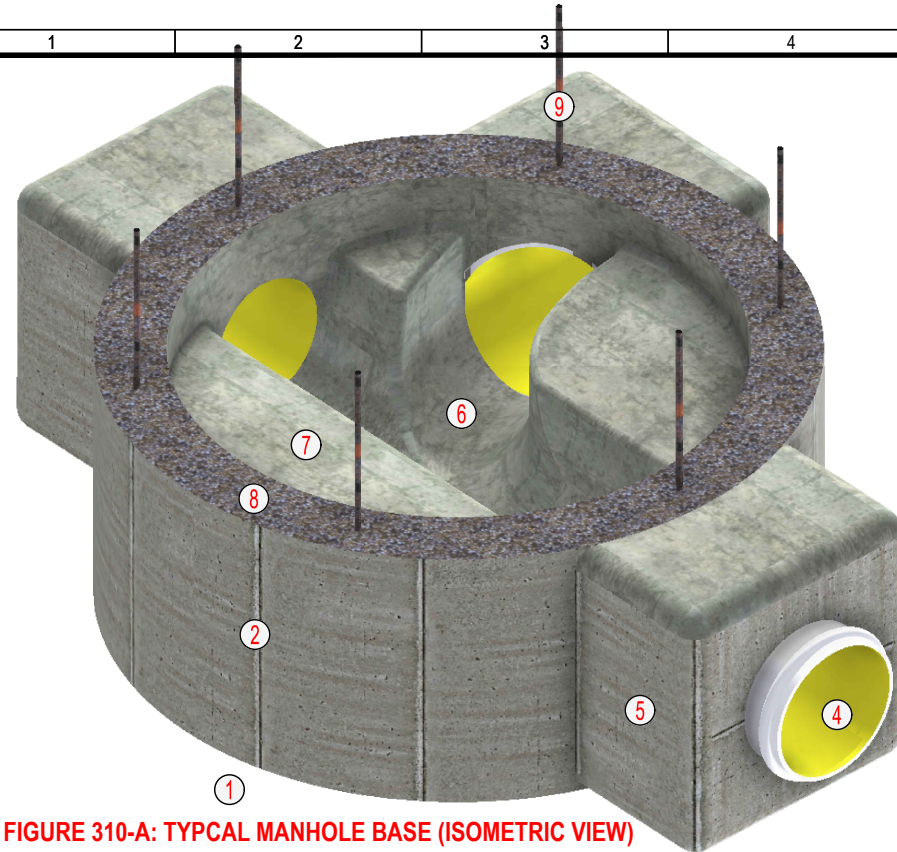


FIGURE 310-A: TYPICAL MANHOLE BASE (ISOMETRIC VIEW)

TABLE 310-A: BASE COMPONENTS

| ITEM | DESCRIPTION | MATERIAL | NOTES |
|------|---------------------|-------------------|--|
| 1 | FOUNDATION | EARTH OR CONCRETE | NATIVE GROUND > 100kPa OR BLINDING CONC |
| 2 | BASE (INC NIB WALL) | CONCRETE | DIAMETER AS PER BASE DESIGN |
| 3 | REINFORCEMENT | MESH / BAR | AS PER TABLE 310-B |
| 4 | PIPE CONNECTORS | TO MATCH PIPE | REFER FIGURES 310-D TO G |
| 5 | CONNECTOR SUPPORTS | CONCRETE | SUPPORT OVER LENGTH AS PER TABLE 310-C |
| 6 | CHASE | | HOT WIRE CUT POLYSTYRENE FOAM BLOCKOUT |
| 7 | TABLE | CONCRETE | BENCH TO 1 IN 8 GRADIENT. EDGES R20 RADIUS |
| 8 | NIB WALL | CONCRETE | CAST IN ONE PIECE WITH BASE |
| 9 | DOWELS | REINFORCING BAR | AS PER TABLE 310-B. INSERT IN WET CONCRETE |

ADDITIONAL NOTES Regarding Table 310-A Items:

- Item 1. MH base shall not be laid onto compacted materials. Where over excavation occurs, for MHs > 8m deep and for MHs ≥ Ø1800, place base onto > 50 of N15 blinding concrete, poured immediately after excavation.
- Item 2. Use N40 concrete to construct MH bases which have external drops or are > 8m deep.
- Item 4. Cast base, nib wall and pipe connector supports in one piece. Cut out any part of pipe connectors which protrude within inner diameter of the MH.
- Item 8. Prepare top of nib wall surface in accordance with Figure 309-B.
- Item 9. Do not insert dowels within 100 of horizontal alignment of pipe. Insert to depth X as per Table 310-B. Inverted "U" shaped dowels with both ends inserted into the base concrete is an acceptable alternative to straight bar. Half as many bars would be required in such cases.

General Notes:

- Concrete and reinforcement as per drawing MRWA-S-309.
- For MHs containing an internal drop, refer to drawing MRWA-S-311 for additional requirements.
- For MHs containing an external drop, refer to drawing MRWA-S-312 for additional requirements.

TABLE 310-B: MANHOLE BASE PARAMETERS

| DEPTH TO INVERT | MAINTENANCE HOLE SIZE | NO. DOWELS | DOWEL SIZE (ITEM 8) | X = DOWEL PROTRUSION | REINFORCEMENT (ITEM 3) | Z = BASE THICKNESS |
|-------------------|-----------------------|------------|---------------------|----------------------|------------------------|--------------------|
| < 8 m | 1050 | 6 | N12 | 400 | SL81 | 150 |
| | 1200 | 8 | N12 | 400 | SL81 | 150 |
| | 1500 | 10 | N12 | 400 | SL81 | 150 |
| | 1800 | 12 | N16 | 500 | N12 - 200 | 200 |
| | 2100 | 14 | N16 | 500 | N16 - 200 | 250 |
| BETWEEN 8 m & 15m | 2400 | 16 | N16 | 500 | N16 - 200 | 250 |
| | 1050 | 6 | N16 | 500 | SL81 | 150 |
| | 1200 | 8 | N16 | 500 | N16 - 200 | 250 |
| | 1500 | 10 | N16 | 500 | N16 - 200 | 250 |
| | 1800 | 12 | N20 | 650 | N20 - 200 | 300 |
| | 2100 | 14 | N20 | 650 | N20 - 200 | 300 |
| | 2400 | 16 | N20 | 650 | 2 x (N20 - 200) | 350 |

NOTES Regarding Table 310-B

- * Two layers of reinforcement required in this case.
- Where base reinforcement is to consist of bars, orientate one set of bars in one direction at 200 spacing and one set of bars at 90° to this direction also at 200 spacing.
- Bases at a depth > 8m require N40 concrete.

