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Standards New Zealand, PO Box 1473, Wellington 6140

Technical Advisory Group representation

This specification was prepared by the P4509 Firefighting water supplies Technical Advisory Group. The membership of the committee was approved by the New Zealand Standards Executive under the Standards and Accreditation Act 2015.

The Technical Advisory Group consists of representatives of the following nominating organisations:

Building System Performance

Department of Conservation

Engineering New Zealand

Federated Farmers of New Zealand

Fire and Emergency New Zealand

Fire Protection Association of New Zealand

Institution of Fire Engineers (IFE)

Insurance Council of New Zealand

New Zealand Defence Force

New Zealand Forest Owners Association Fire Committee

Society of Fire Protection Engineers (SFPE)

Taituarā – Local Government Professionals Aotearoa

Water New Zealand

Wellington Water

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New Zealand Publicly Available Specification

DZ PAS 4509:202X

Firefighting Water Supplies – Code of Practice

Contents

Figures

Tables

Cited standards

For compliance purposes, always refer to the current cited standards. New Zealand and joint Australian/New Zealand standards can be found on www.standards.govt.nz.

Referenced documents

Reference is made in this document to the following:

New Zealand standards

NZS 4404:2010	Land development and subdivision infrastructure
NZS 4512:2021	Fire detection and alarm systems in buildings
NZS 4515:2009	Fire sprinkler systems for life safety in sleeping occupancies (up to 2000 square meters)
NZS 4517:2010	Fire sprinkler systems for houses
NZS 4522:2010	Underground fire hydrants
NZS 4541:2020	Automatic fire sprinkler systems
NZS 9201:2007	Model general bylaws –
Part 7:2007	Water supply
SNZ PAS 4505:2007	Firefighting waterway equipment

Joint Australian/New Zealand standards

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International standards

AS 1668.1-2015	The use of ventilation and air conditioning in buildings, Part 1: Fire and smoke control in buildings
BS 3251:1976	Indicator plates for fire hydrants and emergency water supplies
A-55423 A-A 59326B	General Specification for Coupling Halves, Quick-Disconnect, Cam-Locking Type Hose fittings with clamp units – Part 7: Cam locking couplings. USA: 2005
CID-A-A59326D / EN 14420-7:2022	Camlock coupling standards and norms
NFPA 30	Flammable and combustible liquids code. USA: 2024

Other publications

Andrew H Buchanan and Anthony K Abu. *Structural design for fire safety.* 2nd edition. John Wiley and Sons. United Kingdom: 2017.

Country Fire Authority. *Design requirements – Vehicle access water supply guidelines in residential developments.* Victoria, Australia: 2022.

Fire and Emergency New Zealand. *Designers Guide to Firefighting Operations* (F5-01 to F5-14 series). Wellington: Fire and Emergency New Zealand, 2025.

Fire and Emergency New Zealand. *Firefighter Training Notes Station Reference Manual* vol 2 – *Flow testing of water mains and hydrant testing.* Wellington: 1999.

Ministry for the Environment. *National planning standards*. Wellington: 2019.

Ministry of Business, Innovation and Employment. *New Zealand Building Code Handbook and Approved Documents.* Wellington: MBIE 2014.

New Zealand Society on Large Dams (NZSOL). *New Zealand Dam Safety Guidelines*, 2024

Waka Kotahi NZ Transport Agency. *Manual of traffic signs and markings – Part II: Markings* (also known as MOTSAM 2). Wellington: 2007.

Waka Kotahi NZ Transport Agency. NZTA M07:2022 *Specification for Road Marking Materials*. Wellington: 2022.

New Zealand legislation

Building Act 2004 and Building Code

Building (Dam Safety) Regulations 2022

Fire and Emergency New Zealand Act 2017

Health and Safety at Work Act 2015

Local Government Act 1974 and 2002

Resource Management Act 1991

Websites

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Review of standards

Suggestions for improvement of this specification will be welcomed. Send them to the National Manager, Standards New Zealand, PO Box 1473, Wellington 6140.

Foreword

This Code of Practice sets out what constitutes a sufficient minimum supply of water pressure and volume for firefighting in structures. It also offers guidance on options for establishing water supplies to provide intervention opportunities for wildfires. This includes areas covered by any agreements under section 70 or Part 4, Subpart 1 of the Fire and Emergency New Zealand Act 2017. Compliance with this Code does not guarantee that in each and every case Fire and Emergency New Zealand can control or extinguish a fire with the water supply available.

This Code of Practice is not intended to provide specifications for the water supply required for any individual fire protection systems to operate effectively.

It is intended that the Code will form the basis of a partnership between FENZ, local authorities, water service providers (WSPs), the Water Services Authority, builders, designers and developers, and so on. It is also intended that the Code may be used as a:

- basis for local authorities, WSPs and water organisations' requirements of water supplies, or
- reference called up, for example, by local authorities in relation to rules for the district plan.

The recommended firefighting water supplies may not be adequate for all potential fire scenarios, especially for particularly hazardous facilities, such as fuel terminals, large-scale battery energy storage systems and solar farms.

The Code recognises that sprinkler systems installed to an Approved Standard will almost certainly reduce the flow rates and volumes of water required for firefighting operations.

Users of this document need to understand that firefighting water supplies do not place a normal everyday load on the water supply network. The requirement for firefighting water supplies is to deal with an abnormal, emergency situation.

This Code is published in accordance with section 73 of the Fire and Emergency New Zealand Act 2017.

1. Introduction

1.1 Firefighting water supply – Code of Practice and regulatory alignment

This Code of Practice aligns water supply resources with the operational requirements of Fire and Emergency New Zealand, providing a benchmark for infrastructure design that supports effective firefighting. By complying with the Firefighting Water Supplies Code of Practice, developers and building owners can be reasonably assured that their development:

Will provide a suitable quantity of water to enable FENZ to perform its firefighting and rescue functions;

- Contains water supply systems that have been designed to consider both usability and firefighter safety;
- The Code has been developed in accordance with section 73 of the Fire and Emergency New Zealand Act 2017.

The Code also supports the opportunity to benchmark water requirements for firefighting. It informs local authorities and developers of general infrastructure needs based on zone use, and can be regulated by:

- Resource Consent Authorities – by ensuring infrastructure design and water supply capability is considered and implemented at the resource consent stage;
- Building Consent Authorities – by ensuring buildings provide means to deliver firefighting water to all parts of the structure, in accordance with the Building Code.

The Code should help FENZ meet its principal objectives and functions under sections 10 and 11 of the Fire and Emergency New Zealand Act 2017.

1.2 Responsibility for provision of sufficient firefighting water supply

It is the building owner's responsibility to ensure that the water supply available meets the required demand for the development proposed, including. This includes accounting for future deterioration or pressure reductions in the public network. The Building Code requires that certain buildings (for example, those with water outlets, sanitary fixtures or sanitary appliances) have safe and adequate water supplies with adequate flow rates.

Furthermore, buildings must be provided with the means to deliver water for firefighting to all parts of the building. Sprinkler systems should be designed with a safety margin to accommodate for daily fluctuations and potential long-term changes that may reduce network pressures significantly.

If the available public water supply is insufficient, the building owner must implement appropriate solutions, such as redesigning the system, modifying pipes or installing of pumps and tanks. WSPs are not responsible for upgrading private infrastructure to meet sprinkler demands or to compensate for future pressure reductions in the public network.

