

THREE WATERS MANAGEMENT PRACTICE NOTE

HCC 06: Detention Tank

1. INTRODUCTION

This practice note¹ has been developed to provide general information on the minimum design and sizing requirements for Detention Tanks which are used in residential and non-residential applications for on-site stormwater management. Refer to Section 2 for residential applications and Section 3 for non-residential applications.

1.1 What is a Detention Tank?

Detention Tanks are tanks which temporarily store rain water from your roof and other hard surfaces and release it at a slower rate so that the peak flows are no more than they were before the development took place. These tanks are suitable in an urban environment where there is:

- A lack of capacity in the downstream stormwater system
- Flooding of other properties is a problem, and
- Extended high flows are likely to increase stream erosion.



The Detention Tank works by temporarily storing the collected rainwater and then slowly releasing the water through a small outlet in the tank. This storage and slow release of the rainwater reduces the peak stormwater flows during a rainfall event and hence reduces the impacts on downstream infrastructure and/or streams.

The tank size can vary from 1m³ upwards depending on the required stormwater controls and can be above or below ground. Run-off from roof surfaces and paved areas is generally suitable for collection by the tank.

1.2 When should Detention Tanks be used?

Detention Tanks may be used as the on-site stormwater mitigation method to manage stormwater generated from your site.

The requirement for onsite stormwater quantity mitigation (detention) will depend on whether or not there is an approved downstream detention facility, such as a pond or wetland, designed to accept runoff from the site. If onsite quantity mitigation is required, detention can only be considered if onsite soakage has been found not to be appropriate for the particular site conditions, in accordance with Council's drainage disposal hierarchy². Site suitability for soakage will need to be assessed for every new building consent application. Detention is one of the options that can be used to manage stormwater if soakage is not an option.

1.3 Advantages of Detention Tanks

Detention tanks provide the following benefits:

- *They reduce peak flows from rainfall events up to a 10 year event.*
- *They can be used for managing peak flows from both roof areas and paved areas.*
- *They capture the first flush of runoff which improves water quality.*

2. RESIDENTIAL APPLICATIONS

2.1 Minimum Design Requirements

The following information is intended as a guide only. All detention tanks within Hamilton City require specific design by a suitably qualified person and approval from Hamilton City Council's Building Control Unit.

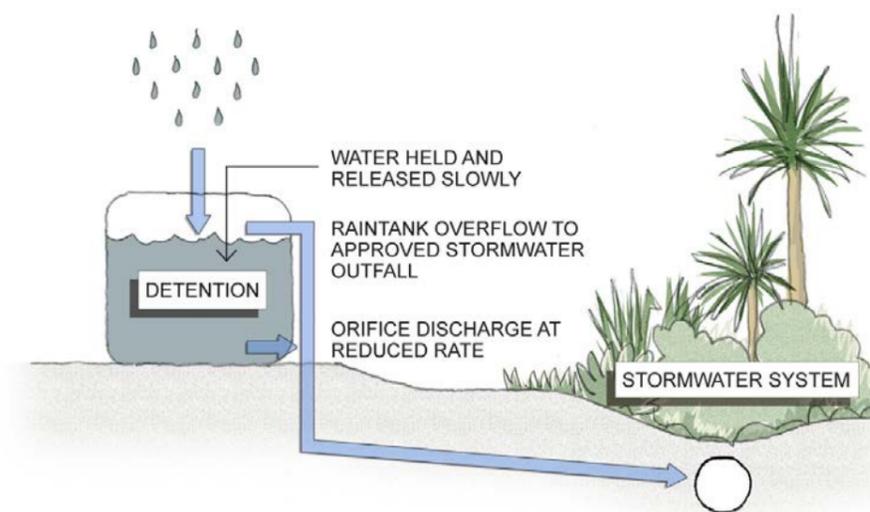
1. **Tank volume:** The tank size will depend on the area that requires mitigation and the proportion of the impervious area that is able to be drained via the tank.