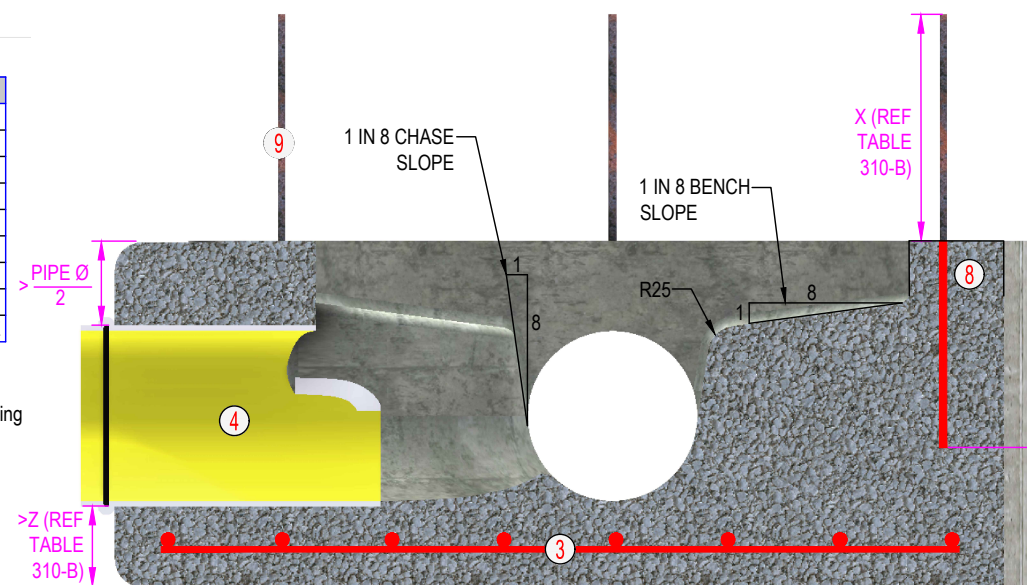


FIGURE 310-B: TYPICAL MANHOLE BASE (SECTION VIEW)

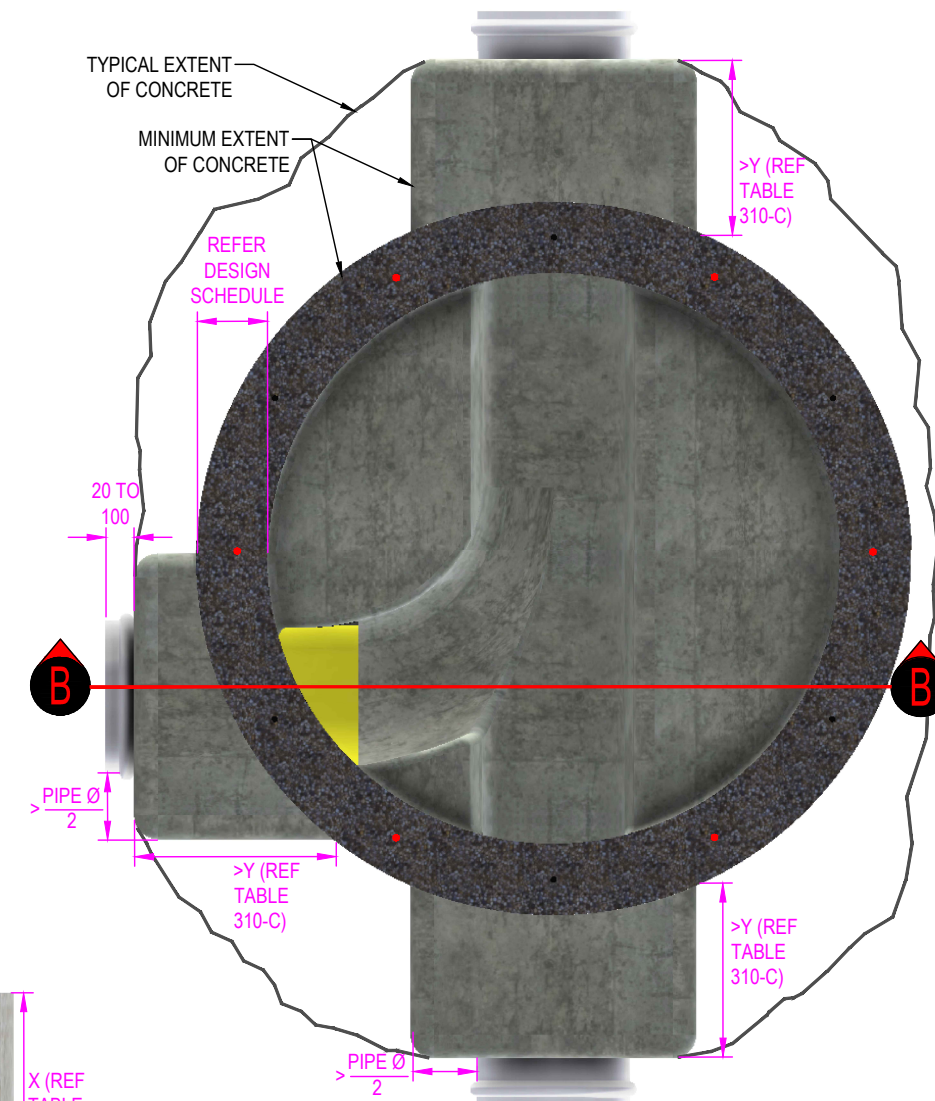


FIGURE 310-C: TYPICAL MANHOLE BASE (PLAN VIEW)

