DAM BUSTER®

Technical Bulletin 1.0 – v2 (23 February 2024)

Non-compliant Sumps / Sump & Rainhead combinations

Re: Non-compliant Sumps / Sump & Rainhead combinations

1.0 INTRODUCTION

Two common sump installations are considered, by way of examples illustrating how many sump / sump and rainhead installations are currently being incorrectly designed and installed, but then presented as allegedly Deemed to Satisfy (DtS) compliant. These installations are, however, **not compliant.**

Photographs (refer attachment 1) are provided of incomplete installations; however, the form of the final construction is mostly evident from the photographs. Architectural drawings indicating both sump types have also been annotated by Dam Buster (refer attachment 2).

Sump type A – used in conjunction with a rainhead.

- Refer to photos 1 to 10, attachment 1.
- 150mm deep x 600mm long x box gutter width
- One downpipe, assumed to either:
  - bend under the sump and discharge into a rainhead (most likely) OR
  - be an internal DP
- Rectangular side overflow discharging above a rainhead (not present yet)

Sump type B – purported 'high-capacity' sump having a vertical piped overflow.

- Refer to photos 11 & 12, attachment 1.
- 150mm deep x 600mm long x box gutter width
- Two DP's, one primary and one overflow
  - The primary DP is an 'internal' DP.
  - The overflow DP to be directed through the outer wall, and into a rainhead.

Both of the above arrangements are **non-compliant** with respect to Deemed to satisfy (**DtS**) requirements, for various reasons, as discussed in the section 3.

2.0 REGULATORY FRAMEWORK

The VBA and the ABCB (NCC) have both recently opined (in publications) that AS/NZS 3500.3-2021 ('3500.3') is a very prescriptive code, meaning that you must comply exactly with this code's Normative (prescriptive) Appendixes including "Clauses" and "Figures" (Drawings) as advised in the Preface on page ii (2) of 3500-2021. Any variation at all to this prescription is not considered Deemed-to-Satisfy ('DtS') and must therefore either be a Performance Solution ('PS') or a combination of a DtS Solution and a PS. Refer also the attached VBA Practice Note RF-01-Regulatory Framework, which describes the DtS provisions as '*prescriptive*' (refer to page 7).

The box gutter design charts in Appendix H of 3500.3 are clearly shown to be prescriptive in nature by the General Method described for each box gutter overflow device. Note that the design flow charts in clause 3.7.4, figures 3.7.4 (A), (B) & (C) require between 13 -17 steps to be followed to design each and every sump or rainhead.

With regards to overflows, 3500.3, clause 3.7.6 Layout part (d) (iv) states (see also excerpt from 3500.3 below):

'provision for flow from each overflow device (see clause 3.7.5) to be discharged, without danger, indirectly to the surface drainage system'

There is in addition the well-known requirement that all overflows must discharge to atmosphere. Although this requirement is implied by the clause note above, it is specifically stated in clause 3.7.7.1 *Hydraulic capacity*, as follows (see also excerpt from 3500.3 below):

'*... Overflow devices shall discharge to the atmosphere.'*

Overflowing water must therefore discharge visibly to atmosphere, so as to alert the building owner or occupant that there is a blockage, and also '*indirectly to the surface drainage system'*.

Hence an overflow cannot discharge over a rainhead* because firstly the overflow discharge will then not be to the surface drainage system, and secondly, the rainhead could obscure the overflow such that it was either not visible, or not very visible. Consequently, such arrangements are non-compliant. See further comments below regarding the Type A overflow.

* An exception to this would be an overflow pipe from a sump, discharging directly and entirely into the overflow chute of a Dam Buster rainhead, however, this would already be a Performance Solution, not DtS.

3.7.6 Layout

The following apply to the layout of box gutter systems:

(a) The location and size of the box gutter shall be taken into consideration.

(b) The size of the support system (see Clause 4.9) shall be taken into consideration.

(c) Provision for the effects of thermal variation (see Clause 4.3) on the box gutter and support system shall be taken into consideration.

(d) Consideration shall be given to the location of associated vertical downpipes with rainheads or sumps in relation to —

(i) features within the building and usage;

(ii) surface water drainage system external to the building;

(iii) the space within or external to the building; and

(iv) provision for flow from each overflow device (see Clause 3.7.5) to be discharged, without danger, indirectly to the surface water drainage system.

3.7.7 Overflow devices

3.7.7.1 Hydraulic capacity

The hydraulic capacity of an overflow device shall be not less than the design flow for the associated gutter outlet. Overflow devices shall discharge to the atmosphere.

NOTE In New Zealand, overflow outlets should be located to give an early, conspicuous warning to the building occupier that maintenance is required. Overflow outlets should discharge outside the building, clear of doors, windows or other opening, and within the property boundary.

Excerpts from AS/NZS 3500.3-2021

3.0 DISCUSSION

The following are reasons for why sump types A & B are not DtS solutions i.e. do not comply with 3500.3, and are as follows:

3.1 Sump type A – Reasons this is not a DtS Solution

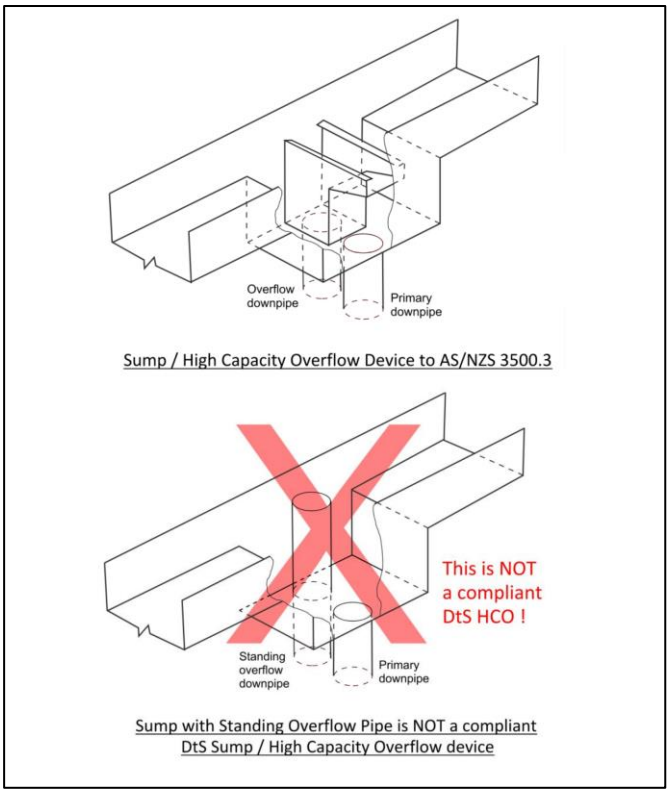
- This arrangement appears to effectively be a Sump/ Side Outlet, with the overflow penetrating the external wall, and discharging over a rainhead (not yet installed in the example provided).
- The overflow duct cannot discharge over a rainhead (as noted above). The reason for this is that there could be a blockage in the sump DP (which is assumed to connect into through the rainhead downpipe) between the sump and the rainhead downpipe. This blockage would typically go undetected if the rainhead and its downpipe were operating normally and the overflow was only discharging small amounts of water over the rainhead, and hence prevent an alert to carry out proper maintenance of the box gutter system. Then, when a high intensity event occurred, the overflow may itself block or partially block and not be able to cope, causing flooding of the building.
- Further to the above, even if discharge of the overflow duct into or over the rainhead were acceptable as a DtS Solution, the rainhead would need to be an 'Open Fronted' rainhead as depicted in the Normative Figures in 3500.3 in order to have compliant overflow provision itself, as no other rainhead design is shown or described with AS3500.3. This has not changed since at least the 1998 version.

- Additional comments:
    - A sump designed as Sump/Side Outlet to 3500.3 typically does not need 150mm deep for domestic construction, where the design flows are relatively low. The sump depth required will typically be significantly less. For example, for 90mm diameter overflow pipe, only a 60mm deep sump is required for the minimum design flow of 3.0 L/s, and for a 100mm diameter overflow pipe, a 60mm deep sump would be adequate for flows up to 3.5 L/s. This would be Approximately 57m2 of roofing in Melbourne city postcode (187mm/hr rainfall AEP).
    - The minimum length of a sump for the Sump and Side Outlet is 400mm. Hence the 600mm length adopted is also not required but instead reflects confusion about the sizing requirements for the entirely different Sump/High-Capacity overflow device shown in Figure 3.7.3(c) of 3500.3
    - Note, it appears the roof plumber has attempted to provide some sort of hybrid between a Sump and Side Outlet and a Sump / High-Capacity overflow device. There are only two types of sump overflow devices to 3500.3, refer to RP-02 (attached) and AS3500.3 Figures 3.7.3(b) and 3.7.3(c), and the hybrid as presented does not meet those DtS requirements.
    - The rainhead is not yet installed, however would also have to conform with Figure 3.7.3(a) of AS3500.3 to be DtS. Alternatively, the rainhead would need to be DtS by Expert Judgement or else a Performance Solution. All Dam Buster rainheads meet these later two requirements.
    - It is difficult to estimate the dimensions of the overflow duct. It should be confirmed that these dimensions comply with Figure H.6 of 3500.3.
    - This design would most likely also need ceiling bulkheads and so incur much greater costs of construction and installation simply because of its entirely non-compliant and poor design.
    - Dam Buster has noted a resistance by some plumbers to use Performance Solutions, however all volumes of the NCC, including volume 3, the PCA, are ‘Performance Based’ codes. A (properly prepared) Performance Solution is equally valid as a DtS Solution, and a combination of both may also be used. Dam Buster products also meet all requirements to be DtS by Expert Judgement where that is acceptable to the responsible regulator. Possible reasons for why some plumbers are resistant to use Performance Solutions are:
        - They do not fully understand that the NCC is a Performance Based code.
        - They perceive them as being ‘higher risk’.
        - The are concerned that they may not be insured for them.

    - Further to the above, all solutions, whether Performance Solutions, DtS or DtS by Expert Judgement, or a combination, require adequate ‘Evidence of Suitability’. For any DtS Solutions complying with 3500.3, this means detailed computations should be provided in accordance with the General Method in 3500.3.

3.2 Sump type B – Reasons this is not a DtS Solution

- This arrangement appears to be an attempt at a Sump / High-Capacity overflow device to 3500.3 Figure 3.7.3(c), however, it is not the same as this device, because it has a vertical piped overflow rather than a weir and funnel shaped overflow as required by the standard. Once again, it is not one of the prescribed DtS Solutions contained in 3500.3. Refer also the diagram below.



A vertical piped overflow is not a DtS Solution to AS/NZS 3500.3-2021

Further to the above, there is no prescribed or suggested method of designing a vertical piped overflow to 3500.3 see Clause 3.7.7.2 Note 2, and hence it would need to be a Performance Solution, properly prepared by a hydraulic engineer, including calculations and testing to support the calculations.

4.0 CONCLUSION

In conclusion, the Sump Types A & B should not be approved by the Building Certifier / Relevant Building Surveyor or the Regulatory Authority. Both types are significantly non-compliant and should not be installed, nor should manufacturers of these products facilitate their production and/or sale in any way. Installers are also at significant risk due to the Non-compliance and Non-Conformance of either Sump Types A or B.

Attachments

1. Photographs 1 to 12
2. Type A and Type B sumps with Dam Buster comments
3. VBA Practice Note RP-01 Regulatory Framework NCC 2022.
4. VBA Practice Note RP-02 Box Gutters.
5. VBA webinar slides Common Enquiries and Faults – Box Gutters.
6. VBA Fact Sheet – Roofing – common roof drainage faults and enquiries – box gutters.

Attachment 1

Photographs 1 to 12

Photograph 1 – Type A overflow

Photograph 2 – Type A overflow

Photograph 3 – Type A overflow

Photograph 4 – Type A overflow

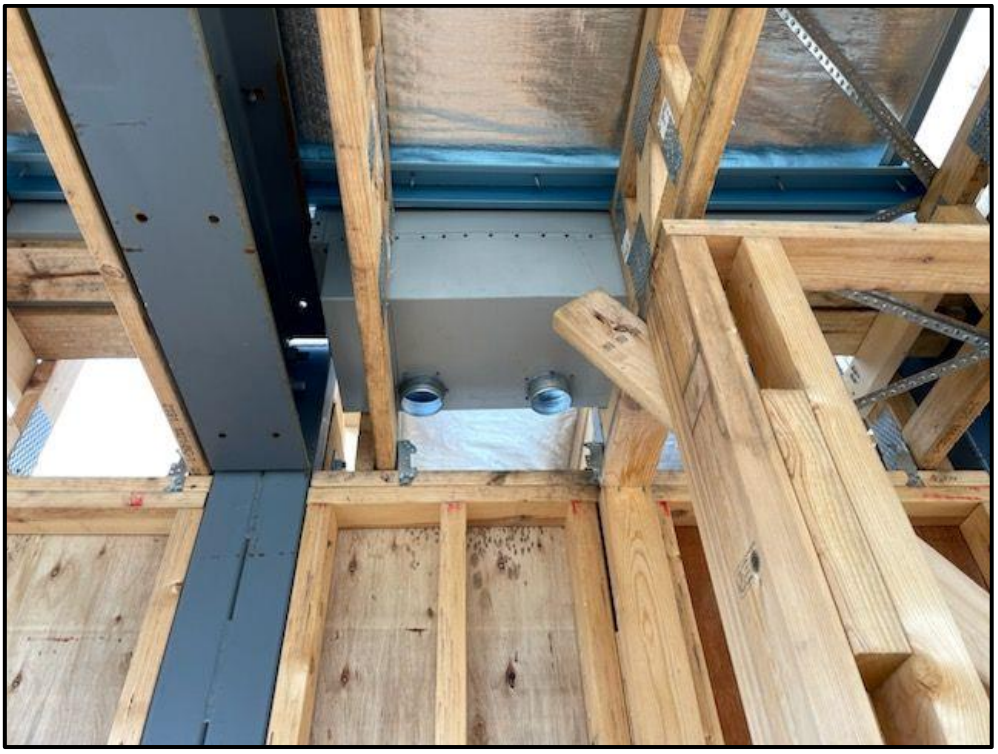
Photograph 5 – Type A overflow

Photograph 6 – Type A overflow

Photograph 7 – Type A overflow

Photograph 8 – Type A overflow

Photograph 9 – Type B overflow



Photograph 10 - Type B overflow

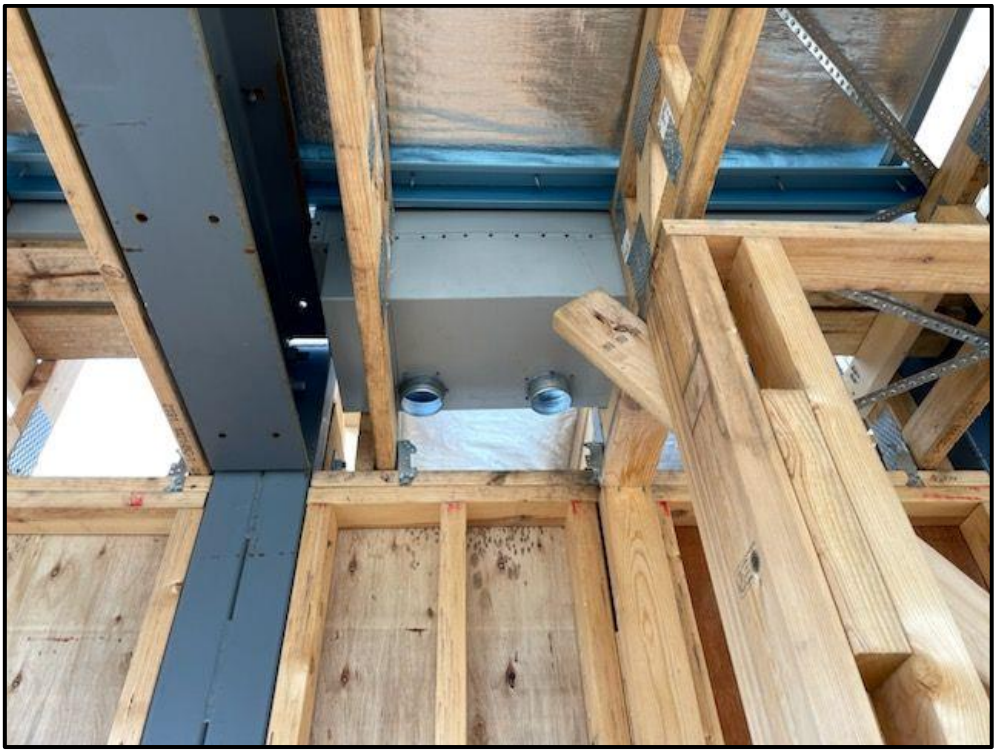
Photograph 7 – Type A overflow

Photograph 8 – Type A overflow

Photograph 9 – Type B overflow

Photograph 10 - Type B overflow

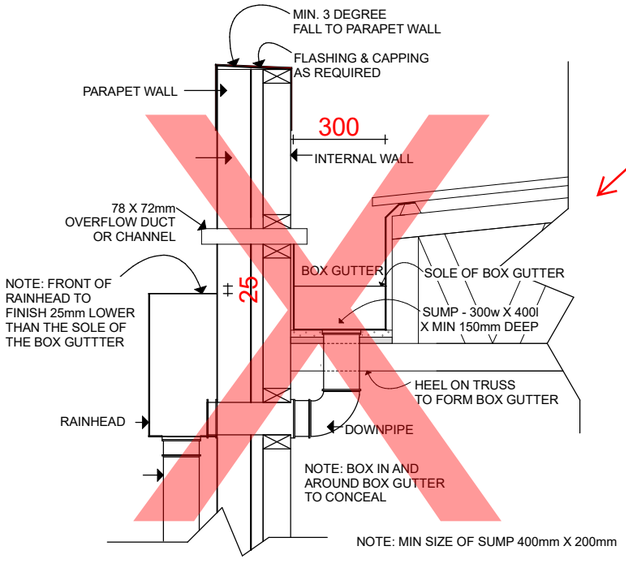
Photograph 11 – Type B overflow



Photograph 12 - Type B overflow

Attachment 2

Type A and Type B sumps with Dam Buster comments



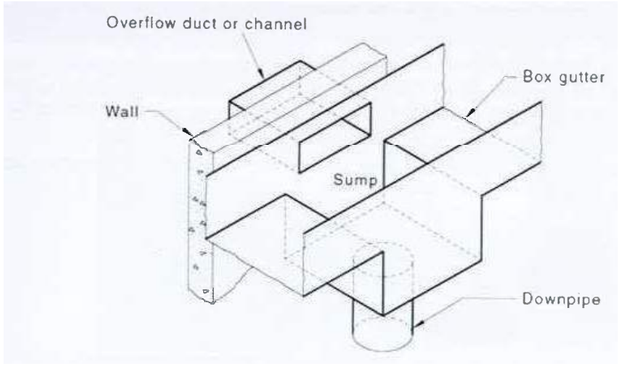
This detail is non-compliant* because:

1) It is not sized correctly as a Sump / Side Overflow to AS/NZS 3500.3 (overflow duct is too small)
2) The overflow cannot discharge into the rainhead, it must discharge to the surface drainage system as per AS/NZS 3500.3. Note, if a blockage occurs in the pipe between the RH and the sump, this may not be detected.
3) Note, even if it were permissible for the overflow duct to discharge into the rainhead, then the rainhead would have to comply with AS/NZS 3500.3 and be an 'open fronted' rainhead.

'**Non-compliant**' in this context means NOT a Deemed-to-Satisfy Solution i.e. does not comply with AS/NZS 3500.3-2021

TYPE A Sump

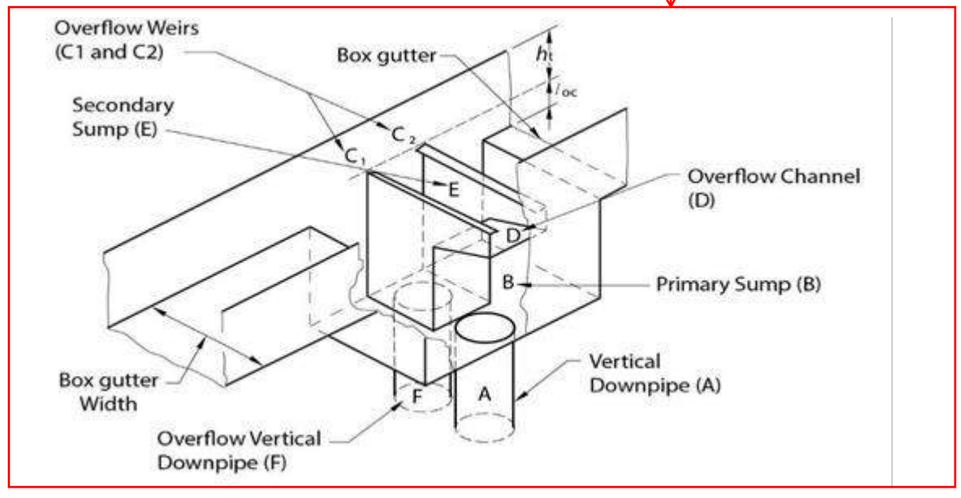
BOX GUTTER DETAIL 1 - 1:20



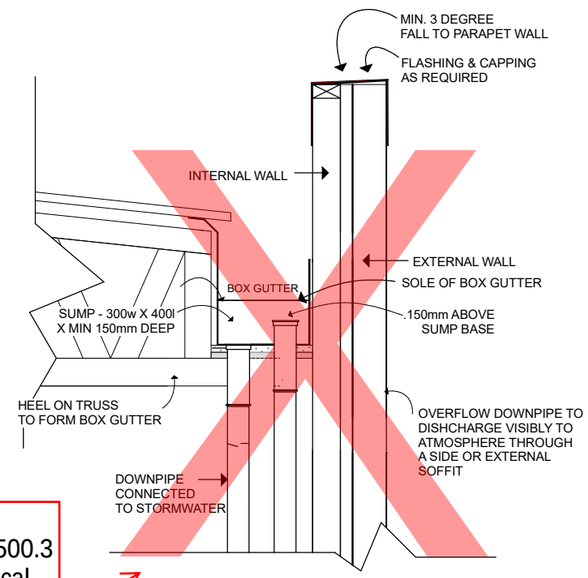
Sump / Side overflow device to AS/NZS 3500.3

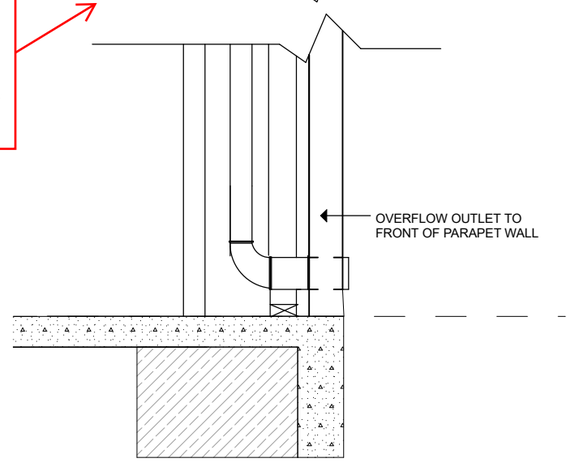
This detail is non-compliant* because:

1) It is not a Sump / High capacity overflow device per AS/NZS 3500.3
2) There is no method provided in AS/NZS 3500.3 to design vertical piped overflows. The hydraulic capacity of the pipe depends on the size of the pipe and head of water over it. Clearly a vertical piped overflow has much less hydraulic capacity than the overflow pipe in a Sump / High Capacity overflow device.



Sump / High Capacity overflow device to AS/NZS 3500.3





TYPE B Sump

BOX GUTTER DETAIL 2 - 1:20

SUMP & BOX GUTTER DETAILS

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Dam Buster comments 20.02.2024

Attachment 3

VBA Practice Note RP-01 Regulatory Framework NCC 2022

VICTORIAN BUILDING AUTHORITY

PLUMBING PRACTICE NOTE

Regulatory Framework RF 01| Plumbing Regulatory Framework– NCC 2022

Audience

The audience/s for this Practice Note include/s:

- ☒ Architects/ Designers
- ☒ Builders
- ☒ Building Surveyors/ Inspectors
- ☒ Engineers
- ☐ Home Owners / Residential Tenants
- ☒ Owner Builders
- ☒ Plumbers
- ☒ Real Estate Management Agents
- ☐ Trades and Maintenance (inc. Electricians)

Purpose

This Practice Note provides guidance on the regulatory framework for plumbing work captured under the National Construction Code (NCC) 2022 Volume Three – Plumbing Code of Australia.

This practice note provides guidance on plumbing work that is captured through the 2022 edition of the NCC. Not all plumbing work is within scope of the NCC, for example there may be requirements regulated under other legislation such as the Gas Safety Act 1997.

Abbreviations & Definitions

The abbreviations and definitions set out below are for guidance only. They are not intended to vary those set out in the Building Act 1993, the Plumbing Regulations 2018 or the National Construction Code.

- **ABCB –** Australian Building Codes Board
- **Act –** Building Act 1993
- **BCA –** Building Code of Australia 2022
- **Building Regulations –** Building Regulations 2018
- **DtS –** Deemed-to-Satisfy.
- **NCC –** National Construction Code 2022
- **PCA –** Plumbing Code of Australia 2022
- **Regulations –** Plumbing Regulations 2018
- **WELS –** Water Efficiency Labelling and Standards Scheme

VICTORIA State Government

Regulatory Framework

Plumbing work in Victoria is regulated through a State based system which includes the Building Act 1993, Plumbing Regulations 2018, the National Construction Code, and referenced documents.

Figure 1 shows a schematic of the regulatory framework.

