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PART 5 : WASTEWATER DRAINAGE

5.1 INTRODUCTION

This Manual sets out the basic design principles for drainage of wastewater. While some construction information is included for completeness, detailed information on construction standards can be found in the Council Standard Specifications (Volume 3).

5.2 GENERAL

All lots shall be provided with a single connection to a wastewater drainage system. Council does not permit lots to be served by multiple connections.

The wastewater drainage system shall be designed to serve the whole of the natural upstream catchment area. The flow from all portions of the upper catchment within the city boundary shall be calculated assuming complete urbanisation (excluding reserves).

The system shall have a design life of not less than 100 years for in-ground pipeline components.

Designers are to confirm with Council the specific requirements for each subdivision, including such information as areas of catchment to be either included or excluded in any design calculation. This will be particularly important where further subdivision, upstream of the one under consideration, is provided for in the district or regional planning scheme. In these cases the wastewater network is to be constructed to the upstream boundaries of the subdivision development.

For general wastewater design requirements in participating districts refer to Volume 5, Part 4.

5.3 STANDARDS

The list of Standards specified in Clause 4.3.2 shall also be applicable to this Part of the Manual.

5.4 CALCULATION OF FLOWS

A statement is to be submitted with each plan to show that the design of the wastewater network has been calculated to meet the projected flows of the area under consideration. The designer shall consider the appropriate allowances for growth and clearly define any assumptions or basis for design inputs.

The pipe system shall be designed to ensure that the system is self cleaning and that the pipe gradients are such that the velocity at peak daily flow meets this requirement.

Design should be in accordance with the information given in Figure 5.1.(see also Section 5.7 Pipeline Minimum Grade Guideline.)

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Figure 5.1 — Design Data

Calculation Of Flows

2.1 Domestic wastewater flows are a function of water consumption, ground water infiltration and surface water ingress and shall be calculated as follows:

2.2 The wastewater flow is calculated as the product of the water consumption, the peaking factor, and the population equivalent of the area being served.

The water consumption for Hamilton is 200 litres per person per day.

The variable peaking factor dependent on population density for residential areas is determined from Figure 5.2.

The following equivalent population densities per hectare should be adopted in the absence of specific supportable design data:

- Urban = 45 persons per hectare
- Commercial = 30 persons per hectare (except central business area)

Other establishments should be treated as follows:-

- Primary Schools = equivalent to 45 persons
- Secondary Schools = equivalent to 150 persons
- Hospitals = equivalent to 3.5 persons/bed
- Boarding houses/motels = equivalent to 0.6 persons/bed

2.3 The infiltration allowance is 2250 litres per hectare per day.

2.4 The surface water ingress allowance is 16500 litres per hectare per day.

2.5 The Average Daily Flow is calculated as the sum of the infiltration allowance and the daily wastewater flow (product of water consumption and the population equivalent).

2.6 The Peak Daily Flow is calculated as the sum of 2.2 and 2.3.

2.7 The Peak Wet Weather Flow is calculated as the sum of 2.2, 2.3 and 2.4.

Industrial Domestic Flow and Trade Waste

2.8 Where the industrial domestic waste and trade waste flows from a particular industry are known, these shall be used as the basis for the wastewater design. When this information is not available, then flows shall be calculated as above, except that the industrial peaking factor shall be used as shown on Figure 5.2 and the equivalent population density shall be 45 persons per hectare.