TABLE 310-C: PIPE CONNECTION CONCRETE ENCASEMENT

| PIPE SIZE (DN) | Y |
|----------------|------------------------|
| 150 | 100 |
| 225 | 150 |
| 300 | 250 |
| 350 / 375 | 300 |
| > 400 | EQUAL TO PIPE DIAMETER |

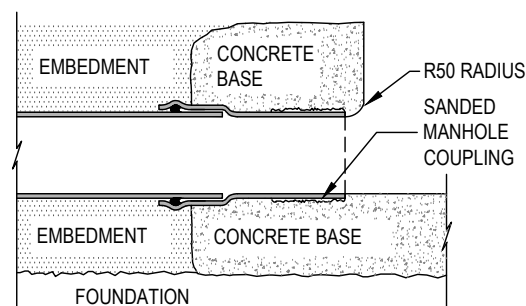


FIGURE 310-D: PVC PIPE CONNECTION (SECTION VIEW)

FIRST PIPE JOINT BACK FROM MH SHALL BE RRJ. THERE IS NO REQUIREMENT FOR A ROCKER PIPE.

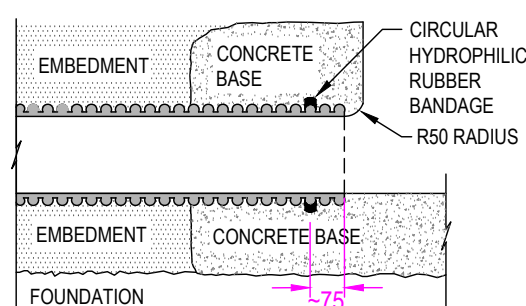


FIGURE 310-E: PP PIPE CONNECTION (SECTION VIEW)

CONNECTING PIPE SHALL BE > 3 x PIPE Ø LONG. THERE IS NO REQUIREMENT FOR A ROCKER PIPE.

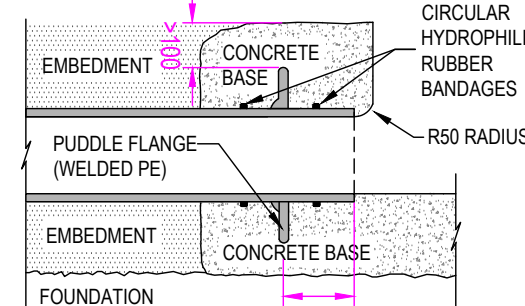


FIGURE 310-F: PE PIPE CONNECTION (SECTION VIEW)

THERE IS NO REQUIREMENT FOR A ROCKER PIPE.

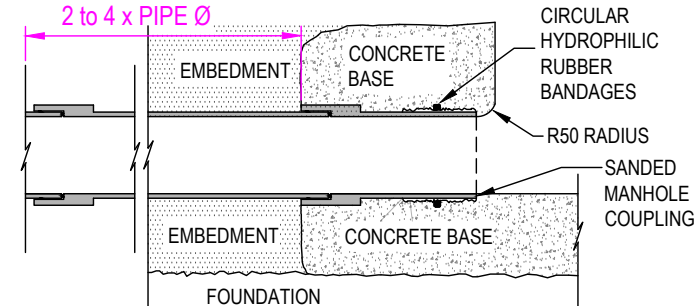


FIGURE 310-G: GRP PIPE CONNECTION (SECTION VIEW)

FIRST PIPELINE JOINT BACK FROM MANHOLE SHALL BE RRJ. CONNECTING PIPE SHALL BE 2 to 4 x PIPE Ø LONG.

| | | | | | | | | | | | | | | | | | | | | | |
|--|--|--|--|---|-----------|----------|---|---------------|----------|---|--|--|-------------|--|--|--|--|--------------|--|--|--|
| ALL DIMENSIONS IN mm UNLESS STATED OTHERWISE | | | | DESIGNED: R. JAGGER | | | DATE: 1 JULY 2015 | | | <div>MELBOURNE RETAIL WATER AGENCIES</div> <div><div>CityWest Water™</div><div>South East Water</div><div>Yarra Valley Water</div></div> | | | | MRWA SEWERAGE STANDARDS | | | | NOT TO SCALE | | | |
| | | | | DRAWN: R. JAGGER | | | DATE: 1 JULY 2015 | | | | | | | CONCRETE MAINTENANCE HOLE BASE CONSTRUCTION | | | | MRWA-S-310 | | | |
| | | | | CHECKED: | NAME | DATE | APPROVED: | NAME | DATE | | | | | | | | | | | | |
| | | | | <input checked="" type="checkbox"/> CWW | D. MOORE | 01/09/15 | <input checked="" type="checkbox"/> CWW | R. CARRUTHERS | 01/09/15 | | | | | | | | | | | | |
| | | | | <input checked="" type="checkbox"/> SEW | C. PAXMAN | 01/09/15 | <input checked="" type="checkbox"/> SEW | D. O'DONOVAN | 01/09/15 | | | | | | | | | | | | |
| | | | | <input checked="" type="checkbox"/> YVW | K. DAWSON | 01/09/15 | <input checked="" type="checkbox"/> YVW | J. TOMASI | 01/09/15 | | | | | | | | | | | | |
| 2 | | | | PUBLISHED FIRST ISSUE | | | 01/10/15 | | | CP / JT / KD / RJ | | | | | | | | | | | |
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| 1 | | | | 2 | | | 3 | | | 4 | | | 5 | | | | | | | | |
| 6 | | | | 7 | | | 8 | | | 9 | | | 10 | | | | | | | | |
| 11 | | | | 12 | | | 13 | | | 14 | | | 15 | | | | | | | | |

