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PART 4 : STORMWATER DRAINAGE

4.1 INTRODUCTION

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

4.2 GENERAL

All lots shall be provided with a means of stormwater drainage at or within the lot boundary. The stormwater system shall provide for the collection and discharge of all stormwater within the land being developed, together with drainage from the entire catchment upstream of the proposed system.

The design intent is to incorporate natural environment-based systems within new works. A natural environment-focussed stormwater system may include features such as groundwater recharge, overland flow, open drains, storm peak mitigation through lake and wetland systems. Key objectives are:

- to minimise the amount of stormwater entering the piped drainage system;
- facilitate groundwater recharge;
- cover the immediate needs as well as those of foreseeable future developments;
- avoid detrimental effects on downstream properties; and
- to build infrastructure that minimises lifecycle costs.

4.2.1 Definitions

Design Level of Service refers to Councils design for capacity (expressed as an average Storm return period) for the stormwater reticulation and this is dependant on the zoning of land services by the reticulation.

Groundwater Drainage refers to any subsoil drainage system as designed by respective landowners. Subsoil drainage systems are permitted to discharge into land drainage systems provided they prevent any transport of fine sediment. Ground water drainage systems remain the responsibility of the landowners.

Infill Development refers to redevelopment of urban land through either subdivision or Building Consent.

Land Drainage System refers to the flow of stormwater and groundwater but concentrates mainly on peak surface discharges and their reticulation under urban conditions.

Primary Design Flow is the estimated runoff selected to provide a reasonable degree of protection to the surrounding land. In most cases this flow will be piped or contained within relatively narrow confines under public control by means of a reserve or easement.

Secondary Flow Path refers to the path taken by runoff in excess of the primary design flow and is to be capable of producing protection to the surrounding buildings for a

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once in 50 years return period rain event for commercial, industrial and habitable residential floor levels.

4.3 REFERENCED DOCUMENTS AND STANDARDS

4.3.1 Referenced Documents

- "Procedure for Hydrological Design of Urban Storm-water Systems". Institution of Professional Engineers, New Zealand.
- Hydraulic Research Paper No. 2 'Charts for the Hydraulic Design of Channels and Pipes'. Third Edition. H.M.S.O. London. 1969. Peter Ackers.
- Approved Document for NZ Building Code — Clause E1 "Surface Water"
- Auckland Regional Council Stormwater Management Devices: Design Guidelines Manual — revision to Technical Publication 10
- Auckland Regional Council TP 90 Erosion and Sediment Control: Guidelines for Land Disturbing Activities in the Auckland Region 1999
- Auckland Regional Council, TP 124 Low impact design manual for the Auckland Region 2000
- Erosion and Sediment Control Guidelines for Soil Disturbing Activities May 2003, Environment Waikato Technical Report 2002/01
- Hamilton City Council Standard Technical Specifications.

4.3.2 Standards

NZS 3107:1978	Specification for Precast Concrete Drainage and Pressure Pipe
AS1741:1991	Vitrified Clay Pipes and Fittings with Flexible Joints
NZS 1260: 1999	PVC-U Pipes and Fittings for Drain Waste and Vent Applications
NZS 4442:1988	Welded Steel Pipes and Fittings for Water Sewage and Medium Pressure Gas
NZS/AS 3725:1989	Loads on Buried Concrete Pipes
AS/NZS 2566.1:1998	Buried Flexible Pipelines — Structural Design
AS/NZS 2566.2:2002	Buried Flexible Pipelines - Installation

4.4 STORMWATER SYSTEMS

Drainage systems both during construction and for completion shall be designed such that principally only urban stormwater is conveyed. The Developer shall be responsible for ensuring that mechanisms exist within the pipeline systems to prevent water-borne litter, such as paper and plastics, and gross sediments from entering the system. As far as practical, these materials shall be restricted from entering the stormwater system. Design plans shall demonstrate how this is achieved.

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Developers are required to provide for stormwater discharge from all allotments by ground soakage or where that is not viable through connection to a public stormwater system. Note connection to the Council system may be required in Environmental Protection Overlay as detailed in the HCC District Plan.

Where not covered by this Council Development Manual, design procedures shall be taken from the Verification Method for the "NZ Building Code Clause E1 Surface Water".

4.5 RESOURCE CONSENTS

Resource Consents from the Waikato Regional Council (Environment Waikato) will almost certainly be required for the following work:

- the discharge of contaminants during construction work
- the diversion of natural water during construction work
- the permanent diversion of natural water as a consequence of the development
- the discharge of stormwater into natural waterways.