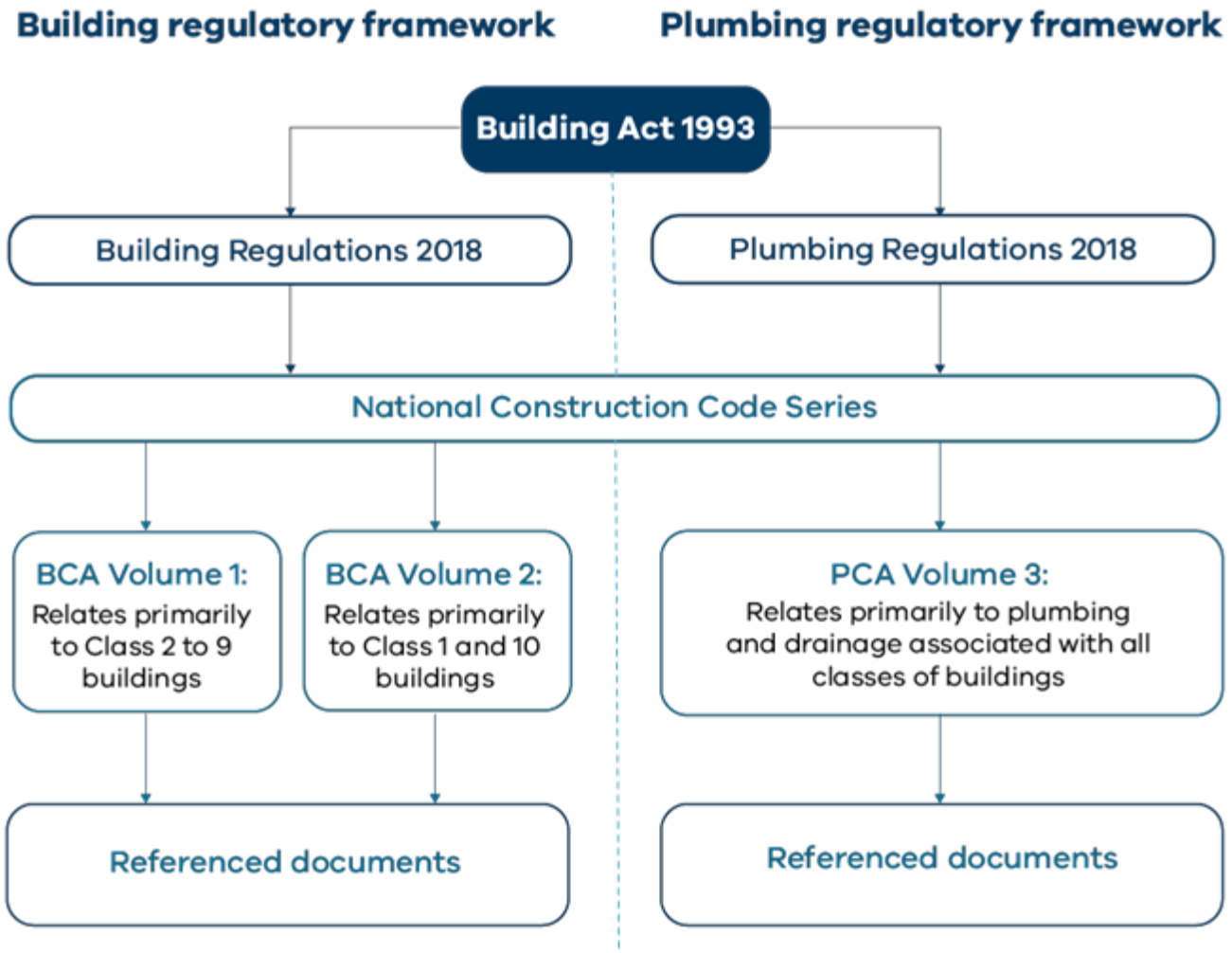

Figure1: Regulatory Framework
VBA owned image

Building Act 1993

The Act is the primary legislation that regulates plumbing work in Victoria. Part 12A of the Act sets out the legal framework for the regulation of plumbing work and plumbers.

This establishes the broader framework for plumbing and includes matters such as:

- licensing and registration of plumbers
- restrictions concerning the carrying out of plumbing work
- compliance certificates
- provisions applying to particular plumbing work (e.g. inspection requirements for sanitary drainage work)
- insurance orders
- rectification of defective plumbing work
- modification of plumbing regulations

- enforcement
- plumbing infringements
- plumbing inquiries and disciplinary action

There are two important sections of the Act that enable the PCA to form part of the overarching framework. These provide the required linkage, and are:

- Section 221ZZZV – enables the creation of the Regulations.
- Section 221ZZZW – enables the incorporation of the PCA into the Regulations and confirms the PCA edition in force.

Plumbing Regulations 2018

The Regulations provide a greater degree of detail to support the function of the Act. Key functions of the Regulations include:

- To specify what plumbing work is
- To define the scope of work for the main classes of plumbing work and specialised classes of plumbing work
- To set out the qualification and experience eligibility requirements for registration and licensing in each class of plumbing work and specialised plumbing work
- To adopt the PCA and modify where necessary
- To prescribe standards of work and other requirements that a licensed or registered plumber must comply with when carrying out plumbing work
- To specify fees that are applicable.

The PCA is adopted and forms part of the Regulations via Regulation 7, which states:

"*The PCA is adopted by and forms part of these Regulations, as modified by these Regulations*."

This means that the PCA should be viewed as a regulation, and that it may also be modified by the Regulations as required. Regulation 9 is an example of how the Regulations can modify the PCA, in that it specifies what version of reference documents need to be used.

National Construction Code Series

The NCC series is produced and maintained by the ABCB, which is a joint initiative of federal, state and local governments, and provides the primary set of technical design and construction provisions for buildings in Australia.

The NCC combines building and plumbing construction requirements into a single code consisting of three volumes. These include:

- BCA Volume One: primarily the technical provisions for the design and construction of Class 2 to 9 buildings
- BCA Volume Two: primarily the technical provisions for the design and construction of Class 1 and 10 buildings
- PCA Volume Three: primarily the design, construction and maintenance of plumbing and drainage systems for all classes of buildings (new and existing).

NCC Volume Three - Plumbing Code of Australia (PCA)

The PCA sets out the technical requirements for the design, construction and maintenance of plumbing and drainage systems in new and existing buildings. It applies to:

- all classes of buildings
- sites where water services are constructed independent of buildings
- whenever specified plumbing work is carried out.

The PCA sets out the requirements for different types of plumbing work. For Victoria, these include:

1. Main section of the PCA:
    - Section A – Governing requirements
    - Section B - Water services
    - Section C - Sanitary plumbing and drainage systems
    - Section D - Excessive noise
    - Section E - Section E Facilities and ancillary additions
2. Victorian variations and additions
    - Vic Part C4 Low risk on-site liquid trade waste systems
    - Vic Part E2 Heating, ventilation and air conditioning systems
    - Vic Part E3 Stormwater - Roof drainage systems
    - Vic Part E4 Stormwater - Surface and sub-surface drainage systems

    - Part A2 Compliance with the NCC
    - Part B1 Cold water services
    - Part B4 Fire-fighting water services
    - Part B7 Rainwater storage
    - Part C1 Sanitary plumbing systems
    - Part C2 Sanitary drainage systems
    - Part C3 On-site wastewater management
    - Part D1 Excessive noise

Note that some PCA requirements are overridden by the Victorian variations, additions and deletions. These must be complied with as part of the PCA. In the PDF version of the PCA these are typically indicated in blue text preceding the clause (denoted as VIC followed by clause number that is varied. E.g. VIC B1D3). Full details of the variation are contained in Schedule 10 - Victoria. If the document is viewed online the links to the variations appear within the general section.

For some types of plumbing, the requirements are a Victorian addition to the PCA, and are only contained in the state(s) specific Schedule. An example is Vic Part E3 Stormwater - Roof drainage systems, which is contained in Schedule 10 – Victoria where there is not a national Part E3, and the details are only included within Schedule 10.

The PCA does not cover gasfitting work.

Relationship between Building and Plumbing Requirements

Many of the Building and Plumbing requirements can be complimentary to each other due to the shared framework of the Act and the NCC series.

An example of this could be a roof drainage system. The Regulations and PCA specify compliance requirements (e.g. through clause 5 of Schedule 2 in the Regulations, and PCA VIC Part E3 Stormwater - Roof drainage systems), and the BCA also specifies requirements (e.g. through BCA Volume 2 Vic H2D6, Housing Provisions Part 7.4, AS/NZS 3500.3). In this situation the plumbing work would need to satisfy both the building and plumbing requirements, including the associated administrative processes such as compliance certificates or building permits.

Examples of areas that may have complimentary building and plumbing requirements include:

- Surface water drainage, including roof drainage systems
- Energy efficiency, including rainwater tanks, hot water systems
- Swimming pool drainage

NCC Requirements

Compliance with the NCC

Compliance with each volume of the NCC is achieved by complying with Part A2. For compliance with the PCA, this means the following must be satisfied:

- the Governing Requirements - as set out in section A of the PCA; and
- the Performance Requirements – as set out under each section (B – E and Schedule 10) of the PCA

Figure 2 illustrates the overarching compliance for the PCA.

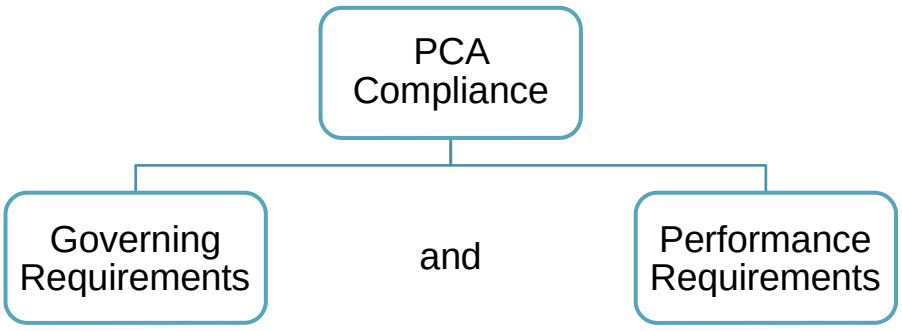

Figure 2: NCC 2022 overarching compliance structure
VBA owned image

Governing Requirements

The Governing Requirements provide the rules and instructions for using the PCA and must be complied with, these include:

- Interpreting the NCC, including definitions
- Complying with the NCC
- Victorian variations, additions and deletions
- Referenced documents, including Australian standards
- Evidence of suitability, such as WaterMark
- Building classifications and use

These governing requirements cannot be modified through functions of the PCA itself, such as the use of performance solutions. They must be complied with unless otherwise modified by the Act or Regulations.

Victorian variations are an example of the governing requirements, where it is mandatory to comply with the variation under Part A3G1.

Performance Requirements

Performance Requirements set the minimum necessary level of performance that plumbing work must achieve. These are the only NCC technical provision that must be satisfied, and are satisfied by one of the following approaches:

- a Performance Solution;
- a Deemed-to-Satisfy Solution (DtS); or
- a combination of Performance Solution and DtS solutions.

Figure 3 provides a diagram for how the performance requirements can be satisfied.

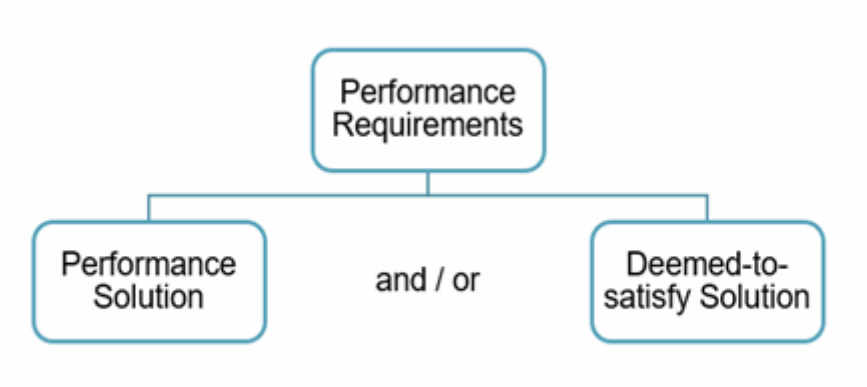

Figure 3: NCC 2022 Part A2
VBA owned image

Performance Solutions

A Performance Solution is a method of complying with the Performance Requirements other than by a DtS solution and is unique for each individual situation and is set out under part A2G2 of the PCA.

Performance solutions involve a process of consultation between the relevant stakeholders, as well as analysis against acceptance criteria. These can offer more flexibility in the methods used to achieve the PCA outcomes and encourages innovative design and technology use.

A Performance Solution can demonstrate compliance by:

- directly assessing the proposed solution against the relevant Performance Requirement(s); or
- demonstrating the solution is at least equivalent to the DtS provisions.

A Performance Solution must:

- demonstrate compliance using one or more of the Assessment Methods under A2G2(2); and
- follow the mandatory process set out under A2G2(4).

It is important that Performance Solutions are well documented to show how compliance with the PCA is achieved for the particular situation.

Deemed to Satisfy Solutions

A DtS solution is a method used to satisfy the Performance Requirements and is set out under part A2G3 of the PCA. The DtS provisions are prescriptive based requirements in which the DtS solution must comply with.

The DtS Provisions are contained in each of the relevant sections of the PCA, and may provide direct detail of the necessary requirements, or provide a reference to another document (e.g. an Australian Standard).

Any determination of DtS compliance must use one or both of the following assessment methods under A2G3(2) as applicable:

- Evidence of suitability under Part A5; or
- Expert Judgement

Evidence of suitability

Evidence of suitability is an assessment method used to determine compliance of a performance solution (under A2G2(2)) or a DtS solution (under A2G3(2)). Where evidence of suitability is used, it must comply with the detail contained within part A5 of the PCA, and as a governing requirement, it cannot be varied by a Performance Solution.

Part A5 of the PCA outlines the evidence of suitability requirements, and explains the evidence needed to show that a plumbing material, product, form of construction or design is fit for their intended purpose to achieve compliance. For a plumbing installation, clauses A5G1, A5G2, and A5G4 are particularly relevant.

To ensure a plumbing product or form of design is fit for purpose, evidence is required under A5G4. For any product intended for use in contact with drinking water, compliance with AS/NZS 4020 must be demonstrated through:

- Compliance with the WaterMark Certification Scheme; or
- A test report provided by a certification body or accredited testing laboratory

Or for a plumbing design or system more broadly:

- A form of documentary evidence that demonstrates compliance with the PCA, such as certificates, reports, calculations or other documents.

WaterMark Certification Scheme

WaterMark Certification Scheme is a national scheme for certifying and authorising plumbing and drainage products (includes materials, fixtures, components, appliances and equipment used in plumbing) to ensure that they are fit-for-purpose as required under the PCA. The scheme is administered by the ABCB and involves WaterMark Conformity Assessment Bodies (WMCAB) that have been authorised to issue a WaterMark Licence.

When using WaterMark through the evidence of suitability requirements of A5G4, there are particular definitions to be aware of when interpreting the provisions:

> WaterMark Schedule of Products *means the list maintained by the administering body of products included in the WaterMark Certification Scheme, and the specifications to which the products can be certified.*

WaterMark Schedule of Excluded Products *means the list maintained by the administering body of products excluded from the WaterMark Certification Scheme.*

WaterMark Schedule Licence *means a licence issued by a WaterMark Conformity Assessment Body*

The WaterMark Schedule of Products and the WaterMark Schedule of Excluded Products can be viewed on the ABCB website.

Where a product has been issued a WaterMark licence it must display the WaterMark symbol (Figure 4) and licence number in accordance with the specific marking requirements set out in the scheme rules.

Figure 4: Watermark Certification Trademark
ABCB owned image

NCC Referenced documents

The NCC does not contain details of every design and construction requirement for a building or plumbing or drainage system. Instead it references other documents (e.g. AS/NZS 3500 series) for this information. Both the Regulations and the PCA contain a list of referenced documents.

Part A4 of the PCA details how documents referenced in the NCC are adopted and applied. It specifies matters such as:

- where and when the use of a reference document is mandatory
- when the NCC takes precedent, and
- when the NCC does not require compliance with requirements or a referenced document.

Part A4 also specifies which version of a standard applies through Schedule 2, however this part should be read in conjunction with the Regulations as the PCA is modified through regulation 9(2)..

Automatic adoption of primary referenced standards

The Regulations provide for the latest version of a referenced standard to be adopted on the date that they are issued, published or remade. This is done through the definitions within Regulation 5.

In addition, the Regulations also modify the PCA through the use of regulation 9(2) stating that:

> *any document that is referenced in the PCA is a reference to the latest edition of that document as issued, published or remade from time to time*.

This means that the Regulations effectively vary the date and title requirement of Schedule 2 of the PCA, and requires the most recent edition of the standard to be used rather than what is listed in the PCA. There is an exception to this, where regulation 9(3) lists a number of standards that are excluded from automatic adoption, including:

- AS/NZS 3500.1;
- AS/NZS 3500.2;
- AS/NZS 3500.3;
- AS/NZS 3500.4;
- AS/NZS 4234.

When the above standards are referenced, the edition used must be in accordance with Schedule 2 of the PCA.

Secondary referenced standards are not automatically adopted

As the automatic adoption of standards in the Regulations and PCA only applies to those that are specifically listed, secondary referenced standards are not automatically adopted (as they are not listed), unless the secondary referenced standard is also a primary referenced standard.

In these situations, the secondary reference standard should be considered as per the PCA part A4G1(5). This states that a secondary reference standard should be considered as a reference to the document as it existed at the time of publication of the primary referenced document.

An updated (amended, published or remade) secondary referenced standard only comes into effect when the primary reference standard that references it is updated (provided it is still referenced in the updated primary standard).

Modifications to the Regulations

The VBA has power under section 221ZZO of the Act to make a declaration modifying the application of the plumbing regulations. This includes anything covered under the Regulations, the PCA or a reference standard (e.g. an Australian Standard).

A modification should only be utilised when all reasonable compliance options have been exhausted. For example, if a performance solution under the PCA is available, this established process should be utilised instead of a modification. The VBA will only exercise this power if:

- the application of the plumbing regulations to the specified plumbing work is not appropriate in the circumstances, and
- if it is reasonable and in the public interest to modify their application in the specified circumstances.

For more information on plumbing modifications including how to apply, see Plumbing modifications Victorian Building Authority (vba.vic.gov.au).

Water efficiency labelling and standards scheme

WELS is an Australian scheme that helps businesses and consumers make decisions to reduce water consumption. Manufacturers, suppliers, retailers, plumbers, builders, developers and real estate agents all have important obligations under the Water Efficiency Labelling and Standards (WELS) Act 2005. Complying with the scheme is mandatory. Under WELS, certain plumbing products/ appliances must meet minimum water efficiency standards and/or be labelled in accordance with the Scheme rules before they can be offered for sale/ supply. The WELS label typically identifies an appliance's water efficiency out of 6 Stars, based on the more stars the more water efficient. The scheme is not directly regulated through the Act, Regulations or PCA.

Related Documentation

- Building Act 1993
- Plumbing Regulations 2018
- National Construction Code Series 2022

List of Amendments

- Updated references with embedded links to NCC 2022
- Title change

Document history

Sector	Plumbing
Category	Regulatory Framework
Topic	Plumbing Regulatory Framework - NCC 2022
Document number	01
Version	2.0
Superseded	• Version 1, published 19 April 2023 Plumbing under NCC 2022
Published	25 September 2023

Contact Us

If you have a technical enquiry, please email plumbingtechnicaladvice@vba.vic.gov.au or call 1300 815 127.

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Attachment 4

VBA Practice Note RP-02 Box Gutters

VICTORIAN BUILDING AUTHORITY

PLUMBING PRACTICE NOTE

Roof Plumbing RP 02 | Box Gutters'

Audience

The audience/s for this Practice Note include/s:

- ☒ Architects/ Designers
- ☒ Builders
- ☒ Building Surveyors/ Inspectors
- ☒ Engineers
- ☐ Home Owners / Residential Tenants
- ☒ Owner Builders
- ☒ Plumbers
- ☐ Real estate management agents
- ☒ Trades and Maintenance (inc. Electricians)

Purpose

This Practice Note provides guidance on the Deemed-to-Satisfy (DtS) requirements for the installation of box gutters with sole widths between 200mm and 600mm.

The content below provides guidance on:

- Defining a box gutter
- Design and installation parameters for box gutters
- Requirements for a box gutter support system
- Overflow provisions in a box gutter
- Expansion provision for box gutters
- Collaboration on the design of box gutters

For guidance on regulatory framework, please refer to Plumbing Practice Note RF-01 | Regulatory Framework- NCC

Abbreviations & Definitions

The abbreviations and definitions set out below are for guidance only. They are not intended to vary those set out in the Building Act 1993, the Plumbing Regulations 2018 or the National Construction Code.

- **Act** – Building Act 1993
- **NCC** – National Construction Code 2022
- **AS** – Australian Standard
- **AS/NZS** - Australian/New Zealand Standard
- **DtS** – Deemed-to-Satisfy
- **PCA**– Plumbing Code of Australia (National Construction Code 2022, Volume Three)

VICTORIA State Government

Defining a box gutter

A box gutter is defined as a graded channel, generally of rectangular shape, for the conveyance of rainwater within the building footprint, typically adjacent to a wall or parapet. A box gutter incorporating a lear is also an acceptable shape, provided the minimum sole widths are observed and the effective cross-sectional area of the gutter is appropriately sized for the roof catchment area.

All box gutter installations, whether new or replacement must satisfy the Performance Requirements of the Plumbing Code of Australia (PCA). The Performance Requirements apply to the design, construction, installation, replacement, repair, alteration and maintenance of box gutters. Compliance with the Performance Requirements of the PCA are automatically satisfied by complying with the AS/NZS 3500.3 and HB 39. Alternatively, they can be demonstrated through the Performance Solution process as set out in Section 2 of the PCA. Typical examples of box gutters are shown in Figure 1.

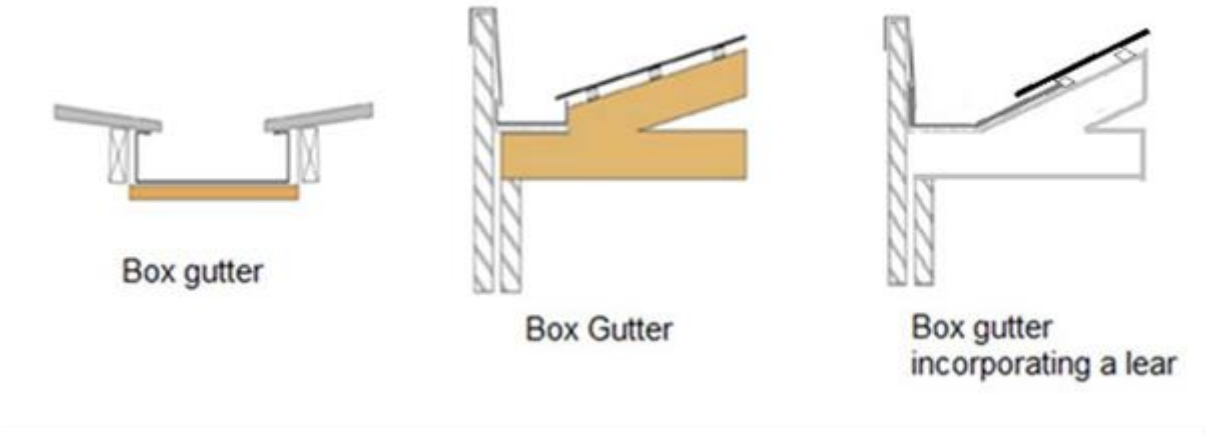


Figure 1: Typical examples of box gutters

V-shaped gutters are not permitted. If installed, they may result in water damage to the building. Damage may be caused by premature failure of the gutter due to inadequate drainage, permanent ponding and debris accumulating in the crevices, which may lead to intense localised corrosion of the gutter.

Guidance on the Plumbing Regulatory Framework and the use of Performance Solutions can be found on the VBA website

Deemed-to-Satisfy design and installation parameters for box gutters

The following information outlines the design parameters that must be adhered to for a box gutter installation to be considered a Deemed-to-Satisfy (DtS) installation:

- All box gutter sizing is based on an AEP (annual exceedance probability) of 1% (100 years ARI),
- The depth of box gutters and sizing of sumps, rainheads, downpipes and overflows must be designed using the general methods specified in the AS/NZS 3500.3,
- The maximum design flow per downpipe can only be plotted between 3 and 16 Litres per second,
- 100mm x 50mm downpipes are not an option that can be plotted from the standard for use with a sump,
- Box gutters sole widths can be plotted in 200mm, 300mm, 375mm 450mm, 525mm and 600mm. (can be a size in between if it is sized to the lower sole width),
- The minimum width of any box gutter: Domestic 200 mm and Commercial 300 mm,
- Box gutter sole widths of 200 mm cannot accommodate flow rates exceeding 10.5 Litres per second,
- Grade of box gutters can be plotted at 1:200,1:150, 1:100 and 1:40,
- The depth of a sump with a high-capacity overflow must be sized using the general method and no sump/high-capacity combination shall be less than 150 mm in depth,
- Length of a sump with a high-capacity overflow is always 600mm,
- Length of a sump with a side overflow device shall not be less than 400mm,
- The width of any sump shall be equal to the width of the box gutter,
- Rainheads shall be left open above the overflow weir, inverted pops, Ned Kelly slots, round holes and vertical chutes or ducts are not deemed-to-satisfy solutions,
- Overflow devices must discharge to the atmosphere and be clear of neighbouring properties and public areas,
- Box gutters must be straight without a change of direction and discharge at the downstream end without a change in direction (i.e. not to the side),
- The box gutter sole width must not be reduced towards the outlet without a proportional increase in depth, the width of the gutter must not reduce to less than the minimum width at which it was designed (i.e. if designed at 200 mm sole width, gutter must not reduce to less than 200mm in width),
- Sumps and rainheads must be fixed and fully sealed to the box gutter,
- All box gutters must incorporate provision for expansion; where the distance between fixed points exceeds 6 metres; and at appropriate intervals for the material and situation as prescribed by the standard,
- No part of the outlet is above the sole of the sump or rainhead, and
- Lap joints of box gutters to have 25mm laps sealed and fastened in the direction of fall.

NOTE: some requirements of HB 39 conflict with the requirements of AS/NZS 3500.3, in these situations the requirements of AS/NZS 3500.3 shall be used.