Onsite residential detention systems within Hamilton City shall be designed to manage peak flows from the 10 Year ARI rainfall event and discharge it at 80% of the pre-development 2 year ARI rate.

2. **Overflow:** An overflow must be provided which drains to an approved stormwater outfall in accordance with the drainage disposal hierarchy. The overflow must be sized so that it is at least the same size as the inlet to the tank.

3. **Offset mitigation:** It is possible for a tank to provide mitigation for some area (up to 15%) that does not drain to it. This is called offset mitigation and results in a slightly larger tank and slightly smaller orifice to compensate for the area not draining to the tank.
4. **Access:** Access must be provided for maintenance. Especially the orifice which must be accessible when the tank is full.
5. **Above or below ground:** Tanks may be above or below ground (above ground is preferred) but must be clearly locatable for maintenance and inspection purposes. Below ground tanks must be located so as not to adversely affect building foundations.
6. **Pre-treatment:** If the Detention Tank is underground, flows from hard stand areas must drain to a Gross Pollutant Trap before draining to the Detention Tank.
7. **Position of the orifice:** A dead storage volume is required at the bottom of the tank for sediment build up. The orifice is to be located at least 100mm above the base of the tank and must be located so that it can easily be accessed for inspection and maintenance.

RAINWATER COLLECTED FROM ROOF OR PAVED AREAS



¹ Three Waters Management Practice Notes are Hamilton City Council controlled documents and will be subject to ongoing review. The latest version can be downloaded from the Hamilton City Council website: <http://www.hamilton.govt.nz/our-council/council-publications/manuals/Pages/Three-Waters-Management-Practice-Notes.aspx> 06-1

² Refer Practice Note HCC 01 Overview

2.2 Procedure for calculating Detention Tank sizing and configuration

The methodology uses the following basic steps. Figures 1 and 2 illustrate typical components for Detention Tanks for above and below ground configurations.

This procedure should be used for residential applications that comply with the following conditions:

- Maximum impervious area to be mitigated of 600m².
- Offset mitigation area no greater than 15% of the total impervious area draining to the Detention Tank.
- Runoff from impervious surfaces, such as roof and other hardstand areas, only. Drainage from pervious surfaces such as lawns and gardens shall bypass the Detention Tank.
- Pre-development site assumed to be undeveloped (greenfields) – Runoff Coefficient, C = 0.30.
- Outlet of tank located above the level of the stormwater reticulation into which it will discharge, with no back water effects.

Should site conditions or design requirements not comply with the above conditions, specific design of the detention system will be required.

Specific design

Specific design of detention systems shall be undertaken in accordance with the methodology presented in 'NZWERF On-site Stormwater Management Guidelines', October 2004, Section 4.5, or other approved method.

Design shall also be undertaken in accordance with the relevant sections of the Hamilton City Council Infrastructure Technical Specifications, as outlined below:

- Runoff volumes calculated using the Rational Method with C factors from Tables 4-3 and 4-4.
- All pre-developed flows shall be calculated using current rainfall data from Table 4-5.
- All post-developed flows shall be calculated using climate change adjusted rainfall data from Table 4-6.
- For residential sites, attenuation of runoff from a 10 Year ARI rainfall event and discharge it at 80% of the pre-development 2 year ARI peak rate is required.
- Calculations shall consider various storm durations (10min, 20min, 30min, 60min and 2 hour) and adopt the worst case storms for both tank volume and orifice size