In the case of both discharge of contaminants and diversion of natural water during construction, the necessary Resource Consent shall be applied for by the Developer and is to be exercised in the name of the Developer.

The Resource Consent, in respect of the permanent diversion of natural water, or where the discharge of stormwater into natural waterways is solely from the Developer's subdivision, shall initially be applied for in the name of the Developer. It will be a matter of negotiation between the Developer and Council as to what scope the consents shall have. Generally construction related consents will not be transferred to the Council. The Resource Consent will not be taken over by Council until:

- All earthworks including building sites have been completed
- All consent conditions are approved by Council
- The Developer obtains agreement from Environment Waikato that the consent has been complied with.

4.6 DESIGN REQUIREMENTS

- (a) The land drainage system shall be capable of serving the entire catchment upstream of the subdivision and must take due regard to the effect it may have on downstream waterways and adjoining areas. It shall be designed within the terms of any approved comprehensive drainage scheme.
- (b) The design calculations shall be in accordance with Section 4.6.1 of this Part for Greenfield sites and 4.6.2 for infill developments.
- (c) Where open watercourses are to form part of the land drainage system this shall be determined at scheme plan approval stage, and the Developer shall submit sufficient engineering design to enable Council to evaluate the proposals.
- (d) The means of stormwater disposal shall be capable of serving the whole of the lot, except where this requirement is unreasonable. Where connection to the Council

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system is utilised, in which case the connection must be able to service at least the whole building and developed area available on the lot. Generally each lot will have a single stormwater connection.

- (e) Where further subdivision upstream of the one under consideration is provided for in the HCC District Plan or Structure Plan, the stormwater pipelines are to be constructed to the upper limits of the subdivision.
- (f) In new residential developments the preferred means of stormwater disposal shall be to adopt stormwater control measures that retain the pre-development catchment characteristics for ground soakage and runoff. Until such time as Hamilton specific guidelines can be introduced, developers should take the lead provided in the Auckland Regional Council publications cited in Section 4.3.1. Note: Council opinion is that 'wet pond' type detention dams should be avoided if possible.
- (g) Stormwater treatment devices such as stormwater detention areas, rain gardens, vegetated filters and swales are to be landscaped with vegetative cover as set out Volume 2: design Guide, Part 9: Landscaping Engineered Stormwater Devices. Landscape plans shall be accepted by Council prior to planting. For treatment devices constructed in conjunction with sub-division or land use consents, planting shall be completed and maintained for at least one year prior to vesting the treatment device to Council.
- (h) The issue of river bank stability shall be considered for stormwater control structures, ground soakage, discharge points etc.
- (i) Under no circumstances shall stormwater be led to or permitted to enter a wastewater system.
- (j) Stormwater secondary flow paths shall be identified for the following situations:
 - Catchpit blockage.
 - Culvert blockage (or alternatively provide an unobstructed waterway capable of passing the once in 100 year return period rainfall event while maintaining at least 0.3 metres of freeboard to building platforms on upstream property).
 - Rainfall in excess of design levels of service.
 - Infill development sites as detailed in Section 4.6.2 of this Part.
- (k) Stormwater secondary flow paths shall be shown on design plans. Water flow levels shall be determined for rainfall events having a once in 50 years return period.
- (l) All stormwater secondary flow paths shall be protected by an easement. The easement shall cover the full extent of the secondary flow path and shall not be less than 1.5 m wide. The easement shall have the effect of preventing alteration of the ground surface and prohibit location of structures that might impede the flow of water across the land. The easement shall be in favour of the Council and/or the upstream lot(s) as appropriate. The easement shall be duly granted, reserved and shown on the survey plan.

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4.6.1 Greenfield Stormwater Flow Estimate

4.6.1.1 Calculation of Runoff

Runoff shall be calculated using the "Rational Method" which is based on the formula:

$$Q = \frac{CiA}{3600}$$

Q = Runoff in litres/second.

C = Runoff Coefficient.

i = Rainfall Intensity in millimetres per hour. (Use a storm duration corresponding to the catchment time of concentration)

A = Area of catchment in square metres.

4.6.1.2 Design Standards

The runoff coefficients shown in Table 4.1 (below) are to be used for the various zones and are provided as a guide for initial calculation of system requirements. More accurate investigations into appropriate return periods and runoff coefficients will be necessary for detailed design. Detailed design should involve calculating a weighted average runoff coefficient by averaging the value for individual parts of the catchment. This may be done for a representative sample area or the whole catchment. The formula for this calculation is shown in Clause 2.1 Verification Method for the "NZ Building Code Clause E1 Surface Water".

