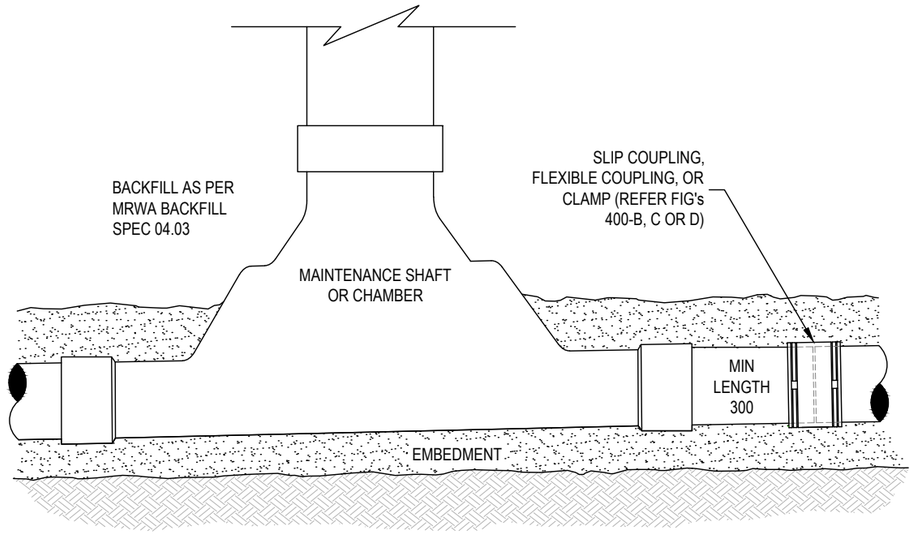

FIGURE 400-A: INSERTING MAINTENANCE SHAFTS AND CHAMBERS INTO EXISTING SEWERS

NOTES Regarding Inserting Maintenance Shafts and Chambers into Live Mains:

- MSs and MCs with flexible RRJ connectors are recommended where one is to be installed within an existing pipeline.
- Comply with confined space entry requirements of the Water Agency throughout the works.

1. Submit Work Method Statement if this has been requested by the Water Agency.
2. Excavate down to and around the pipe where the maintenance shaft / chamber is to be constructed.
3. Minimise the amount of pipe embedment removed around existing pipe.
4. Prepare the base in accordance with MRWA-S-305 & 306.
5. Stop sewer flow from entering the main to be cut.
6. Place a band around the existing pipe to mark straight cut lines where the pipe is to be cut.
7. Cut (+/- 3 mm from straight circumferential line) and dry the main.
8. Place maintenance shaft / chamber with pipe extension and lubricated coupling (if coupling).
9. Ensure grade of MS or MC base is consistent with existing main. If required, remove and adjust level of foundation to ensure correct grade.
10. Pull back couplings or place clamps over joins, ensuring fitting is centered over the gap.
11. Place embedment and backfill as per MRWA-S-201 and 202.

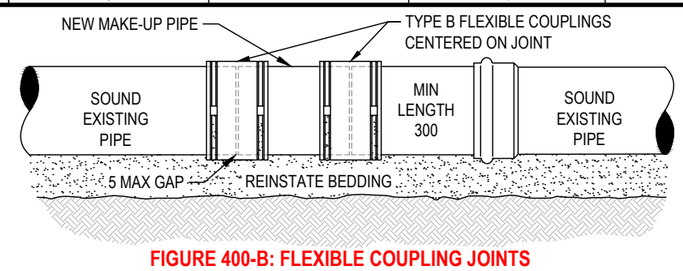

FIGURE 400-B: FLEXIBLE COUPLING JOINTS

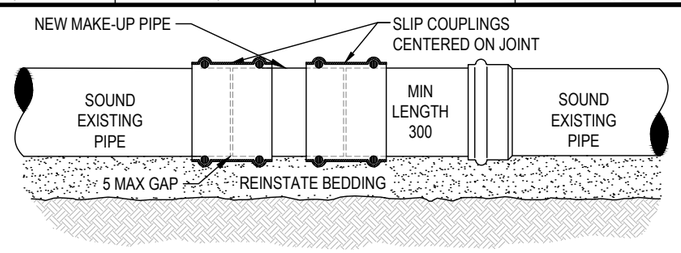

FIGURE 400-C: SLIP COUPLING JOINTS

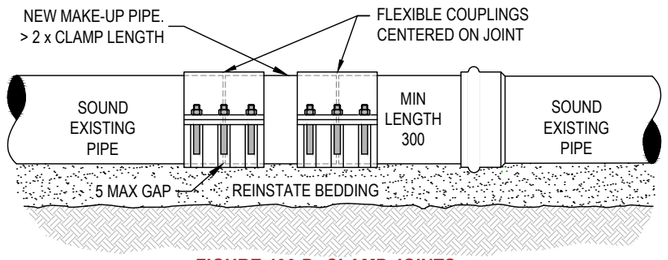

FIGURE 400-D: CLAMP JOINTS

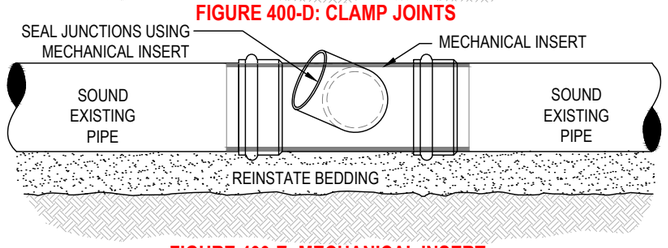

FIGURE 400-E: MECHANICAL INSERT

NOTES Regarding Repair of Damaged Pipe:

- Approved mechanical inserts may be used to repair small defects (ie: defects < ½ length of insert). For larger defects, instead replace a section(s) of the pipe as per Figures 400-B to D.
- All protrusions into the bore of the pipe shall be removed. CCTV all repaired pipe to verify hydraulic integrity.

NOTES Regarding Couplings and Clamps:

- Clamps and couplings shall not be used in the construction of new pipelines.
- Repair clamps and joining clamps for insertion of pipe sections into profiled wall pipe (ie: PP pipe) are available from the relevant manufacturer.
- Ensure clamps overlap existing pipe as per Table 400-A.