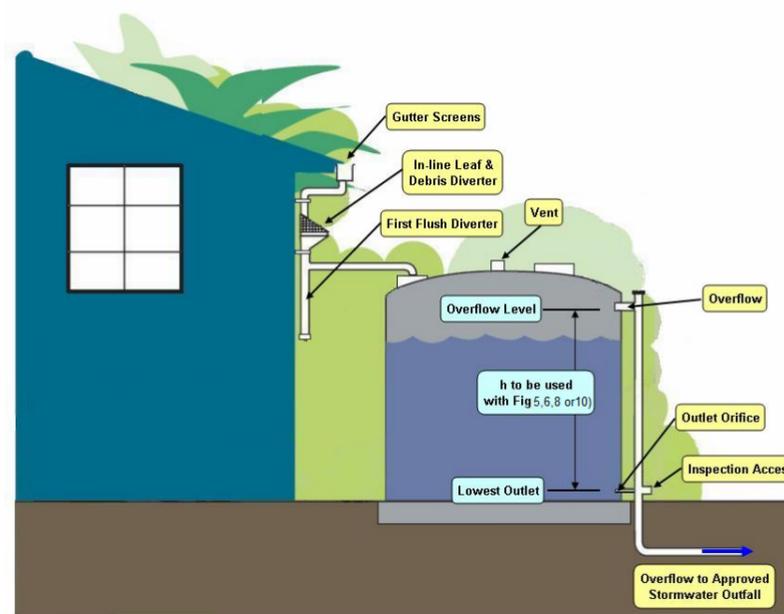


Figure 1: Above ground Detention Tank - typical components

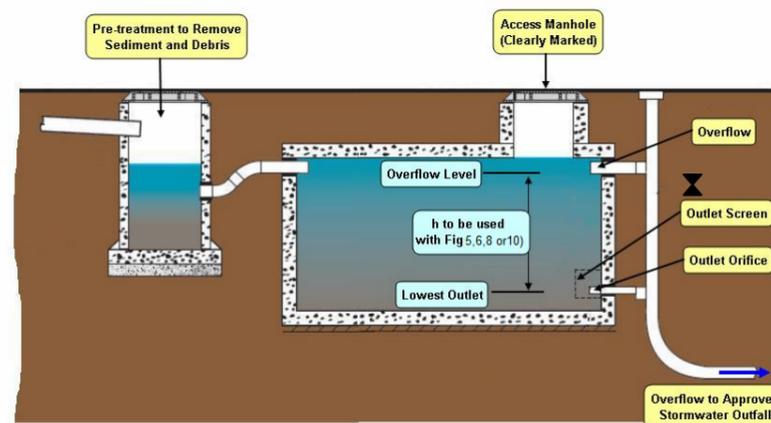


Figure 2: Below ground Detention Tank - typical components

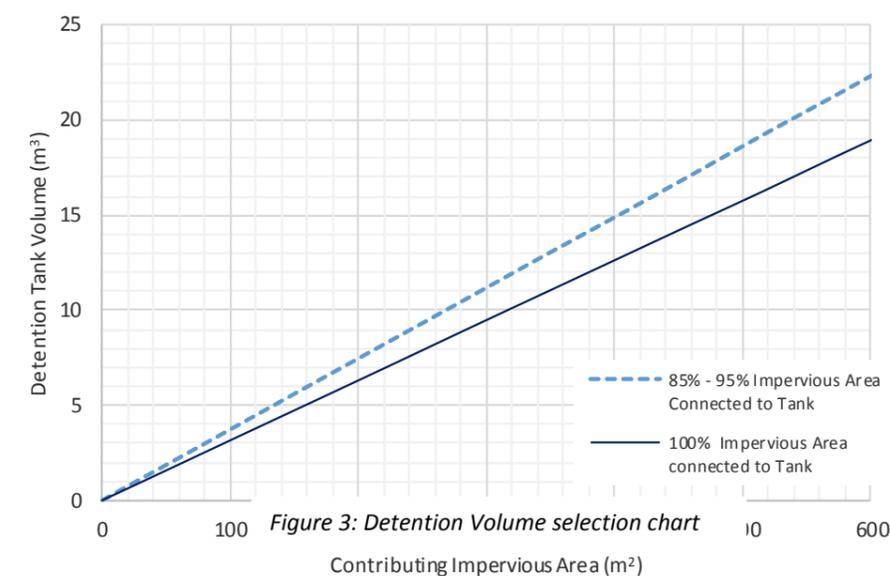
Step 2: Check offset mitigation limit

Measure the areas of concrete driveway, pathways and other impervious areas (A_i) and compare to the total roof area connected to the tank.