Zoning	Industrial	Commercial	Residential (flat terrain)	Residential slopes >5%
Rainfall Intensity Curve Return Period in Yrs	5	10	2	2
Runoff Coefficient (C)	0.75	0.75	0.55	0.6

In refining the estimate of runoff coefficient, the coefficients provided in NZ Building Code E1 Table 2 shall be used. The following Coefficients are provided as a guide.

- | | |
|---------------------------------------------------|----------|
| (i) Roofs | C = 0.95 |
| (ii) Asphaltic & Concrete Areas | C = 0.90 |
| (iii) Uncultivated Ground, Lawns & Playing Fields | C = 0.30 |
| (iv) Cultivated Ground & Dairy Farmland | C = 0.20 |

4.6.1.3 Time Of Concentration

The Time of concentration shall be determined as the 'time of entry' plus the 'time of flow' from the furthest part of the whole catchment to the point of discharge.

The minimum Time of Concentration to be used is 10 minutes.

Time of entry to the system shall be calculated from the Overland Flow Graph in Figure 4.2 or an equivalent published graph and the formula from which it was derived.

Time of flow can be calculated from the flow velocity in pipes and channels (note since this is not known initially, an iterative type solution is necessary with time of concentration recalculated from the catchment flow calculation).

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4.6.2 Infill Developments Stormwater Flow Estimate

4.6.2.1 Catchment Evaluation

Review the site catchment considering issues such as run-on, peat soils and culvert block zones.

4.6.2.2 Run-off Coefficient and Return Period

Use the rational formula as shown in Section 4.6.1.1 to calculate the run-off for the storm durations of 10, 20, 30 & 60 minute duration and 2, 6, 12, 24, 48 and 72 hours duration (the extra storm events are necessary for the soakage calculations).

Zoning	Industrial	Commercial	Residential	High Density Residential
Rainfall Intensity return period for piped discharge - Council level of service.	5	10	2	2
Rainfall Intensity return period for total site system including secondary flows.	50	50	See Table 4.6.3	See Table 4.6.3
Runoff Coefficient C	0.9	0.9	0.65	0.9

Secondary Flow Path Scenario	ARI for system design
i. Falls towards public land >2%	2 year
ii. Flat (+/- 2%)	10 year
iii. Falls away from public land >2%	50 year

4.6.2.3 Soakage Test Calculation and Design

Refer to Volume 2, Part 4, Clause 4.21.

4.6.2.4 Secondary Flow Management Solution

If the site does not flow towards public land detail the management of the 50 year flows including detention and easements as appropriate.

Note Additional guidance is available from Council Water & Waste Services.

4.6.3 Rainfall

Hamilton City's rainfall design data is derived from Ruakura rainfall gauge. Note the HIRDS rainfall design tool tends to provide different data for Hamilton City due to the areal averaging of rainfall gauges; HIRDS derived data is not an acceptable alternative for use within Hamilton City.

In May 2008 Council adopted the following Climate Change adjusted rainfall data for use in determining stormwater flows.

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Ruakura Rainfall Intensity (mm/hr) incorporating climate change											
ARI	5m	10m	20m	30m	60m	2h	6h	12h	24h	48h	72h
2	93	71	51	40	27	16	8	5	3	2	1
5	116	93	68	56	37	23	10	7	4	2	2
10	133	107	80	66	45	27	12	8	5	3	2
50	172	139	106	89	61	37	16	10	6	4	3
100	185	152	117	99	68	41	17	11	7	4	3