TABLE 400-A: CLAMP OVERLAP

PIPE DN	MIN CLAMP LENGTH EITHER SIDE OF GAP
≤DN375	75
≥DN450	125

Pipe Insertion Procedure:

1. Submit Work Method Statement if this has been requested by the Water Agency.
2. Minimise the amount of pipe embedment removed around existing pipe.
3. Stop sewer flow from entering the main to be cut.
4. Place a band around the existing pipe and mark straight cut lines (+/- 3 from straight line).
5. Remove any redundant pipework.
6. Obtain confined space permits and prepare for confined space entry if this has not already been done.
7. Cut the main.
8. Cut an insertion piece, ensuring gaps will be < 5 wide and that the difference in ID is less than 5. Chamfer any internal edge which may protrude into the flow.
9. Clean insertion piece and 400 beyond each existing pipe end and lubricate if RRJ.
10. Place two couplings over insertion piece ends (if couplings being used),
11. Insert pipe piece and pull back couplings or place clamps over joins, ensuring fittings are centered over gaps.
12. Embed and backfill as per MRWA-S-201 and 202.

Maintenance Hole Construction Over Existing Sewers:

- The pipe should not be broken until the MH is virtually fully constructed.
- While it remains unbroken, the excavation may or not be a confined space depending on the likelihood of sewage or gases escaping the pipe. This will depend on the age, type and condition of the pipe.
- Comply with confined space entry requirements of the Water Agency throughout the works.

1. Submit Work Method Statement if this has been requested by the Water Agency.
2. Excavate down to and around the pipe where the maintenance hole is to be constructed, ensuring that the main is stable.
3. Prepare the base in accordance with with MRWA-S-310.
   - 3.2. Prepare the pipe which is to be encased in concrete by thoroughly cleaning the pipe and then;
     - 3.2.1. If PVC DWV- priming the pipe before applying solvent cement around the full circumference of the pipe. Sprinkle builders sand liberally to the solvent cement. Allow to harden before concreting.
     - 3.2.2. If PP- applying a circular hydrophilic rubber bandage on both sides to the outer diameter of a rib 75 back from where the pipe will be cut.
     - 3.2.3. If GRP- sanding the pipe with coarse sand paper. Then apply polyester resin to the abraded surface and then sprinkle builders sand liberally to resin. Allow to harden before concreting.
   - 3.3. Place polystyrene blockout above the existing pipe and for any new chase / channel (for new sewer connections) as per Figure 400-G.
   - 3.4. Install formwork as required in preparation for placement of concrete for the base.
4. Pour the in situ cast base including nib wall and starter bars.
5. Pour the wall segments, top and set cover and frame as per MRWA-S-300 series drawings.
6. Fix ladder / step irons / landings / drop pipe as necessary.
7. Remove the polystyrene blockout from the base.
8. Cut out the top of the pipe as per Figure 400-I or cut and remove all of pipe within the MH channel.
9. Cut out the side of the existing pipe to allow the new channel to enter the existing main.
10. "compo" (render) the top edges of the cut pipe and any gap between pipe and base with epoxy mortar (refer WSA-201- selection and application of protective coatings) in accordance with Figure 400-J
11. "compo" (render) the junction of the new channel where it junctions with the existing main.
12. Once the maintenance hole walls have set sufficiently, backfill in accordance with the MRWA backfill specification MRWA-04-03.

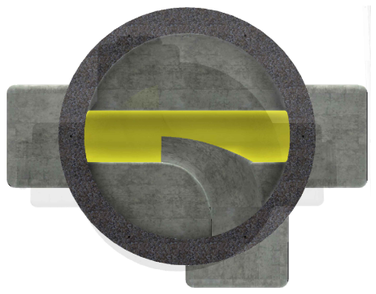

FIGURE 400-F: FINISHED MAINTENANCE HOLE CONNECTION TO AN EXISTING SEWER

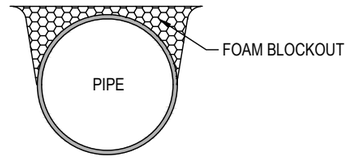

FIGURE 400-G: EXCAVATE AROUND MAIN & ATTACH BLOCKOUT

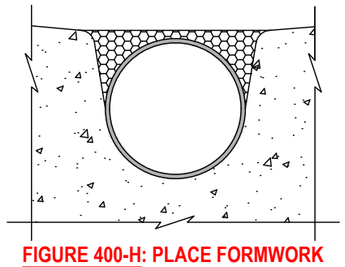

FIGURE 400-H: PLACE FORMWORK AND THEN CONCRETE

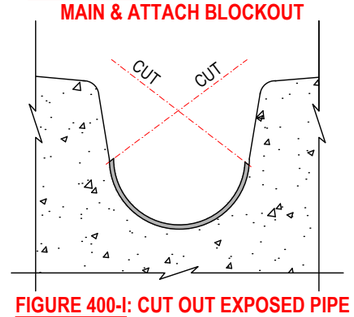

FIGURE 400-I: CUT OUT EXPOSED PIPE

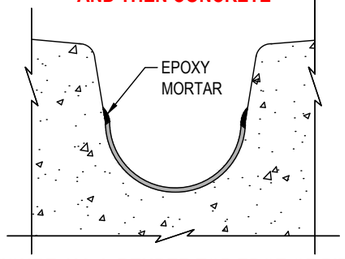

FIGURE 400-J: RENDER TOP EDGE OF PIPE

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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	
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MELBOURNE RETAIL WATER AGENCIES

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INSERTION INTO LIVE SEWERS, and REDUNDANT PRORERTY CONNECTIONS

Planning	Design	Construction
		✓ ✓ ✓

TABLE 401-A: HYDROGEN SULPHIDE RISK CONTROL

SYSTEM TYPE	PRINCIPLE OF H_2S RISK CONTROL	RELEVANT SYSTEM DESIGN RULES (REFER TABLE 401-D)
OPEN SYSTEM (LOW RISK)	Odour: Disperse H_2S at multiple locations while concentrations remain low. Concrete Corrosion: Keep pipe wall dry (maintain a low relative humidity in the head space of the sewerage system) to reduce the formation of sulphuric acid.	• Limited or no property boundary traps or water seals. • Natural ventilation.
CLOSED SYSTEM (MED / HIGH RISK)	Seal system to contain gas where hydrogen sulphide production cannot be adequately controlled.	• Use property boundary traps &/or water seals at all: •• Junctions of properties and closed systems. •• Junctions of closed systems and open systems. • Ventilation requires air treatment. • All concrete MHs in closed systems require protection as per Table 307-E.