2.9 Provision for liquid trade wastes and 'wet' industries shall be considered and provided for by the design.

2.10 Peak Daily and Peak Wet Weather flows shall be calculated as in 2.6 and 2.7.

The Hydraulic Design of Pipelines

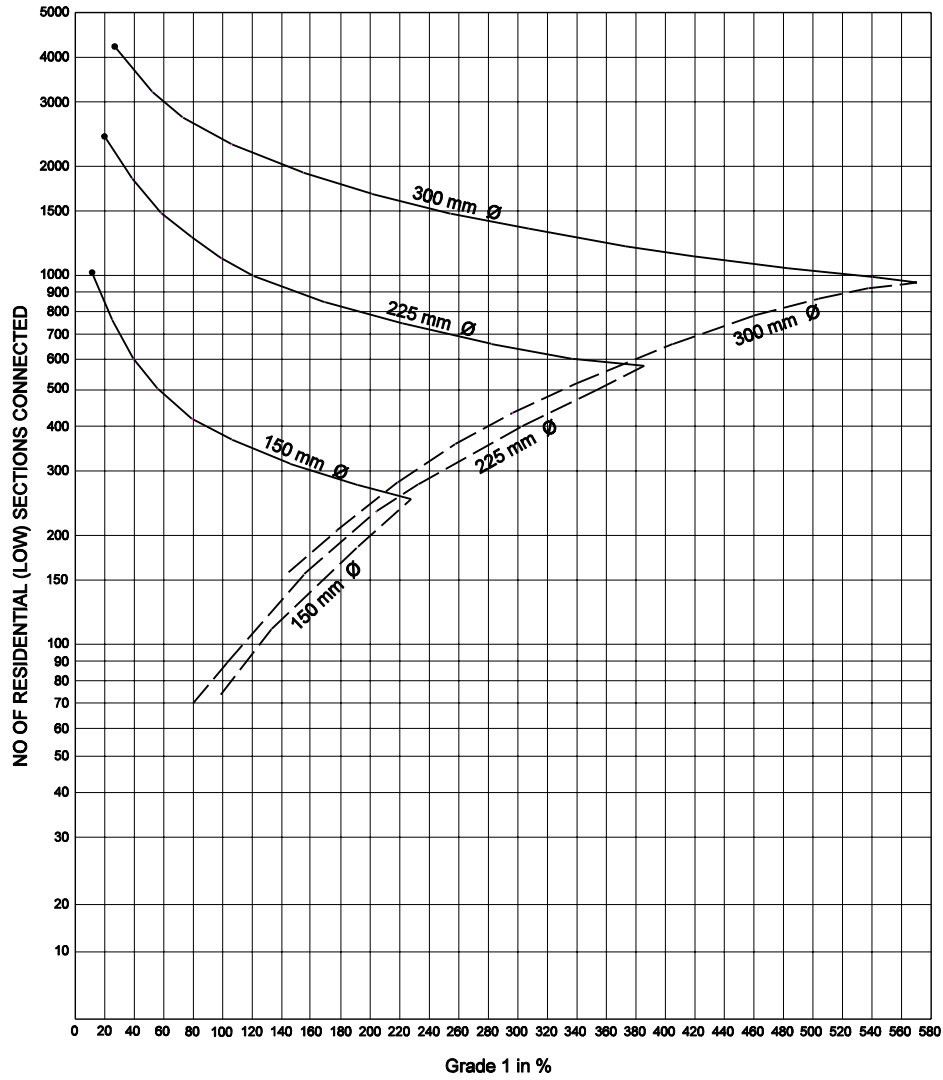
2.11 All wastewater pipelines shall be designed such that they have sufficient capacity to cater for the design wet weather flow from the area they serve without surcharge and that on at least one occasion every day a minimum velocity for solids re-suspension (self cleaning) is achieved. The minimum velocity for self cleaning at peak daily flow will be deemed to be 0.6 m/s.

2.12 The capacity and velocity of flow in wastewater pipelines shall be determined by using the Colebrook White formula with a roughness coefficient (k) of 1.5mm as shown in Figure 4.5.

Figure 5.3 can be used as a check of the design so that if the operational point falls within the appropriate envelope, then the pipeline will have adequate capacity for peak wet weather flows and achieve a self cleaning velocity at least once every day.

**Figure 5.2
Wastewater Peaking Factors**

Population Equivalent for Catchment or Sub-catchment Area	Wastewater Peaking Factor	
	Residential	Commercial
10	14	13
15	12	11
20	10	9.5
25	9.1	8.5
30	8.5	8.0
35	8.0	7.5
40	7.5	7.2
45	7.0	6.9
50	6.8	6.3
55	6.7	6.0
60	6.3	5.7
65	6.2	5.5
70	6.0	5.4
75	5.9	5.3
80	5.8	5.1
90	5.5	5.0
100	5.3	4.8
125	5.0	4.2
150	4.8	4.0
175	4.4	3.8
200	4.1	3.7
250	4.0	3.5
300	3.8	3.3
350	3.7	3.1
400	3.5	3.0
450	3.4	2.9
500	3.3	2.8
600	3.2	2.7
700	3.2	2.6
800	3.1	2.55
900	3.0	2.5
1000	3.0	2.4
1500	2.9	2.2
2000	2.8	2.1
2500	2.8	2.0
3000	2.7	1.9
3500	2.6	1.85