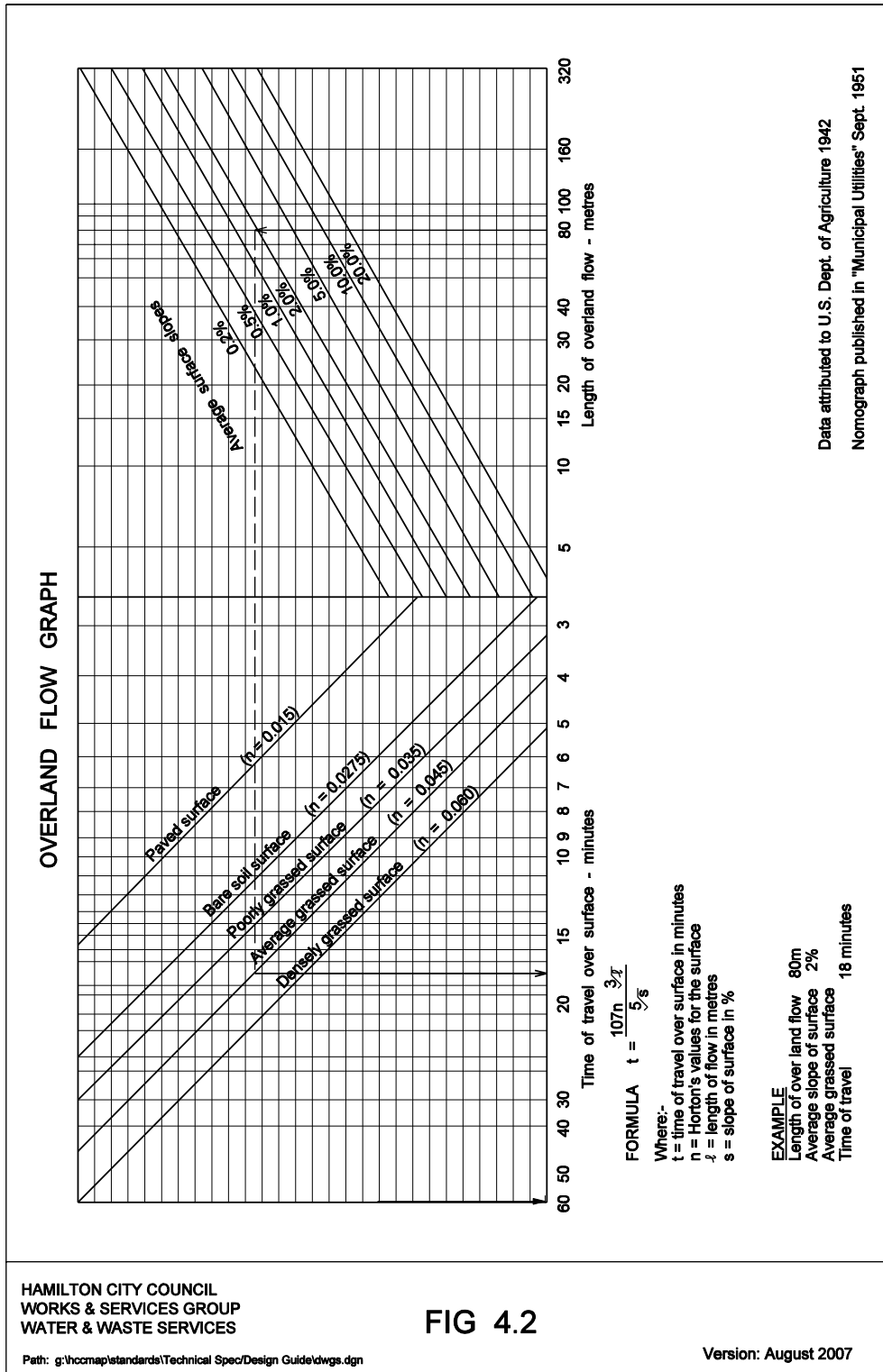
This data prepared by NIWA (NIWA Client Report WLG2008-010) provides for an IPCC medium range average temperature increase of 2.08 degrees Celsius by 2090.

Ruakura Rainfall Depth (mm) incorporating climate change											
ARI	5m	10m	20m	30m	60m	2h	6h	12h	24h	48h	72h
2	8	12	17	20	27	33	47	60	72	85	91
5	10	16	23	28	37	45	62	79	95	114	121
10	11	18	27	33	45	54	72	91	112	135	142
50	14	23	35	45	61	73	95	120	149	180	190
100	15	25	39	49	68	81	104	131	163	198	208

The above Climate Change adjusted rainfall statistics are derived from the following statistical data which represents an analysis of annual maximum rainfall intensities of the Ruakura rainfall gauge for the period 1947 to 2006. Data for ARIs 20, 30, and 75 years is also available.