If $A_i/A_r > 15\%$, specific design incorporating soakage, bioretention or onsite detention of runoff from the additional impervious surfaces is required.

Step 3: Determine the Detention Volume (DV)

Based on the values measured above the required Detention Volume should be sized according to Figure 3 below for two different scenarios: Situations in which 100% of the impervious area is drained via the detention tank, and situations in which between 85% and 95% of the impervious area is drained via the tank.



Step 1: Determine the total roof area of the building (A_R)

Measure the total roof area which shall be connected to the tank, including the eaves. It is advantageous to maximise the roof area connected to the tank as this increases the water captured for re-use and also increases the additional impervious area managed by the tank.

Step 4: Select the desired tank make and model

Select the tank based on the Detention Volume (DV) determined in Step 3. Once the tank make and model have been chosen, obtain the tank dimensions from the manufacturer’s specifications.

Step 5: Determine the tank configuration

Using the chosen tank dimensions: Total Height (H) and Tank Plan Area (PA), and the required tank volume: Detention Volume (DV) from Step 3, determine the required configuration for the Detention Tank. Figure 4 illustrates a schematic of an above ground detention tank configuration.

Dead Storage Height h_2 = Minimum 100mm above the base of the tank for sediment accumulation

Detention Height h_1 = Detention Volume (DV) / Tank Area (PA)

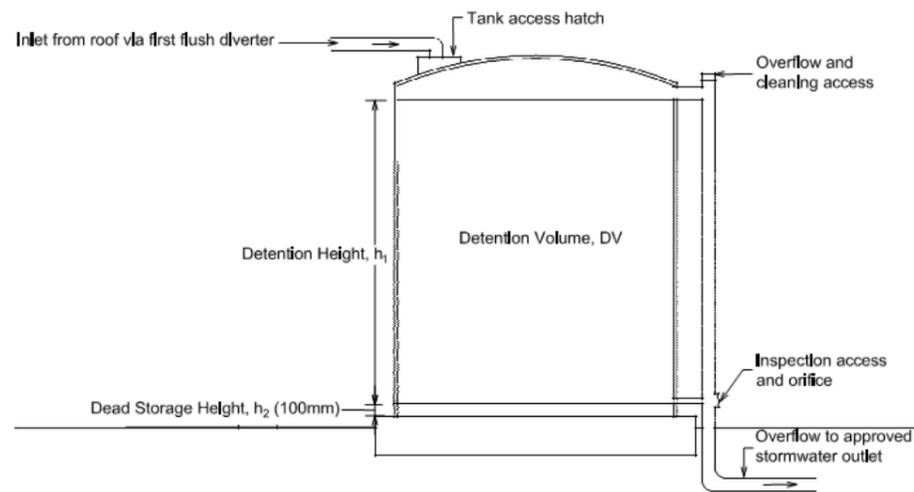


Figure 4: Schematic of Detention Tank configuration

Step 6: Determine the size of the orifice.

The size of the orifice is related to the roof area and the adopted Detention height, h_1 and should be designed as per the chart in Figure 5 and Figure 6 below.

For maintenance reasons the minimum size of the orifice should be 10mm.

3. NON-RESIDENTIAL APPLICATIONS

This section provides general information on the minimum design and sizing requirements for detention systems are used in non-residential applications for on-site stormwater management.

Due to the often large additional impervious areas (car parks etc.) of most industrial and business sites the design procedure below allows for 100% of the impervious area to be connected to the tank (i.e. no offset mitigation). Should offset mitigation be desired a specific design shall be required by a suitably qualified Engineer.

3.1 Detention Volume and configuration for non-residential applications

The methodology uses the following basic steps:

Step 1: Determine the total impervious area requiring mitigation (A_i)

Measure the total impervious area which shall be connected to the tank

Step 2: Determine the Detention Volume (DV)

Based on the values measured above determine the required Detention Volume according to the chart under the zone which is applicable to the site (Figure 7 if industrial and Figure 9 if commercial).

Step 3: Select the desired tank configuration

Based on the Detention Volume (DV) determined in Step 2, select the desired tank configuration and associated dimensions.