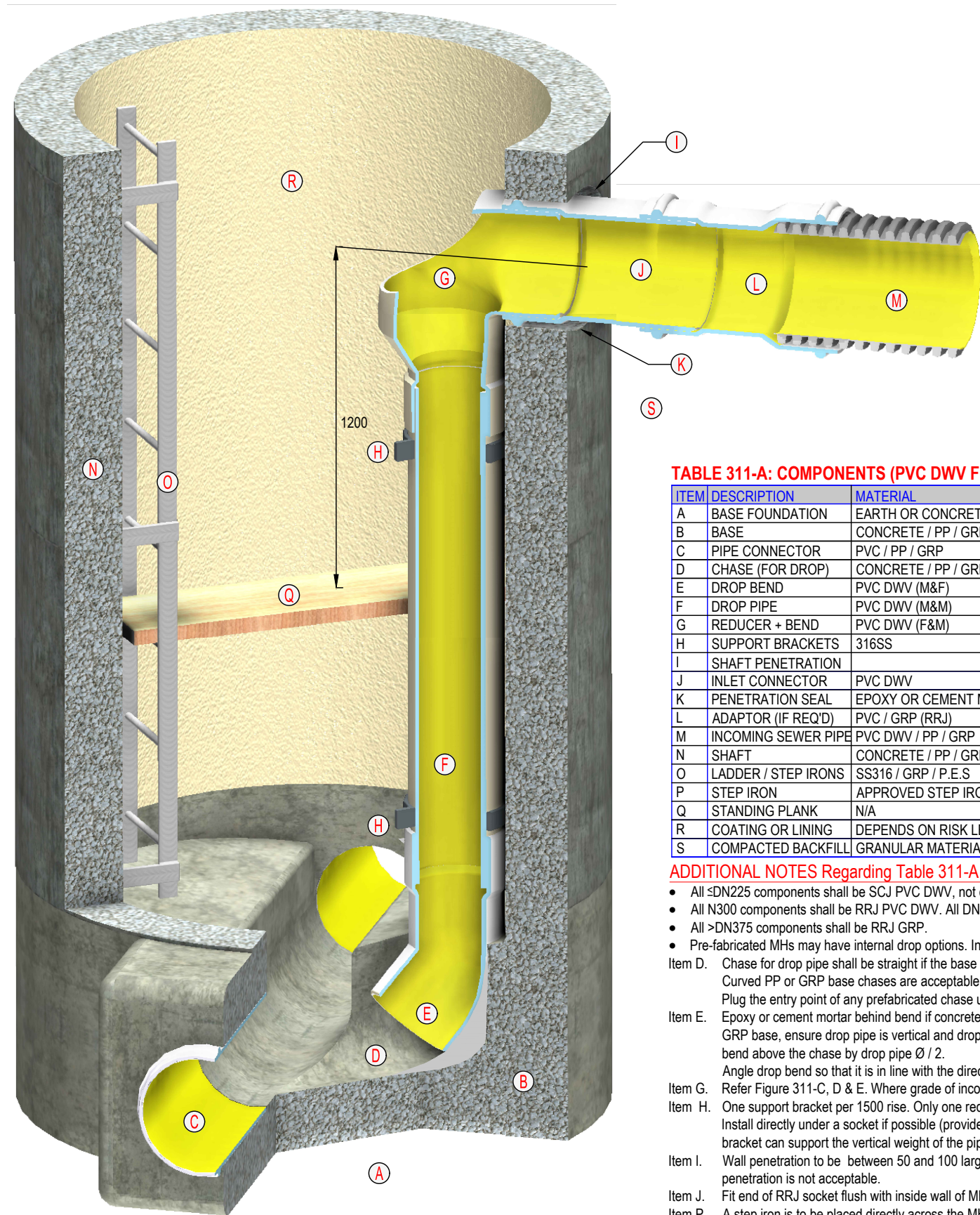


FIGURE 311-A: INTERNAL DROP MAINTENANCE HOLE
DN300 HIGH LEVEL SEWER WITH DN225 DROP SHOWN

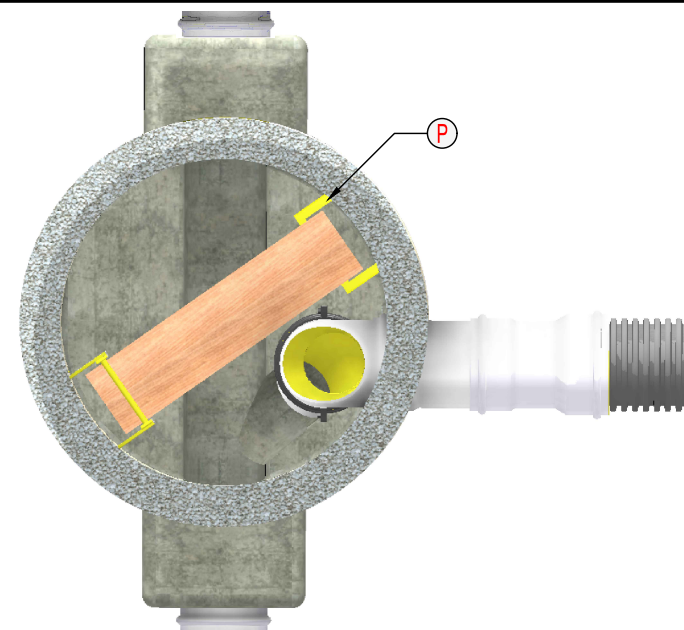


FIGURE 311-B: INTERNAL DROP MAINTENANCE HOLE (PLAN VIEW)

TABLE 311-A: COMPONENTS (PVC DWV Fittings Described)

| ITEM | DESCRIPTION | MATERIAL | NOTES |
|------|---------------------|------------------------|--|
| A | BASE FOUNDATION | EARTH OR CONCRETE | REFER MRWA-S-310 FOR DETAILS |
| B | BASE | CONCRETE / PP / GRP | IF CONCRETE, REFER MRWA-S-310 |
| C | PIPE CONNECTOR | PVC / PP / GRP | REFER FIGURES 310-D TO 310-G |
| D | CHASE (FOR DROP) | CONCRETE / PP / GRP | STRAIGHT IF POSSIBLE AT 135° TO OUTLET SEWER |
| E | DROP BEND | PVC DWV (M&F) | 60° BEND |
| F | DROP PIPE | PVC DWV (M&M) | INSTALL VERTICALLY. SIZE AS PER TABLE 311-B |
| G | REDUCER + BEND | PVC DWV (F&M) | REDUCER + 90° BEND, FACTORY FABRICATED |
| H | SUPPORT BRACKETS | 316SS | REFER FIGURE 314-H |
| I | SHAFT PENETRATION | | DRILL SERIES OF HOLES AND BREAK OUT CENTER |
| J | INLET CONNECTOR | PVC DWV | REFER FIGURES 310-D TO 310-G |
| K | PENETRATION SEAL | EPOXY OR CEMENT MORTAR | ENSURE ENTIRE VOID IS FILLED |
| L | ADAPTOR (IF REQ'D) | PVC / GRP (RRJ) | |
| M | INCOMING SEWER PIPE | PVC DWV / PP / GRP | |
| N | SHAFT | CONCRETE / PP / GRP | REFER MRWA-S-309 |
| O | LADDER / STEP IRONS | SS316 / GRP / P.E.S | REFER MRWA-S-314 |
| P | STEP IRON | APPROVED STEP IRON | REQUIRED TO SUPPORT STANDING PLANK |
| Q | STANDING PLANK | N/A | FOR & SUPPLIED BY MAINTENANCE |
| R | COATING OR LINING | DEPENDS ON RISK LEVEL | REFER DESIGN SPECIFICATION |
| S | COMPACTED BACKFILL | GRANULAR MATERIAL | REFER MRWA BACKFILL SPECIFICATION |