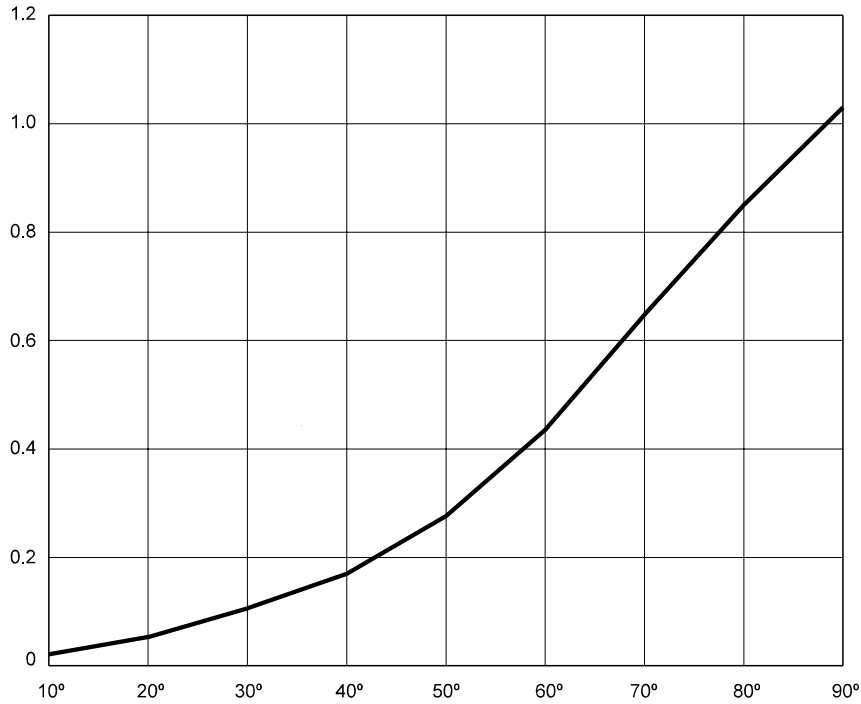
Ruakura Rainfall Intensity (mm/hr)										
ARI	10m	20m	30m	60m	2h	6h	12h	24h	48h	72h
2	60.9	43.7	35.1	23.3	14.5	7.1	4.5	2.8	1.6	1.2
5	79.5	59.0	48.3	32.6	20.0	9.2	5.8	3.6	2.2	1.5
10	91.9	69.1	57.1	38.7	23.6	10.6	6.7	4.1	2.5	1.8
50	119.1	91.3	76.4	52.2	31.5	13.6	8.6	5.3	3.2	2.3
100	130.6	100.7	84.6	57.9	34.9	14.9	9.4	5.8	3.5	2.5

Ruakura Rainfall Depth (mm)										
ARI	10m	20m	30m	60m	2h	6h	12h	24h	48h	72h
2	10.4	14.9	17.6	22.3	27.6	40.8	53.3	63.8	75.7	82.3
5	13.9	20.7	24.8	30.8	36.7	50.7	67.9	81.6	98.4	105.7
10	16.2	24.5	29.6	36.4	42.7	57.3	77.5	93.3	113.4	121.1
50	21.4	32.9	40.1	48.7	56.0	71.8	98.8	119.2	146.4	155.2
100	23.6	36.5	44.6	54.0	61.6	77.9	107.7	130.2	160.3	169.6