KEY:
 Minimum Grade - - - - -
 Minimum Capacity —————
 Minimum Velocity •

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FIG 5.3

Path: g:\hccmap\standards\Technical Spec\Design Guide\dwgs.dgn

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5.5 LOCATION OF PIPELINES

- a) Wastewater pipelines within **RESIDENTIAL ZONES** shall normally be within the road reserve except where the properties served are below road level.
- b) Wastewater pipelines in **INDUSTRIAL ZONES** shall either be in the road reserve or in the front yard area.
- c) Wastewater networks (and connections) in **COMMERCIAL ZONES** shall be either in the rear service lane or at the rear of properties to be served where no service lane exists. The major reticulation and trunk lines, however, shall be in the road reserve (as for Residential Zones).

Where the pipelines are in the road reserve they shall conform to the standard location of underground services and shall be sited within the carriageway, normally 2m from the kerb. Where the offset from the kerb varies due to curves in the street, the manholes shall be located 2m out from the kerb.

Where a wastewater pipeline changes location within a street, it shall do so at an angle of 45 degrees or greater. Where a wastewater pipeline crosses other utility services, it shall do so at an angle of 45 degrees or greater.

On the limited occasions where a wastewater pipeline is within a property, it is required to be parallel to and within 0.5-1.0 m (preferably 0.75 m) from a boundary so as not to reduce the building area available. On sloping ground, the wastewater pipeline should be within the property of the higher land (to avoid conflict with excavation levelling of the lower property).

Where Section 221 Resource Management Act 1991 applies... a consent notice shall be registered on the Certificate of Title of any allotment having a Council owned pipeline crossing the property. The consent notice shall advise that a public stormwater or wastewater (as appropriate) pipeline crosses under the property and conditions will be placed on any building consent for a structure over the pipeline.

Manhole structures shall be clear of all boundary lines by at least 1.5 metres to the centre.

Where the pipeline gradients are greater than 1 in 5, it is expected that anchor and/or anti-scour blocks shall be constructed of a type comparable to that illustrated in Drawing TS405 (Volume 3).

No new private drains shall pass between one lot and another. If crossing of private property is unavoidable, those parts of the pipeline serving more than one lot shall be Council mains with service connections to the property boundaries.

Where Council pipes pass through private property, refer to Clause 5.10.2.

Pipe location for works under all consents should facilitate future fee-simple subdivision.

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5.6 PIPES

Acceptable pipeline products that may be used for wastewater pipe work are listed in Section A of the Drainage Standard Technical Specification (Volume 3 of this Manual).

Where concrete-lined steel pipes are included in the design, these shall be as specified in the Water Technical Specification (Volume 3 of this Manual).

Concrete pipes intended for wastewater applications shall be manufactured using a sulphate resistant concrete mix and, in addition to the standard thickness of concrete mix around steel reinforcing, the pipes shall have a 25 mm thick internal sacrificial lining of concrete mix. This reduced internal diameter shall be taken into account when determining the flow capacity of concrete pipes.

uPVC wastewater pipe may be used for pipe sizes ranging from 100mm to and including 375mm nominal diameter. The pipes and fittings shall comply with AS/NZS 1260:2002. Stiffness class SN16 pipes shall be specified in all cases.

For a list of pipe materials suitable for use in participating districts and gradient requirements, refer to Volume 5, Part 5.

5.7 PIPELINE MINIMUM GRADE GUIDELINE

Section 5.4 "Calculation of Flows" does not lend itself to determining the grade applicable to pipelines draining upper parts of a catchment. Council experience is that the minimum gradients shown in the following table provide satisfactory flow conditions for **150NB Pipe in both general soils and peat soils (those with greater than 300 mm of peat between 0.5 and 4.0m depth of the natural ground surface)**.

Where the depth of soil exceeds 2.0 metres then specific design is required.