ADDITIONAL NOTES Regarding Table 311-A items:

- All ≤DN225 components shall be SCJ PVC DWV, not cemented in place.
 - All N300 components shall be RRJ PVC DWV. All DN375 components shall be RRJ GRP or RRJ PVC DWV.
 - All >DN375 components shall be RRJ GRP.
 - Pre-fabricated MHs may have internal drop options. Install as per products portal conditions.
- Item D. Chase for drop pipe shall be straight if the base is concrete. Curved PP or GRP base chases are acceptable locations to receive drop pipes. Plug the entry point of any prefabricated chase used to receive dropped flows.
- Item E. Epoxy or cement mortar behind bend if concrete base. Do not enclose bend so that it cannot be easily replaced. If PP or GRP base, ensure drop pipe is vertical and drops the high level flow directly into a prefabricated chase. Install bottom of bend above the chase by drop pipe $\varnothing / 2$. Angle drop bend so that it is in line with the direction of the chase at that position. Refer Figure 311-C, D & E. Where grade of incoming high level sewer is > 1 in 10, refer to Figure 311-E.
- Item H. One support bracket per 1500 rise. Only one required below top bend if < 1500 drop. Install directly under a socket if possible (provided the bracket hole is 100 clear of any other penetrations) so that the bracket can support the vertical weight of the pipework.
- Item I. Wall penetration to be between 50 and 100 larger in diameter than the outside \varnothing of the connecting pipe. Smooth cut penetration is not acceptable.
- Item J. Fit end of RRJ socket flush with inside wall of MH.
- Item P. A step iron is to be placed directly across the MH from a ladder rung at ~1.2m height below the center of the high level sewer. Not required for drops < 1.8m. Drill holes in set concrete and install step iron using epoxy as per the manufacturer's specification.