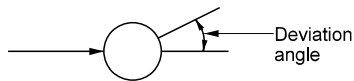


HEAD LOSS IN STORMWATER MANHOLES

$$h_e = -k_e \frac{V^2}{2g} \text{ where } V \text{ is for full pipe flow}$$



DEVIATION OF FLOW THROUGH MANHOLE



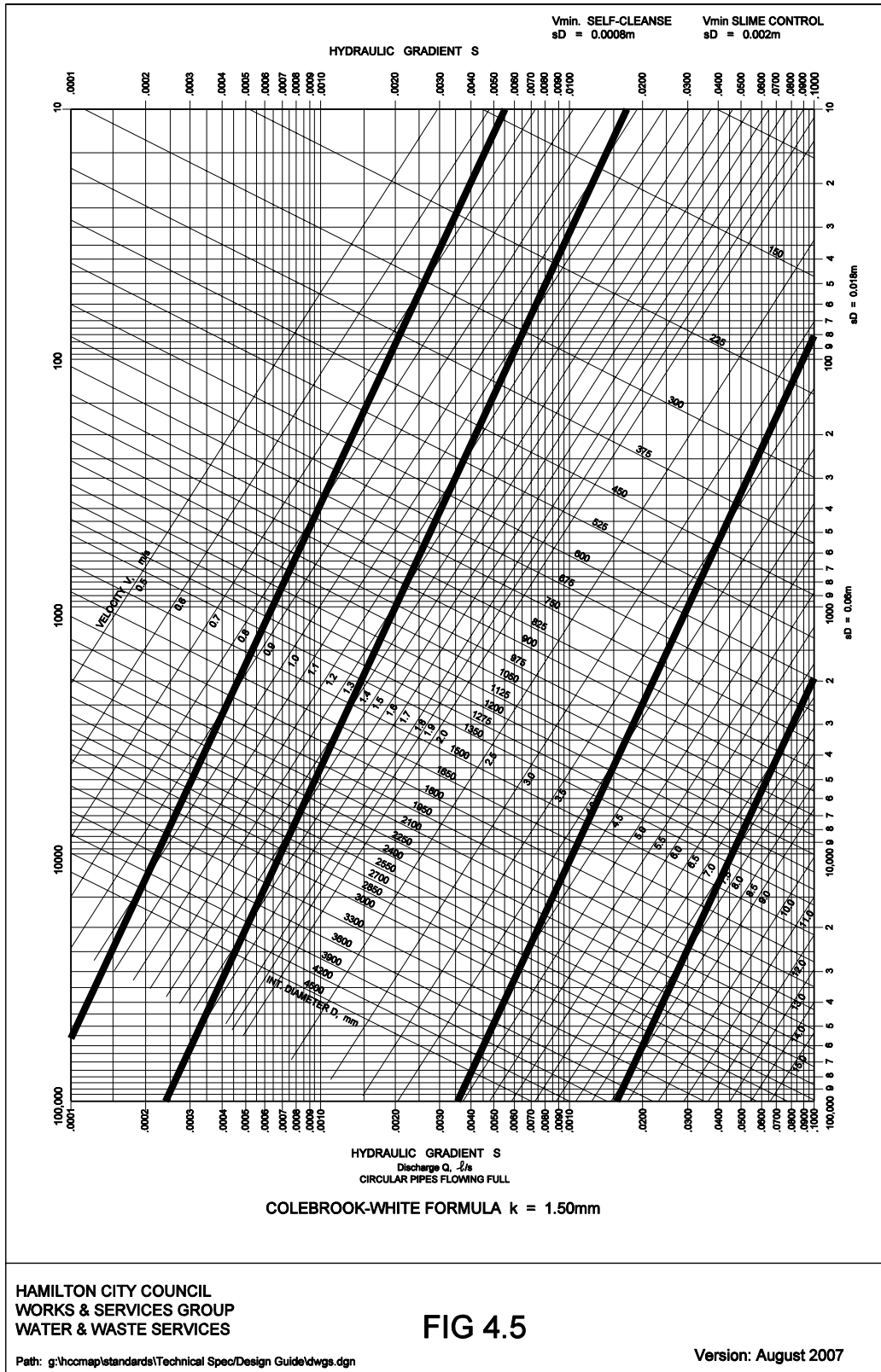
EXAMPLE:-

V = 0.2 m/s, Deviation angle = 50°

$$\text{Drop in manhole} = \frac{0.3 \times 0.2^2}{2 \times 9.8} = 61\text{mm}$$

NOTE: Minimum drop in any stormwater manhole = 20mm

Reference: "Degremonts" Water Treatment Handbook Edition 1965



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4.7 OPEN WATERCOURSES

Natural watercourses are expected to be retained.

The District Plan, and in particular the Environmental Protection Overlay, sets out requirements which must be incorporated into any design.

The extent of stream drainage work shall be designed to achieve a satisfactory solution recognising community flood protection, bank stability, the retention of the natural topography and ecological values, maintenance, hydraulic and safety considerations, including the downstream effects of the work.

Constructed watercourses (open drains) may be piped if there are valid engineering or design considerations. The Engineering Plans should be noted accordingly.

4.8 THE HYDRAULIC DESIGN OF PIPELINES

The hydraulic capacity of stormwater pipelines shall be sufficient to convey the design flow as determined by the procedure outlined in Section 4.6.1 or 4.6.2 of this Part.

All pipes shall be of adequate size to carry the designed flow without surcharge.

The design shall provide that:

- no stormwater pipeline, other than connections to individual lots, shall be less than 225mm diameter. The use of 150mm diameter pipeline for public drains shall be subject to specific approval from Council.
- all public stormwater pipes shall be at least class 4 unless calculations in accordance with NZS 3725 are provided to support the use of another class. Note the preferred method of demonstrating compliance with this requirement is a printout from the software produced by the Concrete Pipe Association of Australasia (<http://www.concpipe.asn.au>).
- catchpit outlets shall be not less than 225mm diameter and shall always be at least class 4.
- the minimum velocity for pipes flowing full shall be 0.7 m/s
- the maximum velocity for pipe flow shall be 4.0 m/s.

Special measures to dissipate energy shall be designed at all outfalls to natural and constructed receiving waterways.

4.9 LOCATION OF PIPELINES

- (a) Stormwater pipelines within **RESIDENTIAL ZONES** shall normally be located within the road reserve.
- (b) Stormwater pipelines in **INDUSTRIAL ZONES** shall either be located in the road reserve or in the front yard area.
- (c) Stormwater reticulation pipelines (and connections) in **COMMERCIAL ZONES** shall be either in the rear service lane or in the rear yard of properties where no service lane

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exists. Major reticulation and trunk lines shall be in the road reserve (as for residential zones).