Image 1: Examples of **non-DtS** box gutter Installations

Image 1 depicts 3 examples of non-DtS box gutter Installations. Designs such as these can only demonstrate compliance with the Performance Requirements of the PCA through the Performance Solution process.

Deemed-to-Satisfy requirements for a box gutter support system

Box gutter support systems shall be designed and manufactured to support the entire weight of the gutter and sumps when full of water, and a trafficable load at any point in the gutter and sumps. For guidance on vertical load testing refer to AS/NZS 2179.1

The sides of each box gutter must have adequate structural strength so that water pressure will not cause deformation.

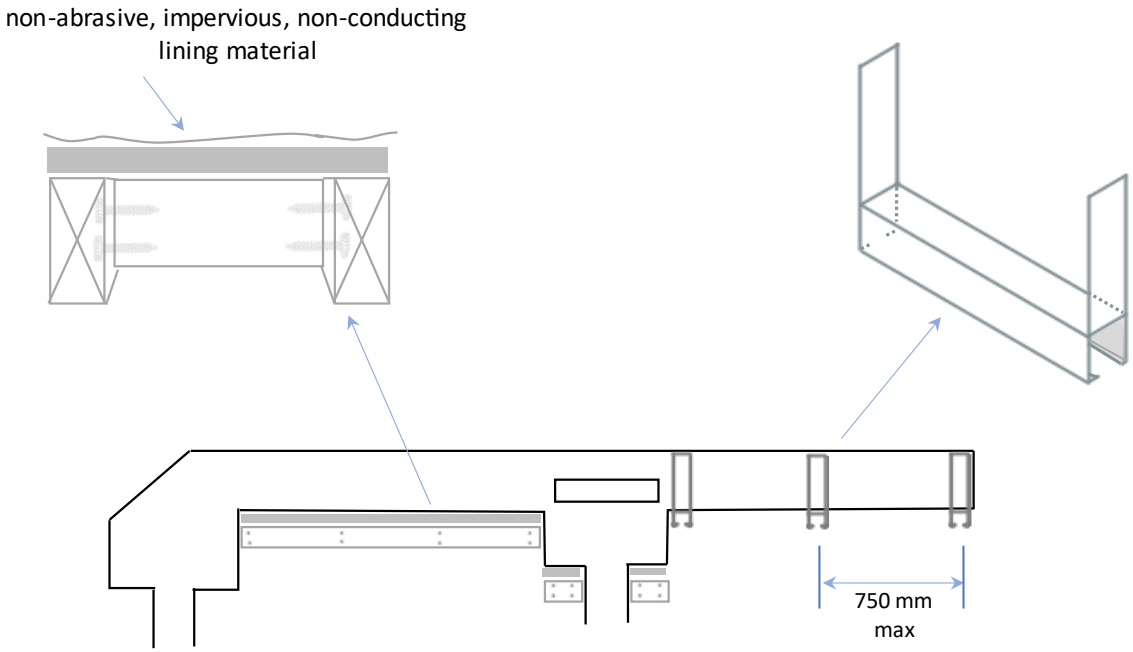
The box gutter support system must be fabricated from a material that is compatible with the box gutter or alternatively, the gutter must be protected against corrosion from an incompatible support material, or where exposed to a corrosive environment. The support system must be resistant to UV degradation and be securely attached to the building structure.

There are two types of DtS box gutter support methods that are available in the standard. These are:

- **Continuous support system -** where the box gutter is supported by multi-ribbed metal roof sheeting or other sheet type material. The support system must be continuous across the full length and sole width of the box gutter. The support of the sheet material must be fit for its intended purpose. Incompatible sheet materials may be used provided the contact surfaces are lined with a non-abrasive, impervious, non-conducting material. Continuous support systems are suitable for all gutter sole widths.

- **Discontinuous (bracket) support system** - where the box gutter is supported by brackets positioned at stop ends, either side of the sump and rainheads. The bracket material must be compatible with the box gutter and located at intervals not exceeding 750mm. Discontinuous support system can only be used for box gutters having a sole width less than 450mm.

Figure 2 provides an example of both types of box gutter support systems.



EXAMPLE OF CONTINUOUS SUPPORT

- Continuous support systems shall be used on sole widths of more than 450 mm
- Where incompatible materials are used (e.g., treated timber), the contact surfaces shall be lined with a non-abrasive, impervious, non-conducting material

EXAMPLE OF DISCONTINUOUS SUPPORT

- Discontinuous support brackets shall only be used on sole widths of 450 mm or less.
- Brackets shall extend across the sole width of the gutter.
- Brackets shall be located at stop ends, both ends of sumps, rainheads and intervals of not more than 750 mm.

Figure 2: Example of box gutter with continuous and discontinuous support.

Deemed-to-Satisfy requirements for box gutter overflow provision

Overflow devices are critical to a box gutter installation. Failing to install appropriately sized and positioned overflow devices can lead to serious damage to buildings and contents, often resulting in high-cost insurance claims.

The Plumbing Code of Australia (PCA) Vic Part E3 sets out the Performance Requirements to safeguard people from illness, injury or loss (including loss of amenity) due to the failure of a roof drainage installation.

Compliance with these requirements can be demonstrated through either a Performance Solution or a deemed-to-satisfy solution, however, roof drainage systems that are designed and installed in accordance with AS/NZS 3500.3 and SA HB:39 are automatically deemed-to-satisfy these requirements.

Where a Performance Solution is used as the compliance pathway, the solution must demonstrate that the box gutter's functionality is at least equivalent to it's deemed-to-satisfy alternative. This will ensure that the box gutter, downpipe, and overflow sizing has sufficient hydraulic capacity and freeboard to prevent wind driven spillages and overtopping from occurring within the building's footprint in the event of a total downpipe blockage.

Rainhead overflow provisions

To ensure that adequate overflow provision is made, and any surcharge is accommodated, the overflow weir of the rainhead must be the full width of the rainhead with the height of the weir positioned 25mm below the box gutter sole, and be fully open above the weir at the front of the rainhead.

Figure 3 shows an example of a rainhead with a weir located a minimum of 25mm below the sole of the box gutter.

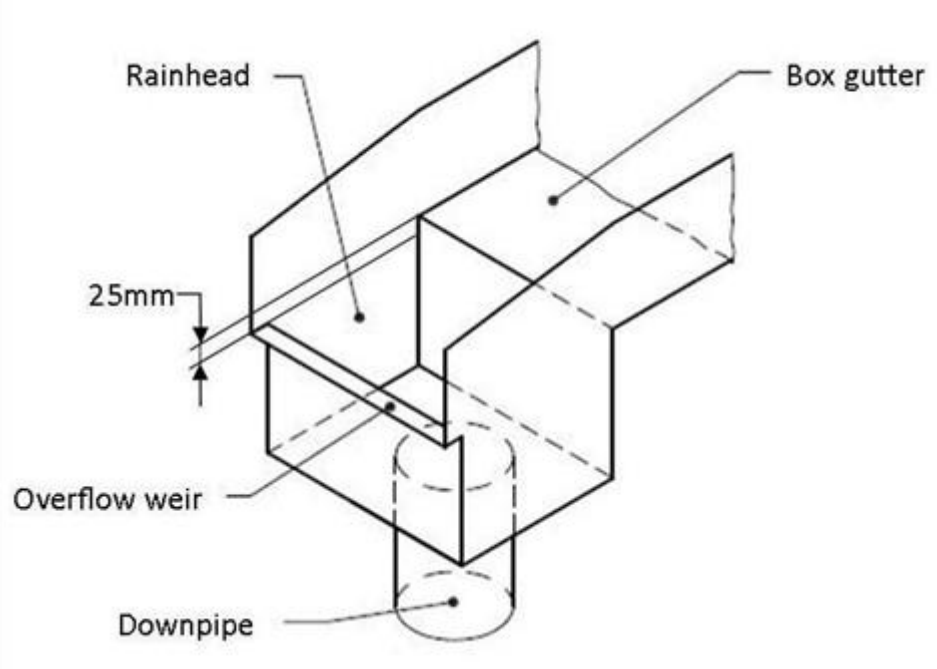


Figure 3: Example of a box gutter with a rainhead overflow provision. referenced from AS/NZS 3500.3 Figure 3.7.3 (a).

Sumps and overflow provisions

Box gutter sumps must incorporate either a side duct/channel overflow, or a high-capacity overflow device. A side overflow device is typically associated with an internal box gutter alongside a parapet wall. In the event of total or partial blockage of outlets or downpipes, the overflow device must discharge to atmosphere and remain within the property that it serves. The location of the discharge should be chosen so as to not cause a nuisance or damage to the property.

The size of the overflow device must be calculated in the accordance with the general methods prescribed by the AS/NZS 3500.3.

Figure 4 depicts an example of a side overflow device.

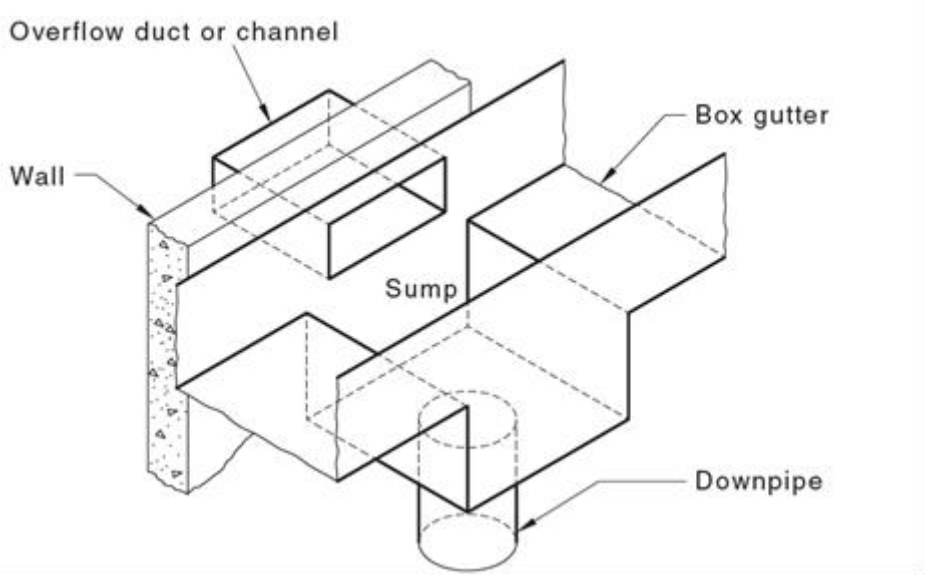


Figure 4: Example of box gutter design fitted with a sump and side overflow provision, *referenced from AS/NZS 3500.3 Figure 3.7.3 (b).*

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Figure 5 depicts an example of a sump with a high-capacity overflow device. Where this type of overflow is used the sump must be 600mm in length. The depth of the sump and the overflow weir height must be calculated in the accordance with the general method prescribed by the AS/NZS 3500.3. Sumps fitted with a high-capacity overflow device shall have a minimum depth of not less than 150mm.

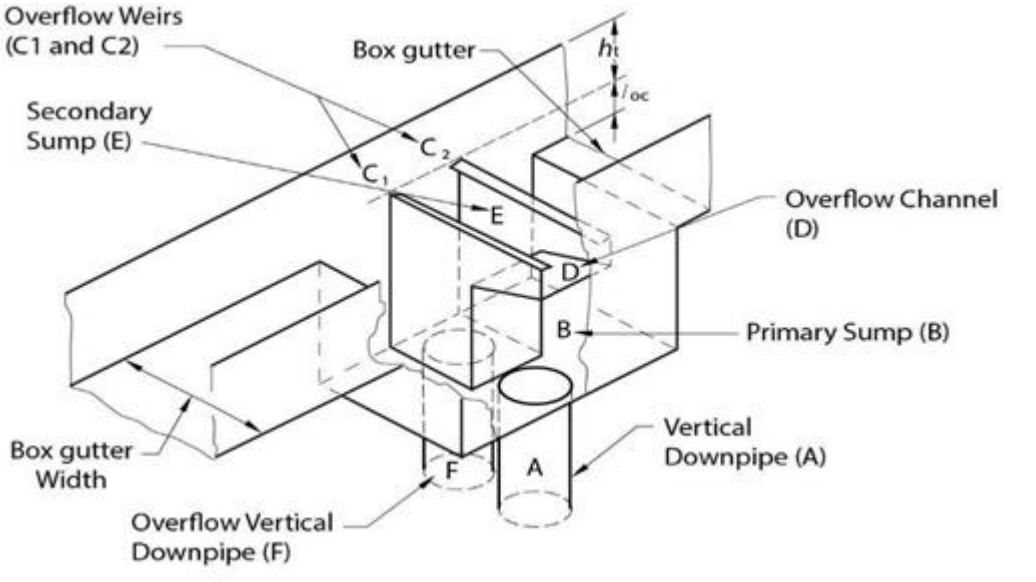

Figure 5: Example of box gutter design fitted with a sump and high-capacity overflow provision, *reference AS/NZS 3500.3 Figure 3.7.3 (c).*

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Deemed-to-Satisfy design requirements for expansion provision in box gutters

Roofing materials expand and contract due to temperature variations and this can cause unsightly oil-canning and structural problems in the roof drainage material if the installation does not cater for the movement. The range of expansion required will depend on the type and the thickness of the material being used.

For DtS guidance on the maximum lengths between expansion joints and minimum expansion space refer to clause 4.3 of AS/NZS 3500.3 and figure 6 below.

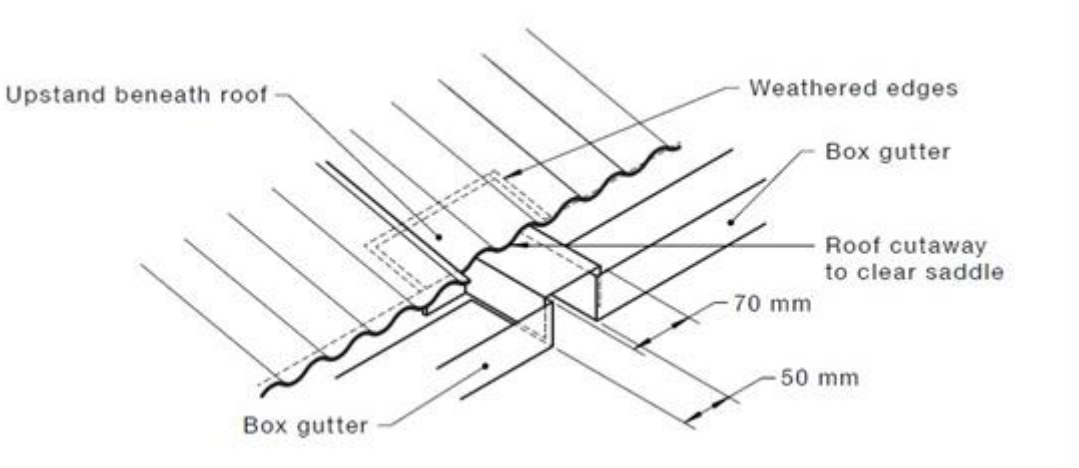

Figure 6: Example of box gutter design with provision for 50mm expansion space, referenced from HB 39 Figure 5.3.2 (B).

Collaboration on the design of box gutters

Designers, architects and building surveyors must ensure that approved designs can satisfy the Performance Requirements of the PCA. This means where design parameters of AS/NZS 3500.3 and HB 39 cannot be adhered to a Performance Solution must be agreed between the relevant stakeholders prior to work commencing. During construction, if designs are found to be outside of the DtS parameters, the roof plumber should consult with the Relevant Building Surveyor and builder as a Performance Solution may need to be developed and an amended Building Permit may need to be issued.

For example, where a roof frame does not readily allow the installation of a DtS compliant box gutter (due to the location or layout of roofing members) the alteration of any structural element of the building will require an approved building permit (new or amended) to be obtained prior to the structural alteration work commencing.

Image 2 (below) is a typical example of a box gutter that is not DtS compliant due to the change of direction. Collaboration with the designer, building surveyor, builder and plumber is necessary to ensure that all parties are aware of how the work is to be certified prior to the installation commencing.

Image 2: Depicts a box gutter with a change of direction.

Further information about box gutters

Further information on the deemed-to-satisfy design of box gutters systems is available from the VBA website through the following links:

- PDF- Common Roof Drainage Enquiries & Faults – Box Gutters
- WEBINAR- Common Roof Drainage Enquiries & Faults – Box Gutters

Compliance with the Performance Requirements of the PCA can be demonstrated through the Performance Solution process. Refer to Part A2G2 of the PCA for guidance on how a Performance Solution can be achieved. Further information is available on the VBA's website.

Related Documentation

- Building Act 1993
- Building Regulations 2018
- National Construction Code, Volume 3, Plumbing Code of Australia (PCA) 2022: VIC Part E3
- AS/NZS 3500.3:2021 Part 3: Stormwater Drainage
- HB 39:2015 Amd 1:2021 Installation code for metal roofing and cladding
- Plumbing Practice Note RP-01: Regulatory Framework
- Plumbing Practice Note RP-03: Eaves Gutters
- Plumbing Practice Note RP-04: Downpipes
- Plumbing Practice Note RP-05: Flashings

List of Amendments

- Updated to reference NCC 2022
- New figure added to expand on support requirements
- Reconfigure and simplify content to improve readability

Document history	
Sector	Plumbing
Category	Roof Plumbing
Topic	Box Gutters
Document number	02
Version	4.0
Superseded	• Version 3, published 4 May 2023 • Version 2, published 25 March 2021
Published	1 August 2023

Contact Us

If you have a technical enquiry, please email plumbingtechnicaladvice@vba.vic.gov.au or call 1300 815 127.

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Attachment 5

VBA webinar slides Common Enquiries and Faults – Box Gutters

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PRACTITIONER EDUCATION SERIES

Common Roof Drainage Enquiries & Faults – Box Gutters

Neville Campbell

Senior Technical Advisor (Plumbing)

This webinar will start shortly to allow participants to join.

VICTORIA State Government

The VBA respectfully acknowledges the Traditional Owners and custodians of the land and water upon which we rely. We pay our respects to their Elders past and present. We recognise and value the ongoing contribution of Aboriginal people and communities to Victorian life.

We embrace the spirit of reconciliation, working towards equality of outcomes and an equal voice.

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As Victoria's Building and Plumbing Regulator, we **safeguard Victoria's future liveability, promoting safe, compliant buildings, built to last**

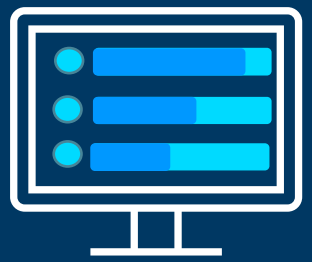
Our role is not to set policy, but to **support industry to understand and comply with the rules**.

Our Practitioner Education series **helps support the industry by providing practical insights, evidence-based strategies** and **useful resources**.

Housekeeping

Today’s session is **recorded** and will be available

Questions can be submitted and voted on via the Q&A function



We will conducting **live polls** today, which will automatically appear on your screens

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Purpose of this webinar/ (problem statement)

The purpose of this webinar is to highlight the most common enquiries and faults relating to box gutter systems that are not being designed in a Deemed-to-Satisfy manner.

Learning goal

The learning goal for this session is to identify fundamental requirements for the design and installation of box gutter systems using Deemed-to-Satisfy methods.

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Learning objectives

The learning objectives for this session are for participants to understand the fundamental Deemed-to-Satisfy installation requirements for:

- Box gutters discharging to a rainhead
- Box gutters discharging to a sump with a side overflow
- Box gutters discharging to a sump with a high-capacity overflow

By the end of this webinar, you should be able to:

- Identify sizing parameters for rainheads and sumps
- Identify appropriate overflow size and location
- Identify correct downpipe sizing and outlet location

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What we will cover

Box gutters discharging to a rainhead

1.1 Grade and design flow

1.2 Rainhead sizing

1.3 Overflow

1.4 Downpipe sizing and outlet location

Box gutters discharging to a sump with a side overflow

2.1 Grade and design flow

2.2 Sump sizing

2.3 Overflow

2.4 Downpipe sizing and outlet location

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What we will cover

Box gutters discharging to a sump with a high-capacity overflow

3.1 Grade and design flow

3.2 Sump sizing

3.3 Overflow

3.4 Downpipe sizing and outlet location

Box gutters- General

4.1 Gradient

4.2 Sole width

4.3 Changes of direction

4.4 Discharge to sump or rainhead

4.5 Overflow designs

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What we will cover

Box gutters- General

4.6 Sealing of sumps and rainheads

4.7 Expansion provision

4.8 Support

4.9 'A box gutter'- for sizing purposes

4.10 Conflict within and between standards

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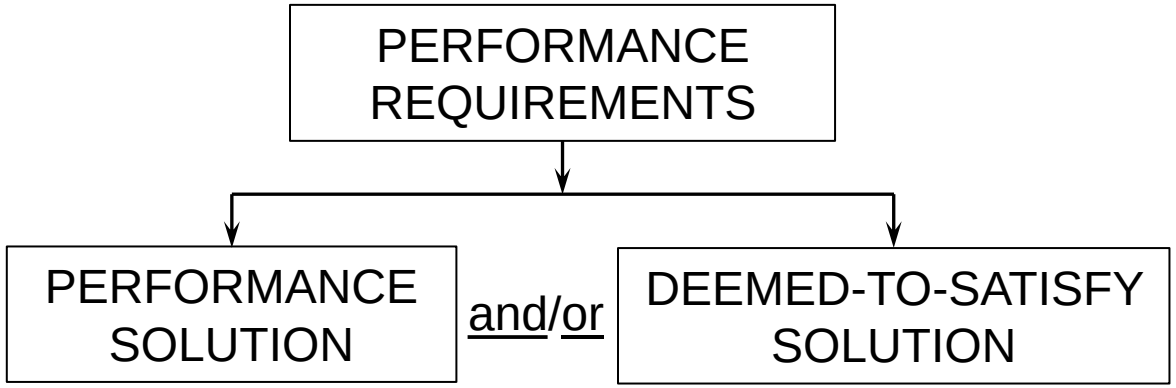
Box gutter compliance pathways and the National Construction Code (NCC)

In Victoria, the design of box gutters must:

- demonstrate compliance with all relevant Performance Requirements of the National Construction Code; or
- demonstrate that the solution used is at least equivalent to the Deemed-to-Satisfy provisions



The VBA have produced a 3-part webinar series on developing Plumbing Performance Solutions which can be found using this QR Code

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Box gutters designs and the National Construction Code

In Victoria, provisions of the National Construction Code (NCC) require both building and plumbing practitioners to comply with the AS/NZS 3500.3 for the Deemed-to-Satisfy design of box gutter system. Alternatively, a Performance Solution may be developed to demonstrate compliance.

The latest version of this standard was published on 28 May 2021 and the VBA has applied a transition period until 1 May 2023, before it requires the revised standards to be applied in practice.

From the 1 May 2023, a Victorian variation to volume 3 of the NCC (Plumbing Code of Australia) will adopt the HB:39 under the plumbing code and give precedence to the AS/NZS 3500.3 in circumstances where there is any inconsistency between these two documents.

You can learn more about the transition period and Victorian variations through these QR codes

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Box gutters designs and the National Construction Code

The box gutter designs in the following presentation are typical of designs that are prescribed by the general methods of AS/NZS 3500.3:2021, and as such, these designs are Deemed-to-Satisfy (DtS) the Performance Requirements of the Plumbing Code of Australia.

Where gutter designs that are inconsistent with DtS methods are intended to be installed a Performance Solution must be developed prior to construction commencing.

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Australian Standards Committee WS-014

The AS/NZS 3500.3:2021 was prepared by the joint Standards Australia/Standards New Zealand Committee WS-014, Plumbing and Drainage, to supersede AS/NZS 3500.3:2018.

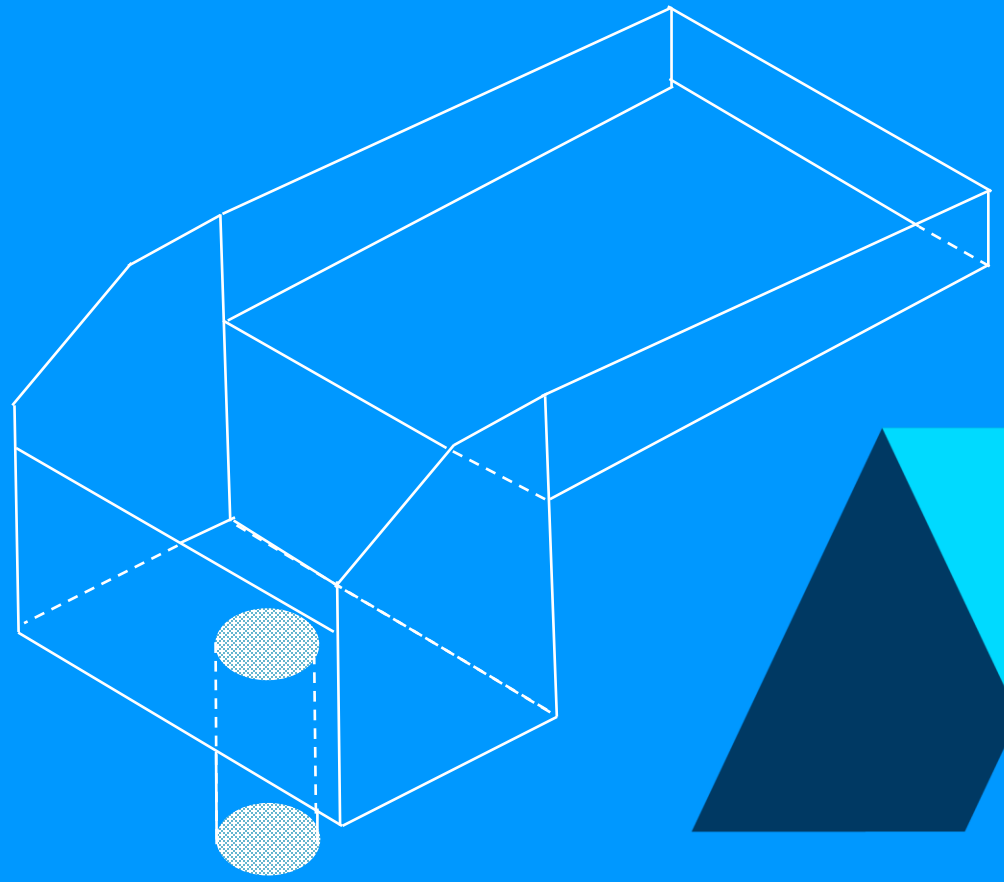
A full list of the WS-014 committee members is published in the front of the document, and it should be noted that the Australian Building Codes Board represent the VBA on this committee by proxy.