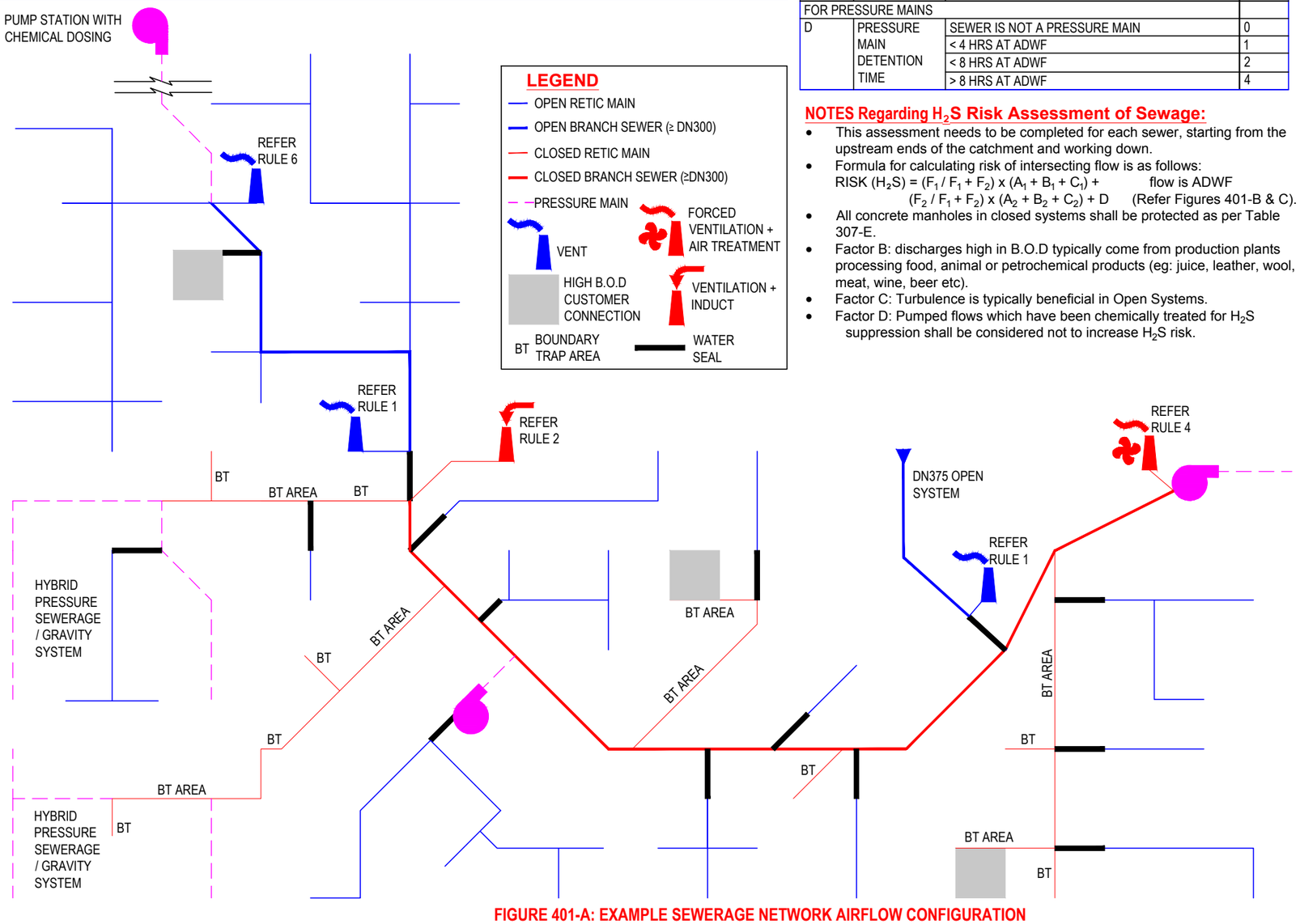

FIGURE 401-A: EXAMPLE SEWERAGE NETWORK AIRFLOW CONFIGURATION

TABLE 401-B: HYDROGEN SULPHIDE RISK FACTORS

FACTOR	RISK FACTOR DESCRIPTION	KEY CONSIDERATIONS	NO. POINTS
FOR GRAVITY SEWERS			
A	AGE OF SEWAGE	SEWER < 375	0
		SEWER ≥ 375	1
		SEWER ≥ 525	2
		SEWER ≥ 750	3
B	SEWAGE CONTENTS	> 90% RESIDENTIAL	0
		IND / COMM- SIGNIFICANT B.O.D DISCHARGE	1
		IND / COMM HIGH B.O.D DISCHARGE	2
C	VENTILATION & TURBULENCE	UPSTREAM SYSTEM IS OPEN	0
		U.S SYSTEM IS CLOSED WITH MINIMAL DROPS	2
		U.S SYSTEM IS CLOSED WITH OCCASIONAL DROPS	3
		U.S SYSTEM IS CLOSED WITH NUMEROUS DROPS	4
FOR PRESSURE MAINS			
D	PRESSURE MAIN DETENTION TIME	SEWER IS NOT A PRESSURE MAIN	0
		< 4 HRS AT ADWF	1
		< 8 HRS AT ADWF	2
		> 8 HRS AT ADWF	4

NOTES Regarding H_2S Risk Assessment of Sewage:

- This assessment needs to be completed for each sewer, starting from the upstream ends of the catchment and working down.
- Formula for calculating risk of intersecting flow is as follows:
  RISK (H_2S) = $(F_1 / F_1 + F_2) \times (A_1 + B_1 + C_1) +$ flow is ADWF
  $(F_2 / F_1 + F_2) \times (A_2 + B_2 + C_2) + D$ (Refer Figures 401-B & C).
- All concrete manholes in closed systems shall be protected as per Table 307-E.
- Factor B: discharges high in B.O.D typically come from production plants processing food, animal or petrochemical products (eg: juice, leather, wool, meat, wine, beer etc).
- Factor C: Turbulence is typically beneficial in Open Systems.
- Factor D: Pumped flows which have been chemically treated for H_2S suppression shall be considered not to increase H_2S risk.

TABLE 401-C: H_2S RISK SCORES

RISK LEVEL	LOW RISK	MEDIUM RISK	HIGH RISK
SCORE	< 3	≥3 & <6	≥ 6

- Low risk sewers typically should be open.
- Medium and High risk sewers typically should be closed.