Where stormwater pipelines are in the road reserve, they shall conform to the standard location of underground services and shall normally be 2m out from the kerb. The pipeline shall at all times be located within the carriageway. 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 stormwater pipeline changes location within a street, it shall do so at an angle of 45 degrees or greater. Where a stormwater pipeline crosses other utility services, it shall do so at an angle of 45 degrees or greater.

On the limited occasions where a stormwater pipeline is within a property, it is required to be parallel to and within 0.5-1.0m (preferably 0.75m) from a boundary so as not to reduce the building area available. On sloping ground, the stormwater 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.

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 4.10.2.

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

4.10 PIPES

4.10.1 General

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

4.10.2 Requirements for Building Near or Over Drainage Pipelines

4.10.2.1 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 pipes must be constructed to a depth of at least 1m below the 45 degree influence line from the pipe invert.

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- All structural loads on piles shall be absorbed outside the 45 degree envelope and below the pipe invert of the first row of piles.

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

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

4.10.2.4 The structure must allow for settlement of the pipe trench line and backfill.

4.10.2.5 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.

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

These requirements are shown in TS 410 (Volume 3).

4.11 JOINTS

All pipes shall be rubber ring jointed unless specifically required to be flush jointed or solvent cemented by the Engineer.

The jointing method must consider the effects on groundwater levels — particularly in peat soils where all efforts are required to minimise groundwater level reduction.

4.12 PIPE LAYING

The pipe bedding shall be selected to meet the requirements of the class of pipe to be used and the design loading conditions.

The strength of Council pipes shall be Class 4 unless a specific design in accordance with the pipe laying tables and bedding diagrams in AS/NZS 3725 shows that Class 2 or 3 is acceptable. Catchpit outlets shall always be Class 4. Specific design may be required for flush jointed pipe bedding.

The construction of pipelines shall be carried out in accordance with the requirements of AS/NZS 2566, AS 2032 and AS 3725 and the Council Standard Technical Specifications for Stormwater and Wastewater Sewers.

4.13 MINIMUM COVER OVER PIPES

4.13.1 General

All pipelines shall be specifically designed to support the likely loadings in relation to the minimum cover to be provided in accordance with the terms of NZS/AS 3725. The

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minimum cover for all types of pipes under all conditions shall be 600mm except as otherwise specified in Clause 4.13.2 below.

4.13.2 Private Property

The minimum cover over Council pipes in private property shall be 500mm. Where due to the topography this cover cannot be provided, specific design and approval will be required by Council.

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

4.13.3 Private Pipes

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

4.14 MANHOLES

4.14.1 General

Manholes shall normally be designed at each change of direction or gradient, and at each branching line and at a spacing of not more than 100m. Manholes may either be cast in situ or of precast concrete in accordance with the Standard Technical Specifications (Volume 3, Part 4).

On stormwater pipelines equal to or greater than 900mm diameter, the spacing of manholes may be extended up to 200m, and uniform curvature on the pipeline may be permitted providing that joint deflections are within the limits of the manufacturer's recommendations.

On stormwater pipelines equal to or greater than 1.8m, the spacing of manholes may be extended up to 300m between manholes.

4.14.2 Shallow Manholes

Shallow manholes less than 1m deep shall be 750 mm diameter and designed to conform with Council Drawing TS400.6 (Volume 3).

4.14.3 Stormwater Manholes on Larger Pipelines

Manholes on stormwater pipelines more than 600mm diameter and on smaller pipelines where the use of standard manholes is not suitable, should be specifically designed. The minimum diameter of the manhole shall be equal to the largest pipe size plus 450 mm.

On larger pipelines, recessed steps with rungs may be required below pipe benching level. In all cases, the lowest rung must be easily reached by a person standing at invert level (see drawings TS400.1-6).

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4.14.4 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 Figure 4.4 of this Part).

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

4.14.5 Junctions

Catchpit leads not more than 300mm diameter and not more than 20m in length may be saddled on to pipes 600mm diameter and larger, with manholes not required.

Branch lines should normally be connected into a manhole. However branch lines 300mm diameter and smaller may be saddled on to pipelines 600mm diameter or larger, providing a manhole is supplied on the branching line within 40m of the main line. Proprietary 'Y' connections shall be used where possible.

4.14.6 Step Irons and Steps

All manholes other than shallow manholes shall be provided with approved manhole steps in order to give reasonable access. (Refer to the Standard Technical Specification - Volume 3, Part 4).

4.14.7 Manhole Covers and Frames

Manhole covers and frames shall be designed in accordance with the Standard Technical Specification (Volume 3, Part 4).