Houses	Population	General Minimum Grade	Peat soil Grades	
3-4*	7-10	1:100	1.0%	1:60
5-8	12-20	1:120	0.83%	1:80
9-18	22-45	1:150	0.67%	1:80
More than 18	45 and above	1:200	0.50%	1:80

*see also the guidelines for service connections Section 5.13

5.8 JOINTS

Specification of joints shall be as follows:

- All pipes shall normally have flexible joints of an approved type, such as RRJ.
- Steel pipes shall be flexibly jointed (gibault or approved rubber ring).
- Solvent cement joints shall only be used for PVC if specifically required by Council.
- Joints shall be provided adjacent to manholes to the requirements of AS/NZS 2566 with the exception of PVC where proprietary connections may be used.

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- All joints are to be designed and constructed to remain fully watertight for the design life (100 years) of the pipe network.

5.9 STRUCTURAL STRENGTH OF PIPES AND BEDDING

Pipe bedding will be designed to meet the requirements of the class of pipe used under the design loading conditions set out in the manufacturer's specifications.

5.10 PIPELINE CONSTRUCTION

The construction of the pipelines shall be carried out in accordance with the requirements of Standard Technical Specification (Volume 3 of this Manual).

5.10.1 GENERAL

Pipes acceptable for use in stormwater drainage work in Hamilton are listed in the council Standard Technical Specifications for Stormwater and Wastewater Sewers.

5.10.2 Requirements for Building Near or over Drainage Pipelines.

5.10.2.1 No structural loads are to be placed on public drainage pipelines.

- The first row of piles must be at least 1m clear of the outside of the pipe and down to a depth of at least 1m below the invert of the pipe.
- Subsequent rows of piles must be constructed to a depth of at least 1m below the 45 degree influence line from the pipe invert.
- All structural loads on piles shall be absorbed outside the 45 degree envelope and below the pipe invert level of the first row of pipes.

5.10.2.2 No pile ramming is permitted within 5m from the sewer centre line, or within the 45 degree envelope (piles within 5m must be drilled).

5.10.2.3 The building or other work must be designed and constructed so that the sewer and trench line is not adversely affected by any future excavation necessary for maintenance of the sewer.

5.10.2.4 The structure must allow for settlement of the sewer trench line and backfill.

5.10.2.5 Drawings of the proposed works must accurately identify the location of the drainage pipeline affected and the distances with cross section details for all structures, footings or piles within the 45 degree line.

5.10.2.6 Buildings are not permitted to be located over connections to pipes or manholes.

5.10.2.7 Pipes to be built over shall be jetted and CCTV'd before and after construction work.

These requirements are shown in Figure TS 410.

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5.11 MINIMUM COVER OVER PIPES

5.11.1 General

All pipelines other than those in private property shall be specifically designed to support the likely loading in relation to the minimum cover to be provided in accordance with the terms of NZS 3725. The minimum cover for all types of pipes (other than those in private property) under all conditions, shall be 600mm.

5.11.2 Private Property

The minimum cover over unreinforced Council pipes in private property shall be 500mm. Where, due to the topography, this cover cannot be provided, the pipeline shall be protected. Specific design information will be required.

Where the reticulation lines are located in the front yard of lots, the invert level shall be deep enough so as not to interfere with any future development such as driveway construction.

5.11.3 Under Carriageways

Where pipes are designed below carriageway, they shall be specifically designed to support the pavement design loading appropriate to the minimum cover to be provided at both subgrade and finished level.

5.11.4 Private Pipes

The depth of cover of private pipes is dealt with under the Building Act, 2004 and overseen by the Council Building Control Unit.

5.12 MANHOLES

5.12.1 General

Manholes shall be located away from areas likely to pond water and away from potential building sites. They are to be designed and constructed to exclude groundwater for the life of the network.

Manholes up to 2400mm deep shall be constructed using a single riser with a pre-cast external flange base. Manholes in excess of 2400mm deep shall be constructed using a 2400mm long pre-cast riser with external flange base and then completed to final ground level using no more than a single riser for manholes up to 5.0m deep. Three risers are allowable for manholes in excess of 5.0m depth.

In no case shall a series of short risers be permitted.