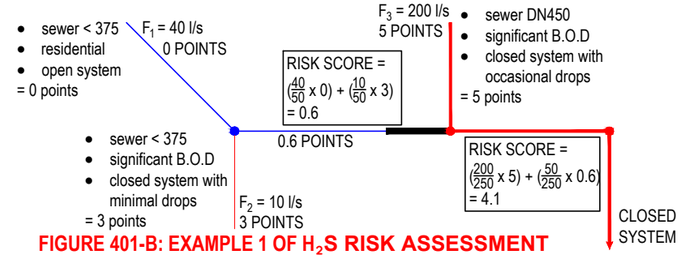

FIGURE 401-B: EXAMPLE 1 OF H_2S RISK ASSESSMENT

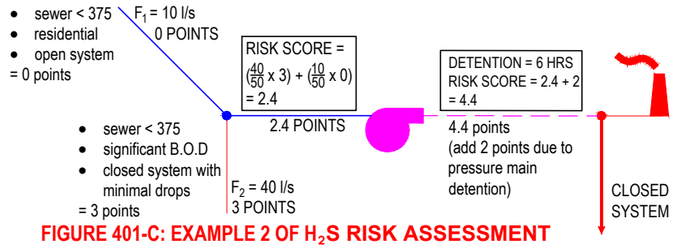

FIGURE 401-C: EXAMPLE 2 OF H_2S RISK ASSESSMENT

TABLE 401-D: SYSTEM DESIGN RULES

RULE		RULE DESCRIPTION
1	VENTS ON **OPEN** BRANCH SEWERS	Install a vent adjacent to water seals at the termination of open branch sewers. Install vents on open branch sewers (≥DN300) at 1000m spacing (without air treatment).
2	VENTS ON **CLOSED** BRANCH SEWERS	Not typically required (unless pressure main discharge point or sewer terminates at a wet well). Where required, forced ventilation with air treatment is required unless there is a significant buffer of land around vent (ie: > 100m). Upstream end of ventilated Closed System requires ventilation with an In-duct.
3	BOUNDARY TRAP (BT) AREAS	Required where: 1) a retic sewer which contains ≤5 property connections discharges to a closed system , or 2) the property connects directly to a closed system.
4	SPS WET WELL VENTILLATION	Typically, at least natural ventilation will be required at sewage pump stations. Forced ventilation with air treatment may be required where: 1) Detention time within the wet well is excessive, or 2) the SPS is in a built up area with limited buffer, or 3) the sewage entering the SPS presents a medium or high risk.
5	JUNCTION OF OPEN & CLOSED SYSTEMS	Where the combined flow from an Open and Closed system is considered low risk: 1) the downstream system shall be considered an Open system, 2) install a water seal just upstream of the junction on the Closed system. Where the combined flow from an Open and Closed system is considered a medium or high risk: 1) the downstream system shall be considered a Closed system, 2) install a water seal just upstream of the junction on the open system. Refer Figure 401-B.
6	DISCHARGE OF PRESSURE MAINS	Where a pumped flow discharges to a gravity sewer, consideration should be given to venting the discharge maintenance structure. Air treatment may be required when the receiving sewer is part of a closed system (depending on Rule 2).

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DRAWN: R. JAGGER DATE: 1 JULY 2015

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SEWERAGE NETWORK AIRFLOW MANAGEMENT

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TABLE 402-A: VENT SIZE DETAILS (PIPE & BASE)

SEWERAGE MAIN SIZE (D.S) DN	VENT DIAMETER	MAX HEIGHT- m (56 m/s WIND)	MAX HEIGHT- m (89 m/s WIND)	VENT PIPE SCHEDULE	VENT OD	VENT ID	VENT WALL THICKNESS	REQUIRED PILE LENGTH (m)			
								Cu = 25 kPa	Cu = 50 kPa	Cu = 100 kPa	Cu = 200 kPa
225 to 375	150	14	9	S80	168.3	146.4	11.0	3.0	2.5	2.0	1.8
450 to 525	225	18	12	S40	273.1	254.6	9.3	4.0	3.2	2.6	2.1
600 to 750	300	18	14	S40	323.9	304.8	9.5	5.0	3.8	3.0	2.4
> 750	CUSTOM DESIGN, TYPICALLY CONSTRUCTED FROM FIBREGLASS, UP TO 400 IN DIAMETER AND UP TO 16m HIGH										

NOTES Regarding Table 402-A:

1. Both induct and educt vents shall be set nominally 2m above the level of adjacent buildings.
2. Where there is no suitable public open space or there are buildings higher than the vent maximum height, consult the Water Agency.
3. SS vent pipe to ASTM312M.
4. Vent diameters given assume total vent pipework (maintenance structure to top of vent) is < 10m long.
5. Where total vent pipework is between 10 and 25m long, upsize underground pipework one size.
6. Where total vent pipework is between 25 and 50m long, upsize underground pipework two sizes.
7. Vent pipework > 50m long requires Water Agency approval.
8. Wind speed of 89 m/s shall be chosen in highly exposed areas.
9. Wind speed of 56 m/s shall be chosen in areas with a high degree of protection (eg: large, high and closely spaced constructions nearby).
10. Erect vent pipe when concrete base is > 25MPa strength.

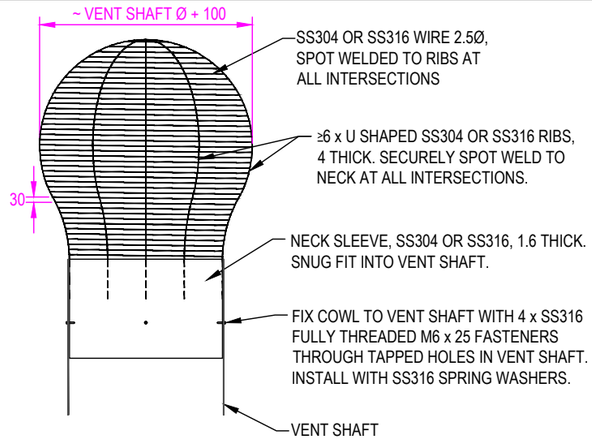

FIGURE 402-F: EDUCT COWL (ELEVATION)

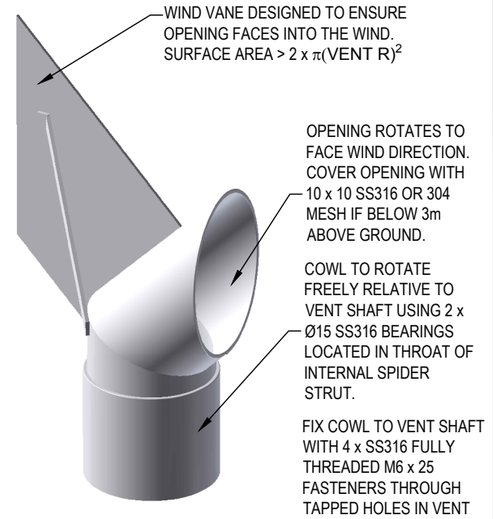

FIGURE 402-G: INDUCT COWL (ISOMETRIC)

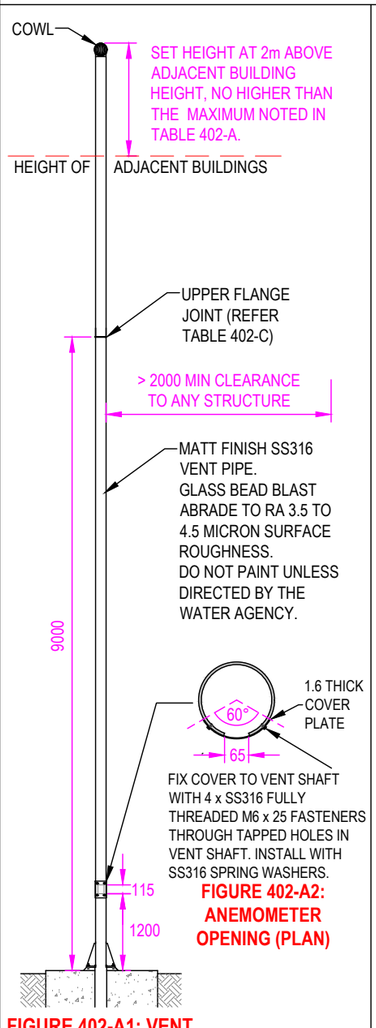

FIGURE 402-A1: VENT SHAFT (ELEVATION)