Developers and designers must assess current and future water supply capabilities and design accordingly. Coordination between WSPs and the sprinkler industry is encouraged to align on design pressures and probable future network changes. Designers should note that water supply bylaws generally prohibit directly connecting pumps to a public water supply network due to the risk of pressure surges that can cause damage and disrupt the supply. You should always check the local bylaws to ensure you are meeting the local authority's requirements.

1.3 Definitions

For the purposes of these guidelines, the following definitions shall apply:

Access	The path of entry and exit from a hardstand location. Most often this will be via public roads. but on large allotments, access on site will be required. For vehicular hardstands, the minimum requirements are contained in the compliance documents for the Building Code Refer to F5-02 *Emergency vehicle access*, which can be downloaded from www.fireandemergency.nz. for additional considerations NOTE – When considering access for wildfire purposes, operations may not necessarily be undertaken using FENZ appliances.
Additional water	Remaining volume of total stipulated firefighting water
Approved Standard	A Standard listed in the Referenced documents section of this Code of Practice.

Approved tester	A person authorised by the WSA, WSP or FENZ as competent to conduct measurements of flow and pressure to test the adequacy of firefighting water supplies.
Attendance point	The place where the first attending FENZ pumping vehicle may stop and set up. There is only one attendance point, usually at the building's primary entry point. Firefighters may be deployed to other firefighter access points from there.
Building Consent Authority	A Building Consent Authority as defined in the Building Act 2004.
Couplings	See FENZ coupling.
Distance from a fire hydrant or non-reticulated firefighting water supply	Distance as measured from the fire hydrant or non-reticulated firefighting water supply to the attendance point – it must be trafficable by a fire appliance, or as agreed with FENZ NOTE – If the trafficable route is unknown, the distance should be measured orthogonally.
Dynamic pressure	See Running pressure.
Extra high hazard	Commercial and industrial occupancies having high fire loads. NOTE – Taken from NZS 4541:2020, which provides further information.
Extra light hazard	Non-industrial occupancies where the amount and combustibility of the contents are low. NOTE –Taken from NZS 4541:2020, which provides further information.
Fire cell	Has the same meaning as in the New Zealand Building Code, Clause A2 – Interpretation.
Fire district	A geographic area defined by FENZ to manage the risk of fire.
Firefighting water supply	Means water supplies that may be used for firefighting purposes, and: (a) To which the Code of Practice for firefighting water supplies applies, and; (b) Includes water from: (i) Any reticulated water supply, waterworks, or fixed bulk water supply systems, and; (ii) Any reservoir, dam, water race, or tank water supply systems.
Fire hazard	The danger of potential harm and degree of exposure arising from both the: (a) start and spread of fire; (b) smoke and gases that are generated by the start and spread of fire.
Fire hydrant	An assembly contained in a pit or box below ground level, made up of either a: • valve and outlet connection from a water main, or • a pillar upstand connected to a water main and fitted with a valve and instantaneous coupling(s) adaptor, which provide a controlled supply of water for firefighting to a FENZ fire appliance or fire pump. NOTE – This does not include building hydrants designed to NZS 4510. Refer to NZS 4522:2010 *Underground fire hydrants.*
Fire protection system	Includes detection, alarm and suppression systems installed and maintained in accordance with the applicable approved Standards

FENZ coupling	Fittings or devices conforming with the Standard(s) referenced in this document that permit the connection of fire hose or firefighting waterway equipment to a source of water supply
Hardstand	A level area sufficient to allow placement of equipment and portable pumps near a water source NOTE – See Vehicle hardstand for fire appliance requirements.
Key fire hydrant	A key fire hydrant is one considered by FENZ or the WSP with flow characteristics that are representative of that part of the network. The criteria to determine key fire hydrants are set out in Appendix C1 – Example 1 – Residential 1: Reticulated firefighting water supply. NOTE – May have been previously referred to as an 'indexed hydrant'.
Lay-flat hose	A non-rigid hose used by firefighters to deliver of water from a pressurised water supply source to the firefighting appliance, pump or other equipment.
Local authority	A regional council or territorial authority, as defined by section 5 of the Local Government Act 2002
Non-reticulated firefighting water supply	Any water source available for firefighting that is not part of a piped water system (reticulation) provided by a water utility or local council. See also Appendix C – Examples of water supplies.
Ordinary hazard	Commercial and industrial occupancies involving the handling, processing and storage of mainly ordinary combustible materials unlikely to develop intensely burning fires in the initial stages NOTE – Taken from NZS 4541:2020, which provides further information.
Outbuildings	As defined by the Building Code Clause A1 – Classified Uses
Peak demand	The water supply flow for domestic and commercial use as determined by the WSP
Private fire hydrant	A fire hydrant not owned by a WSP. Water from such a fire hydrant may be included in firefighting water supplies if the fire hydrant complies with approved Standards and is sufficiently maintained
Residual pressure	See Running pressure
Reticulated supply	A network designed for the express purposes of delivering drinking water and firefighting water supply fitted with fire hydrants
Required water flow	Half of total stipulated firefighting water within 135 m of attendance point NOTE – This applies to reticulated supplies only.
Running pressure	The water pressure in a water main as measured at an adjacent fire hydrant when the fire hydrant in use is fully open
Rural water supply area	An area formally designated by a WSP as being serviced by a reticulated water supply system intended to supply water for specified purposes via restricted flow supplies and/or on-demand supplies, but not necessarily with a firefighting capability.

Static pressure	The water pressure in a water main as measured when none of the fire hydrants are open.
Suction hose	A rigid hose used by firefighters for the supply of water when drafting from non-reticulated water supplies.
Territorial authority	A city council or district council named in Part 2 of Schedule 2 of the Local Government Act 2002, as defined by section 5 of the Local Government Act 2002.
Upstand connection	An above-ground connection to a water supply, such as a tank, with an approved coupling.
Urban water supply area	An area formally designated by a WSP as being serviced by a reticulated water supply system with a firefighting capability intended to supply water to customers via on-demand supplies.
Vehicle hardstand	A hard (roading) surface capable of withstanding the fully laden weight of a fire appliance from which fire operations are conducted. The size of a vehicle hardstand must include sufficient room for the fire appliance to enter and exit, and for firefighters to move around it to connect hose and safely access equipment. In most cases, the vehicle hardstand will be the main road if the structure is close to it.
Water organisation	Means either: (a) A water organisation set up under section 44 of the Local Government (Water Services) Act; or (b) A council-controlled organisation that was providing water services prior to 2025, and intends to continue to provide water services, and complies with the requirements set out in sections 45, 46 and 48 of the Local Government (Water Services) Act within six months of the commencement of the Act.
Water Service Authority (WSA)	The Water Services Authority – Taumata Arowai.
Water services provider (WSP)	The entity responsible for providing water, including its authorised agents. Means either: (a) A territorial authority or regional council that is still responsible for providing water services; or (b) A water organisation that has been set up by a territorial authority or regional council and is responsible for providing water services; or (c) An Auckland water organisation.
Water supply classification	An index assigned to a group of fire hydrants or non-reticulated firefighting water supplies that meet the specifications contained in Tables A1 and A2, pages X–Y.
Wildfire	An unplanned vegetation fire. A generic term that includes grass fires, forest fires and scrub fires.
Wildfire-prone areas	An area where wildfire poses a high risk to people, property, and the environment.