The following presentation will outline many of the requirements for the Deemed-to-Satisfy design of box gutter systems in accordance with the AS/NZS 3500.3:2021.

Anyone who has a concern or special interest can submit a proposal for change to the standard via this QR code.

Box gutters discharging to a rainhead

What does a Deemed-to-Satisfy (DtS) installation look like?



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Box gutters discharging to a rainhead

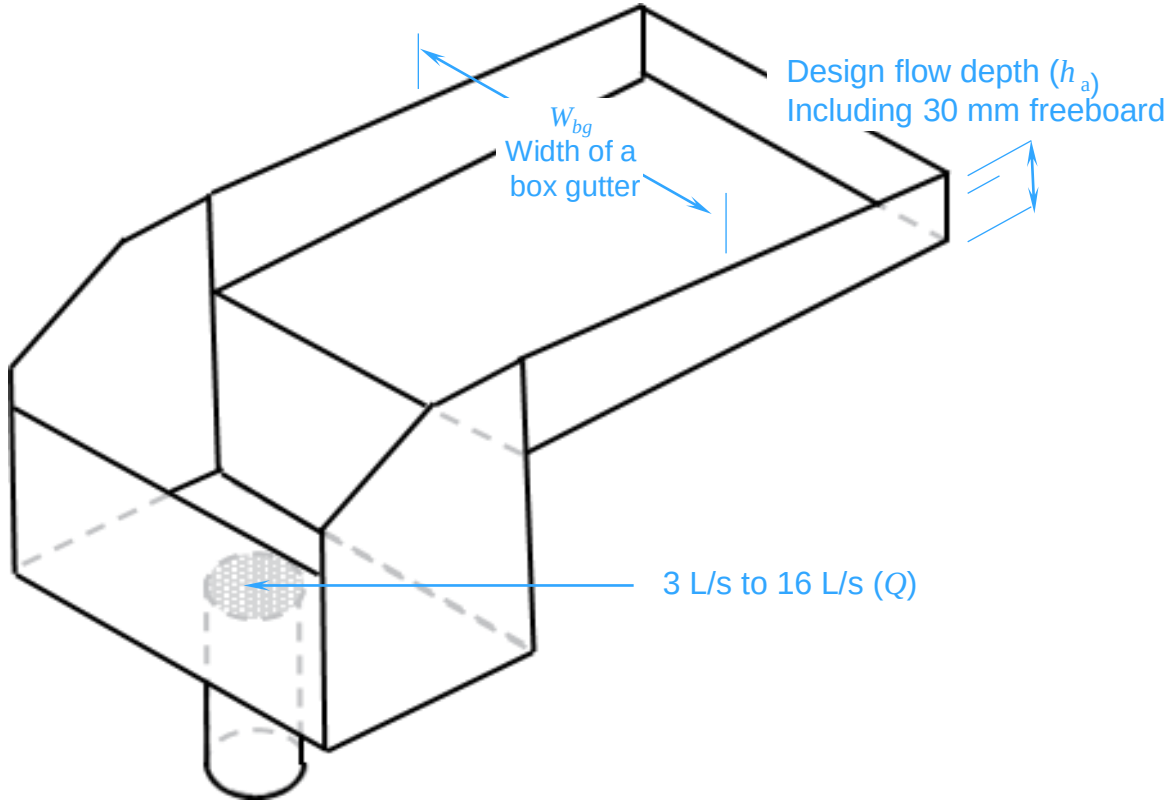
Deemed-to-Satisfy grade and design flow

- Box gutter width, grade and flow rate are required to chart the minimum depth of a box gutter that discharges to a rainhead.

- The design flow rate (Q) can be plotted between:
  - 3 and 16 Litres per second (L/s)
  - Sole widths of 200mm cannot accommodate flow rates exceeding 10.5 L/s

- Larger buildings may also require internal sumps to prevent box gutter flows exceeding 16 L/s.

- Grades for box gutters can be charted at 1:200, 1:150, 1:100. and 1:40.



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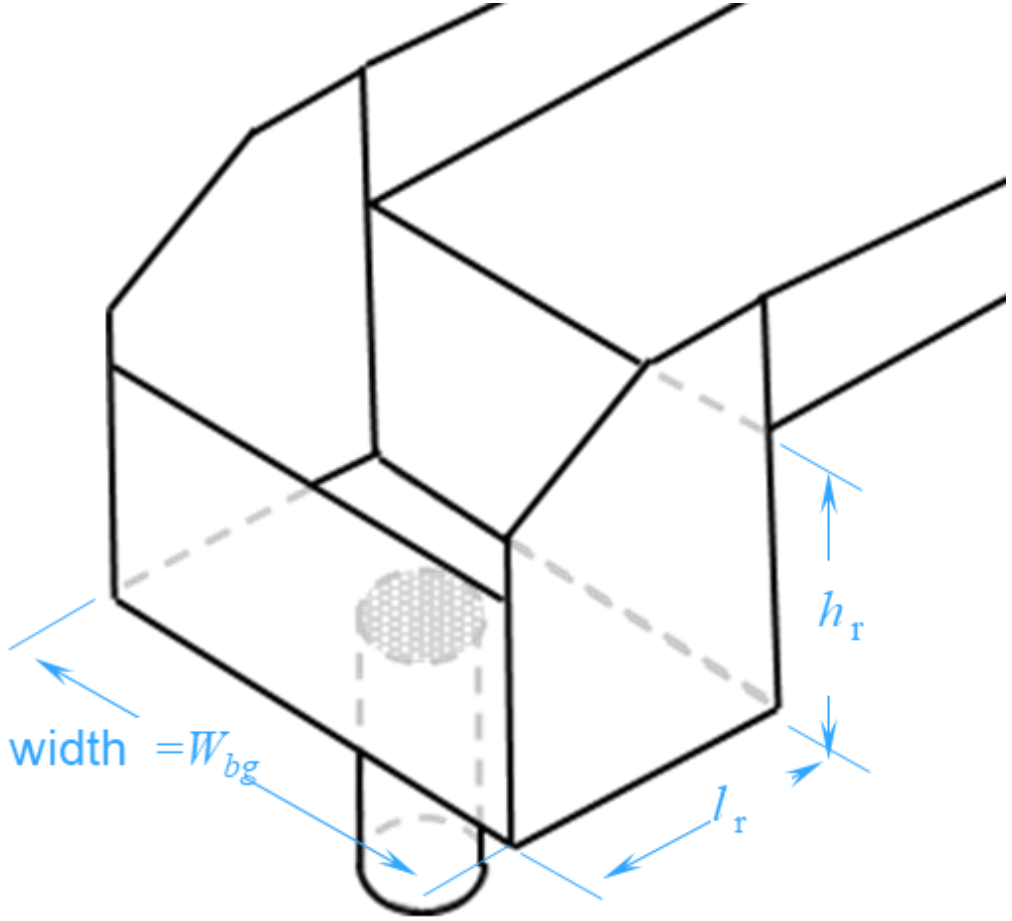
Box gutters discharging to a rainhead

Deemed-to-Satisfy rainhead sizing

- The minimum depth (h_r) and length of a rainhead (l_r) are dependent on:
  - the design flow rate (Q)
  - the size and shape of the downpipe selected (round/ square/ rectangle)
  - the box gutter sole width (W_{bg})

- The width of the rainhead must be at least equal to the width of the box gutter (W_{bg})



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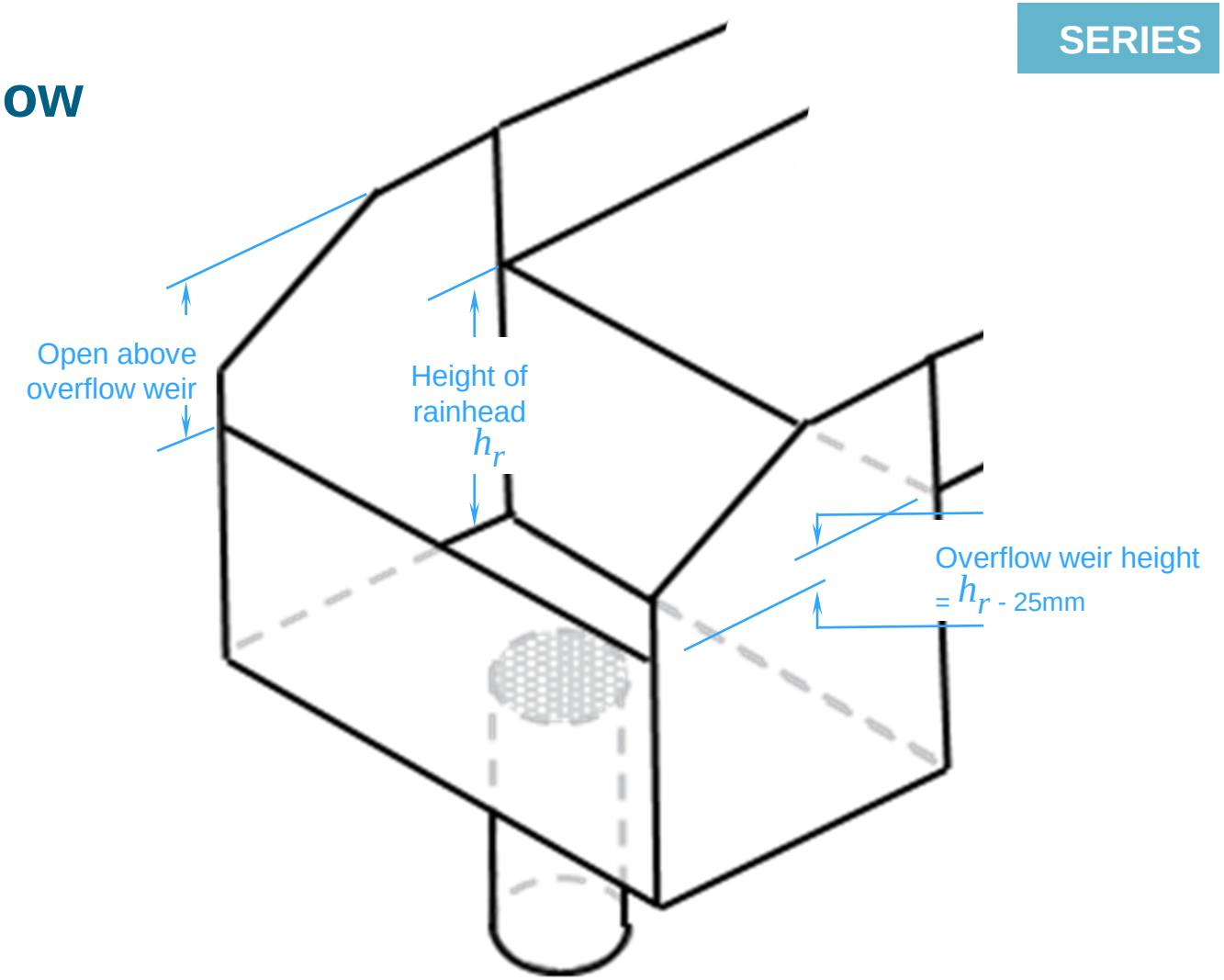
Box gutters discharging to a rainhead

Deemed-to-Satisfy rainhead Overflow

- The weir of the rainhead overflow must be 25mm below the sole of the box gutter.
- The width of the overflow is equal to the width of the rainhead.
- The rainhead must be left open above the overflow weir.
- Ned Kelly slots, round holes and vertical chute/ducts are not deemed-to-satisfy designs.



PRACTITIONER

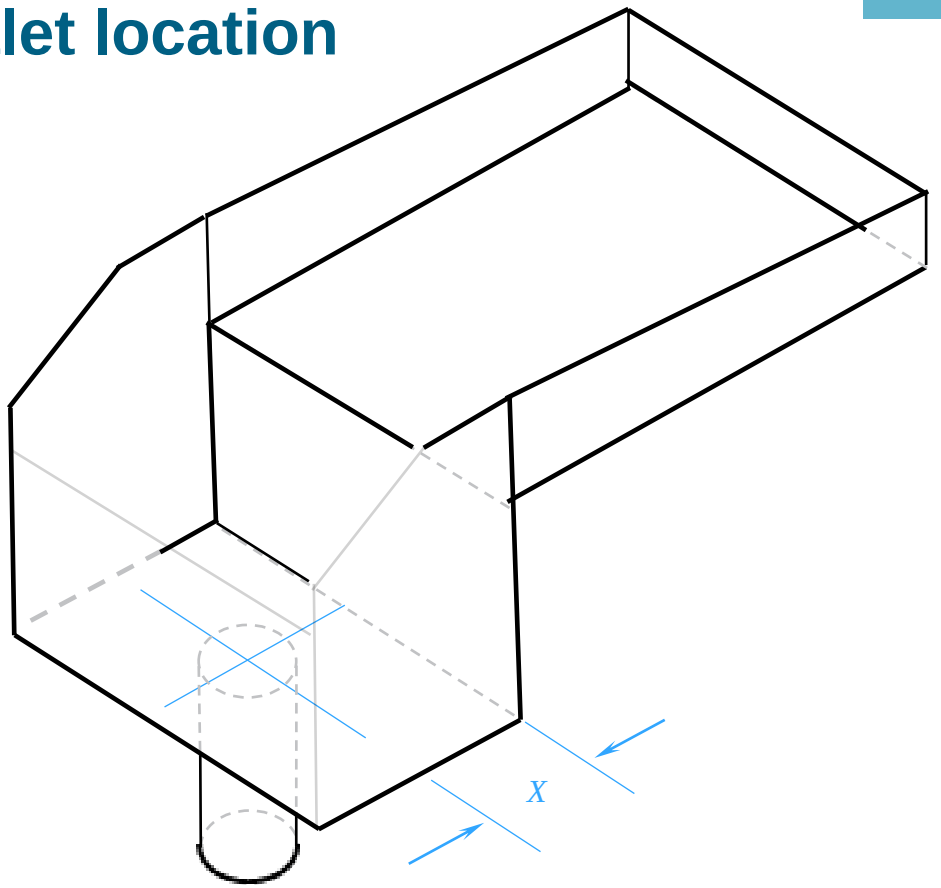
EDUCATION

SERIES

Box gutters discharging to a rainhead

Deemed-to-Satisfy downpipe sizing and outlet location

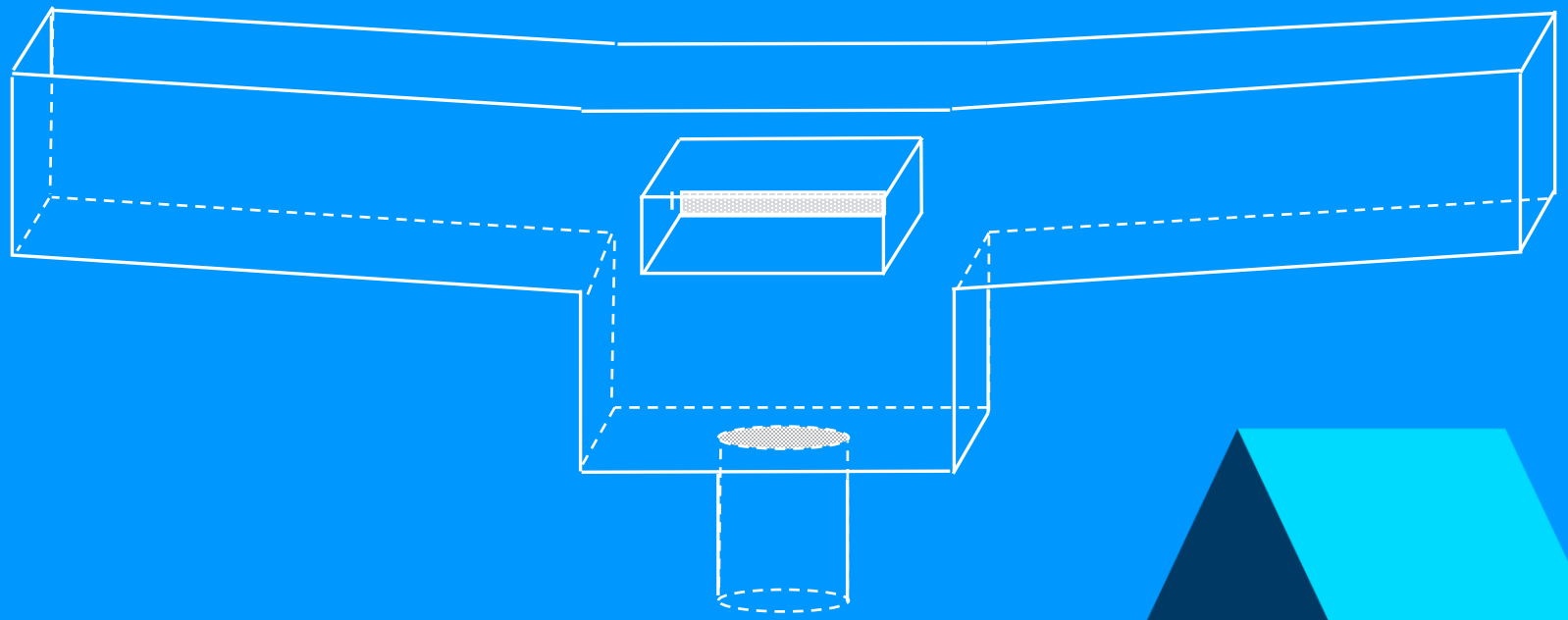
- The size and shape of the downpipe is selected when sizing the downpipe.
- Round downpipes must be fitted so that the centre of the downpipe is not further than the diameter of the downpipe from the nearest vertical side of the rainhead.
- Square or rectangle downpipe must be fitted so that the centre of the downpipe is not further than the average of the two side dimensions of the downpipe from the nearest vertical side of the rainhead.
- Downpipes must discharge vertically from the sole of the rainhead.



Poll question

Box gutters discharging to a sump with side overflow

What does a Deemed-to-Satisfy (DtS) installation look like?



PRACTITIONER

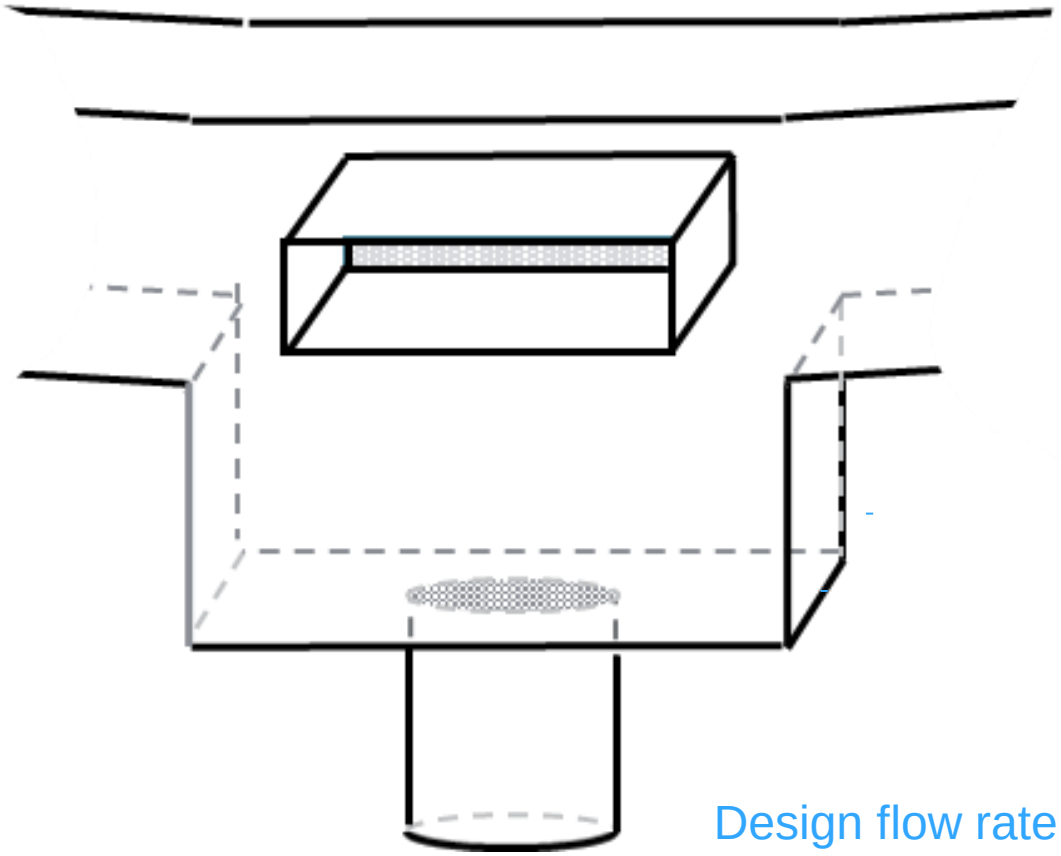
EDUCATION

SERIES

Box gutters discharging to a sump with side overflow

Deemed-to-Satisfy grade and design flow

- The flow rate of each box gutter is required to chart the minimum depth of the gutter.
- The design flow rate (Q) can be charted between:
  - 3 and 16 Litres per second (L/s)
  - Sole widths of 200 mm cannot accommodate flow rates exceeding 10.5 L/s
- Grades for box gutters can be charted at 1:200, 1:150, 1:100 and 1:40.



Design flow rate (Q)

PRACTITIONER

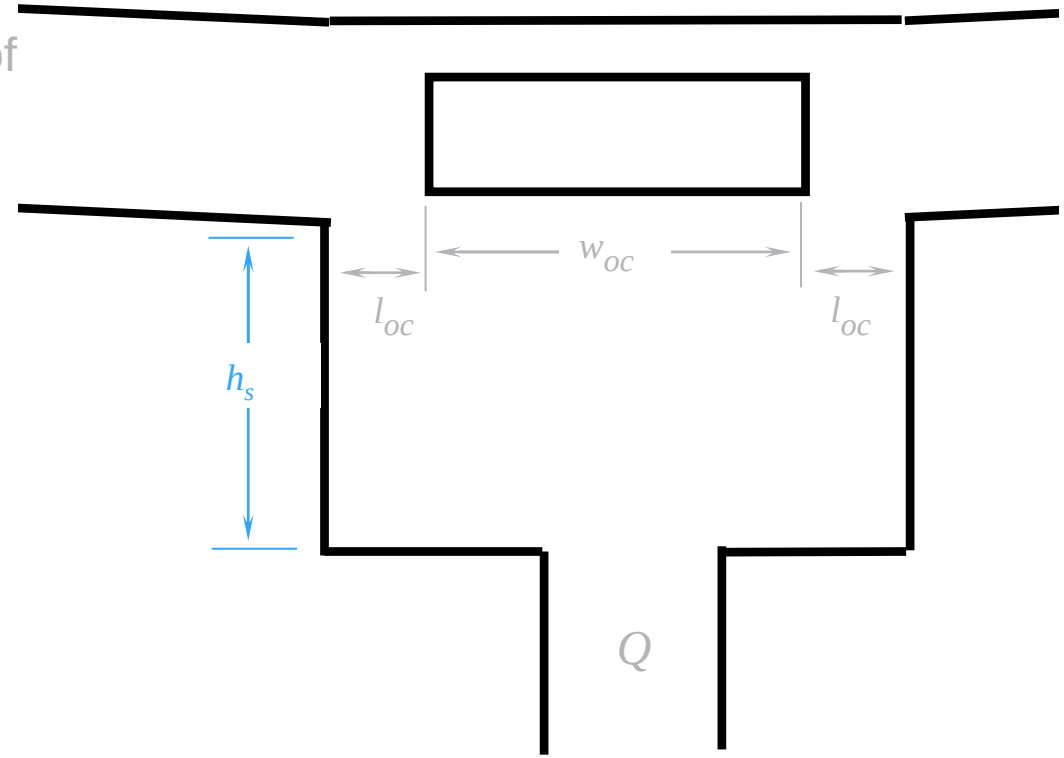
EDUCATION

SERIES

Box gutters discharging to a sump with side overflow

Deemed-to-Satisfy sump sizing

- The depth (h_s) of the sump is dependent on the downpipe options available for the design flow rate (Q).
- The minimum length of the sump is equal to the sum of the width of the overflow channel (w_{oc}) and 2 times the clearance from the side of the sump (l_{oc}).
- Under no circumstances should the sump length be less than 400 mm in length.
- The width of the sump is at least equal to the width of the box gutter (W_{bg}) (It is permitted to put 25 mm lap around the sump).