Manholes shall be a minimum of 1050mm diameter for depths of 1.0m or more. Manholes of 750 mm diameter may be used for depths less than 1.0m (typically infill situation).

Manholes on pipelines less than 300mm diameter shall be provided at each change of direction or gradient, and at each branching pipe, and at a spacing of not more than 100m.

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Manholes in pipelines 300mm diameter and over may have the spacing increased with the specific approval of Council.

For infill developments, manholes shall not be required for a 150mm connection on a 150mm pipeline where a manhole is provided immediately inside the property being served and another manhole exists within 100 metres on the existing pipe and these provide adequate accessibility without needing another manhole.

For specific requirements relating to manholes in participating districts, refer to Volume 5, Part 5.

5.12.2 Standard Manholes

These are to be circular manholes with a minimum internal diameter of 1050mm (refer Drawing No. TS40?) and are to be used on pipelines up to and including 600 mm diameter. Manhole steps shall be provided in accordance with Standard Technical Specification (Volume 3 of this Manual).

5.12.3 Specific Design Manholes

Where manholes are more than 5.0m deep they shall be specifically designed (wall strength, foundation support and adequate ballast to resist buoyancy).

Where a manhole is to be constructed in soft ground, the area under the manhole shall be undercut down to solid and backfilled with suitable hard fill to provide an adequate foundation for the manhole base. Where undercutting exceeds 1.5m, a special design will be required.

5.12.4 Hydraulic flow in Manholes

In addition to the normal pipeline gradient, all manholes for pipelines less than 1 metre in diameter shall have a minimum drop of 20mm plus 5mm per 10 degrees of the angle of change of flow within the manhole.

In addition to the normal pipeline gradient, all manholes on pipelines greater than 1 metre in diameter shall have the drop through the manhole designed to a minimum of 20mm plus compensation for the energy lost due to the flow through the manhole at the deviation angle (see Volume 2 Part 4 Figure 4.1, Clause 2.3).

The construction tolerance for drop through the manhole shall be;
 Constructed Manhole Drop = Manhole Drop (as calculated above) + 5 mm — 0 mm.

5.13 CONNECTIONS

5.13.1 General

A single connection provided at the boundary of each lot shall be of a type capable of taking an approved pipe of 100mm nominal diameter, unless a larger size is required by design. Council does not permit lots to be served by multiple connections.

Each connection shall be capable of serving the whole of the lot by gravity. This requirement shall allow adequately graded drains within the lot, together with the depth

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required for gully traps. The standard depth of a new connection at the boundary is 1.2m (range 0.9 — 1.5 metres). Note: Private wastewater pumps will not be approved where gravity discharge is feasible.

In laying 'greenfield' service connections which are capped pending connection of house drainage (refer drawing TS404) the maximum depth at the end of the service connection pipe shall be 1.5 metres. Sections which slope away from the drainage direction may require a service connection which is deeper than 1.5m at the boundary in order to comply with the requirement to drain the whole of the lot. In such cases the service pipe shall be extended into the property on grade and to the extent that its end cap is no deeper than 1.5metres. Note the service pipe needs to be located near the boundary or within a right of way in order to avoid conflict with possible building locations. This detail shall be shown on construction plans.

Where the wastewater pipe is outside the lot to be served by it, the connection shall be extended to the boundary of the lot.

If the above conditions cannot be met, then contact Council for further advice.

Drop connections at manholes shall be designed as external connections in a manner similar to the illustrations in Drawing TS400. Internal drops shall only be used where manhole diameters are 1200mm or greater.

All connections, which are to be made directly to the line, shall be designed using a factory manufactured "wye" or "London Junction" and shall be watertight.

Service connections shall generally enter each lot from the road frontage. Where a property has no road frontage, pipes are located within that property's legal access (right of way).

Where feasible:

- Private pipes will cross property boundaries;
- Existing private connections crossing boundaries shall be replaced by a public connection;
- Existing private pipe work will not usually be acceptable for vesting to Council.

The standard size and material for single lot domestic connections is 100mm RRJ SN16 uPVC.

5.13.2 Infill Developments

Connection proposals for infill developments shall be fully documented with regard to depth to invert, pipe size and distances to boundaries. (Where Council records are not available, applicants must determine the details of existing connections).