1.4 Abbreviations

Abbreviations have the following meanings:

Abbreviation	Definition
CBD	Central Business District

EHH	Extra high hazard
ELH	Extra light hazard
GIS	Geographic Information System
HRR	Fire heat release rate
pH	Measure of the acidity or alkalinity of water
NZTA	New Zealand Transport Agency
OH	Ordinary hazard
PRV	Pressure-reducing valves
RRPM	Raised reflective pavement markers
WSP	Water services provider

1.5 Symbols and units

The following general symbols and units are used in this Code, together with others specific to certain applications:

Symbol	Quantity	Unit
A_{exp}	Surface area of adjacent firecell(s) and/or structure(s) exposed to a firecell involved in fire	m^2
A_f	Floor area of firecell	m^2
A_h	Area of horizontal opening	m^2
A_v	Area of vertical openings	m^2
F_{tot}	Total fuel load of firecell	MJ
H	Average height of the firecell	m
H_m	Vertical height from the mid-height of the window opening to the mid-height of the horizontal opening	m
H_v	Weighted average height of vertical openings	m
$M_{available}$	Total firefighting water available	L/min
M_{exp}	Required water flow rate to protect the exposure	L/min
M_{fuel}	Mass of fuel in the firecell	kg
$M_{measured}$	The measured flow rate recorded from flow tests	L/min
M_{tot}	Total water flow rate	L/min
M_{water}	Water flow rate required for firefighting	L/min
Q_{fire}	Smaller value of Q_{vent} or Q_{fuel} for a firecell	MW
Q_{fuel}	Rate of heat release from the fuel-controlled fire	MW

Symbol	Quantity	Unit
Q''_{fuel}	Rate of heat release per unit area of fuel burning	MW/m^2
Q_{max}	Maximum rate of heat release from fire	MW
Q_{vent}	Rate of heat release from ventilation-controlled fire	MW
P	Pressure measured in kilopascals	kPa
t_{fire}	Fire duration	s

1.6 Document structure

This document has been subdivided into the following parts:

Section 2: General requirements

This section contains general requirements that are applicable at all stages of a development's lifecycle.

Section 3: Planning stage

This section focuses on the requirements that apply at the resource consent stage and/or subdivision stage of a development. At this stage, key water supply infrastructure is being designed, but information on the individual buildings may not be available. This stage will usually focus on the water supply for multiple allotments and their intended use.

Section 4: Building design and developing individual allotments

This section focuses on the requirements that apply within a single allotment. As the design of buildings within allotments is being developed, this additional information can be used to verify whether the design remains within the capabilities of the installed infrastructure. If this is not the case, then additional options to mitigate the increased risk can be incorporated.

Section 5: Firefighting water supplies for wildfires

This revision of the Code contains new information relating to water supplies for wildfires. This part is informative only and does not form part of the normative requirements of this Code.

1.7 How to use this Code of Practice

It is recommended to read SNZ PAS 4509:202X in the following order:

(a) Read section 3 when calculating water supply for districts or subdivisions, section 4 for individual allotments or section 5 for wildfire areas
(b) Determine the water supply classification using Appendix A: Table A1 – Method for determining required water supply classification.
(c) If in a reticulated supply area, determine the water supply requirement using Appendix A: Table A2 – Water supply requirements – Reticulated systems;
(d) If in a non-reticulated supply area determine the water supply requirement using Appendix A: Table A3 – Total water supply volumes and non-reticulated systems;
(e) Ensure the proposed development meets FENZ access requirements. For vehicular access requirements, see F5-02 *Emergency vehicle access* for additional considerations;
(f) Produce a site plan or map indicating the water supply (including distances from the hazard to hardstands, coupling and tanks, if applicable). Also include any special access requirements, such as driveway gradients, bridge weight limits and clear trafficable widths that may impact on emergency service vehicle access;
(g) Submit your plan as part of your application to the relevant local authority for assessment. If FENZ comment is required, the territorial authority will contact the appropriate FENZ staff.

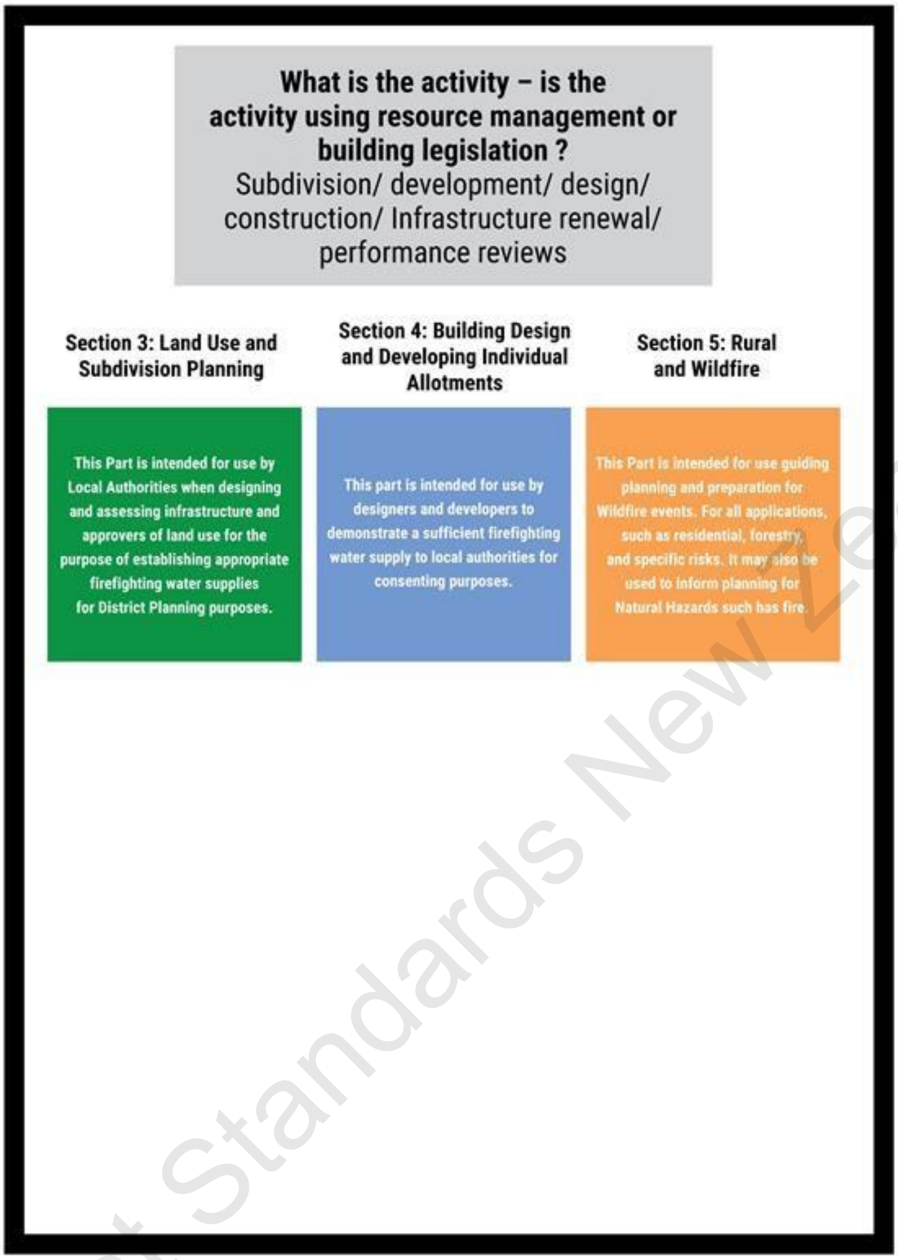


Figure 1 – Methodology for determining required firefighting water supply

2. GENERAL REQUIREMENTS

2.1 Aim

This Code of Practice (the Code) sets out what constitutes a sufficient minimum supply of water pressure and volume for firefighting in structures. It also offers guidance on options for establishing water supplies to provide intervention opportunities for wildfires. This includes areas covered by any agreements under section 70 or Part 4, Subpart 1 of the Fire and Emergency New Zealand Act 2017. Compliance with this Code does not guarantee that FENZ can control or extinguish every fire with the water supply available.