Step 4: Determine the tank configuration

Using the chosen tank dimensions: Total Height (H) and Tank Plan Area (PA), and the required tank volume: Detention Volume (DV) from Step 3, determine the required configuration for the Detention Tank.

Dead Storage Height h_2 = Minimum 100mm above the base of the tank for sediment accumulation

Detention Height h_1 = Detention Volume (DV) / Tank Plan Area (PA)

Step 5: Determine the size of the orifice

The size of the orifice is related to the roof area and the adopted Detention Height, h_1 and should be designed as per the chart under the zone which is applicable to your site (Figure 8 if industrial and Figure 10 if commercial). For maintenance reasons the minimum size of the orifice should be 10mm.

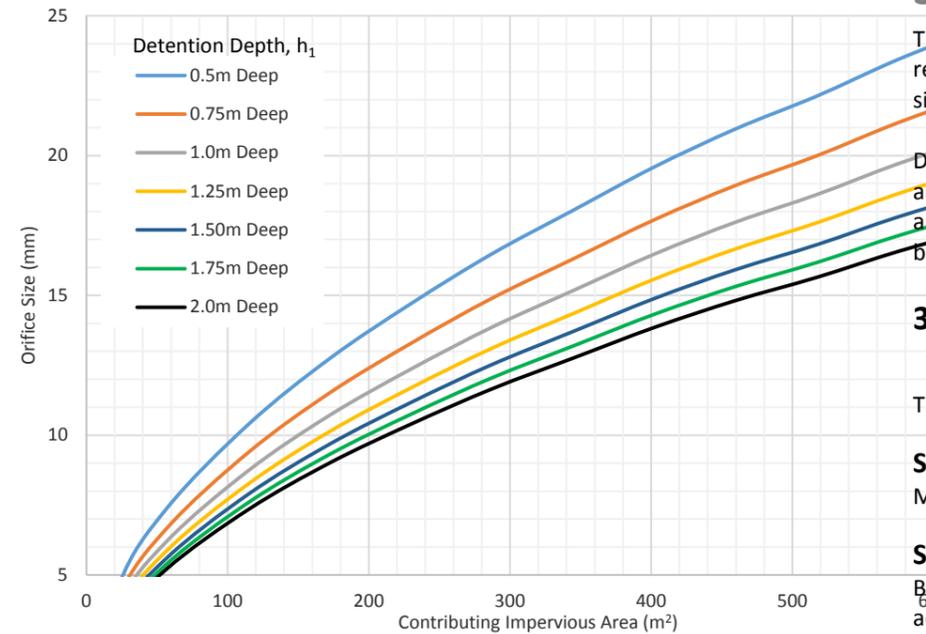


Figure 5: Orifice Sizing Chart (85-95% impervious area connected to tank)