Any private pipe work needs a Drainage Consent from Council's Building Control Unit.

All connections and disconnections of Council services to the property boundary are undertaken by a Council approved Contractor.

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5.14 REQUIREMENTS FOR SERVICE PIPE SIZE AND ALIGNMENT

- For 1 to 4 dwellings a 100mm nominal bore service pipeline is adequate.
- For 5 or 6 dwellings the capacity of a 100mm nominal bore service is only adequate if installed at a grade 1:60 or steeper.
- The service pipeline shall be laid to a public drain as a straight pipeline between boundary inspection fitting and manhole, or between boundary inspection fitting and a wye connection on the wastewater main, or between a boundary inspection fitting and a wye connection on a service pipeline conforming to either of the previously listed variations.
- The minimum acceptable grade is 1:80 (preferred grade 1:60).
- It shall be no longer than 50 metres.
- It must comply generally with the in-roadway alignment guideline, ie where a wastewater pipeline changes location within a street, it shall do so at an angle of 45 degrees or greater. Where a wastewater pipeline crosses other utility services, it shall do so at an angle of 45 degrees or greater.

More than 6 dwellings (also suitable for 3 or more dwellings) — requires the capacity of a 150mm nominal bore pipeline. (Refer Vol 2, Part 5, Clause 5.7).

5.15 RAMPED RISERS

Unless required otherwise by the Engineer, a ramped riser shall be constructed to bring the connection to within 0.9-1.5 metres of ground level, or to such depth that will permit a gravity connection to service the whole lot.

Ramped risers shall constructed as shown in Council Drawing TS 404.

5.16 CONNECTION TO TRUNK AND INTERCEPTOR PIPELINES

Connections to wastewater interceptor pipelines shall only occur at manholes.

Connections to wastewater trunk pipelines shall be preferably at manholes, or alternatively, and only with specific approval of Council, utilizing factory fabricated 'wye' junctions in pipelines of PVC or vitrified clay materials.

For specific requirements relating to wastewater connections in participating districts, refer to Volume 5, Part 5.

5.17 CONNECTIONS TO DEEP LINES

Where an existing or proposed sewer is more than 5m deep to the top of the pipe, or where required by the ground conditions, the connection shall be designed as a manhole constructed on the deep line and a shallower branch sewer shall be laid from the manhole.

5.18 TESTING

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All wastewater mains and branch pipelines, including extended connections, shall be pre-tested during construction. On completion of all other engineering work within the subdivision, there shall be a final test conducted. Test requirements are set out in Volume 3, Part 4, Section 16.

For specific testing requirements in participating districts refer to Volume 5, Part 5.

5.19 PUMPING STATIONS

For specific pump station requirements in participating districts refer to Volume 5, Part 5.

5.19.1 General

All equipment and/or components used for similar functions and purposes must be of the same design, make or model for ease of operation and maintenance. This includes new pumping stations. The requirements for the design of new pumping stations are detailed on Drawing No. TS503, and must be in accordance with the Council Standard Technical Specifications (Volume 3).

Calculations shall be submitted in a similar format as that shown in Checklist 5.1 of Volume 2, Part 5.

5.19.2 Structural Stability

The pump station wet well shall be designed to have negative or zero buoyancy. Ground water level shall be assumed to be at ground level unless an actual level is established by geotechnical investigation. The mass of the wet-well structure included in the stability analysis shall not include the associated mechanical and electrical components of the pump station. Nor can the soil friction forces of backfill around the wet well chamber be taken into account. Any additional weight needed shall be added in the form of mass concrete in the bottom of the chamber as indicated in drawing number TS503 and TS504. The pump station drawings shall provide dimensions of the extent of mass concrete needed to counter buoyancy of the chamber.

5.19.3 Pumps, Rising Main, Delivery Point and Overflow

Pumps shall be Flygt MT pumps (medium head performance range) models CP or NP versions 3085, 3102, 3127 or 3152 or Homa equivalent for the 3152 models.

The pumping range shall be selected to give between 1 and 15 starts per hour at peak daily flow.

The pump system shall be an N + 1 system where N pumps are required for duty and a standby pump identical to the duty pumps shall be installed.