4.14.8 Drop Connections

Drop connections on stormwater manholes may be avoided by allowing pipes up to and including 300mm diameter to have an open 'cascade' inside the manhole, providing the steps are clear of any cascade. Otherwise a short ramped section must be provided on the connecting line.

4.15 CONNECTIONS

4.15.1 General

Connections shall be capable of taking the full primary design flow from the area to be serviced by the connection (refer Volume 2 Part 4 Clause 4.6). Where a secondary flowpath needs to be directed to a Council pipe it shall be detained to reduce the flowrate to the level of service provided for the zone.

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Service connections shall be generally located on the lot road frontage. Where a property does not have a road frontage, pipes should be located within that property's legal access (right of way).

Where feasible:

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

The standard size and material for single lot domestic connections is 100mm RRJ SN16 uPVC. The standard depth of a new connector to the boundary is (minimum) 1.2 metres (range 0.9 — 1.5 m).

4.15.2 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 shall be undertaken by council approved contractors.

4.16 RAMPED RISERS

Ramped risers shall be designed in terms of good drain laying practice. A typical example is illustrated in drawing TS404.

4.17 CONNECTIONS TO DEEP LINES

Where an existing or proposed stormwater pipeline is more than 5m deep to the top of the pipe, connections shall be provided to lots from a shallower branch pipeline connected to the deep stormwater line at a manhole. This method may also be used where ground conditions preclude direct connection to pipelines less than 5 m deep.

4.18 INLET AND OUTLET STRUCTURES

Approved structures shall be constructed at the inlets and outlets of pipelines. An acceptable type of concrete structure is shown in Council drawing TS452. Alternative proprietary structures are permissible subject to site specific approval by Council.

Provision must be made for energy dissipation and the design shall ensure non-scouring velocities at the point of discharge.

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4.19 CATCHPITS & CATCHPIT OUTLET-PIPES

Standard drawings showing catchpits are included in Volume 3 of this Manual. Design requirements for catchpits are included in Part 3: Roading Design of this Volume. All catchpit outlet-pipes shall be Class 4 pipe.

4.20 SUBSOIL DRAINAGE

Subsoil drainage shall be designed as private drainage such that it does not pass from one lot to another. Sub-soil drainage is subject to approval under the Building Act 1991. Building Consents shall be obtained before commencement of site work.

To prevent instability of the local ground, the design should ensure that no fine soil particles are transported into the stormwater system.

Any subsoil drainage design must consider the affects on groundwater, particularly in peat areas.

4.21 STORMWATER DISCHARGE FROM PRIVATE LAND

Stormwater discharge from private land (impervious surface runoff) shall be provided for by either:

- ground soakage within the property, or
- where soakage not viable, connection to a public stormwater system.

Surface Flow — Normal hydrological surface flow from undeveloped land and sub-surface flow may follow a natural drainage path to an appropriate outfall in accordance with common law¹. Such flow shall not create nuisance at lot boundaries. Where nuisance is likely, allotments may need to be drained to an enclosed pipe system.

Direct discharge to natural water courses may be subject to both Regional and District Council approvals. Resource consents shall be obtained before commencement of site work.

At the time of sub-division, where ground soakage is proposed as the means of stormwater disposal from individual lots, it will be sufficient to submit for approval the soakage system design. It is intended that the soakage system design approved at time of subdivision will be further submitted for approval in conjunction with the Building Consent for the site and the approved design shall be implemented in conjunction with building construction work. Soakage systems for roads and RoWs shall be constructed and inspected before application for 224c Completion Certificates are submitted. All soakage systems shall be protected from sediment ingress both through the discharge surface areas (e.g. by suitable geotextiles) and in the incoming pipe (e.g. by a suitable sediment trap).

The design shall be based on soil soakage tests in accordance with “NZ Building Code Compliance Document E1 Surface Water” or guidelines prepared by Council Water and

¹ A useful reference for this is a paper presented to the 2004 NZWWA Stormwater Conference titled “Legal Liability for Water Escape (and what you can do to avoid it) by Stuart Ryan partner Hesketh Henry Lawyers

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Waste Services. The number and extent of soakage tests shall be sufficient to ensure representative testing of all soil profiles and groundwater levels within the development.

Stormwater connections to public stormwater drains shall be directed to the nearest manhole if practical or, alternatively by way of a saddle or wye connection to an adjacent stormwater pipeline.

Connection directly to Kerb and Channel is only permitted

- ground soakage is not viable;
- the section is higher than the kerb;
- a kerb outlet can be located at least 1m clear of any driveway crossing; and
- the property is only serving a single dwelling.

If ground soakage is not viable and public reticulation is not available, then a bubble up pit is acceptable. See Drawing TS 408 for construction details.