PRACTITIONER

EDUCATION

SERIES

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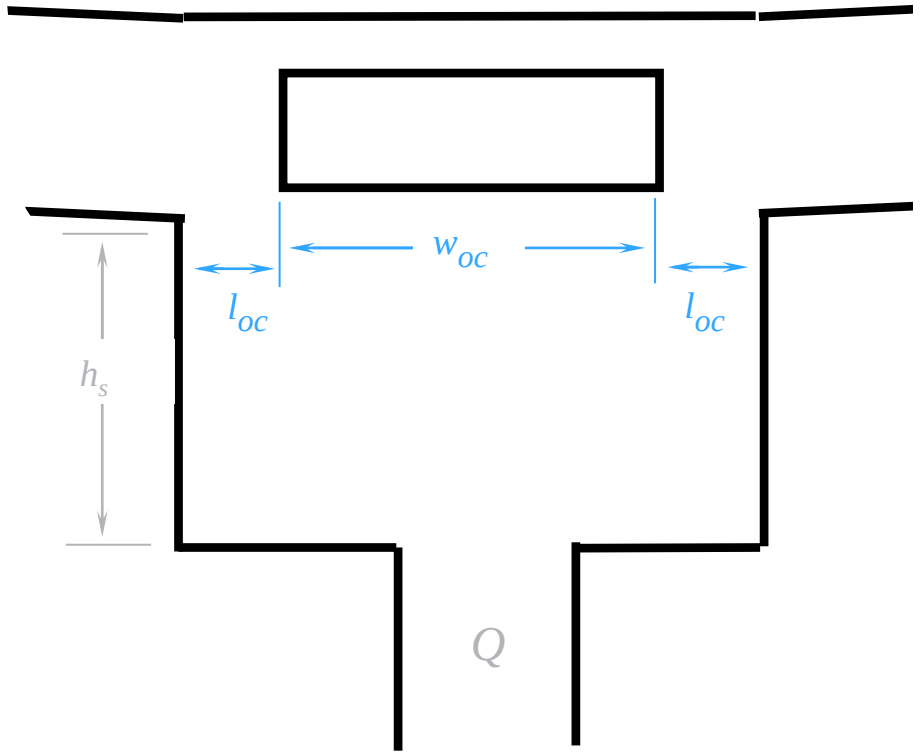

PRACTITIONER

EDUCATION

SERIES

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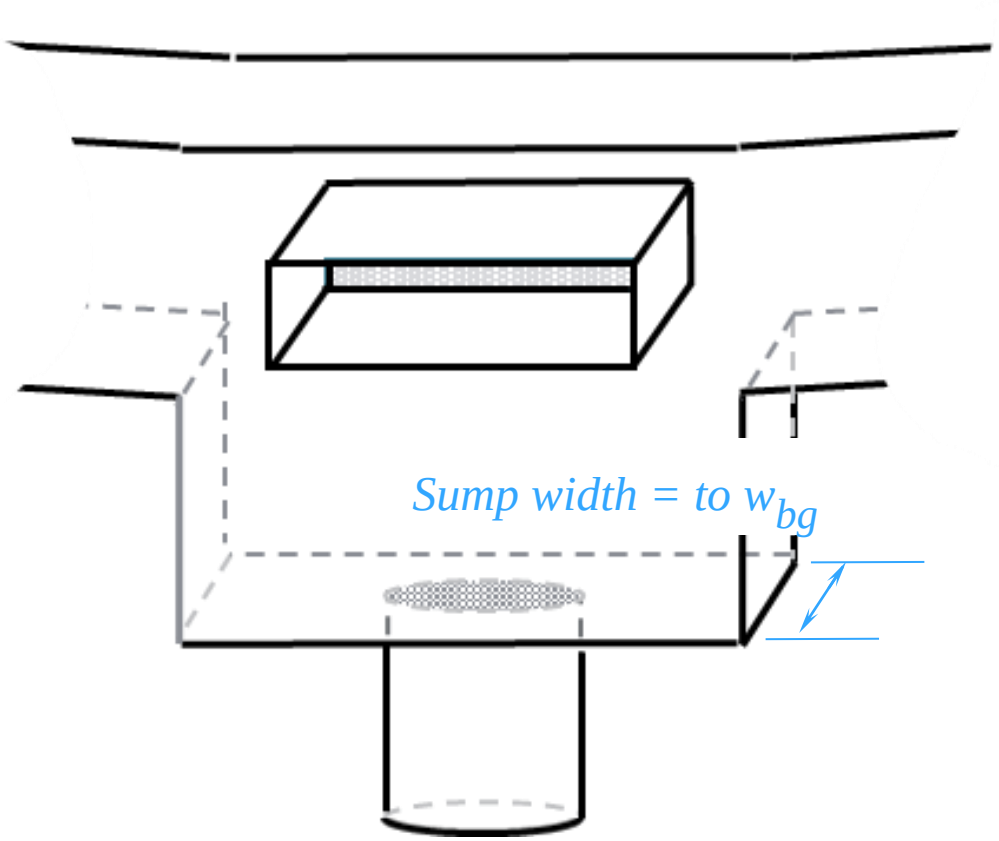


PRACTITIONER

EDUCATION

SERIES

Box gutters discharging to a sump with side overflow

Deemed-to-Satisfy overflow

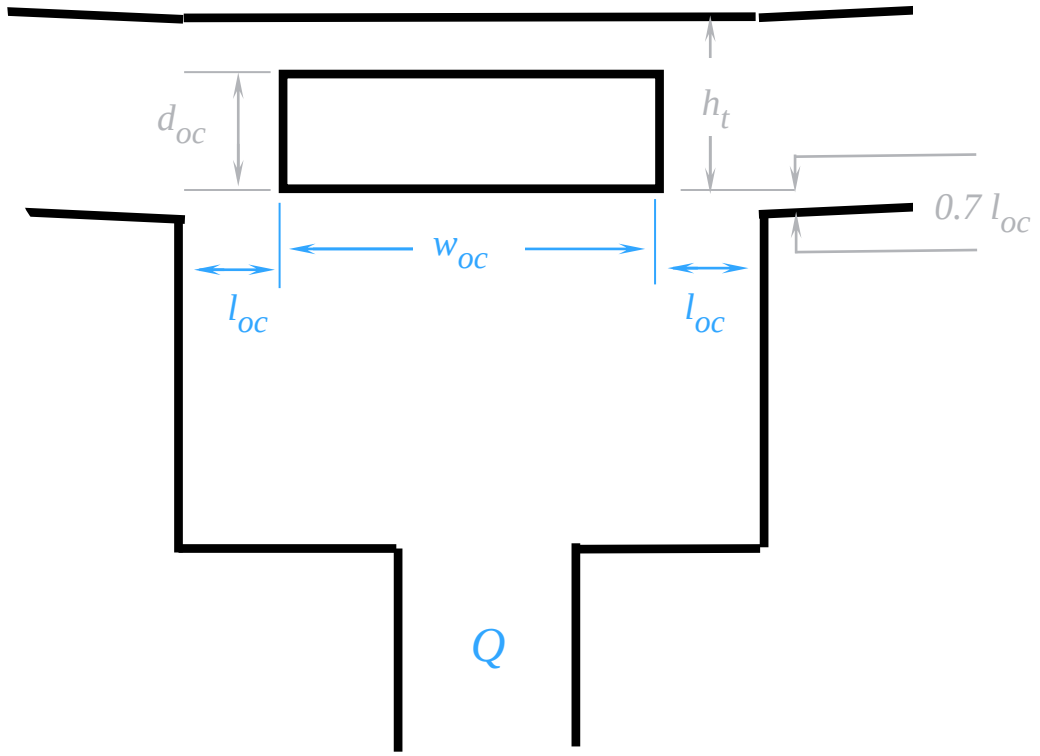
- There are 3 available options for the width of the overflow channel (Woc), these are 200mm, 300mm, and 450mm.

- If wider slots than necessary are used the sizing should be based on the lower DtS width and the length of the sump adjusted to accommodate the loc.

- The depth of the overflow channel (d_{oc}) is dependent on the width chosen and the corresponding design flow (Q) for the box gutter.

- The vertical position of the overflow (h_t) (minimum height from top of gutter to bottom of overflow) is calculated using the formula: $h_t = l_{oc} + d_{oc} + h_f - 0.7\,l_{oc}$

- Round holes and vertical chutes/ducts are not deemed-to-satisfy designs



PRACTITIONER

EDUCATION

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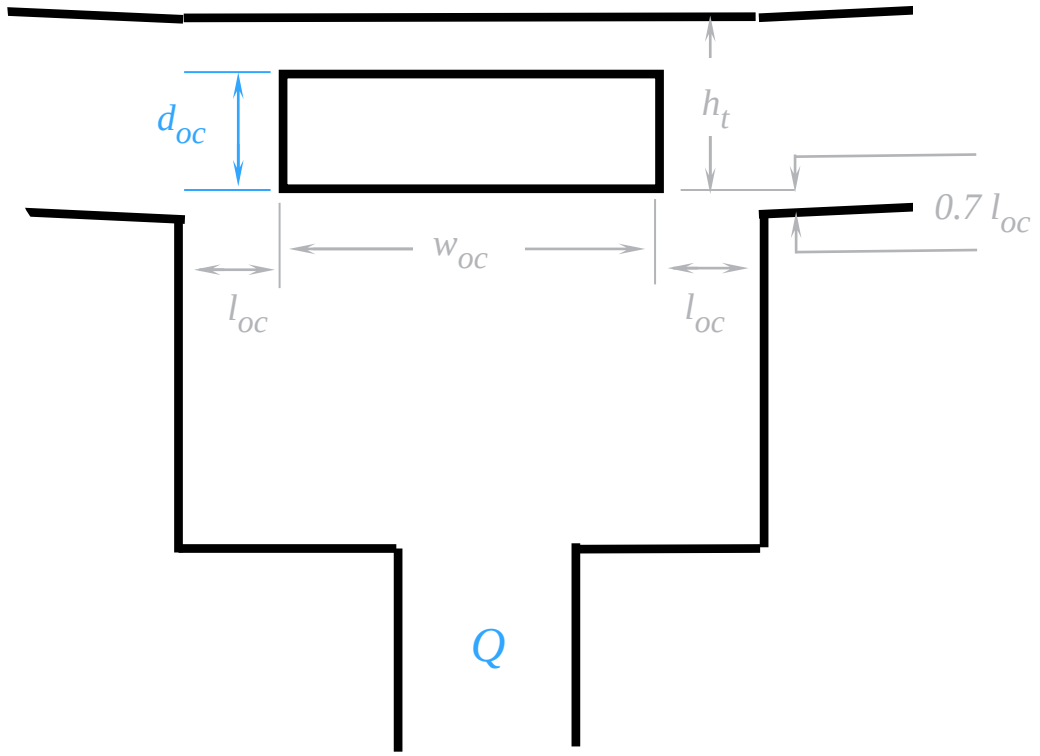

PRACTITIONER

EDUCATION

SERIES

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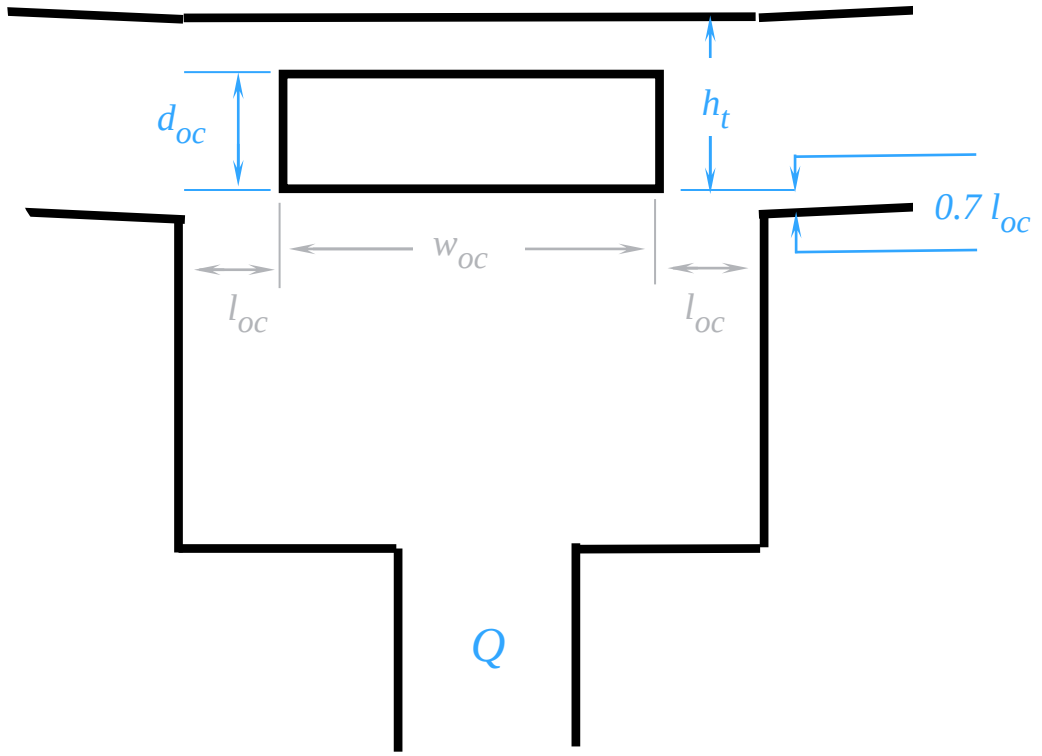

PRACTITIONER EDUCATION SERIES

Box gutters discharging to a sump with side overflow

Deemed-to-Satisfy overflow

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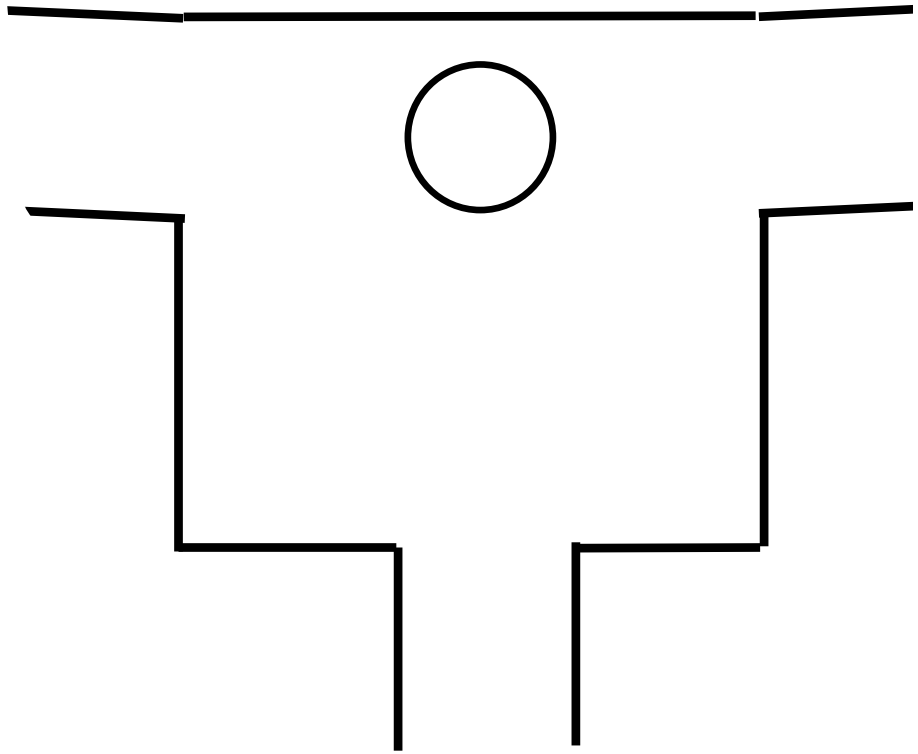

PRACTITIONER

EDUCATION

SERIES

Box gutters discharging to a sump with side overflow

Deemed-to-Satisfy downpipe sizing and outlet location

- The available downpipe sizes are dependent on the design flow rate (Q) of the box gutter and the corresponding sump depth.
- Round downpipes must be fitted so that the centre of the downpipe is not further than the diameter of the downpipe from the nearest vertical side of the sump.
- Square or rectangle downpipe must be fitted so that the centre of the downpipe is not further than the average of the 2 side dimensions of the downpipe from the nearest vertical side of the sump.
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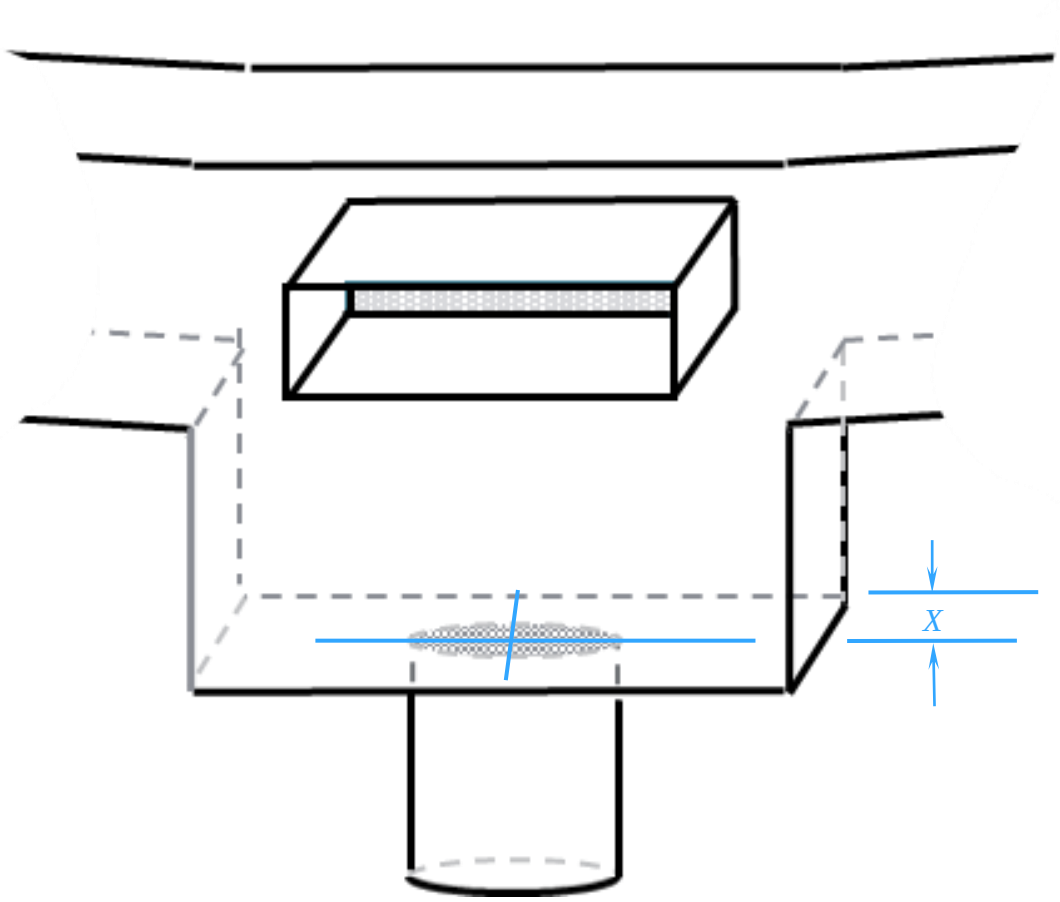
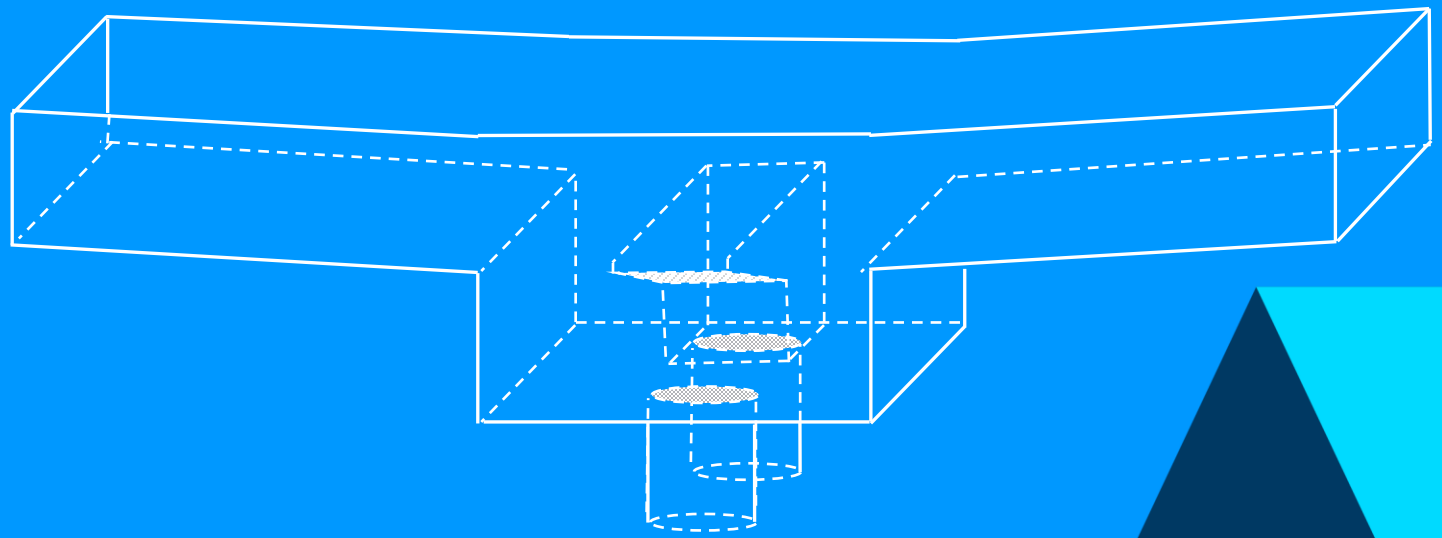


Poll question

Box gutters discharging to a sump with a high-capacity overflow

What does a Deemed-to-Satisfy (DtS) installation look like?

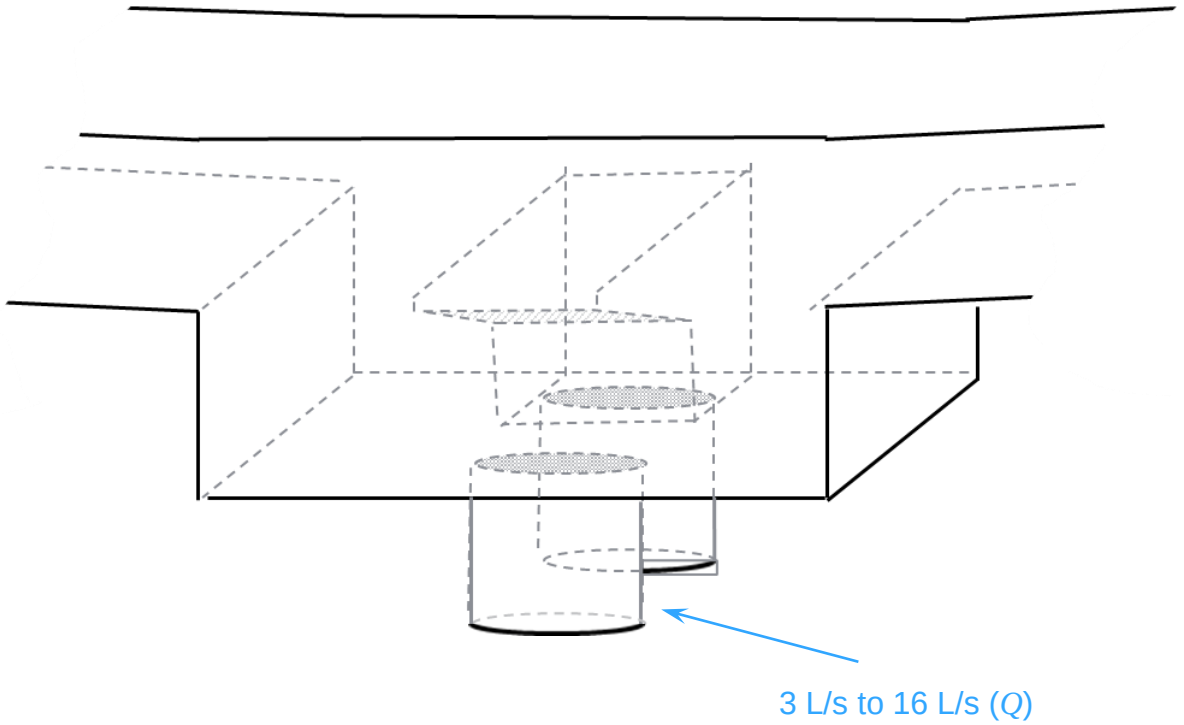


PRACTITIONER EDUCATION SERIES

Box gutters discharging to a sump with a high-capacity overflow

Deemed-to-Satisfy grade and design flow

- The flow rate (Q) of each box gutter is required to plot the minimum depth (h_a) of the gutter from AS/NZS 3500.3.
- Where one gutter receives more catchment than others the sizing must be based on the largest gutter.
- The design flow rate (Q) can be plotted between:
  - 3 and 16 Litres per second (L/s)
  - Sole widths of 200 mm cannot accommodate flow rates exceeding 10.5 L/s
- Grades for box gutters can be plotted at 1:200, 1:150, 1:100. and 1:40.



PRACTITIONER EDUCATION SERIES

Box gutters discharging to a sump with a high-capacity overflow

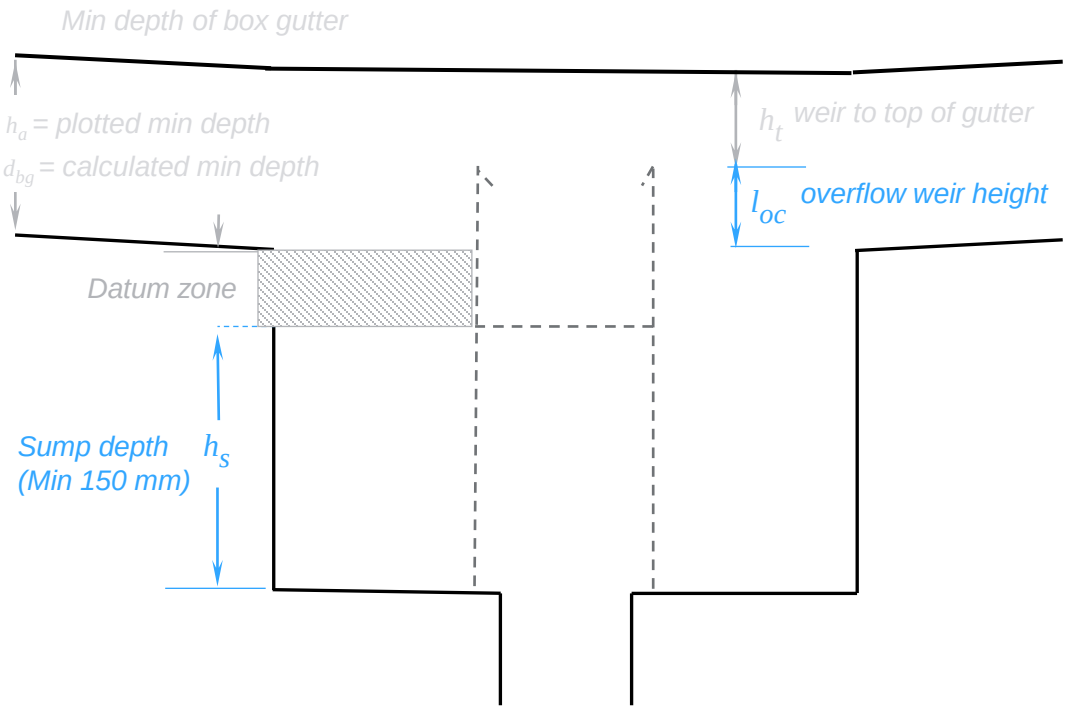
Deemed-to-Satisfy sump depth

- The depth of a sump (h_s) with a high-capacity overflow is dependent on the plotted overflow weir height (l_{oc}) and the datum level from where the sump depth is measured.