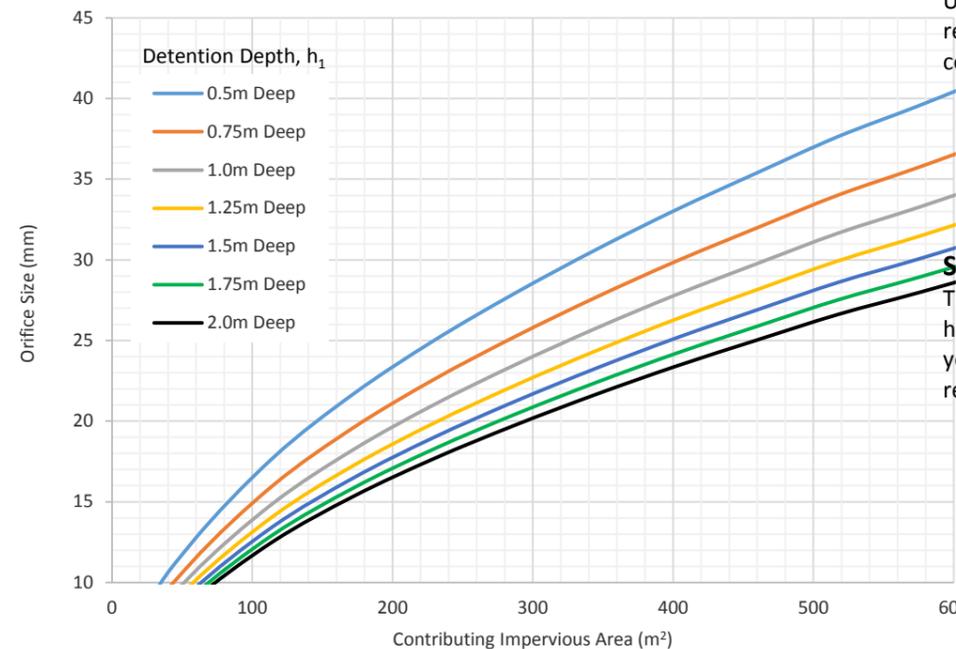


Figure 6: Orifice Sizing Chart (100% impervious area connected to tank)

3.2 Industrial Zones

Industrial detention systems within Hamilton City shall be designed to manage peak flows from the 10 year ARI rainfall event and discharge at 80% of the pre-development 5 year ARI rate.

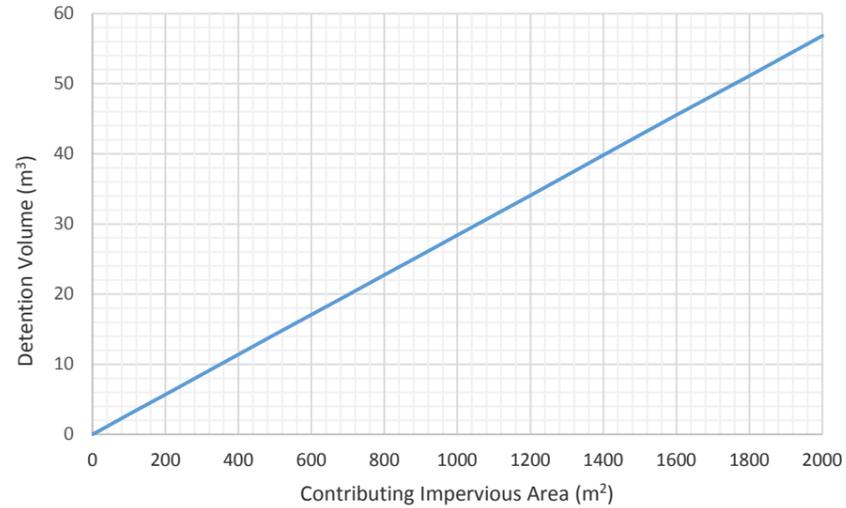


Figure 7: Detention Tank selection chart - Industrial Zones

3.3 Other Business Zones

Commercial detention systems within Hamilton City shall be designed to manage peak flows from the 10 year ARI rainfall event and discharge at 80% of the pre-development 10 year ARI rate.

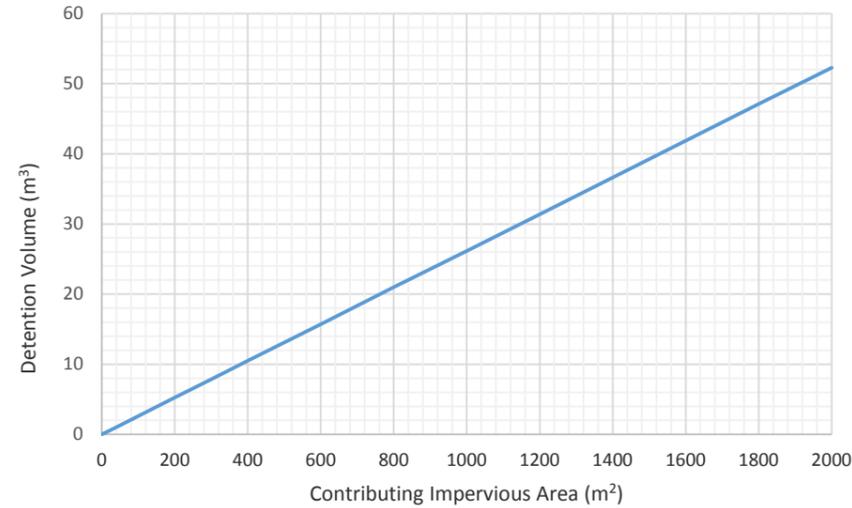


Figure 9: Detention Tank selection chart - other Business Zones

4. SUMMARY OF PLANNING REQUIREMENTS

Your detention system must be consented either as part of the whole site's building consent or as a separate building consent.