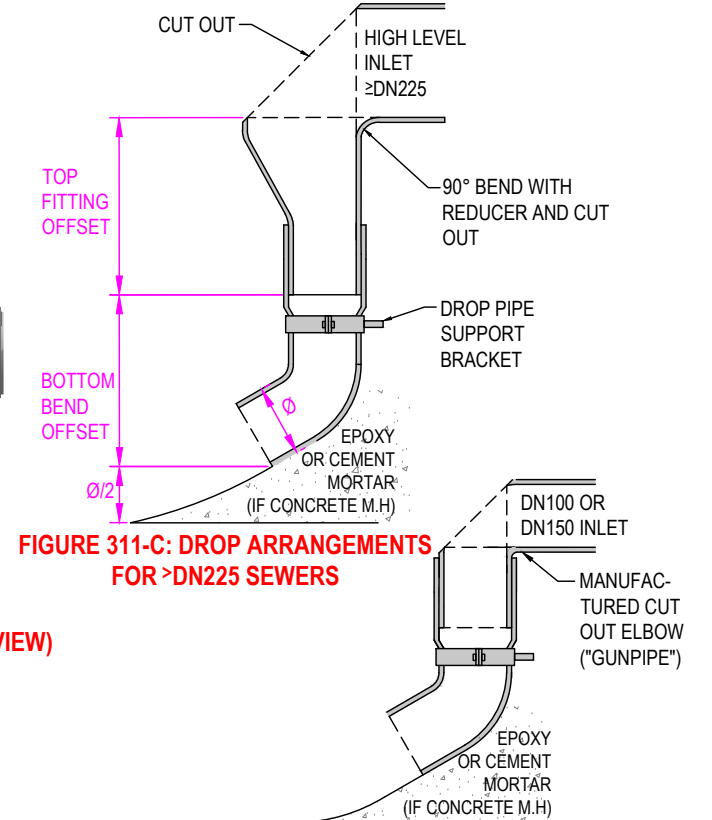


FIGURE 311-C: DROP ARRANGEMENTS FOR >DN225 SEWERS

FIGURE 311-D: DROP ARRANGEMENTS FOR DN100-150 SEWERS

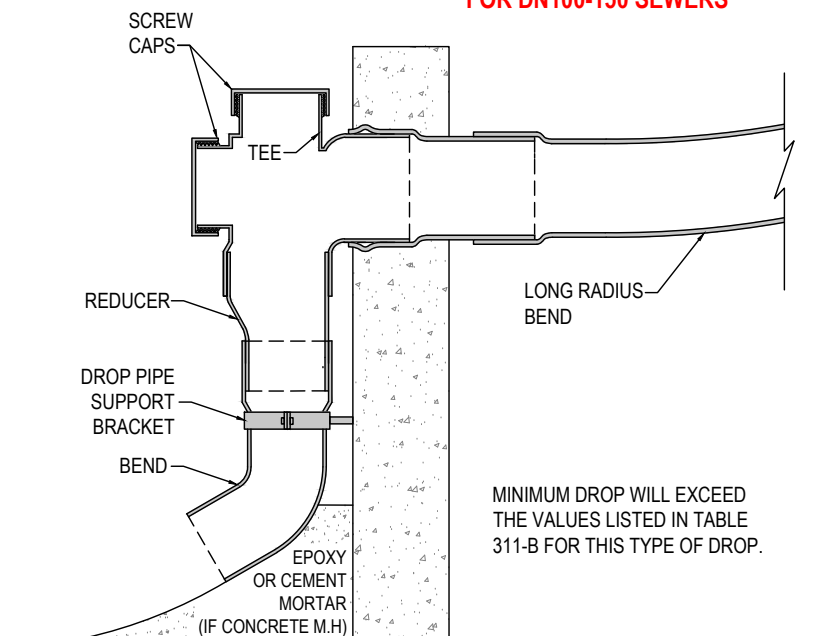


FIGURE 311-E: DROP ARRANGEMENTS FOR STEEP INCOMING SEWERS

TABLE 311-B: DROP PARAMETERS

| SEWER SIZE | MIN DROP DN | TOP FITTING OFFSET | BOTTOM BEND OFFSET | $\varnothing / 2$ | MIN POSSIBLE DROP | MIN PERMITTED DROP |
|------------|-------------|--------------------|--------------------|-------------------|-------------------|--------------------|
| 100 | 100 | 95 | 147 | 55 | 300 | 500 |
| 150 | 150 | 130 | 253 | 85 | 470 | 600 |
| 225 | 150 | 530 | 253 | 85 | 870 | 900 |
| 300 | 225 | 530 | 418 | 123 | 1080 | 1100 |

Minimum drop represents the minimum difference between the IL of the incoming sewer and outgoing sewer that can be achieved using conventional fittings.

| | | | | | | | |
|--|-----------------------|----------|-------------------|---|----------|---|----------|
| ALL DIMENSIONS IN mm UNLESS STATED OTHERWISE | | | | DESIGNED: R. JAGGER | | DATE: 1 JULY 2015 | |
| | | | | DRAWN: R. JAGGER | | DATE: 1 JULY 2015 | |
| | | | | CHECKED: NAME | DATE | APPROVED: NAME | DATE |
| 2 | PUBLISHED FIRST ISSUE | 01/10/15 | CP / JT / KD / RJ | <input checked="" type="checkbox"/> CWW D. MOORE | 01/09/15 | <input checked="" type="checkbox"/> CWW R. CARRUTHERS | 01/09/15 |
| 11 | PRE-PUBLISHED DRAFT | 01/03/15 | CP / JT / KD / RJ | <input checked="" type="checkbox"/> SEW C. PAXMAN | 01/09/15 | <input checked="" type="checkbox"/> SEW D. O'DONOVAN | 01/09/15 |
| | | | | <input checked="" type="checkbox"/> YVW K. DAWSON | 01/09/15 | <input checked="" type="checkbox"/> YVW J. TOMASI | 01/09/15 |
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MELBOURNE RETAIL WATER AGENCIES



CityWest Water™



MRWA SEWERAGE STANDARDS

CONCRETE MAINTENANCE HOLES
INTERNAL DROP CONSTRUCTION

NOT TO SCALE

MRWA-S-311

| Planning | Design | Construction |
|----------|-------------------------------------|-------------------------------------|
| | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |

TABLE 313-A: CONCRETE MH CONSTRUCTION TYPE

| ID | SITUATION | MH PREFERENCE |
|----|-----------------------------------|---|
| A | ≤1200 Ø MH (WITH NO OTHER ISSUES) | CONICAL TOP MH |
| B | ≥ 1500 Ø MH | FLAT TOP MH |
| C | SURCHARGED CONDITIONS | FIXED FLAT TOP MH WITH HOOP REINFORCED NECK |
| D | IN ROAD PAVEMENT | FLAT OR CONICAL TOP MH |
| E | DEPTH TO NIB WALL > 1900 | FLAT OR CONICAL TOP MH |
| F | DEPTH TO NIB WALL B/W 1400 & 1900 | FLAT TOP MH |
| G | DEPTH TO NIB WALL < 1400 | CONTACT THE WATER AGENCY FOR ADVICE |

TABLE 313-B: MAINTENANCE STRUCTURE COVER REQUIREMENTS

| SITUATION | TYPE | SURFACE | COVER LEVEL |
|--|------------------------|------------|--------------|
| ROADWAY, CARPARKS, COMMERCIAL / INDUSTRIAL DRIVEWAYS | CLASS D | CONCRETE * | FLUSH |
| PARKLAND, RESERVES, SCHOOL GROUNDS | CLASS D | CONCRETE * | 25 ABOVE FSL |
| SUBJECT TO SURCHARGE | CLASS D | CONCRETE * | NA |
| FOOTPATHS, RESIDENTIAL DRIVEWAYS | CLASS B | CONCRETE * | FLUSH |
| NATURE STRIPS (IN ROAD RESERVE) | CLASS B | ANY | 25 ABOVE FSL |
| UNPAVED PRIVATE PROPERTY | CLASS B | ANY | 50 ABOVE FSL |
| NORMAL ACCESS | 600Ø | | NA |
| CONNECTING SEWER ≥DN600 | 750 x 750 SQUARE | | NA |
| FLAT TOP MHs WITH NECK > 150 DEEP | | | NA |
| M&E EQUIPMENT WITHIN THE STRUCTURE | MULTI-PART / ALUMINIUM | | NA |

* Concrete infill covers may not always be available for MSs. Where none of the suppliers have concrete infill MS covers available, solid top covers may be used.

NOTES Regarding Covers:

- Grease all metallic mating surfaces.
- Where the cover level is above the FSL, grade the surrounding surface level at 1 in 5 to the edge of frame.
- Ensure area around cover is free draining to ensure water does not pond over the cover.
- Bolt down covers shall be installed in accordance with the code.
- IS covers may utilise any approved cover at any location.
- Maximum slope of 1 in 7 in non-trafficable areas.
- Maximum slope of 1 in 10 in trafficable areas.