FIGURE 402-A2: ANEMOMETER OPENING (PLAN)

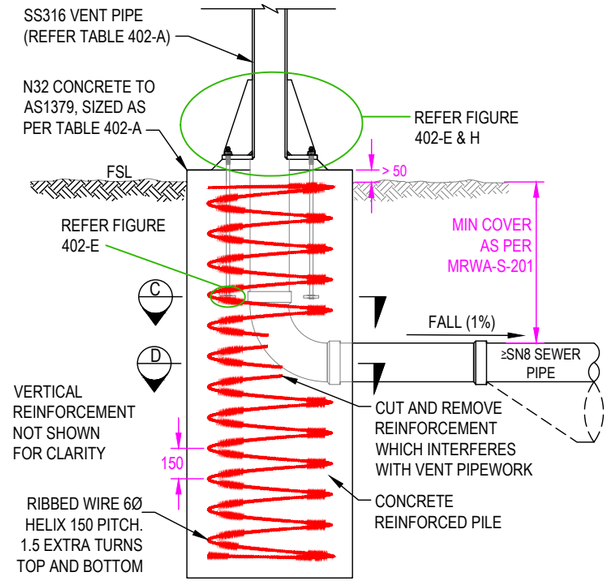

FIGURE 402-B: VENT SHAFT BASE DETAIL (ELEVATION)

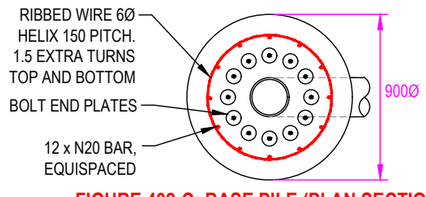

FIGURE 402-C: BASE PILE (PLAN SECTION C)

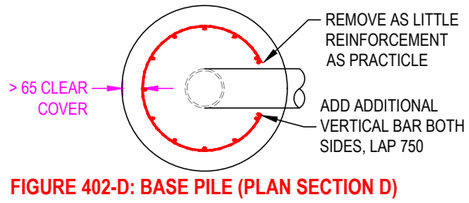

FIGURE 402-D: BASE PILE (PLAN SECTION D)

NOTES Regarding Pile Construction:

1. Concrete and reinforcement as per MRWA-S-309.
2. Place concrete in a single pour.
3. Piles in sloping ground (> 1 in 7) or in ground water require specialist design advice.
4. Piles to be located to avoid existing infrastructure.
5. Determine ground bearing resistance (Cu) in consultation with geotechnical specialist.
6. Pour concrete within 24 hours of excavation.
7. Remove all loose material from excavation prior to placement of concrete.
8. Reinforcement chairs must be sufficiently robust and installed in sufficient number to resist the weight of the reinforcement without depressing into the excavation floor.

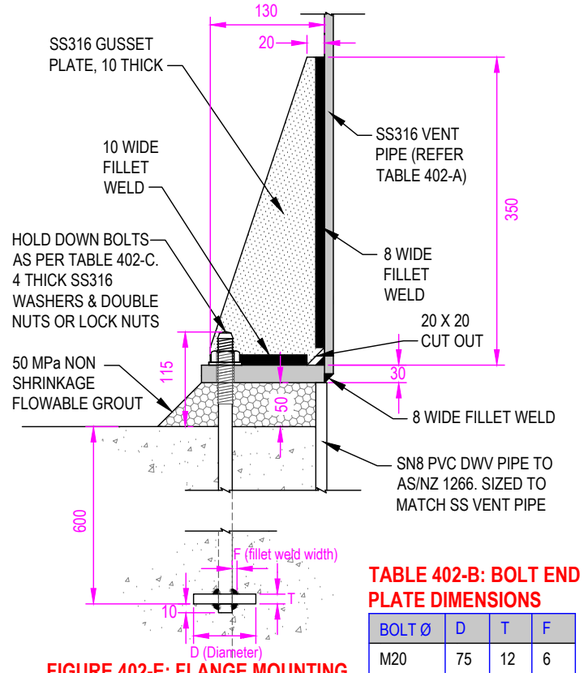

FIGURE 402-E: FLANGE MOUNTING ARRANGEMENT (ELEVATION)

TABLE 402-B: BOLT END PLATE DIMENSIONS

BOLT Ø	D	T	F
M20	75	12	6
M24	125	16	6

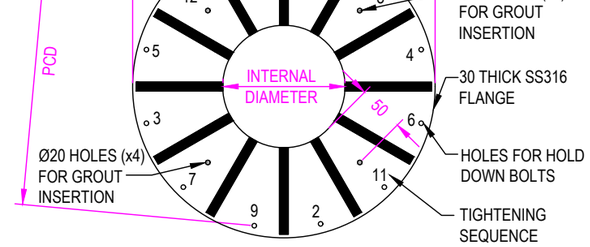

FIGURE 402-H: VENT SHAFT BASE FLANGED SUPPORT
(12 HOLD DOWN BOLTS SHOWN)

TABLE 402-C: VENT FLANGE DETAILS

VENT DIAMETER	PIPE ID	BASE FLANGE					UPPER FLANGE				
		OD	PCD	NO. HOLES	HOLE SIZE	BOLT SIZE	OD	PCD	NO. HOLES	HOLE SIZE	BOLT SIZE
150	170.5	480	400	12	26	M20	280	235	8	18	M16
225	275	580	500	12	30	M24	405	356	8	22	M20
300	325	630	550	16	30	M24	455	406	12	22	M20

NOTES Regarding TABLE 402-C:

1. Fasten lower flange to snug fit.
2. All welds to be factory fabricated to AS1554.6.
3. All bolts to be grade A4 to ISO3506.
4. No stop-start positions of weld within 40 of end of gusset.
5. Hammer peen and weld toe grind all welds after cessation of welding.
6. Install 3 thick EPDM rubber gasket to WSA 109 between upper flange faces.
7. Fasten upper flange as per part turn method or use load indicating washers.
8. Weld upper flanges to vent pipe using 8 wide fillet welds at internal and external seams.