The Code does not provide guidance for unusual or particularly hazardous facilities such as fuel terminals, large-scale energy storage facilities, large aircraft hangars and large warehouses. For facilities like these, consultation is recommended with key stakeholders such as the facility owner, facility operators, insurers, WSAs, WSPs, and FENZ.

While the volume of water required from a public supply may exceed the indicative volumes suggested in this Code, ,the volumes used in a sprinkler-controlled fire will be almost always be significantly less than used in a non-sprinkler-controlled building fire. This also provides other environmental benefits, such as less polluted run-off water, fewer airborne contaminates and less landfill disposal.

Cities and districts may have various water supply systems. These may include:

- a fully reticulated water supply system (an urban water supply area)
- a rural water supply system that feeds a supply tank (a rural water supply area)
- a stand-alone tank supply using rainwater, local well or bore for maintaining its contents
- an open water source
- a combination of these.

There may also be some private reticulated water supply systems.

The following factors affect the effectiveness of firefighting:

- travel time and distance from a fire station
- availability of FENZ resources (appliance and personnel)
- suppression tactics chosen
- fire loading in the structure (or the quantity and condition of vegetation fuels for wildfires)
- speed of fire development
- ready access to a sufficient quantity and flow rate of water
- (seasonal) sustainability of the water supply.

Because it takes longer to respond to fires a long distance from a fire station, FENZ recommends considering sprinklers at the planning stage of building construction.

2.2 Compliance

This Code seeks to act as a risk apportionment tool and users need to be aware that when considering fire risk, the provision of a readily available sufficient water supply will affect the extent to which a firefighting resource can save life and prevent damage to property. Should a fire occur, FENZ will still respond if called and will commence firefighting operations using whatever water is available but delays in accessing a water supply allow a fire to continue to develop to a size that can result in more damage and increase the risk of fire spreading beyond the original source.

For water supplies to comply with this Code, they must have sufficient flow and duration to allow effective firefighting operations. Water supplies that are not of a duration considered sufficient by FENZ may still be used, if they comply with other legislative or regulatory requirements, but will not be classed as a complying firefighting water supply. The available water may be used for a defensive fire attack to prevent fire spread rather than extinguishment, including reducing the spread of fire to allow FENZ to carry out search and rescue operations.

NOTE – Firefighting resources may be provided by other agencies, such as forestry companies or industrial brigades, especially in rural areas.

2.3 Seeking a consistent approach

This Code is based on principles of fire science and uses options for either a prescriptive or specific solution. In doing so, it acts as a planning tool, guiding the user on how to provide a firefighting water supply that FENZ can use at a fire. It also seeks to support a consistent approach among local authorities to resource management and building requirements regarding firefighting water supplies.

This Code provides techniques to define a sufficient firefighting water supply that may vary according to circumstances. It relates to FENZ requirements only: local authorities and building owners may choose to exceed the provisions of this Code. It is written in a way that should encourage flexibility and provide options for developers and local authorities to achieve compliance.

This Code does not provide specifications for the total water supply required for the effective operation of fire protection systems that may be installed to protect structures, properties or other assets. Requirements for fire protection systems vary and are dependent on the system design parameters. Except in special or isolated cases, fire protection system water requirements must be considered in addition to firefighting water supplies (see Appendix A: Tables A2 and A3). If the water supply is shared between two or more users, then to comply with this Code, it must be shown that all reasonable and appropriate steps have been taken to consider other users' normal expected use.

NOTE – Where building use changes, the existing water supply system should be evaluated against the requirements of the changed use. If there is a serious deficiency in requirements, this should be brought to the attention of the WSP and building owner.

2.4 Application

This Code has been developed to show different parties how they can help manage the consequences of fire. It does this by guiding users on firefighting water supplies during the planning stage of land development or construction.

This Code is also intended for use by local authorities, WSPs, and FENZ to establish the quantity of water required for firefighting purposes in relation to the expected fire hazard within local authority planning zone boundaries. This is based on expected activities within each planning zone. Water supply infrastructure isn't required to be upgraded due to the construction of a single building with a risk profile beyond that currently planned for. However, if a planning zone has a large proportion of buildings that exceed the capacity of the available water supply, then upgrading the water supply infrastructure should be considered.

This revision of the Code is primarily aimed at the resource consent planning level. At that stage, details on an individual building will not be available, so detailed calculations cannot be undertaken. Firefighting water requirements are therefore determined using tables in this Code as described in Section 3 Planning stage.

This Code may also be used to assess whether the available firefighting water supply to individual buildings is adequate. This will be required when the building size and use indicates a firefighting demand greater than the capacity of the available water supply infrastructure. For projects at this stage, refer to Section 4 Building Design and Individual Allotments.

To comply with this Code, it must be shown that this minimum supply is designed to be always available as far as practicable. If it is not, then either the water supply must be increased or the fire hazard in the premises must be reduced.

This Code provides for minimum flows for firefighting water supplies. It recommends the level of domestic and fire sprinkler system demand that water reticulation systems should deliver at the same time as supplying firefighting water.

FENZ personnel giving advice on firefighting water supplies must do so in accordance with this Code.

2.5 Legislative requirements

2.5.1 Fire and Emergency New Zealand Act 2017

This Code is developed and published in accordance with section 73 of the Fire and Emergency New Zealand Act 2017

This Code itself is non-mandatory, but the requirements in the Code can be incorporated into relevant bylaws made under section 146 of the Local Government Act 2002 or incorporated by reference into district plans prepared by local authorities under s 75 of the Resource Management Act 1991 (the RMA). Where the Code is incorporated into a district plan, the enforcement provisions in Part 12 of the Resource Management Act 1991 may be used. The Code may also be referenced in New Zealand Standards and other standards or documents. When incorporating the Code into a legally enforceable document, care must be taken to clearly identify the roles and responsibilities of different bodies (for example, providing water versus maintaining water infrastructure).

Section 74 of the Act gives FENZ the power to check, or require checks to be made, that firefighting water supplies are adequate. This includes testing water volume or pressure to ensure compliance with the Code. Regardless of whether the Code has been incorporated into a legally enforceable instrument, FENZ can still exercise its powers under s 74 to check, or require checks to be made, that water supply is adequate. The

Code can therefore be used as a benchmark or reference for adequacy, even if not enforceable in a legal sense. Where the Code is not legally enforceable, FENZ can still play an advisory role, using its statutory powers to influence planning, infrastructure, and risk management decisions.