- The datum level is equal to the sole of the box gutter if the value of l_{oc} is greater than 60mm; or

- Below the sole of the gutter if the value of l_{oc} is less than 60mm.

- Under no circumstance should a sump with a high-capacity overflow be shallower than 150 mm from the datum point.



PRACTITIONER EDUCATION SERIES

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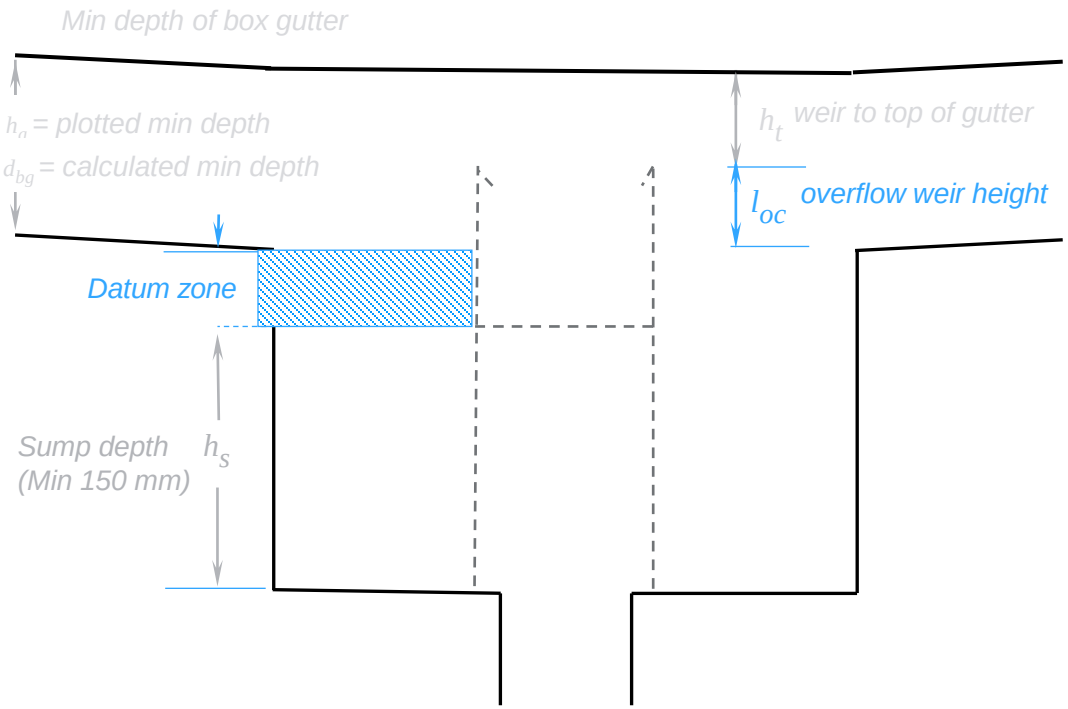

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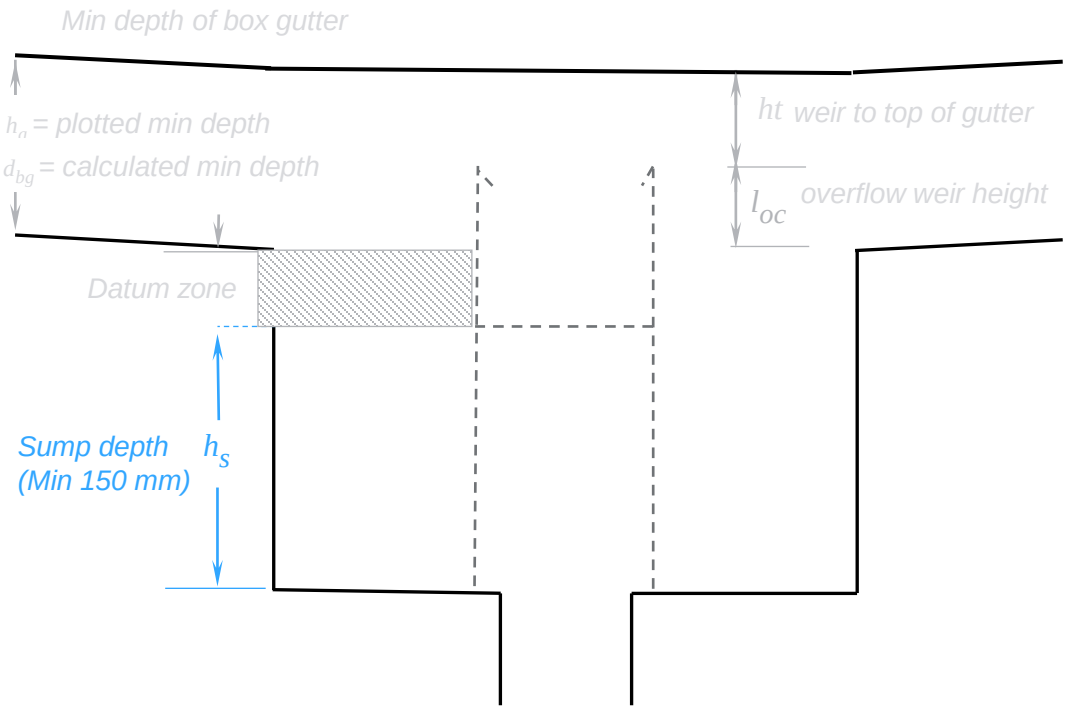


PRACTITIONER

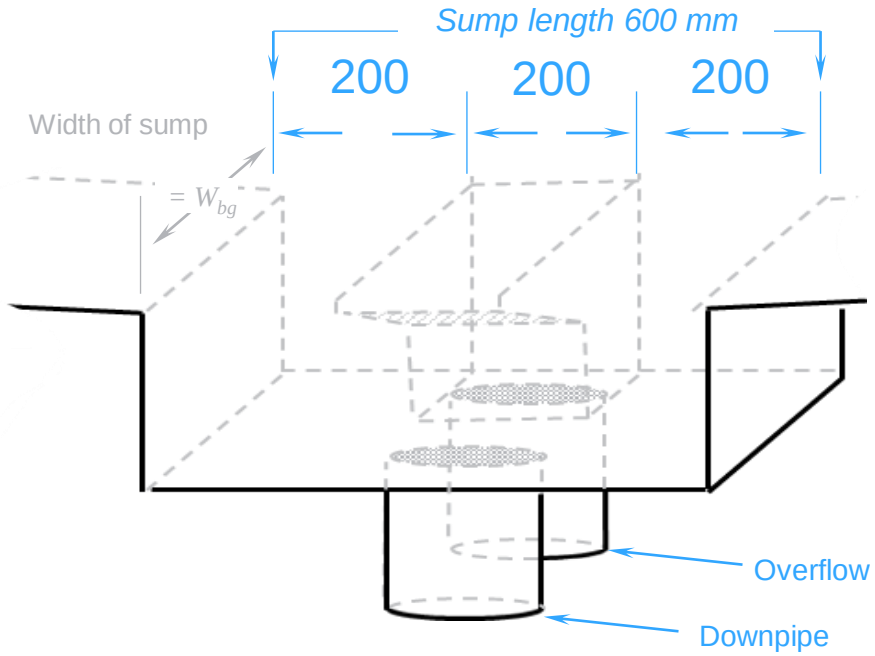
EDUCATION

SERIES

Box gutters discharging to a sump with a high-capacity overflow

Deemed-to-Satisfy sump length

- Primary sumps incorporating a high-capacity overflow must be 600 mm in length, this includes a 200 mm secondary sump and 200 mm space either side of the secondary sump
- The width of the primary sump is the same as the box gutter width



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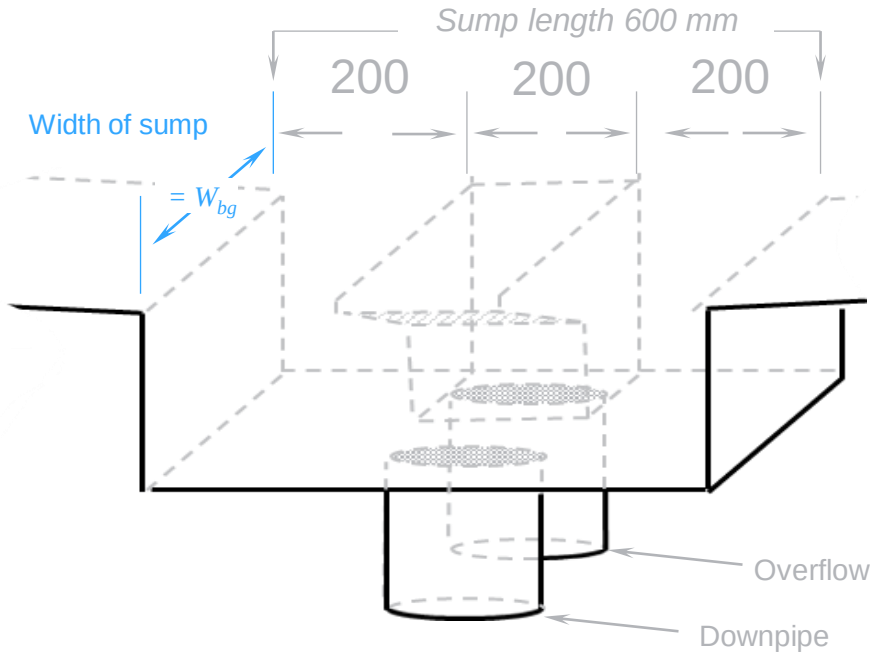


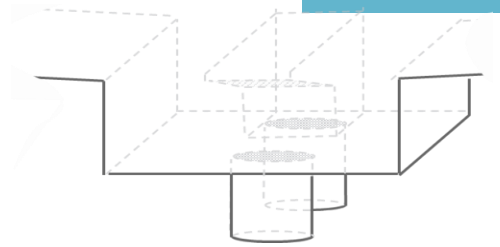
PRACTITIONER EDUCATION SERIES

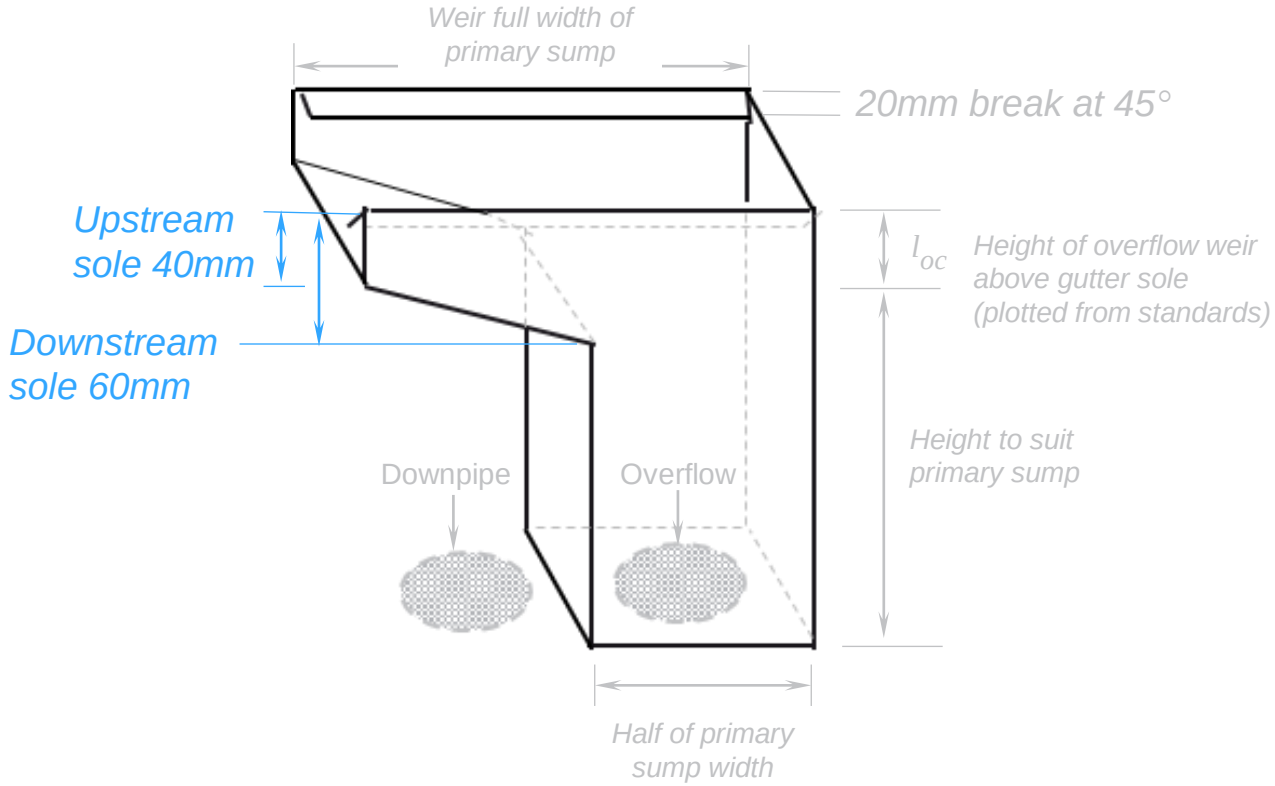
Box gutters discharging to a sump with a high-capacity overflow

Deemed-to-Satisfy overflow (secondary sump)

The standard requires:

- Upstream sole to be 40mm.
- Downstream sole to be 60mm.
- Weir to be full width of the box gutter and sump.
- Height of the weir above the gutter sole to be plotted as required by the general method.
- Overflow outlet to have equal or greater design flow than the downpipe.
- Inverted pops and other designs used as a high-capacity overflows are not deemed-to-satisfy designs.





PRACTITIONER EDUCATION SERIES

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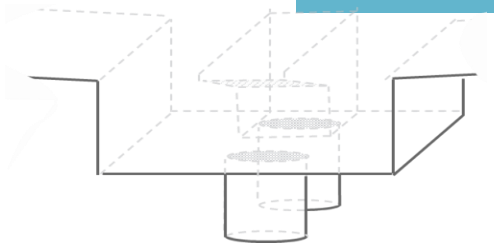

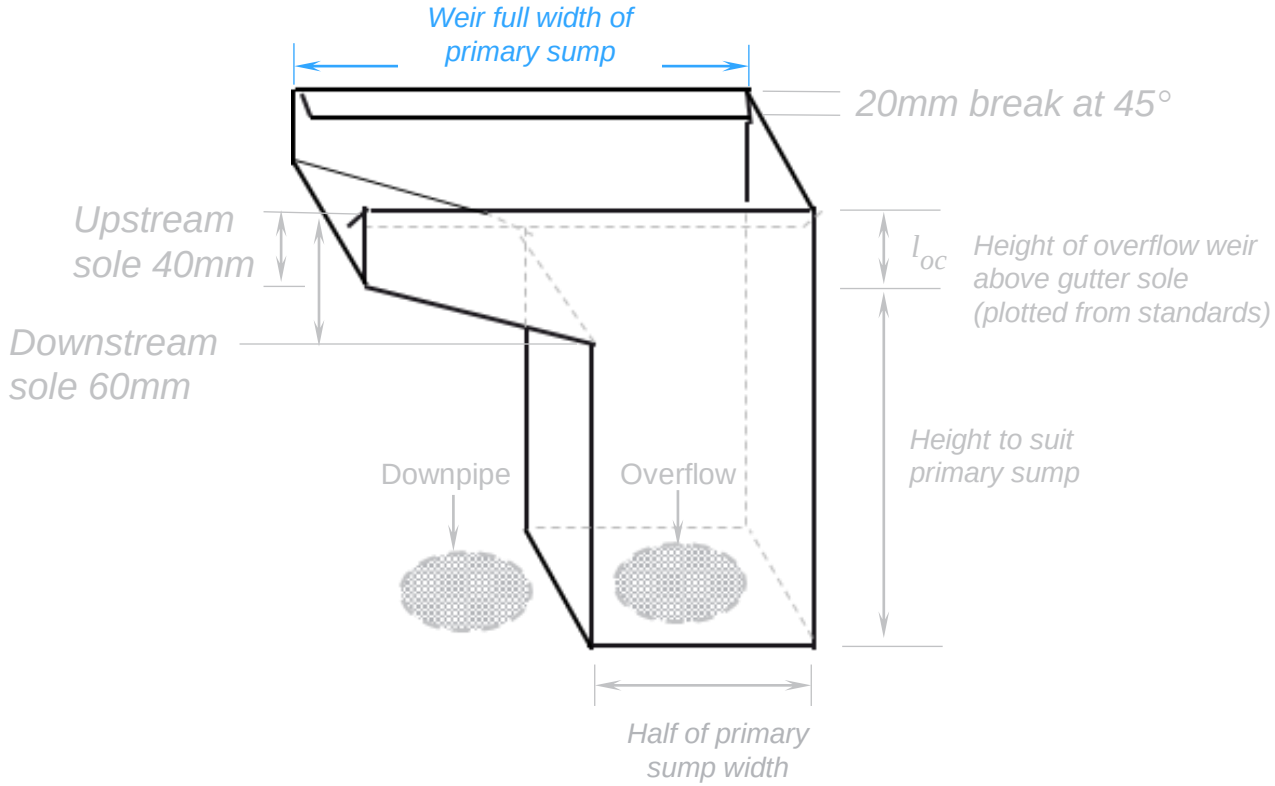

PRACTITIONER EDUCATION SERIES

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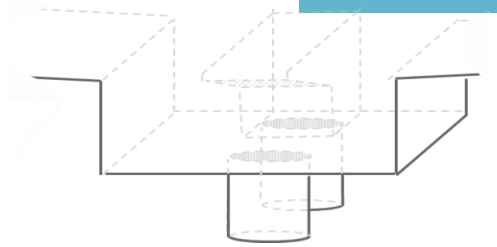

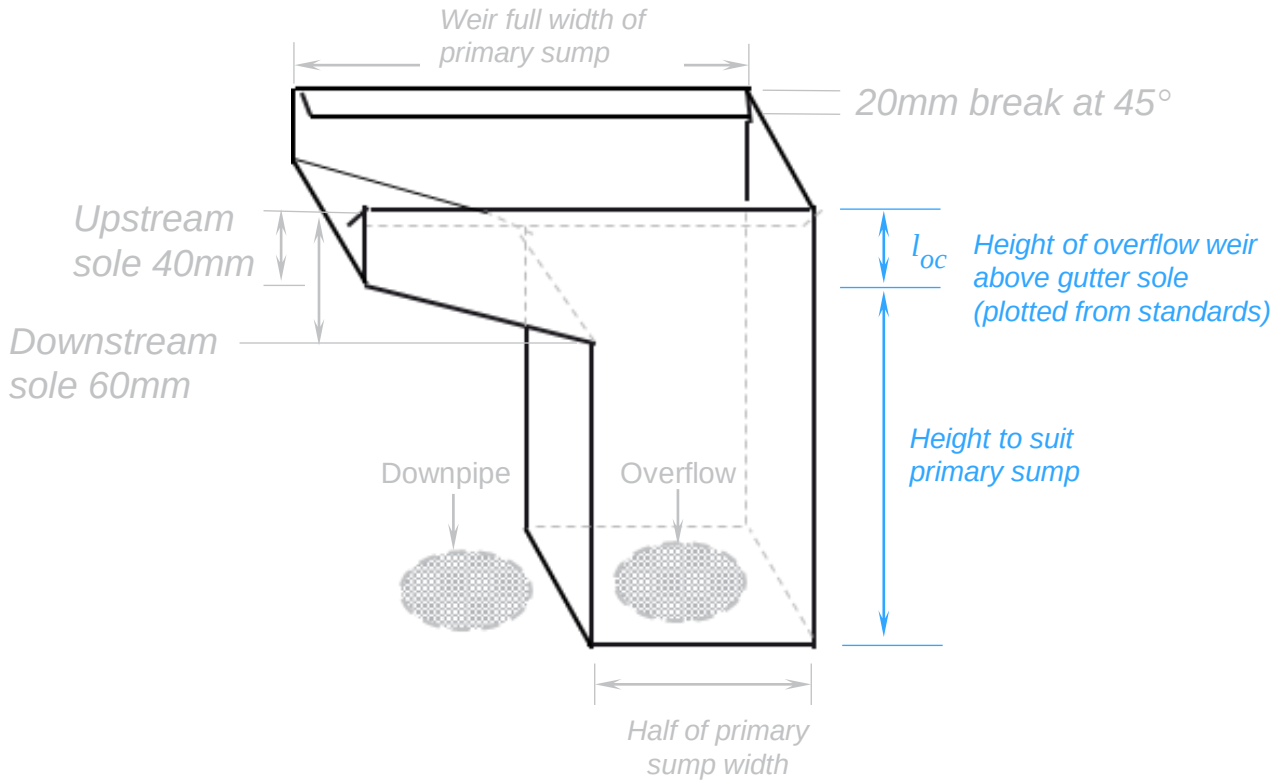

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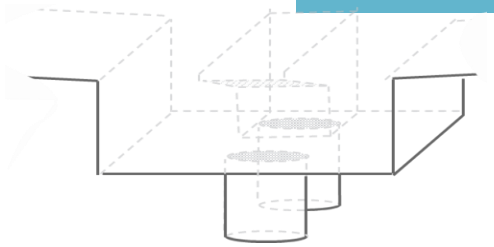
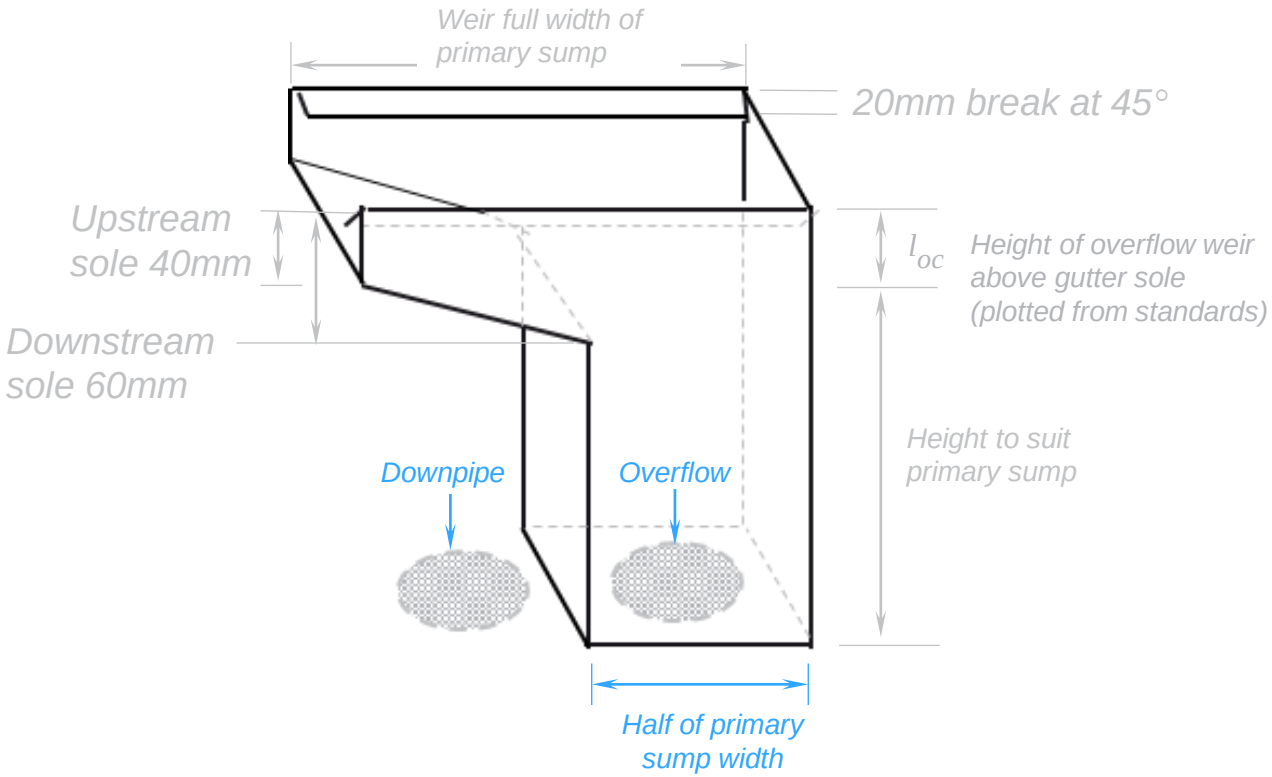




PRACTITIONER

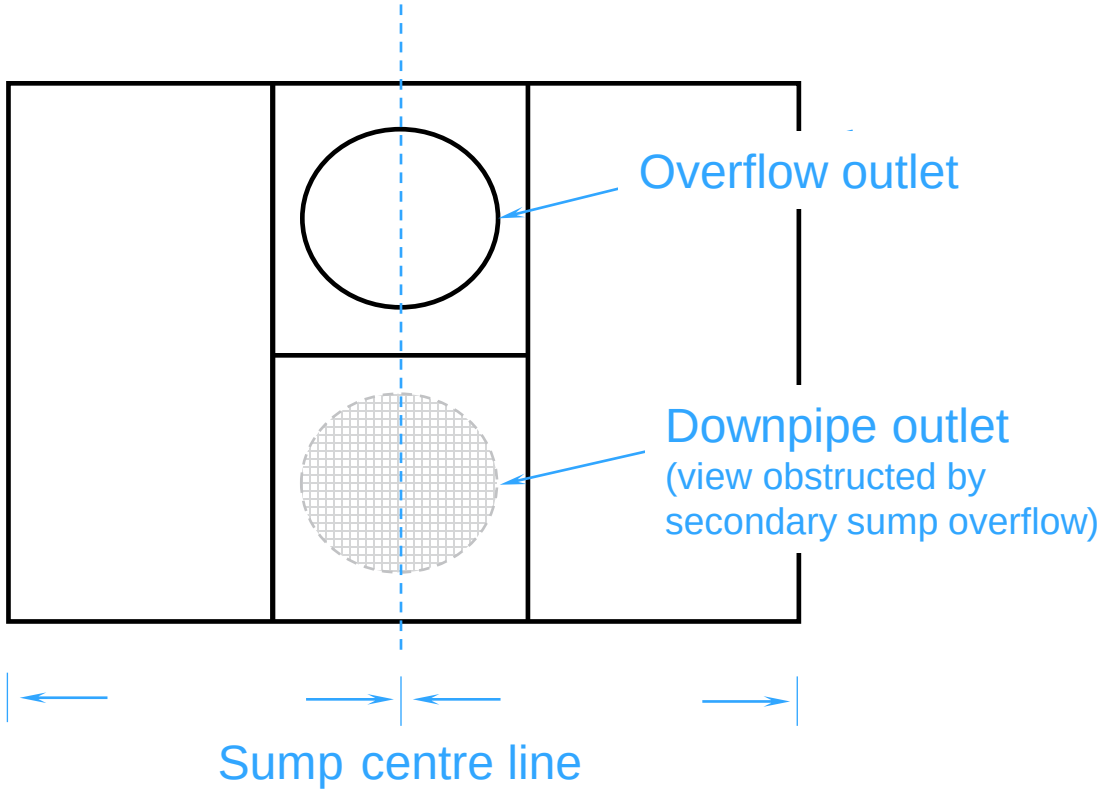
EDUCATION

SERIES

Box gutters discharging to a sump with a high-capacity overflow

Deemed-to-Satisfy downpipe sizing and outlet location

- The downpipe must be sized for total design flow through the outlet.
- Downpipe and overflow must discharge vertically from the sole of the sump.
- Overflow outlet must be positioned on the centre line inside the secondary sump.