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☒ YVW	K. DAWSON	01/09/15		☒ YVW	J. TOMASI	01/09/15	
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MELBOURNE RETAIL WATER AGENCIES

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MRWA SEWERAGE STANDARDS

VENTS

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TABLE 403-A: WATER SEAL TYPES

SEWERAGE MAIN TYPE	WATER SEAL
DN150 or DN225 PVC DWV	USE VERTICAL LONG RADIUS 22.5° BENDS
DN300 or DN375 PVC DWV	DN300 or DN375 PVC DWV SHORT RADIUS BEND WATER SEALS ARE NOT PERMITTED
PP OR GRP	MITERED 22.5° GRP BENDS R>2.5Ø

NOTES Regarding Water Seals:

1. Water seals shall be designated by the Water Agency in accordance with MRWA-S-401.
2. Water seals require vehicular access. Locate within the road reserve or within open reserves with vehicular access. Do not locate within private land.
3. Whole of sewer line containing the water seal shall be constructed of the same pipeline product (eg: all PP, all GRP).
4. For DN300 and DN375 pipelines, long radius PVC DWV bends (which would be acceptable) are typically not available and therefore PVC DWV would not be an appropriate material for the sewer line and water seals. Instead, the whole sewer from maintenance structure to maintenance structure shall be PP or GRP pipe with 22.5° GRP bends at the water seal bends.
5. Locate water seals adjacent to and as close as possible upstream of maintenance structures at the junction of sewers (ie: within 2000).
6. Embedment around and within 1m of the water seal shall be Type B (cement stabilised). Refer to MRWA-S-202 for details.
7. Bends shall otherwise be as per vertical bend specification within MRWA-S-104B, except where vertical bends are not normally allowed, where 22.5° GRP bends shall be used.

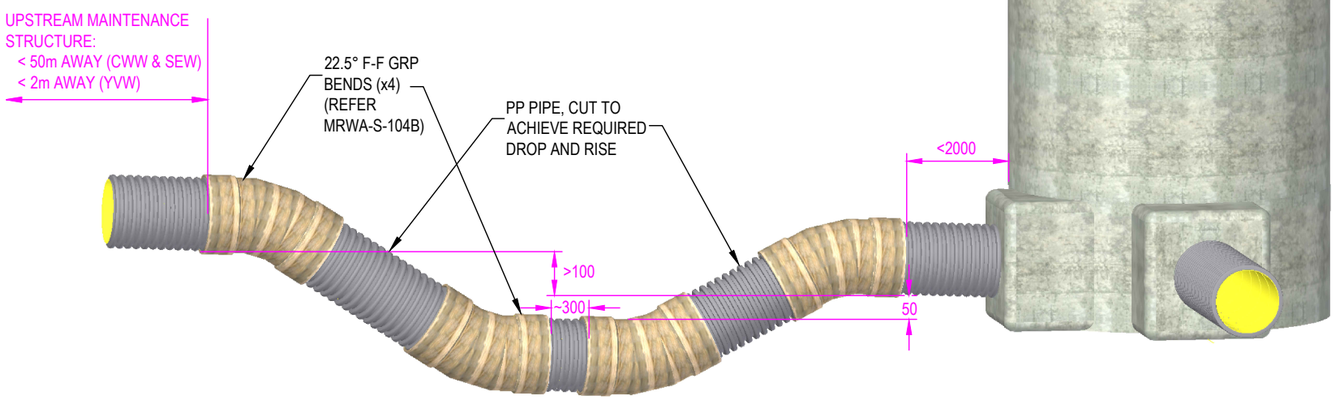

FIGURE 403-A: PP WATER SEAL CONNECTING TO A MAINTENANCE HOLE

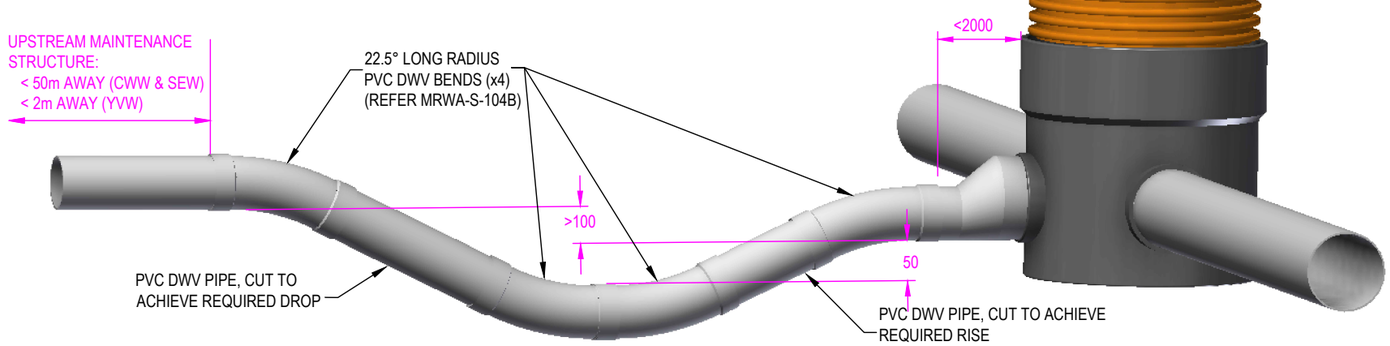

FIGURE 403-B: PVC DWV WATER SEAL CONNECTING TO A MAINTENANCE CHAMBER

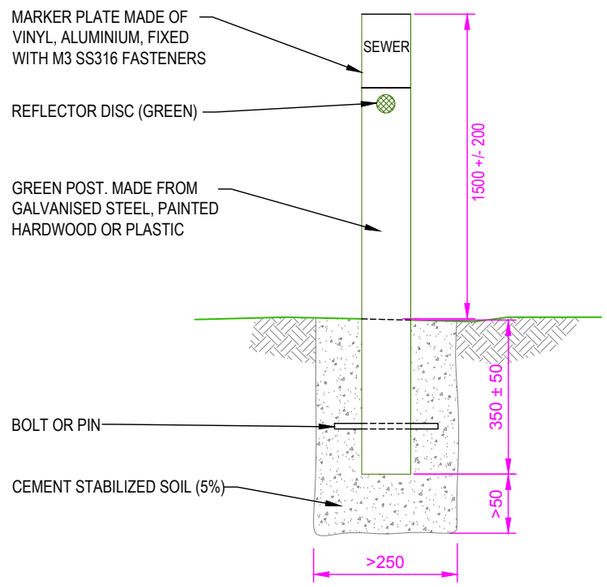

FIGURE 403-C: MARKER POST FOR SEWERS

NOTES Regarding Marker Post:

1. Install marker post where maintenance structures or bends are in public land where there may be:
   1.1. long grass
   1.2. significant vegetation
2. Install 1m from maintenance structures with the marker plate facing towards the structure's cover.