In making decisions on water supplies, local authorities should consider the requirements of all relevant legislation. The main requirements are listed below.

2.5.2 Local Government (Water Services) Act 2025

Previously contained in the Local Government Act 1974, the Local Government (Water Services) Act 2025 sets out WSPs' obligations relating to fire hydrants, including the obligation to install fire hydrants and to keep them charged.

The main requirements relating to fire hydrants are contained in section 215 of the Local Government (Water Services) Act, which includes an obligation on WSPs to attach fire hydrants to the main pipes, other than trunk mains, of the waterworks. Fire hydrants must be attached at the most convenient places for extinguishing any fire, as determined by the WSP with the approval of FENZ. WSPs must also determine, with the approval of FENZ, how far apart to attach the fire hydrants. It must also maintain those fire hydrants in effective working order.

Under section 216 of the Local Government (Water Services) Act, territorial authorities must ensure hydrants in its district are marked to show where they are located.

Section 217 of the Local Government (Water Services) Act requires a WSP to keep the pipes hydrants are fixed to filled with water at all times. WSPs are also required to allow any person to take and use water free of charge to extinguish fires. Refer to Appendix B – Legislative requirements, which sets out the requirements of sections 215, 216 and 217 of the Local Government (Water Services) Act in more detail.

2.5.3 Resource Management Act 1991

Local authorities control development and land use through their district plans, which are made under the Resource Management Act 1991. Resource consents can include conditions that firefighting capability is considered, and fire hydrants are provided, but only to the extent the requirements of the Code have been incorporated into a district plan as an applicable rule.

This document describes the expected water supply capacity within each zone under the district plan. For new developments that will change the district plan zone, consider the new intended use rather than the current zone classification.

It can also be used during district planning cycles as a tool for managing natural hazards such as fires.

2.5.4 Building Legislation

Clause C5 of the Building Code includes the requirement to provide access and the means to deliver water for firefighting to all parts of a building. It also requires the building's design and construction to allow firefighters to reach the floor of fire origin and search the general area of fire origin while keeping their means of egress protected, taking into account the firefighters' personal protective equipment and standard training.

Section 18 of the Building Act 2004 states that building work is not required to achieve performance criteria that are additional to, or more restrictive than, the requirements of the New Zealand Building Code, unless expressly provided for in any other Act. Section 37 provides that, where a territorial authority has received an application for a project information memorandum (PIM) or a building consent, and a resource consent has not yet been obtained, the territorial authority must issue a certificate if it believes the consent will or may materially affect the building work to which a PIM or building consent relates. The effect of the certificate will be that until the resource consent has been obtained, no building work may proceed or may only proceed to the extent stated in the certificate.

In practice, this means that, where this Code is incorporated into a district plan, a territorial authority must put building work on hold or limit building work if the authority believes the conditions of the resource consent (including the condition to have adequate water for firefighting) will or may materially affect the building work.

Section 46 of the Building Act requires copies of certain building consent applications to be provided to FENZ. Under section 47, FENZ advise on providing means of escape from fire, and the needs of people authorised by law to enter the building to undertake firefighting, in relation to the building to which the application relates. These matters could include firefighting water supplies. For more information refer to Part 4 – Building Design and Developing Individual Allotments.

2.5.5 Bylaws

Local authorities may make bylaws to manage water supply under section 146 of the Local Government Act 2002. This Code provides a means by which local authorities can determine water supply requirements.

2.6 Firefighter safety considerations

Under section 4(2)(h) of the Building Act 2004, territorial authorities are required to consider the reasonable expectations of firefighters to be protected from injury and illness while undertaking rescue operations and firefighting, but only when the territorial authority is:

(a) Performing its functions or duties, or exercising powers, in relation to earthquake-prone buildings;
(b) Considering granting a waiver or modification of the building code; or
(c) Adopting or reviewing a policy on dangerous or insanitary buildings.

When managing buildings affected by an emergency, responsible persons under s 133BB(1) of the Building Act (defined as a controller or a recovery manager under the Civil Defence Emergency Management Act 2002 (CDEM) or a constable) must also take into account the reasonable expectations of firefighters to be protected from injury and illness while undertaking rescue operations and firefighting.

The Building Code requires buildings to be designed and constructed so that there is a low probability of illness or injury to firefighters or other emergency services personnel during rescue and firefighting operations. Furthermore, when designing and constructing the means of access for and safety of firefighters in buildings, regard should be given the likelihood and consequence of the failure of any fire safety systems.

Sections 37 and 38 of the Health and Safety at Work Act 2015 set out the duties of a PCBU (Person Conducting a Business or Undertaking) who manages and controls either:

(a) A workplace; or
(b) Fixtures, fittings, or plant at workplaces.

PCBUs must ensure, as far as reasonably practicable, that anything arising from the workplace, or any fixtures, fittings or plant at the workplace, are without risks to the health and safety of any person, including firefighters.

Key firefighter safety considerations include:

(a) Provision of volumes of water are available to support firefighting operations for the purpose of entering a property to search for occupants and extinguish the fire;
(b) Provide water supply access and connection points at locations that do not expose firefighters to undue risks such as:
    (i) high amounts of thermal radiation from the fire
    (ii) falling from heights of more than 1 m;
(c) If firefighting water is to be provided from open water sources such as ponds and irrigation reservoirs, providing means for firefighters to exit from the pond in the event of falling;
(d) Regularly inspecting and maintaining the water supplies to confirm that water quality meets minimum firefighting standards, including testing for contaminants (refer 4.9.4 – Unacceptable quality of supply, 5.3.7 Types of water source);
(e) Adhering to maximum safe flow rates and pressure limits for firefighting equipment, as outlined in the Running (dynamic) pressure section 3.6.2 of this Code.

The standard equipment and training that firefighters use in structural firefighting operations rely on the provision of a sufficient, reliable firefighting water supply as a key safety consideration.

2.7 Places of significance

When considering firefighting water supply, it is important to recognise and respect the significance of certain locations and to integrate factors related to these locations. Consulting iwi and/or local authorities is imperative to understanding specific requirements and considerations associated with these locations.

Places of significance include:

(a) Water catchments;
(b) Places of tapu (sacred places);
(c) Places where rāhui have been placed;
(d) Places of cultural significance, such as mahinga kai, archaeological sites, ancestral lands, burial sites;
(e) Heritage sites and buildings;
(f) Lifeline utilities;
(g) Ecological protected areas.

2.8 Emergencies

Emergencies can be declared by several different organisations. For example:

(a) A national emergency can be declared under s 66 of the Civil Defence Emergency Management Act 2002 (CDEM);
(b) A state of local emergency can be declared under s 48 of the CDEM Act;
(c) The WSA can declare a drinking water emergency under s 59 of the Water Services Act 2021 if it believes, on reasonable grounds, there is a serious risk to public health due to poor water quality or a lack of water (or both).

Once an emergency has been declared, agencies have a range of powers to deal with the emergency. For example:

(a) Both the Director of Civil Defence Emergency Management and Emergency Management Groups have emergency powers under ss 9 and 85 of the CDEM Act;
(b) In the case of a water emergency, the WSA has emergency powers available under s 62 of the Water Services Act to prevent, reduce or eliminate the serious risk to public health;
(c) WSPs can restrict or interrupt the provision of drinking water, if necessary, due to maintenance, risk to public health, environmental factors affecting the source (for example, drought), or an emergency under s 25 of the Water Services Act;
(d) Where a WSP considers its ability to maintain a sufficient quantity of drinking water is, or may be, at imminent risk, the WSP must notify the WSA, FENZ, and local authorities. Local authorities may be asked to exercise their powers to assist the WSP.