PRACTITIONER

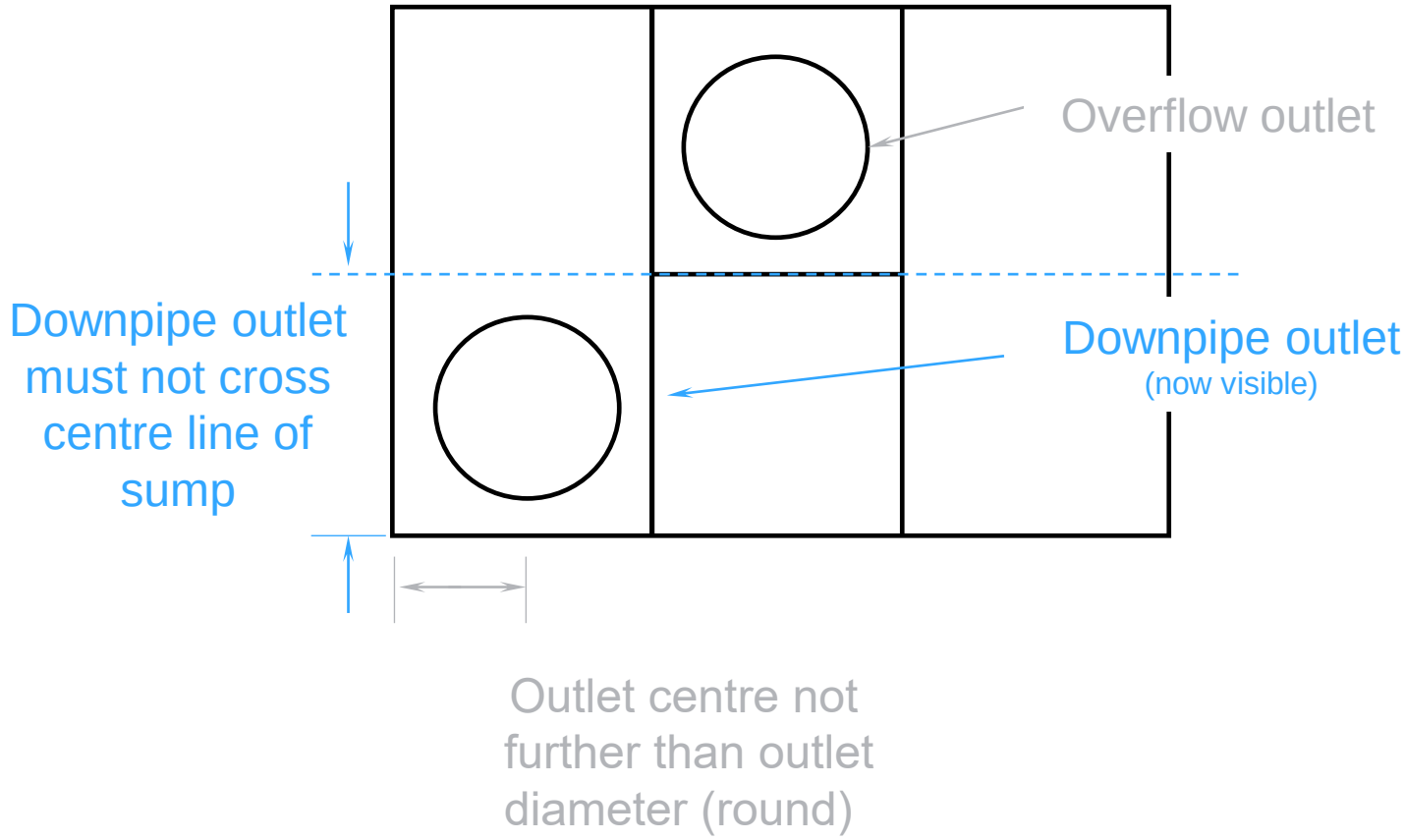
EDUCATION

SERIES

Box gutters discharging to a sump with a high-capacity overflow

Deemed-to-Satisfy downpipe sizing and outlet location

- The downpipe outlet may be moved longitudinally to allow for maintenance access but must not cross the centre line of the sump.
- Downpipe centre must not be further from edge of sump than the diameter of the outlet (round).
- Or the average of the 2 sides (square/rectangle).



PRACTITIONER
EDUCATION
SERIES

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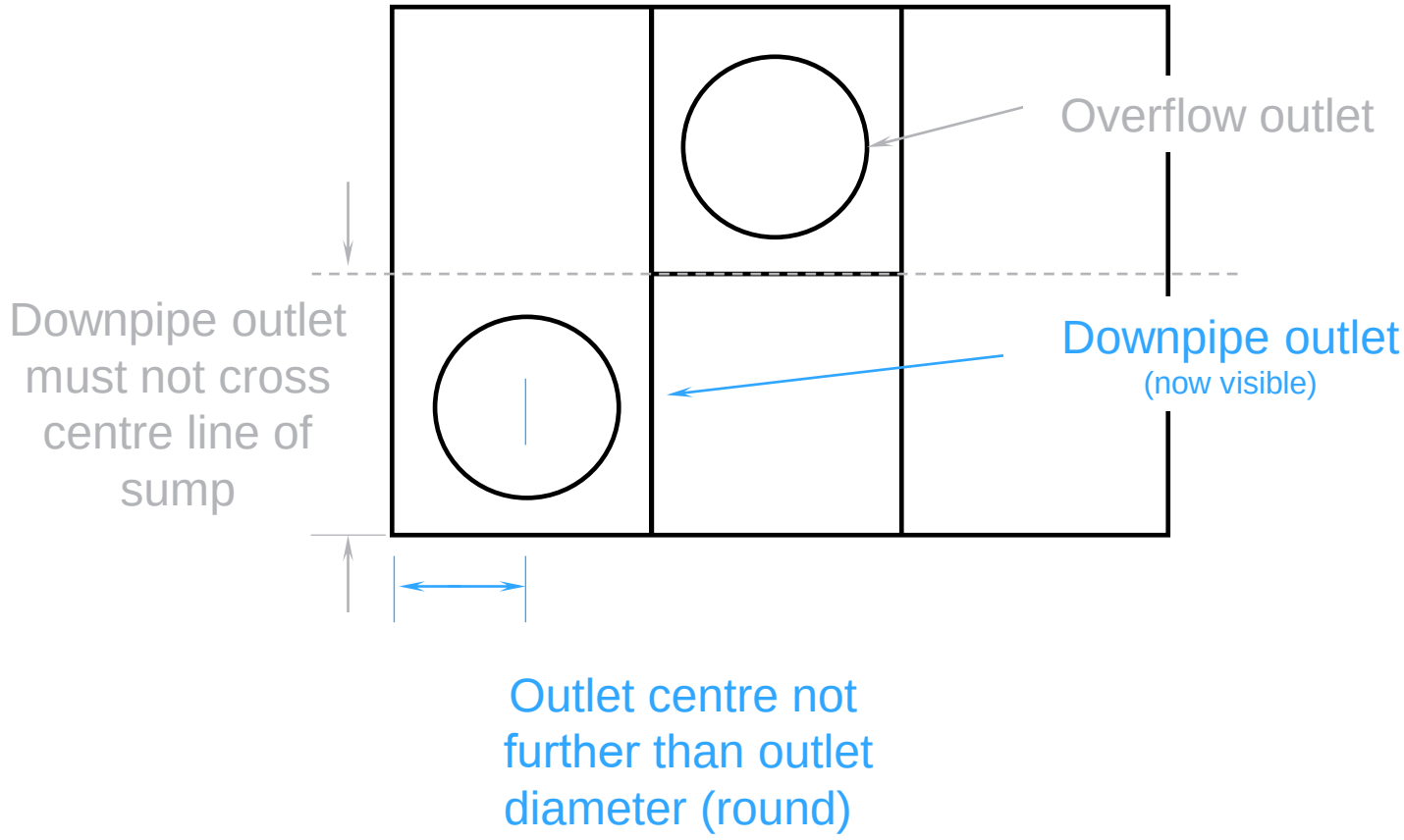
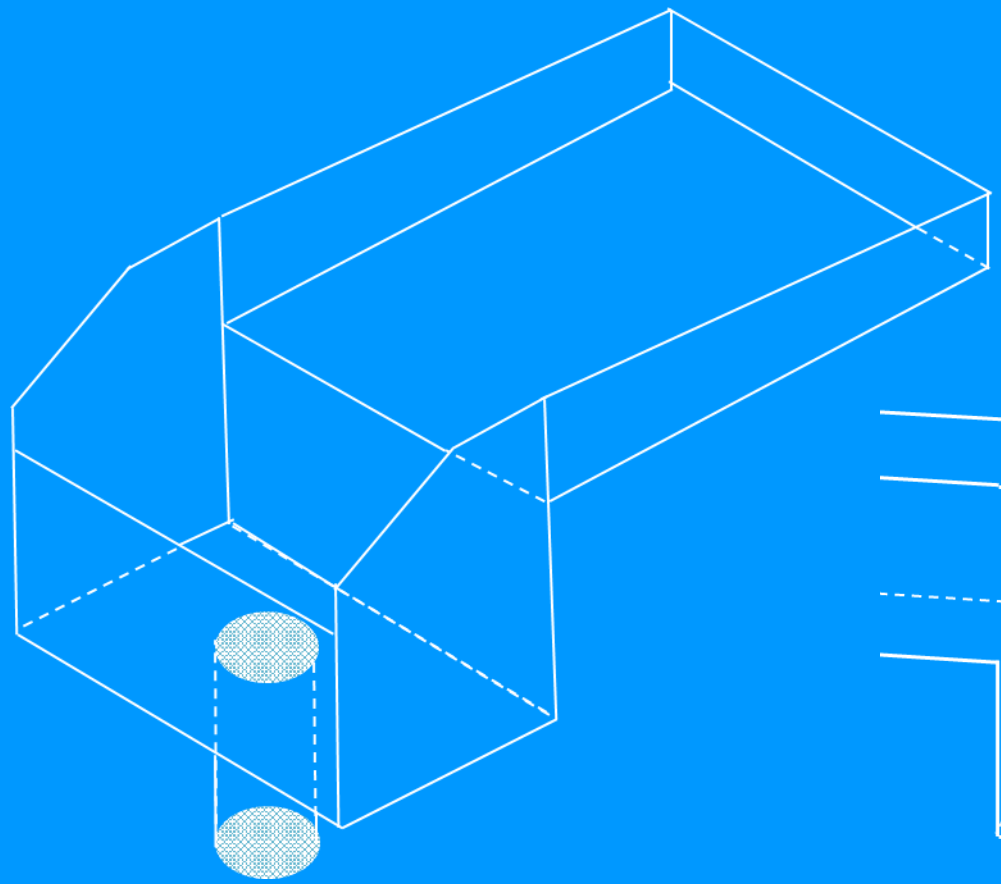
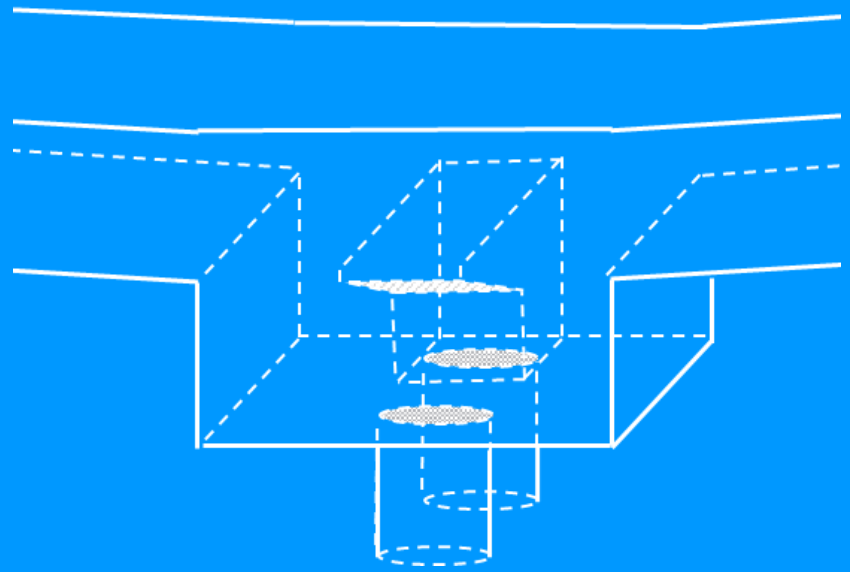
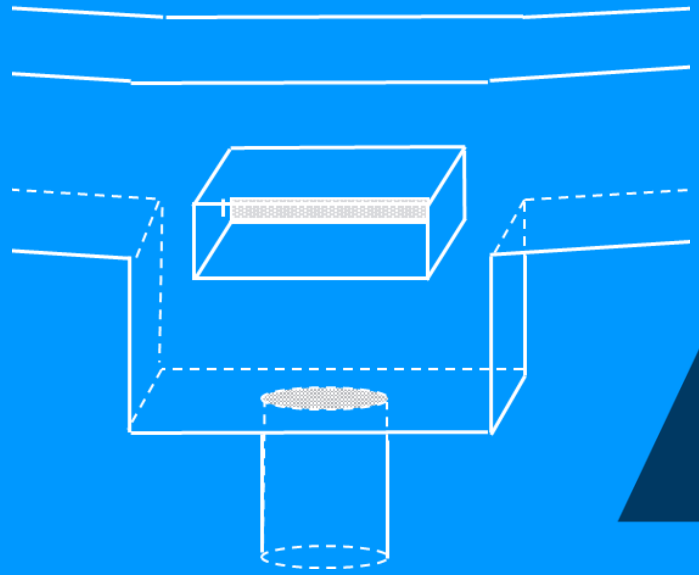


Poll question

Box gutters - General







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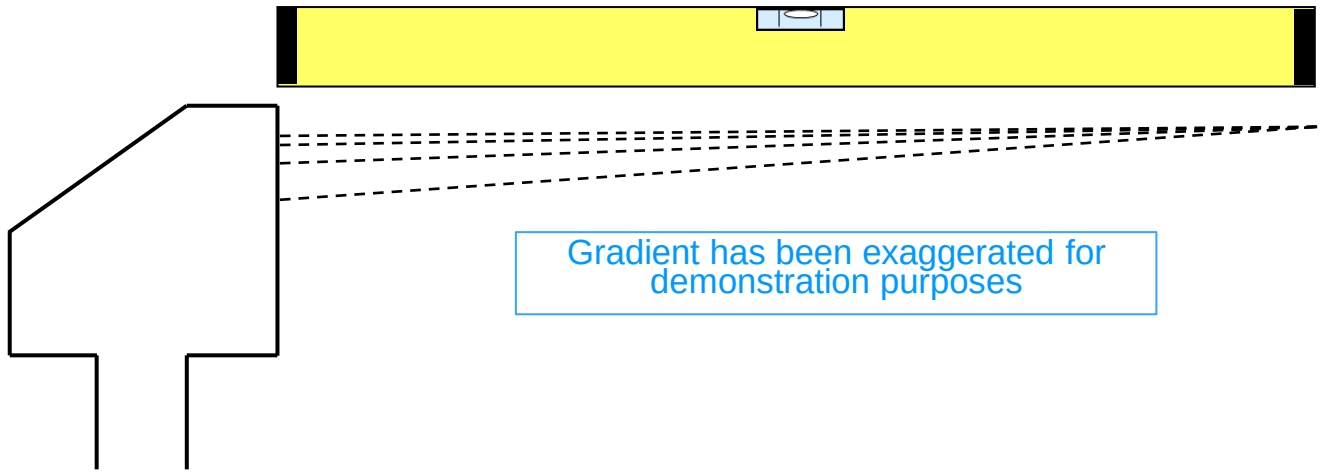
Box gutters - General

Gradient

To be considered a DtS solution:

- Box gutters must have a uniform longitudinal slope towards the outlet.

- Box gutter grades can be plotted from the standard at 1:200, 1:150, 1:100 and 1:40.



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Box gutters - General

Sole width

To be considered a DtS solution:

- Box gutters sole widths can be plotted from the standard in 200 mm, 300 mm, 375 mm 450 mm, 525 mm and 600 mm.
- Sizes between the minimum and maximum can be used if they are sized to the lower DtS size.
- Gutters passing through a parapet must not reduced below the minimum design width and depth of the gutter.
- The sole of the gutter can taper toward the outlet if there is a proportional increase in depth; and
- The sole width of the gutter is not reduced below its minimum design width.

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Box gutters - General

Changes of direction

To be considered a DtS solution:

- Box gutters must be straight and not change direction.

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Box gutters - General

Discharge to sump or rainhead

To be considered a DtS solution:

- Box gutters must discharge to a sump or rainhead at the downstream end without changing direction.
- Side chutes, 3-sided sumps, and pops in the sole of the box gutter are not Deemed-to-Satisfy solutions.

Box gutters - General

Overflow designs

- Inverted pops, Ned Kelly slots, round holes and vertical chutes or ducts are not deemed-to-satisfy solutions.

- Overflow devices must discharge to the atmosphere and be clear of neighboring properties and public areas.

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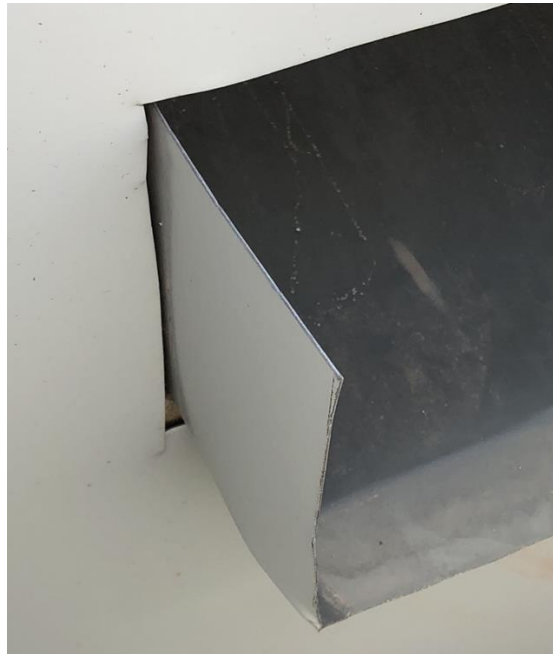
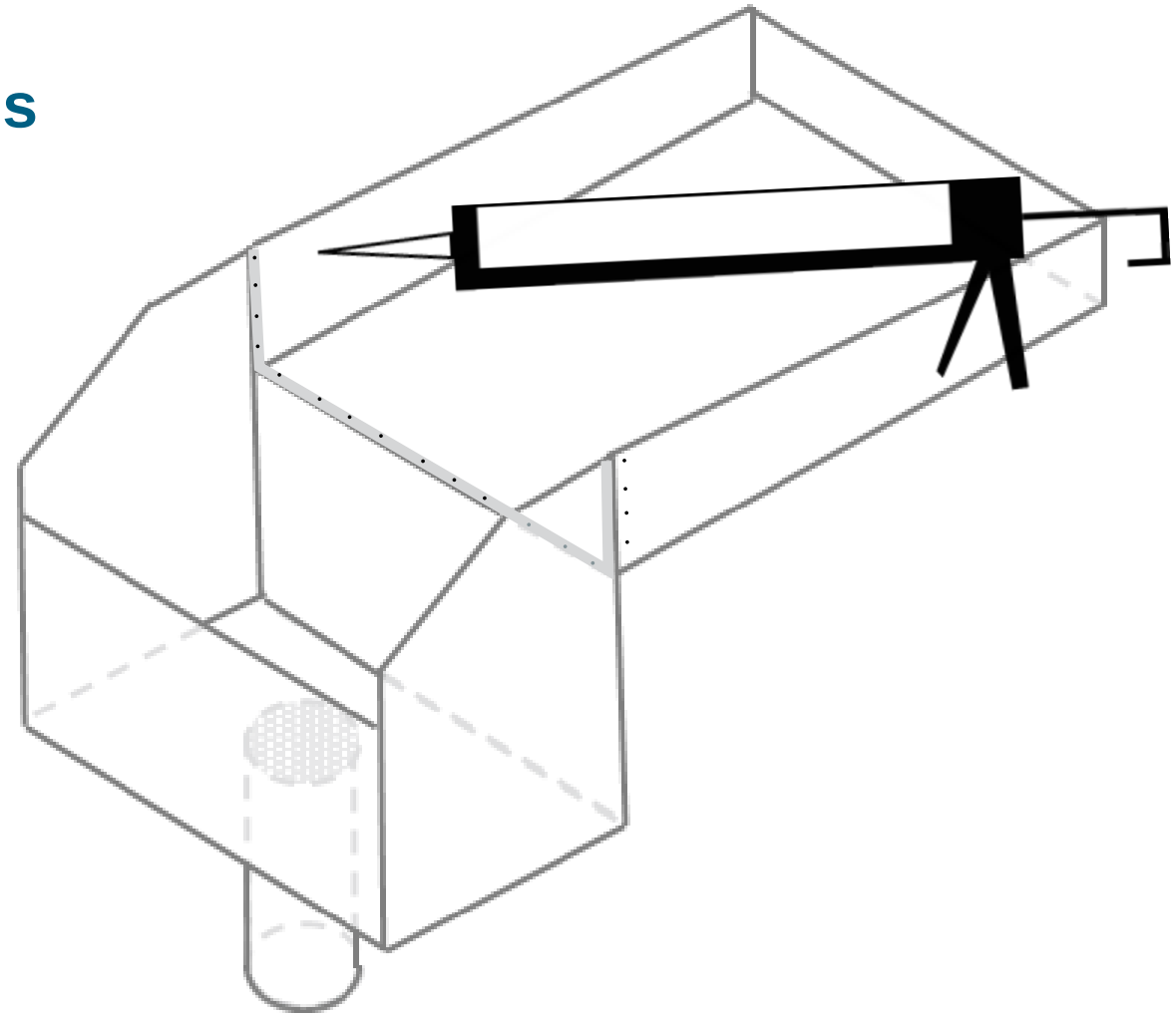
Box gutters - General

Sealing of sumps and rainheads

To be considered a DtS solution:

- Sumps and rainheads must be fixed and fully sealed to the box gutter.