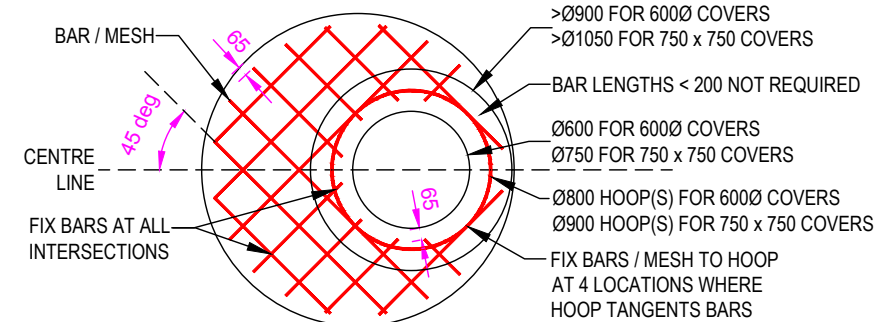


FIGURE 313-B: FLAT TOP REINFORCEMENT ARRANGMENT (PLAN VIEW)

TABLE 313-D: TOP SLAB REINFORCEMENT DETAILS

| IN CARRIAGEWAY (ROAD PAVEMENT) | | | | | NOT IN CARRIAGEWAY | | | |
|--------------------------------|---|------------|------------|----------------|--------------------|------------|------------|----------------|
| M.H ID | A | SLAB DEPTH | MESH / BAR | FLAT TOP HOOPS | A | SLAB DEPTH | MESH / BAR | FLAT TOP HOOPS |
| 1050 | 1 | 200 | SL81 | N12 | 1 | 200 | SL81 | N12 |
| 1200 | 1 | 200 | N16 -200 | N20 | 1 | 200 | SL81 | N12 |
| 1500 | 1 | 200 | N20 -200 | N20 | 1 | 200 | SL81 | N12 |
| 1800 | 1 | 250 | N20 -200 | N20 | 1 | 200 | N12 -200 | N16 |
| 2100 | 1 | 300 | N20 -200 | N20 | 1 | 200 | N16 -200 | N20 |
| 2400 | 2 | 300 | N20 -200 | N20 | 1 | 200 | N16 -200 | N20 |

A = NUMBER OF LAYERS OF REINFORCEMENT

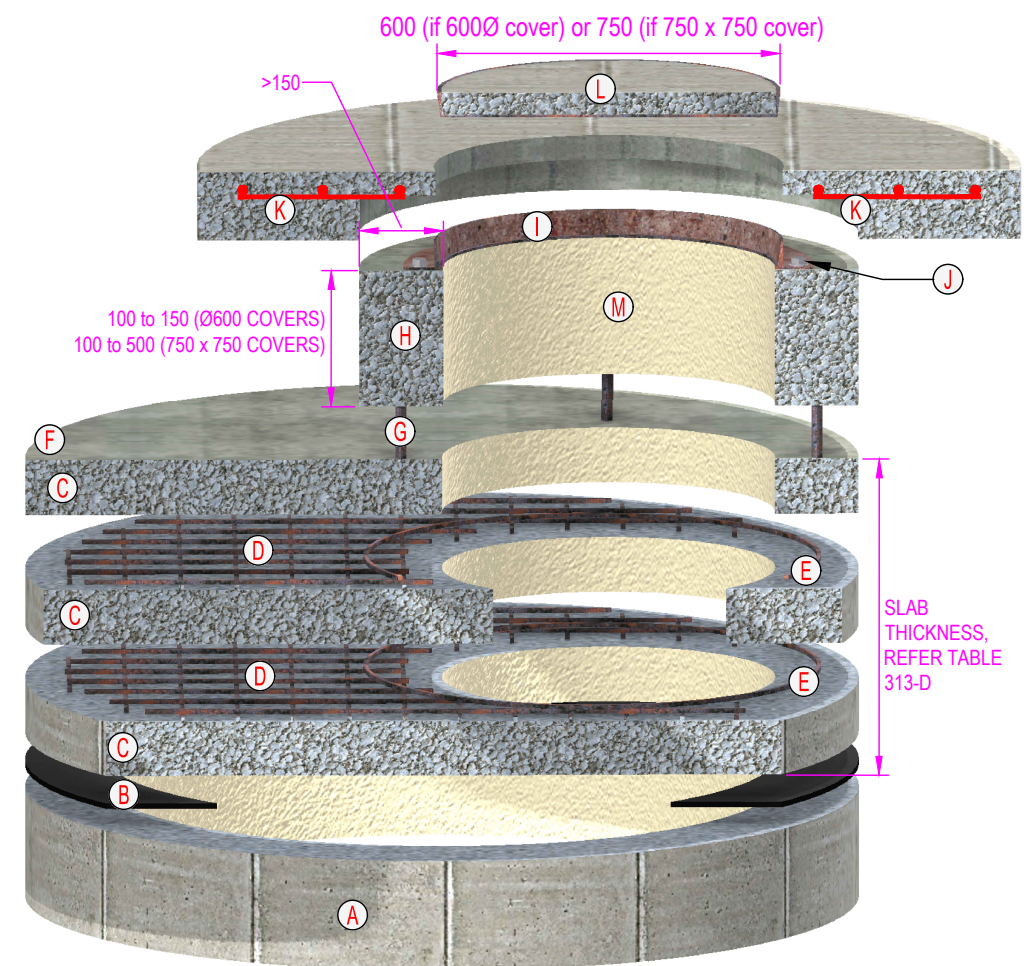


FIGURE 313-D: FLAT TOP MH (Trafficable Arrangement Described):

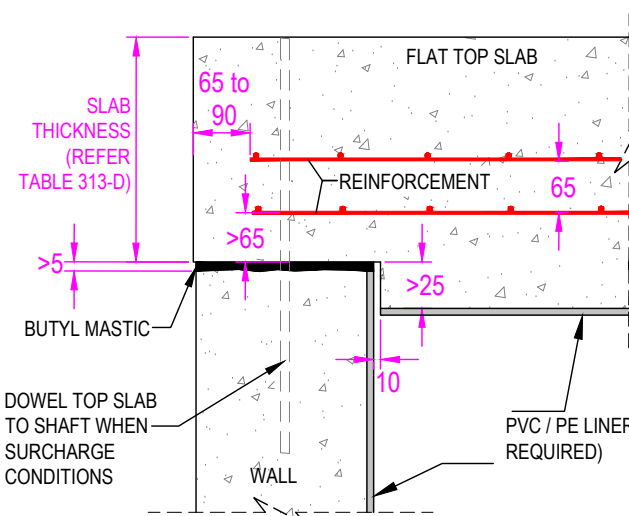
FIGURE 313-A: CONICAL TOP MH
(Non Trafficable Arrangement with Vent Described)