Exceptions to the duty plus one standby pump requirement can be made in small installations serving no more than 12 residential dwellings. The typical arrangement of these single-pump type pump stations is shown in Drawing No. TS504. In such installations the wet well shall be designed to have a minimum storage capacity sufficient to contain 12 hours of the catchment's Average Daily Flow.

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The rising main will be a minimum size of 80mm and designed such that the minimum velocity, with one pump operating, is one metre per second and the maximum velocity, with all duty pumps operating, is three metres per second.

The point at which the pumping station is connected to the City system will be governed by the capacity of the network downstream from that point.

The emergency overflow pipeline shall be of sufficient capacity to carry peak wet weather flow from the station without surcharge. The inlet to the overflow pipe shall be baffled to restrict the entry of solid floatable material. This can normally be done using a 90 degree downturn bend.

The overflow pipe shall be from the pump station chamber to the nearest stormwater system. A backflow device shall be fitted where there is potential for stormwater to backflow into the pump well.

The upstream impacts of a pump station overflow shall be checked to ensure no overflow occurs elsewhere.

5.19.4 Pump Chamber, Valve Chamber and Manifolding

The layout of the pumping chamber, valve chamber and pipe work shall be similar to that shown on Drawing TS503 (Volume 3). The valve chamber shall be attached to the pumping chamber. Where the delivery point is within close proximity to the pumping station the valve chamber may be dispensed with and a separate rising main from each pump laid to the delivery point.

The floor of the pumping station shall be set at such a level below the inlet pipe so that the inlet pipe will not surcharge during the normal pump operation cycle.

The floor shall be designed to be of sufficient thickness to ensure that the pump station cannot become buoyant with groundwater at ground level and in any case not less than 600mm thick.

Other specific requirements for standard Council pump stations are covered by the Standard Technical Specifications (Volume 3).

5.19.5 Pump Station Storage

Pump stations shall provide for wastewater storage in the event of pump failure, control malfunction, electricity outage etc.

A minimum of six hours storage at Average Daily Flow, shall be provided before emergency overflow occurs. For pump stations having just one pump, 12 hours storage at Average daily Flow shall be provided before emergency flow occurs. The required storage volume shall be provided in the volume of the wet well, plus any additional ancillary storage chambers, plus the volume of pipelines (below overflow level) draining to the facility. The wet well volume below pump switch off level shall be excluded from the calculation of available storage volume.

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If necessary the required storage capacity can be obtained through use of an associated storage chamber constructed as an adjacent manhole haunched and connected to the wet well so as to completely drain into the wet well before the pump shuts off on the pump out cycle.

Preferably the storage volume shall be provided in the pumping wet well structure and upstream pipelines. Where this is impractical, additional storage can be provided in an additional manhole type structure adjoining the wet well. Or if this configuration is impractical, the storage shall be provided in a horizontal chamber made from large pipes. Standard configuration and details are in preparation (in the interim refer to Council for assistance).

5.19.6 Water Supply

A standard 630D MDPE pipeline as used for water supply rider mains (Volume 3 Part 6 Section D Installation of MDPE Pipelines) shall be provided to the pump station. Wastewater pump stations are a "High Hazard" risk requiring reduced pressure zone type backflow prevention devices installed above ground level (refer BIA Acceptable Solution G12/AS1 and AS.NZS2845.1). The backflow prevention device is to be positioned adjacent to the electrical control cabinet as shown on drawing No.TS507.

5.19.7 Access

A permanent concrete all-weather vehicle access shall be provided to the pump station to allow maintenance vehicles to access wet wells.

5.20 RISING MAINS

Rising mains shall meet the requirements for pressure mains. Rising mains in private property shall be located clear of building sites and the alignment protected by 'Easement in Gross'. The test pressure shall be at least twice the maximum working pressure and the final test must be witnessed by Council.

Only polyethylene pipe may be used for wastewater rising mains. (Refer Vol 3 Part 5 Section A: Acceptable Fittings and Materials)

Air relief valves shall be fitted as necessary and/or as required by Council.

5.21 COMMISSIONING TEST — PUMP STATIONS

All pumping stations shall undergo a commissioning test witnessed by Council. A minimum of 24 hours notice shall be given prior to the test taking place.

See Volume 3 Part 5 Section C of this Manual for as-built requirements.