In the event of an emergency declaration, all guidelines outlined in this Code can be overridden and users will be required to comply with directions from the relevant agency. This includes complying with the provisions of a:

- National Civil Defence Emergency Plan or
- a local Civil Defence Emergency Management Group Plan, or
- a source water risk management plan prepared by a WSP or a drinking water supplier.

FENZ will coordinate with the relevant local authority and emergency management authority as required to assess the impact of water redistribution on fire safety or response capability in affected areas. Adjustments to FENZ responses, particularly for buildings with internal places of safety, such as rest homes, hospitals, and places of detention, may be necessary.

2.9 Disputes

In the event of a dispute about the application or interpretation of this Code, a complaint should first be raised with FENZ via the online complaints system Complaints | Fire and Emergency New Zealand.

If you are unhappy with FENZ's response, the dispute may be raised with the Independent Complaint and Review Authority (ICRA) for resolution via the Fire and Emergency Dispute Resolution Scheme. Applications can be made via the online form: Apply for Fire & Emergency Dispute Resolution | ICRA.

3. PLANNING STAGE

3.1 Introduction

This section outlines the general requirements applicable at the resource consent and/or subdivision stage of a development. At this stage, key water supply infrastructure is being designed but information on the individual buildings may not be available.

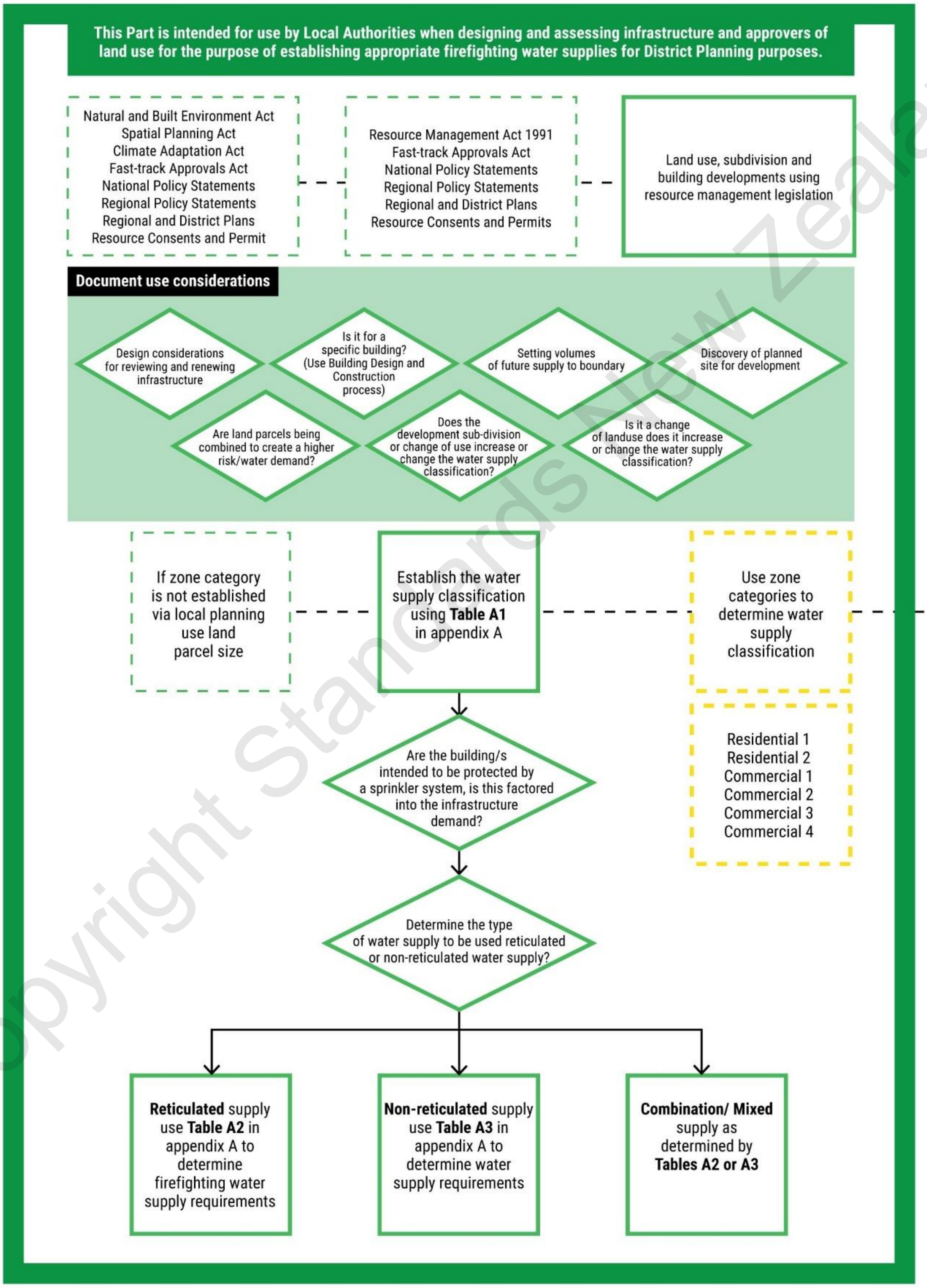


Figure 2 – Design and infrastructure assessments for local authorities

3.2 Classification of water supply

The local authority, in consultation with FENZ and the WSP, should establish the classification of the reticulated water supply within the planning zone (as taken from the district plan) in accordance with Appendix A Table A1 – Method for determining required water supply classification.

3.3 Water supply flow rates and volumes

Once the classification has been determined, flow rates for firefighting and hydrant placement shall be in accordance with the requirements of Appendix A Table A2 – Water supply requirements – Reticulated systems.

Volume capacities for infrastructure shall be in accordance with the requirements of Appendix A Table A3 – Total water supply volumes and non-reticulated systems.

It is recommended that water supply systems be designed to provide two-thirds of expected/known annual peak demand in addition to the fire flow.

The water supply infrastructure for a development with multiple allotments should be adequate to meet the water flow rate and volume requirements of at least 90% of the allotments within that development.

Compliance with the requirements set out in Appendix A Tables A1, A2, and A3 will meet the expectations on the WSP under this Code of Practice.

In the following situations, a risk assessment should be carried out to determine measures to mitigate the hazard or increase the water supply:

- Isolated fire hazards (for example, up to 10% of the development) in an area with a lower water supply classification
- Developments in an area with no reticulated water supply.

In some situations, a combination of supply types may be required to achieve a final total supply: for example, a tank supply to make up a shortfall in a reticulated flow rate.

For existing infrastructure, WSPs may use the same process to identify areas where the current infrastructure does not provide adequate capacity for the actual risk. It is expected that infrastructure decisions are determined based on consideration of the wider network rather than individual buildings.

Understanding the distribution of gaps within the wider network can inform decision making in relation to system upgrades.