FIGURE 313-C: TOP SLAB CONSTRUCTION JOINT

TABLE 313-C: CONICAL TOP COMPONENTS (In Approximate Order of Construction):

| ID | DESCRIPTION | MATERIAL | NOTES |
|----|---------------------|----------------------|--|
| 1 | SHAFT | PLAIN CONCRETE | REFER MRWA-S-309 FOR DETAILS |
| 2 | CONICAL SECTION | PLAIN CONCRETE | POUR CONICAL SECTION AND TOP OF SHAFT TOGETHER |
| 3 | NECK | PLAIN CONCRETE | POUR NECK AND CONICAL SECTION TOGETHER |
| 4 | VENT PENETRATION | | DRILL SERIES OF HOLES AND BREAK OUT THE CENTRE |
| 5 | VENT PIPE | TYPICALLY PVC DWV | REFER FIGURES 310-D TO 310-G |
| 6 | FRAME | APPROVED PRODUCT | SET IN WET CONCRETE OF NECK. LOCATE CENTRALLY |
| 7 | LADDER / STEP IRONS | SS316, FRP OR PES | REFER MRWA-S-314 |
| 8 | COVER | CLASS B / D | REFER TABLE 313-B |
| 9 | COATING OR LINING | PE / EPOXY / PVC etc | IF REQUIRED. REFER DESIGN DRAWING AND MRWA-S-301 |

ADDITIONAL NOTES Regarding Table 313-C Items:

- Concrete as per drawing MRWA-S-309.
- Inlet sewers shall not connect into the conical part of MH.
- Note that vents may also connect to flat top MHs as described in this section.
- Item 2. Inner and outer formwork required. No construction joints in the cone or neck allowed. Thickness as per shaft.
- Item 3. Pour the neck to finished surface level with frame held in the correct location within the concrete. Neck thickness same as shaft. Top surface shall be flat to class 2 finish (AS3610). Angle to match the finished top surface.
- Item 4. Vent penetrations should occur in a vertical section of the cone wall, behind the ladder, >200 away from ladder wall brackets. Penetration shall be between 50 and 100 larger than the vent pipe Ø. Smooth cut penetration is not acceptable. Vent pipe requires continual grade to the manhole so that it drains. Seal gap between vent pipe & penetration with epoxy or cement mortar, ensuring there are no gaps or voids.
- Item 6. Set top of frame as per Table 313-B. Frames in non trafficable areas to have a maximum slope of 1 in 7. Batter back the surrounding ground where necessary to achieve a greater slope.
- Item 7. Step irons, ladder rungs or stiles shall not protrude into the neck (applies to both conical and flat top MHs).

TABLE 313-E: COMPONENTS (In Approximate Order of Construction):

| ID | DESCRIPTION | MATERIAL | NOTES |
|----|---------------------|-------------------------|--|
| A | SHAFT | CONCRETE | REFER MRWA-S-309 FOR DETAILS. ENSURE FLAT HORIZONTAL TOP SURFACE |
| B | MASTIC | BUTYL RUBBER | MIN 5 THICK 100% BROMO BUTYL POLYMER. PLACE AS PER FIGURE 313-C |
| C | TOP SLAB | CONCRETE | POUR CONCRETE ONTO A PREPARED FLAT SURFACE (STEEL / TIMBER) NEARBY |
| D | REINFORCEMENT | | REFER FIGURE 313-B AND TABLE 313-D |
| E | REINFORCING HOOP(S) | | REFER FIGURE 313-B AND TABLE 313-D |
| F | LIFTING ANCHOR | | INSTALL 4 CORRECTLY RATED LIFTING ANCHORS AT 0°, 90°, 180° & 270° |
| G | NECK DOWELS | REINFORCING BAR | INSERT INTO TOP SLAB WHEN WET AT 0°, 90°, 180° & 270°. N12 BAR |
| H | NECK | CONCRETE | INNER AND OUTER FORMWORK REQUIRED. > 150 THICK |
| I | FRAME | APPROVED PRODUCT | SET ON NECK. LOCATE CENTRALLY |
| J | FRAME FASTENERS | 4 x M12 x 100 GAL STEEL | INSTALL BOLTS AS PER FIGURE 314-F & G |
| K | PAVEMENT | CONCRETE OR BITUMEN | CONSTRUCTED BY OTHERS. PAVEMENT REINFORCEMENT TO SIT ON NECK |
| L | COVER | APPROVED PRODUCT | REFER NOTES TABLE 313-B |
| M | COATING OR LINING | PE / EPOXY / PVC etc | IF REQUIRED. REFER DESIGN SPECIFICATION |

ADDITIONAL NOTES Regarding Table 313-E items:

- Concrete and reinforcement as per MRWA-S-309.
- Inlet sewers shall not connect into shaft within 500 of top slab.
- Item B. Prior to mastic placement, prime surfaces of shaft and flat top as recommended by the mastic supplier.
- Item C. Use inner and outer formwork.
- Move slab into position when concrete has achieved > 60% strength (ie: 3 days).
- Item E. Hoop shall overlap mesh / bars as much as possible. Fix to mesh / bars at all intersections.
- Item F. Install as per manufacturers requirements in consideration of top slab weight.
- Item G. Locate centrally. Insert 130 and protrude min 200.
- Item H. Where MH shaft reinforced, reinforce neck with N12-150 reinforcing hoops (Ø800 if Ø600 cover, Ø900 if 750 x 750 cover). Overlap 400.
- Item J. Set top of frame flush with the top of the paved surface.

ALL DIMENSIONS IN mm UNLESS STATED OTHERWISE

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| 2 | PUBLISHED FIRST ISSUE | 01/10/15 | CP / JT / KD / F |
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MELBOURNE RETAIL WATER AGENCIES



MRWA SEWERAGE STANDARDS

CONCRETE MAINTENANCE HOLE
TOP CONSTRUCTION

NOT TO SCALE

MRWA-S-313

| Planning | Design | Construction |
|----------|--------|--------------|
| | ✓ | ✓✓✓✓ |