For details on building consents please contact Hamilton City Council's Building Control Unit phone (07) 838 6699.

Your detention system is required to be designed by a suitably qualified person based on the guidance provided in this practice note, council's Infrastructure Technical Specification and other base practice guidance. As-laid plans, authorised by a registered drain layer, are required for your detention system and shall be provided to council.

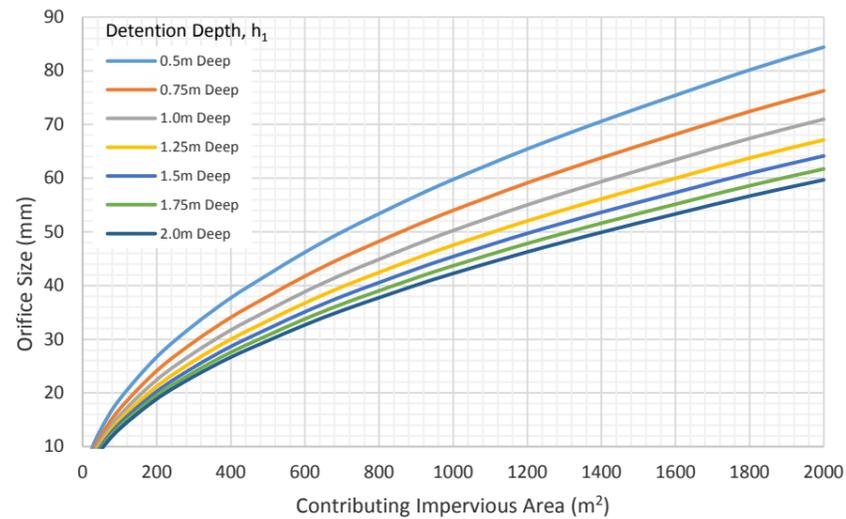


Figure 8: Orifice selection chart - Industrial Zones

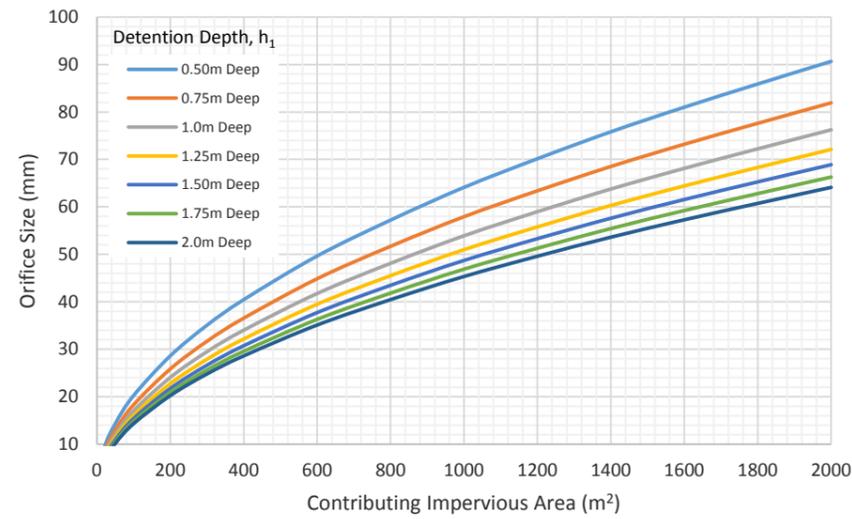


Figure 10: Orifice selection chart - other Business Zones