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ALL DIMENSIONS IN mm UNLESS STATED OTHERWISE

	NAME	DATE
DESIGNED:	R. JAGGER	1 JULY 2015
DRAWN:	R. JAGGER	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

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MELBOURNE RETAIL WATER AGENCIES

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MRWA SEWERAGE STANDARDS

WATER SEALS AND MARKER POSTS

NOT TO SCALE

MRWA-S-403

Planning	Design	Construction
	✓ ✓	✓ ✓

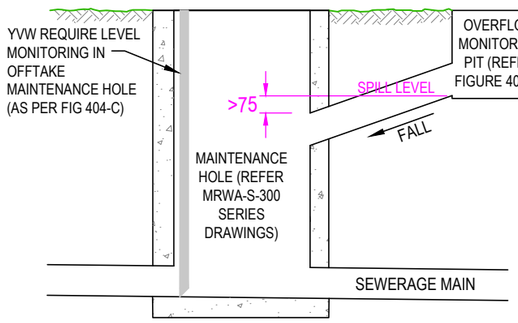

FIGURE 404-A: GENERAL ARRANGEMENT A
(WHERE THERE IS ADEQUATE DISTANCE BETWEEN M.H AND DISCHARGE POINT TO INSTALL BACK FALLING SEWER)

NOTES Regarding ERSs:

1. The Water Agency shall specify the approximate location, spill level and capacity of the overflow.
   The overflow shall be designed to cater for 1 in 100 yr flows (approximately 2 x 1 in 5 yr flows).
2. The designer shall specify the points of connection and the location, type and inverts of pipework and pits.
3. Discharge preferences as follows:
   3.1. Drainage pit
   3.2. Waterway
   3.3. Drainage pipe
4. Where the discharge point and MH is less than 800 apart, consult with the Water Agency about alternative overflow monitoring arrangements.

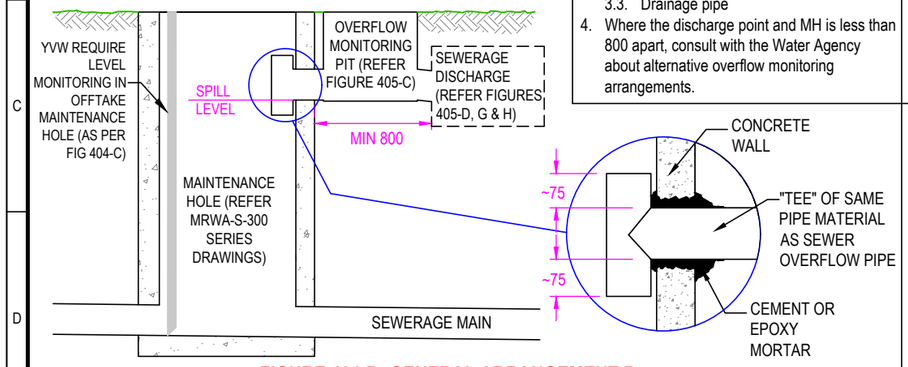

FIGURE 404-B: GENERAL ARRANGEMENT B
(WHERE THERE IS NOT ADEQUATE DISTANCE BETWEEN M.H AND DISCHARGE POINT TO INSTALL BACK FALLING SEWER)

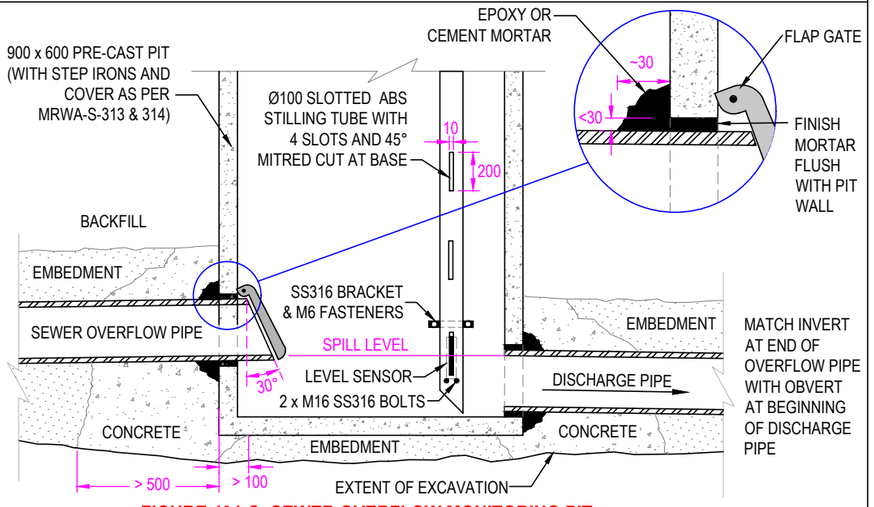

FIGURE 404-C: SEWER OVERFLOW MONITORING PIT

NOTES Regarding Figure 404-C:

1. Support stilling tube with brackets top and bottom.
   Add centrally to maintain no more than 1.5m spacing between brackets.
2. Locate stilling tube 100 from vertical alignment of step irons.
3. Above ground electrical and telemetry connections and level sensor as per Water Agency requirements.
4. Flap gate not required in overflow monitoring pit where discharge is to waterway as per Figure 405-D.
5. Initially, locate pre-cast pit on an undersized bed of compacted embedment material to enable concrete to later support the underside perimeter of the pit.

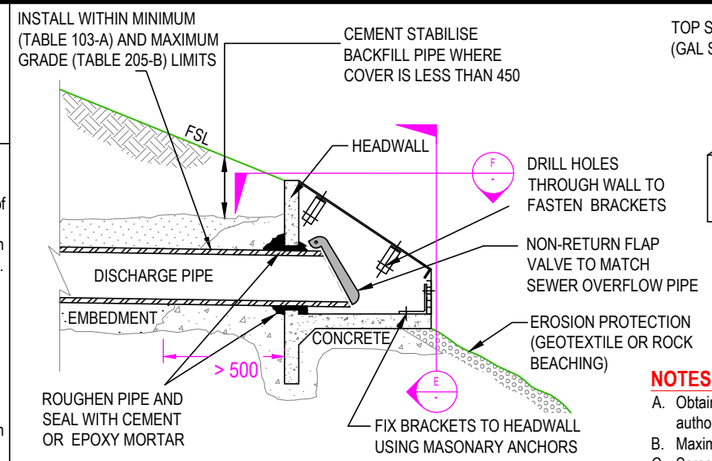

FIGURE 404-D: SEWER OVERFLOW TO WATERWAY

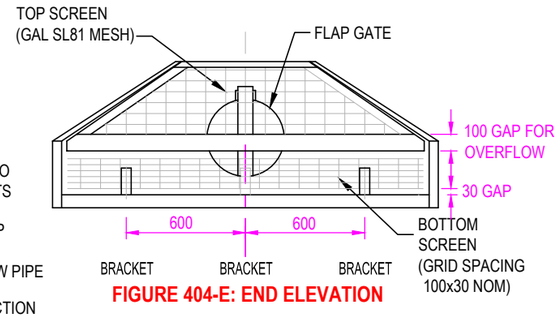

FIGURE 404-E: END ELEVATION

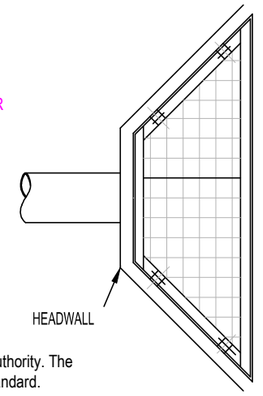

FIGURE 404-F: SECTIONAL PLAN

NOTES Regarding Figures 404-D, E & F:

A. Obtain approval for and conditions of connection to the waterway from the relevant authority. The authorities' conditions shall take precedence over any conditions stated within this standard.
B. Maximise the height of the discharge point within embankment of the waterway.
C. Screens and brackets to be hot dipped galvanised mild steel or stainless steel min grade 316.
D. Fasteners and masonry anchors to be 316 stainless steel.

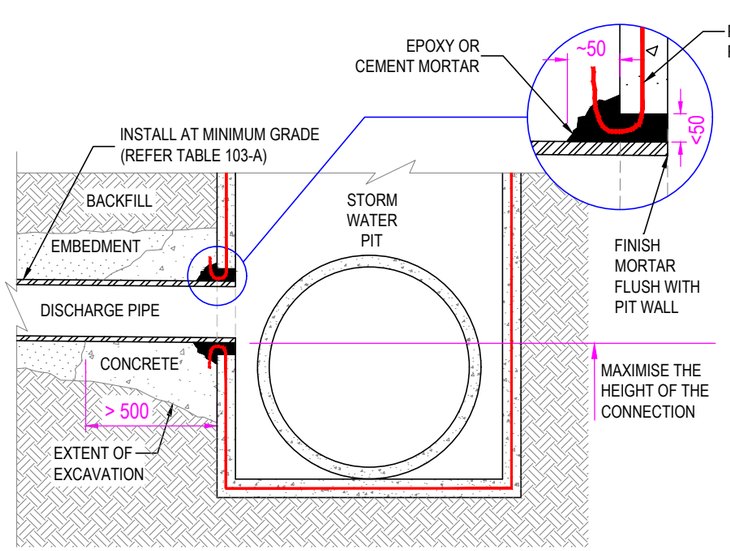

FIGURE 404-G: SEWER OVERFLOW TO STORM WATER PIT CONNECTION

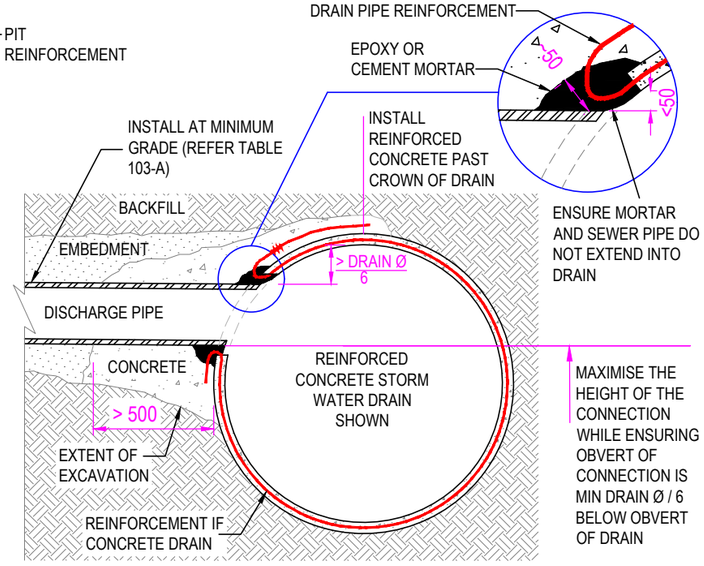

FIGURE 404-H: SEWER OVERFLOW TO STORM WATER DRAIN CONNECTION

NOTES Regarding Figure 404-G & H:

1. Obtain approval for and conditions of connection to the storm water system from the drainage authority. The drainage authorities conditions shall take precedence over any conditions stated within this standard.
   (eg: refer Melbourne Water drawing 7251/8/307 for their requirements).
2. Diameter of sewer overflow pipe must be less than half the diameter of any existing drain.
3. Connect the sewer pipe to the storm water drain or pit at between 45° and 90° of the upstream alignment of the drain.
4. Construct as follows:
   4.1. Do not undertake works during or shortly after wet weather events where the water level in the storm water drain may approach the level of the cut out.
   4.2. Mark the centre of the hole to be cut, ensuring the connection is as high as possible (while not connecting within Drain Ø/6 of the crown of a drain).
   4.3. For connections into R.C drainage pipe or pits, carefully break through concrete, keeping the reinforcement intact and minimising the overbreak (to < 50).
   Cut any reinforcement centrally and bend bars back and into the space to be concrete encased.
   For larger drains, fix additional reinforcement bars above the drain to beyond the crown of the drain.
   4.4. For connections into plastic / GRP drainage pipe, machine core a hole through the drain no more than 20 greater in diameter than the outside diameter of the sewer overflow pipe.
   4.5. Profile the end of the sewer overflow pipe so that it matches the curvature of the storm water drain / pit at that location.
   4.6. Using a suitable adhesive, "sand" the end of the sewer overflow pipe to ensure this pipe bonds adequately to the drainage pipe or pit. Wait until the bonding agent has satisfactorily set.
   4.7. Draw a witness mark on the sewer overflow pipe, set back the thickness of the storm water pit (if connecting to pit) or the thickness of the pipe - 10 (if connecting to a pipe).
   4.8. Insert the sewer overflow pipe into the cut out to the witness mark.
   It is essential that the overflow pipe does not over extend into the storm water drain.
   4.9. Epoxy or cement mortar fill the gap around pipe penetration and produce a fillet 50 (in radius) around the outside of the join.
   Finish the inside mortar from within the pit or drain if practicable to ensure a clean inside finish.
   4.10. Embed the joint in concrete to a minimum 500 back from joint.
   Ensure minimum 65 clear cover of reinforcement is achieved.
   4.11. Bed and backfill as per MRWA-S-201 & 202 after concrete has set (ie: min 24 hours after placement).

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MRWA SEWERAGE STANDARDS

EMERGENCY RELIEF STRUCTURES

NOT TO SCALE

MRWA-S-404

Planning	Design	Construction
✓	✓	✓ ✓