3.4 Water supplies that do not meet requirements of this Code of Practice

It is not uncommon for situations to arise where the provision of firefighting water is not able to meet the requirements of this Code and so, by definition, the water supply made available cannot be deemed a ‘firefighting water supply’. Usually, the shortfall is in flowrates or storage capacity and occurs in situations including but not limited to:

(a) Very remote locations with no water supply infrastructure, or a brigade resource being so far away it is unlikely to respond in time to mount an effective attack;
(b) Remote locations with very little brigade resource able to respond to a fire incident, and in particular very little pumping resource that would be able to viably use complying firefighting water supply flowrates;
(c) Relatively small developments of an unusual nature that do not easily fit into the broader building/planning usage categories, and so warrant further consideration;
(d) Inability to provide suitable firefighting water supply for various other reasons, which simply warrants discussion with FENZ.

While such situations do occur from time to time, it should be noted that the need to undertake the process described below should very much be the exception rather than the norm. In most situations, a viable firefighting water supply should be able to be accommodated, and FENZ resources in the area are likely to be able to utilise complying firefighting water supply flowrates and storage.

The liaison process should start with the design team completing a Fire Fighting Facilities Checklist, F5-SC-Firefighting-Facilities-Checklist.pdf. The checklist should appropriately describe the project and situation, as well as the water supplies that might be available. It should then be submitted to local FENZ representatives for review and discussion. This could be coupled with an introductory meeting to explain the situation and answer any initial questions posed by FENZ and the design team.

FENZ will review this information internally, aiming to advise the design team of what might and might not be acceptable to FENZ from a firefighting perspective in the circumstances.

If:

- it is clearly not practical to provide a compliant firefighting water supply, or
- a compliant firefighting water supply is well more than what could viably be utilised by the local responding brigade assets

then a mutually agreeable pragmatic outcome can be arranged.

This might take the form of:

(a) An acknowledgement that the water supply provided is not (by definition) a 'firefighting water supply' as it does not meet the requirements of this Code of Practice;

(b) FENZ advice that the water supply being made available is not enough to extinguish a fire in the building concerned, so they will not be able to protect the property itself. They might, however, have sufficient water to mount an attack, protect exposures, or carry out search and rescue operations only – and will advise on the quantity and location of water they will need to achieve these objectives;

(c) FENZ will also be able to advise on any other provisions that might support this position, such as vehicle access, panel locations, vehicle hardstands, hose connection requirements, alternative water supplies, and so on.

This will usually be coupled with a request for the owner to provide a written statement acknowledging:

(d) What has been agreed, such as;
   (i) That a firefighting water supply is not being provided; or
   (ii) That the water supply that is being provided is only sufficient for certain firefighting activities (for example, exposure protection, search and rescue);
   (iii) That if a fire occurs, it is likely the brigade will not be able to extinguish or suppress the fire enough to save their building, so they are likely to suffer more extensive damage or complete loss;
   (iv) That they and their insurers acknowledge and accept this as a practical and pragmatic outcome.

The details of this agreement and acknowledgement should be recorded by FENZ, and also in the resource consent or building consent documentation by the Building Consent Authorities (BCA). Consideration should also be given to keeping this agreement on record within the Land Information Memorandum (LIM) if possible.

Where the Code has been incorporated into a district plan or bylaws, the building designer/owner will need to work with their local authority to ensure they can get the necessary consents, even where an alternative solution has been agreed with FENZ.

3.5 Recording water requirements

3.5.1 General

FENZ and the WSP should record firefighting water requirements.

The WSP should maintain data on the location and status of its fire hydrants and water mains. A Geographic Information System (GIS) is recommended for this purpose. If made available, FENZ may use a REST API or Web Feature Server (WFS) endpoint provided by the WSP to regularly collect firefighting water asset data.

Each fire hydrant or water main should have a unique asset ID maintained by the WSP. FENZ may use a prefix with the WSP asset IDs to maintain national ID uniqueness. Asset attributes, including testing results, should be held against this asset ID. Street addresses alone should not be used to describe a fire hydrant location. The preferred coordinate system is New Zealand Transverse Mercator 2000 (EPSG:2193).

When used by the WSP to describe its water network, water supply zones should be available to FENZ as a geospatial polygon dataset. Zone names should be based on a locality or significant road name, but should not duplicate name words with neighbouring supply zones and should not be generic. This is to reduce communication errors between FENZ and WSP contractors. Water supply zone ID codes should be unique across the WSP operating area.

The WSP should maintain a 'status' attribute for the fire hydrant or water main, indicating if it is operational. Water main asset data should include a nominal diameter attribute in millimetres. When a WSP adopts previously non-WSP water mains and fire hydrants, it should load the adopted firefighting water asset data into its database. For residential developments, WSPs should update their water mains and fire hydrant data as soon as practical to make it available to FENZ before a new dwelling is occupied.

For subdivisions with their own 'non-WSP-managed' water mains and fire hydrants, the property owner or a delegated facility manager should retain records about these assets to share with FENZ on request. GIS data about these non-WSP firefighting water assets is preferred, but a table of asset information with X and Y coordinates, annotated site plans, or map documents is also acceptable. Non-WSP firefighting water assets should be assigned a unique name based on access or location or assigned a non-WSP asset ID kept within the retained records.

3.5.2 Example 1 – Combined residential and commercial development

A satellite town development is planned with 500 residential allotments surrounding a town centre area with 50 commercial allotments. The residential allotments range between 500 m^2 and 1000 m^2, and the commercial allotments range between 500 m^2 and 1500 m^2, except for two 2500 m^2 allotments.

District planning rules limit residential site coverage to no more than 35% and the water supply is from the reservoir for the nearby city.

Solution:

(a) Fire duration is 30 minutes by Table 3;
(b) Water supply classification is Residential 1, requiring 25 L/s;
(c) Water storage requirement is 25 x 60 x 30 = 45,000 litres.
(d) Due to the allotment size and coverage requirements, the residential allotments are not high density, so Table A1 classifies the residential allotments as Residential 1.
(e) As the commercial activity is unknown, the commercial allotments are assessed based on their area. Table A1 classifies the commercial allotments as Commercial 2, except for the 2500 m^2 allotments, which are Commercial 3.
(f) As more than 90% of the commercial allotments can be covered by Commercial 2, the water supply for the commercial portion of the development is Commercial 2.
(g) Table A2 specifies a flow rate of 1500 L/minute in the residential area and a flow rate of 6000L/minute in the commercial area.
(h) To reduce the flow rates in the commercial area (and therefore demand on the water supply infrastructure), the developer could specify commercial buildings are to be sprinkler protected as a condition of the resource consent. This would reduce the commercial flow rates to 1500L/minute sprinkler flow plus 1500L/minute hose flow = 3000L/minute.
(i) Specific assessments can be done for the large allotments once additional information is available on their intended use. For example: the actual structures could be shown by calculation to be within the capacity of the Commercial 2 water flow rates, additional fire protection could be specified, or additional water could be provided by a tank for these allotments.

3.5.3 Example 2 – Remote commercial building

A remote factory without water infrastructure has 750 m^2 of external elevation area within 20 m of the boundary. Warehouse is classed as Commercial 2 building. Building is not sprinkler protected.

Solution:

(a) Building requires 75 L/s for exposure protection (Equation D2);
(b) Fire duration is calculated as 60 minutes by time equivalence method;
(c) Water storage required is 75 x 60 x 60 = 270,000 litres.