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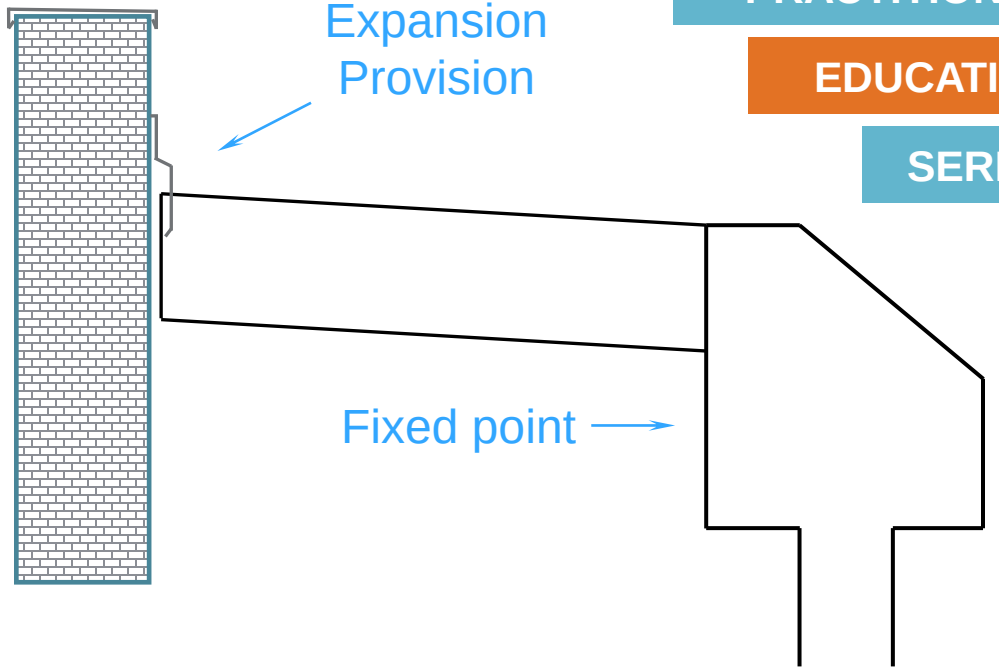
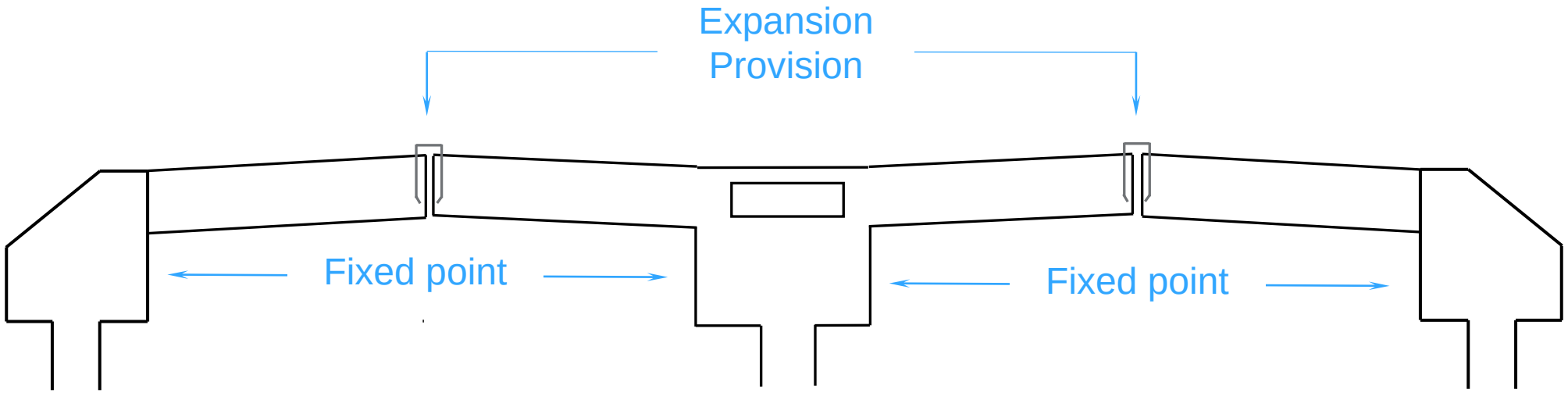
Box gutters - General

Deemed-to-Satisfy expansion provision

To be considered a DtS solution box gutter support systems must have provision for expansion;

- where the distance between fixed points exceeds 6 metres; and
- at appropriate intervals for the material and situation as prescribed by the standard.





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Box gutters - General

Support

To be considered a DtS solution box gutter support systems must:

- be able to support the weight of the gutter and sumps when full of water as well as a trafficable load at any point in the gutter and sumps;
- be supported by a compatible material; or
- be shielded from incompatible support materials with a non-abrasive, impervious, non-conducting material.
- The sides of any box gutters must have enough structural strength so that water pressure will not cause deformation

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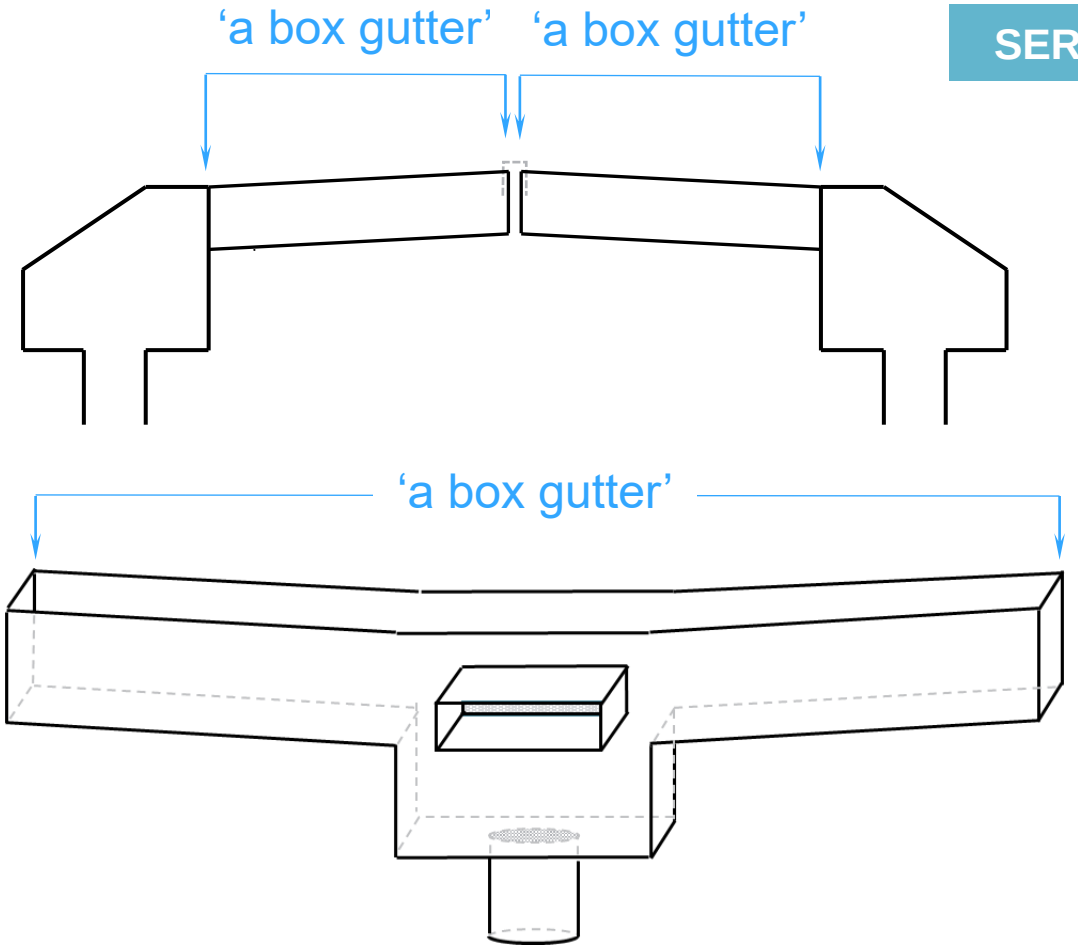
Box gutters - General

A box gutter- for sizing purposes

For the purpose of sizing box gutters sumps and rainheads;

‘a box gutter’ is <u>all</u> the box gutter that discharges to a sump or rainhead

- For a rainhead this a straight length.
- For a sump, the discharge could come from 2 opposing sides.
- Sumps with high-capacity overflows positioned in a corner and receiving discharge from box gutters at 90 degrees are beyond the scope of the standard.



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Box gutters - General

Conflict between standards

The primary standard for Deemed-to-Satisfy box gutter design is the AS/NZS 3500.3

The HB:39 is also a primary referenced document and provides the installation requirements for box gutters

In some circumstances information contained in HB:39 is inconsistent with the requirements set out in AS/NZS 3500.3

In these situations, the requirements of AS/NZS 3500.3 are the requirements that should be applied

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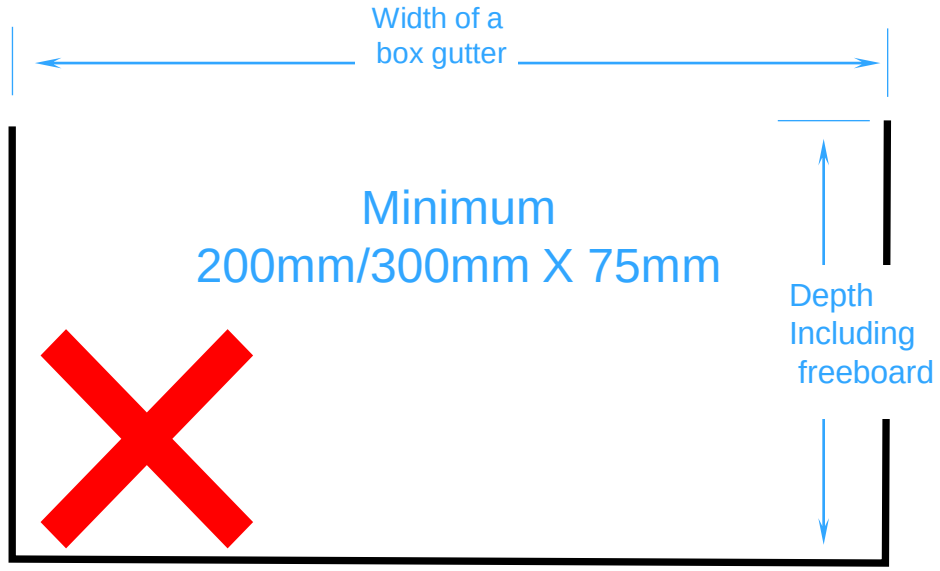
Box gutters - General

Conflict between standards - box gutter minimum depth

SA HB:39 says

- For commercial or industrial installations, gutters to have a minimum size of not less than 300 mm wide and 75 mm deep at the high end.

- For domestic installations a minimum size of not less than 200 mm wide and 75 mm deep at the high end, commensurate to the roof catchment area serviced by that gutter.



These dimensions are beyond the scope of the standard as they cannot be plotted from the sizing graphs in AS/NZS 3500.3.

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Minimum Deemed-to-Satisfy depth of a box gutter -3l/s

MINIMUM DEPTH OF A BOX GUTTER AT THE MINIMUM DEEMED-TO-SATISFY DESIGN FLOW (3 litres per second)				
BOX GUTTER WIDTH	MIN DEPTH OF BOX GUTTER (including h_f) 1:200	MIN DEPTH OF BOX GUTTER (including h_f) 1:150	MIN DEPTH OF BOX GUTTER (including h_f) 1:100	MIN DEPTH OF BOX GUTTER (including h_f) 1:40
200	107	104	102	93
300	96	94	92	85
375	92	89	87	81
450	88	86	84	79
525	85	83	82	77
600	83	81	80	75

The minimum box gutter depths in this table are based on the parameters of AS/NZS 3500.3:2021, Figure H.1, 3 litres per second.

When using the standard to chart depth slight variations may occur due to parallax error.

Higher design flows will result in a non-linear increase in gutter depth. Design flows below 3 litres per second are beyond the scope of the standard.

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Minimum Deemed-to-Satisfy depth of a box gutter -16l/s

MINIMUM DEPTH OF A BOX GUTTER AT THE MAXIMUM DEEMED-TO-SATISFY DESIGN FLOW (16 litres per second)				
BOX GUTTER WIDTH	MIN DEPTH OF BOX GUTTER (including h_f) 1:200	MIN DEPTH OF BOX GUTTER (including h_f) 1:150	MIN DEPTH OF BOX GUTTER (including h_f) 1:100	MIN DEPTH OF BOX GUTTER (including h_f) 1:40
200	N/A	N/A	N/A	N/A
300	169	162	156	136
375	154	148	143	126
450	144	138	134	119
525	135	131	127	113
600	129	125	121	108

The minimum box gutter depths in this table are based on the parameters of AS/NZS 3500.3:2021, Figure H.1, 16 litres per second.
When using the standard to chart depth slight variations may occur due to parallax error.
Higher design flows are beyond the scope of the standard.

PRACTITIONER

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Box gutters - General

Conflict within a single standard – downpipe size

- AS/NZS 3500.3 says that a 100 mm × 50 mm rectangular downpipe may be used for connection to a sump or rainhead.

- **Downpipes of this dimension are not an available option that can be plotted from the sizing graphs in AS/NZS 3500.3**

Poll question

Conclusion

We have looked at deemed-to-satisfy design parameters for rainheads and sumps sizing, overflow size and location, and downpipe sizing and outlet location.

Participants should now be able to:

- Identify sizing parameters for rainheads and sumps
- Identify appropriate overflow size and location
- Identify correct downpipe sizing and outlet location

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Q & A

VICTORIAN BUILDING AUTHORITY

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Thank you

VICTORIA State Government

Attachment 6

VBA Fact Sheet – Roofing – common roof drainage faults and enquiries – box gutters.

Fact sheet

March 2023

Research insights: Roofing: Common roof drainage faults and enquiries – box gutters

Q&A

The following answers have been provided to questions asked during the Roofing: Common roof drainage faults and enquiries – box gutters Practitioner Education Series webinar on 9 March 2023.

The answers provided are correct as at 22 March 2023.

Will the VBA provide a copy of the presentation slides?

A copy of the presentation slides and recording of the webinar is available from the VBA website: https://www.vba.vic.gov.au/plumbing/PES-previous-sessions

We do a lot of work on old shopping centres and industrial buildings. How do we ensure that these standards are met on old buildings when we are simply replacing rusted out old box gutters and sumps are within spaces without access- i.e. we can't always provide the extra overflow provisions due to locations that were compliant in the 70-80s?

The compliance pathway for roofing doesn't make any provision for like-for-like replacement, and instead only specifies what the Deemed-to-Satisfy provisions are. As a result, all new and replacement works need demonstrate compliance with the Performance Requirements of the National Construction Code, through either a Deemed-to-Satisfy or Performance Solution.

Why aren't all roof plumbers producing a set of documents of their intended design solutions first and then reviewed and approved by a qualified person prior to implementation?

Plumbers are seldom involved in the design process and are generally provided with an approved set of plans and specifications. The plans should indicate the standards to which the work must comply. If the plumber identifies a roof design that is not consistent with the Deemed-to-Satisfy provisions, they must contact the Builder and Relevant Building Surveyor in the first instance, to clarify how the work will be certified.

Regarding galvanised sheet products, how does this affect a plumber's certificate of compliance?

Please refer to the material manufacturer for information about these products.

Do plumbers need to consider warranty of materials used when certifying plumbing work they have carried out? Example (Where a manufacturer will not provide warranty for galvanised roof sheets due to white rust and the plumber is requested to install galvanised roof sheets).

Product warranty is not a general requirement of a certified plumbing installation, but it is recognised and a requirement for that the product must be fit for its intended purpose.

Can you please clarify whether a box gutter can discharge to a sump with a rainhead?

To be considered a Deemed-to-Satisfy design, a box gutter must discharge to either a sump or rainhead.

What is the VBA's position on the Dambuster rainhead/performance solution they provide?

The VBA does not endorse any specific plumbing products and is satisfied as long as the products are fit for the intended purpose & meet the relevant Performance Requirements of the NCC Volume Three.

When sizing to meet DTS, what is the VBA wanting the sizing based on? AS3500:3 or is it acceptable to size from the HB114 even though it has been withdrawn? VBA licence exams are still referencing the HB114 as an acceptable sizing method.

HB114 & HB39 both reference AS/NZS3500:3 for all sizing requirements. Some practitioners find the steps/examples in HB114 easier to follow, however, there are some inconsistencies between these documents and in such cases, the AS/NZS3500:3 takes precedence.

A performance solution will mean that a hydraulic engineer would need to create the performance solution??

The performance solution process requires the preparation of a Performance Based Design Brief. This may be prepared by a person with appropriate qualifications and experience in the specific area of plumbing. This may be a professional engineer or potentially even a licenced plumber who has the appropriate knowledge and experience.

Do Building Surveyors need to list plumbing Performance Solutions on Building Permits or Occupancy Permits or is having it referenced on the plumbing compliance certificate enough?

The Performance Solution should be documented in the Building Permit conditions. The licenced practitioner must also indicate this on their compliance certificate.

Can you discuss:
a) the approval approach for leer gutters where the side of the box gutter follows the slope of the roof;
b) approval of box gutter discharging onto an apron flashing into an eaves gutter and;
c) upper roofs dropping via spreaders onto lower roofs or via DP dropping directly to box gutters/sumps etc.

The Deemed-to-Satisfy provisions are explicit in the following:
a) box gutters (including leer gutters) must have a uniform grade/consistent grade.
b) box gutters must discharge to a sump or rainhead.
c) discharge of higher catchments to lower roofs, sumps or rainheads is explicitly prescribed by the standards. Where any of these requirements cannot be achieved, a Performance Solution should be developed prior to works commencing.

Can the VBA clarify the role of the building surveyor to complete these calculations?

The Relevant Building Surveyor (issuing the building permit) is responsible for ensuring compliance, which may include a review of calculations to ensure they comply with the NCC requirements.
A Building Surveyor may be involved in the design and calculations however, caution must be exercised to ensure that they are not performing a statutory function in the process, e.g. acting as the RBS for their design.

Please define "clear of neighbourhood properties". It's very common to have a box gutter on a boundary.

All stormwater drainage should be controlled to the nominated Legal Point of Discharge for the property it serves. In circumstances where side overflows will discharge onto a neighbouring property, the design of the box gutter system should be reviewed prior to construction to ensure the correct overflow provisions can be accommodated.

Who at the VBA reviews a performance Solution?

The VBA is not involved in the design process and does not approve performance solutions. The role of the VBA is to confirm that the mandatory documentation requirements of the PCA have been followed and confirm that an acceptable Verification Method has been used.

If a Performance Solution ticks every box as per the NCC requirements in conjunction with the ABCB process, can the VBA reject the Performance Solution and if so, on what grounds and who is the expert in the VBA reject these?

A VBA plumbing inspector or compliance auditor may reject a Performance Solution if they believe that the assessment methods used to verify that the Performance Solution are unacceptable.

It's not the role of the VBA to assess the design – please refer NCC Governing requirement A2.4.

Are you allowed to install a cover around the rainhead that has a 50mm space around it to keep the look neat and tidy but still has all overflow provisions?

Where the rainhead is fitted with a shroud it forms a vertical chute or duct for which there is no DtS examples nor methods of sizing. AS/NZS 3500.3:2018, Figure I2 is a normative figure which depicts a compliant rainhead. Note 4 to this figure requires rainheads to be left open above the weir, which is expressed in mandatory terms. Statements expressed in mandatory terms in notes to figures and tables are deemed to be requirements of this Standard.

Can the downpipe be located anywhere within a high-capacity sump?

Downpipes from high-capacity sumps can be moved longitudinally but must not cross the centre line of the sump and the centre of the downpipe must not be further to the edge of the sump than; if round, the diameter of the downpipe, and if square or rectangle, the average of the 2 side dimensions of the downpipe.

Can 800mm & 1000mm wide box gutters be used?

800 mm or 1000 mm box gutters are outside the scope of AS/NZS 3500.3 and could only be designed, installed and certified as a performance solution.

How far below the rainhead is the downpipe to be vertical? Often there is a bend to offset the downpipe to the drain.

The standards do not specify a distance and only stipulate downpipes to be connected to the base of rainheads or sumps.

Is there a maximum length of a box gutter before a sump is required for a straight run only?

Box gutter length is only limited by the maximum design flow and must discharge to a rainhead or sump.

NCC 3.5.3.5 notes maximum 12.0m gutter length for each downpipe – does this apply to box gutters too? Isn't roof area not considered too?

Victoria has a variation to NCC 2019, Volume 2, Clause 3.5.3.0 which states; *In Victoria, except for 3.5.3.0 - Acceptable construction manuals, Part 3.5.3 does not apply*. The Vic variation removes the acceptable construction practice (ACP) but keeps the acceptable construction manual (ACM) under 3.5.3.0. So, the variation only removes the ACP option, meaning both builders and plumbers need to comply with AS/NZS 3500.3 for the sizing and design of all roof drainage systems.

What is the maximum length of a box gutter in one slope direction?

There is no specific maximum length as such, but any box gutter must have appropriate expansion provision for the material used and it must also be noted that under the Deemed-to-Satisfy provisions of AS/NZS 3500.3 and not have a downpipe with a flow rate of greater than 16 litres.

Why is the bottom of the overflow above the bottom of the gutter?

Sumps and rainheads have different provisions for overflow. Box gutters that discharge to a sump require an increase in depth relative to the gradient. This is not the case for box gutters that discharge to a rainhead unless the gutter tapers toward the outlet. The hydraulic flow within a box gutter might discharge via the overflow rather than the outlet if the overflow was to be submerge into the sump.

Why is there a limit for the spreader to flow on the lower roof?

Spreader discharge is only limited to 15m^2 for tiled roofs or corrugated roof profiles. This catchment area can be increased provided the additional upper roof discharge does not exceed the lower roof profile manufacturer's design-carrying capacity, and the lower roof gutter and downpipes are sized to accommodate the additional flow.

How come there are no calculations for box gutters larger than 600mm?

There are no calculations for box gutters wider than 600mm as this is the maximum sole width that can be plotted from the standard.

Could it be worthwhile to do away with side overflow ducts and just have high-capacity overflows give the extent of calculations, they can still terminate the same?

The Deemed-to-Satisfy provisions provide options for both side and high-capacity overflow devices. Sumps with side overflows are prescribed by the standard and must discharge to atmosphere, sumps with high-capacity overflows can be piped to a safe location but are beyond the scope of the standards.

Why are not standard DtS rainheads and high-capacity sumps provided by suppliers for various flow rates and sole widths? This will reduce costs and reduce errors?

The VBA cannot speak for any specific manufacturers however, as there a several combinations of width and depth for rainheads and sumps depending on the design flow, this would be a very large range of products to produce. Additionally, the plumber would still be required to size the roof catchment areas to ensure they purchase the correct sized rainhead or sump.

Can it be clarified if all design and documentations should be by architects/draftsperson/building designer or plumber?

Building designs that incorporate box gutters rarely include box gutter sizing details. Instead, the approved plans should specify whether the box gutters are required to comply with AS/NZS 3500.3 or whether a performance Solution has been agreed. It is incumbent on the licenced plumber to confirm the compliance of the gutter when developing the incidental design for the site.

Can we use two smaller downpipes in lieu of one larger downpipe of same cross-sectional area as the two smaller?

As there are no examples of this within the Deemed-to-Satisfy provisions, this design would need to demonstrate compliance with the Performance Requirements of the Plumbing Code of Australia, through a Performance Solution.

Are nylon anchors approved for fixing flashings to parapet and building masonry walls? This is hard to discern this from HB39.

SA HB39 only states that the fixings are compatible to the materials being fixed and fit for purpose.

How are plumbers to interpret DtS box gutter sizing for very low flow rates below 3 litres per second when AS/NZS3500.3 chart only provides for greater than 3 L/s?

Design flows of less than 3 litres per second are beyond the scope of the standard.

How does the DtS rainhead accommodate hail protection for outlets?

The Performance Requirements for roof drainage systems set out in the Plumbing Code of Australia are based on extreme rainfall events and only require access for maintenance and clearing blockages. Similarly, the general method for sizing Deemed-to-Satisfy rainheads makes no allowance for blockages caused by snow, hail or debris.

Given the requirements of calculations, should this not fall upon a hydraulic engineer to calculate?

Under the definition of Roofing (Stormwater) Work, prescribed by the Victorian Plumbing Regulations 2018, a plumbing practitioner licenced in that class of work can perform the associated design. Additionally, where a Performance Solution is proposed a person who holds the relevant knowledge and experience may also develop the design.

Can a cap be installed to the top of a high-capacity overflow to prevent water from the roof constantly falling into the overflow from the roof?

A note in the AS/NZS3500.3 advises 'where water flowing directly into the overflow is a problem, a deflector or cap may be installed to divert the water' however, the standard does not provide a DtS provision for the deflector.

When the VBA carries out an audit of a DtS roof drainage installation, does the auditor request computations for the installation? Why or why not? The Audit Form simply asks, 'Has the roof drainage system been designed and sized properly?' Computations are required for all roof drainage installations, not just Performance Solutions.

A Plumbing Inspector or Compliance Auditor may request documentation if compliance with either a Performance Solution or Deemed-to-Satisfy solution is in doubt.

Are you able to clarify synthetic rubber expansion joints? The regulations seem to state gutters must overlap by 50mm under the rubber. Rubber manufacturer states a 50mm gap between gutters under the rubber. I've heard examiners are saying gutters must be lapped 50mm.

Synthetic rubber expansion joints should be installed in accordance with the standards and the manufacturer’s instructions to ensure the joint avoids pinching and is supported appropriately.

Can you explain again the approved size of box gutters in domestic application? Is 200x75 the minimum?

Box gutters that have minimum dimensions of 200mm x 75mm, or 300mm x 75mm are beyond the scope of the AS/NZS 3500.3, and as such they could only be designed through the Performance Solution process.

How can you provide a Deemed-to-Satisfy solution to an existing box gutter replacement when you'll be lucky to get even 75mm, which was the previous minimum? Will you have to reconstruct the gutter support?

The compliance pathway for roofing doesn't make any provision for like-for-like replacement, and instead only specifies what the Deemed-to-Satisfy provisions are. As a result, all new and replacement works need demonstrate compliance with the Performance Requirements of the National Construction Code, through either a Deemed-to-Satisfy or Performance Solution.

Is the minimum box gutter depth measured from the highest point or the point where box gutter meets railhead/sump?

The minimum box gutter depth is measured from the upstream end and increases in depth towards the sump, this ensures that box gutters discharging to a sump are at their deepest at the entry to the sump. For box gutters that discharge to a rainhead the minimum depth is measured in the same location (upstream end). The difference with a box gutter discharging to a rainhead is that it must still be on grade but is not required to increase in depth.

Why are sump overflows above the box gutter base height but that cannot be done for a rainhead?

Sumps and rainheads have different provisions for overflow. Box gutters that discharge to a sump require an increase in depth relative to the gradient. This is not the case for box gutters that discharge to a rainhead unless the gutter tapers toward the outlet.

High flow overflow devices have constant water run-off from the roof in all rains. What is the solution to stop this occurring?

A note in the AS/NZS3500.3 advises 'where water flowing directly into the overflow is a problem, a deflector or cap may be installed to divert the water' however, the standard does not provide a Deemed-to-Satisfy provision for the deflector.