3.6 Fire hydrants ‑ Specification, location, marking, and testing

3.6.1 Introduction

This section provides specifications on how to specify and mark the location of fire hydrants and other firefighting water supplies so they can be readily identified. Testing requirements for fire hydrants are set out in cl 9 of NZS 4510:2022.

Fire hydrant installation is covered by NZS 4510:2022. The WSP is responsible for maintaining fire hydrants under section 215(2)(c) of the Local Government (Water Services) Act 2025.

3.6.2 Running (dynamic) pressure

FENZ controls water flow from water mains using the pumps on the fire appliance. The minimum running pressure in the water main should not be less than 100 kPa while the water main is flowing the required amount of water from the maximum number of fire hydrants. The minimum running pressure is also known as the residual pressure.

3.6.3 Safety notices

Due to the bore size of a standpipe, the maximum safe flow for design purposes (assuming pressure in the street water main is not a limiting factor) from a hydrant/standpipe assembly is 2100 L/min (35 L/s). Therefore, if a structure risk requires a firefighting water supply of 6000 L/min (100 L/s), then no less than three hydrants should be located (preferably as a hydrant group) in close proximity to the vehicle hardstand. The minimum distance apart should be calculated using the WSP modelling to prevent any turbulence created by the hydrant grouping that may prevent full flow. FENZ and the WSP should consult and agree on the outcome of the modelling.

For health and safety, and operating reasons, FENZ specifies a maximum working pressure for lay-flat hoses of 1050 kPa.

For more health and safety considerations relating to firefighter safety refer to 2.4 Firefighter safety considerations.

3.6.4 Uncharged water mains

The WSP should advise local FENZ as soon as practicable when new water mains are charged and commissioned, or existing water mains are decommissioned, and again when reinstated either temporarily or permanently. Fire hydrant boxes, lids, markings, and marker posts must be removed from abandoned water mains and hydrants. Water mains status should be set to ‘Unused’ within the WSA GIS data.

NOTE – It is advised that the building owners should inform the insurers if a water main is uncharged for more than 12 hours.

3.6.5 Water network monitor equipment installed onto fire hydrants

Fire hydrants primarily supply water for firefighting. When hydrants are fitted with water network monitoring equipment that could hinder activation, the WSP should inform Fire and Emergency promptly, providing the location and asset ID of the equipped hydrant.

Water network monitoring equipment that takes more than 10 seconds to uninstall or requires the hydrant to be keyed off and the equipment removed from the valve before a standpipe can be installed, is considered to impede hydrant operation. However, externally attached equipment using magnetism, which can be quickly removed, does not typically impede hydrant operation.

FENZ aims to reinstall monitoring equipment after hydrant use, but if reinstallation requires multiple steps the WSP should provide training materials to local fire brigades. Hydrants with obstructive equipment should have a distinct lid marking for quick identification, as specified in 3.6.8 Marking of fire hydrants.

3.6.6 Fire and Emergency vehicle access requirements

The adequacy of a firefighting water supply includes not only an assessment of the water supply that must be available, but also the location, connections, marking, and access to fire hydrants to enable the water supply to be used.

Refer to the design guide for information on access requirements for FENZ appliances.

3.6.7 Location of fire hydrants

The minimum number of firefighting hydrants required, as specified in Appendix A Table A2, must be located within 135 metres of the attendance point. The maximum number of firefighting hydrants required in Appendix A Table A2 must be located within 270 metres of the attendance point.

In residential settings, and in some commercial developments where properties are directly accessible from a road, right-of-way, or similar vehicle access path, the attendance point is generally taken to be the area immediately adjacent to each property. In these cases, the required hydrants must be located within the specified distances from that point.

For larger commercial properties and more complex residential developments, additional firefighting hydrants may be required where the specified distances cannot be achieved due to the size, layout, or configuration of the structures and accessways. These situations typically involve attendance points that are remote from public roads where hydrants are installed as per the Code. In such cases, hydrant placement should be assessed to ensure adequate coverage and accessibility for firefighting operations. In addition, hydrants should be positioned to support effective hose lay and water supply to all areas of the site. Refer Figures 3 and 4 below.

This maximum hydrant-to-structure distance is calculated as straight-line segments along the road, main access path, or drive to the front door (main entrance). This is the ‘as you would lay the hose’ distance, which means that this path must be free from obstructions, smooth, and trafficable at all times.

NOTE – Most fire appliances run hose from their rear-facing locker as the vehicle is moving or positioned to allow the firefighter to run direct from the locker to the hydrant. See Figures 3 and 4 below.

Firefighting water supply is most effective when targeted for a specific risk, so where a structure requires, for example, 6000 L/min (100 L/s) of firefighting water, then (as each hydrant for design purposes cannot provide more than 2100 L/min (35 L/s)) a minimum of three hydrants should be grouped as close as reasonably possible to the building’s vehicle hardstand. If the structure is very large or the main entry point (front door) is located more than 18 m from the road’s edge, a ring water main and/or grouped hydrants at the main entry points are better solutions. This will facilitate faster FENZ set-up and increased likelihood of fire control. See Figure 4 below.

To be of practical use, hydrants should be within 25 m (one hose length) of the vehicle hardstand and must be readily accessible for the fire appliance. In assessing where hydrants should be sited, each structure needs to be assessed based on its location to the street frontage, which is most often where vehicle hardstands for the structure will be. This applies to hydrants on both footpaths and grass verges.

Fire hydrants should be no more than 135 m apart. Where there are no premises to be protected, the spacing may be greater. To enable the required flow to be obtained from a water main, fire hydrants may be installed in groups at the minimum distance apart to reduce turbulence when all hydrants are on the same water main. The FENZ district manager must approve the location and number of these grouped fire hydrants.

For commercial activities, at least 50% of the required minimum flow shall be available from hydrants within 135 m of the attendance point. Any remaining flow shall be from hydrants within 270 m of the attendance point.

Fire hydrants must be readily accessible for fire appliances. They should be positioned near road or street intersections and not less than 6 m from any building structure to maintain a clear working space.

Existing fire hydrants may be found at the sides of buildings or structures, or within 6 m of them. These fire hydrants do not comply with this Code but may be included in the calculation of firefighting water supply at the discretion of the FENZ district manager.

To determine whether a building is within the specified distance to a fire hydrant (or water supply), the 'as you would lay the hose distance' must be trafficable to a fire appliance, as measured from the main entrance of the building to the water supply. If in an undeveloped subdivision no building platforms have been specified, the value to be used to obtain the distance to the main entrance of the building should be not less than half the longest lot dimension. For example, a lot measuring 40 m x 60 m would require not less than 30 m to be added to the 'as you would lay the hose' distance.

The minimum number of firefighting hydrants required in Table 2 should be located within 135 m of the attendance point.

The remaining hydrants to satisfy the flow requirements of Table 2 should be within 270 m of the attendance point.

These distances may be measured in a straight line from the Fire and Emergency coupling or fire hydrant to the designated attendance point. However, where physical barriers are present or anticipated in the site design (for example streams, vegetation, fencing), alternative measurement methods should be used to reflect realistic hose runs to support deployment of hose from the rear locker(s) of the appliance while driving.

Refer Clause C5 of the Building Code.

Internally, the measurement should reflect the practical deployment path of firefighting hose within the building and be within 75 m of any point of the building from the attendance point.

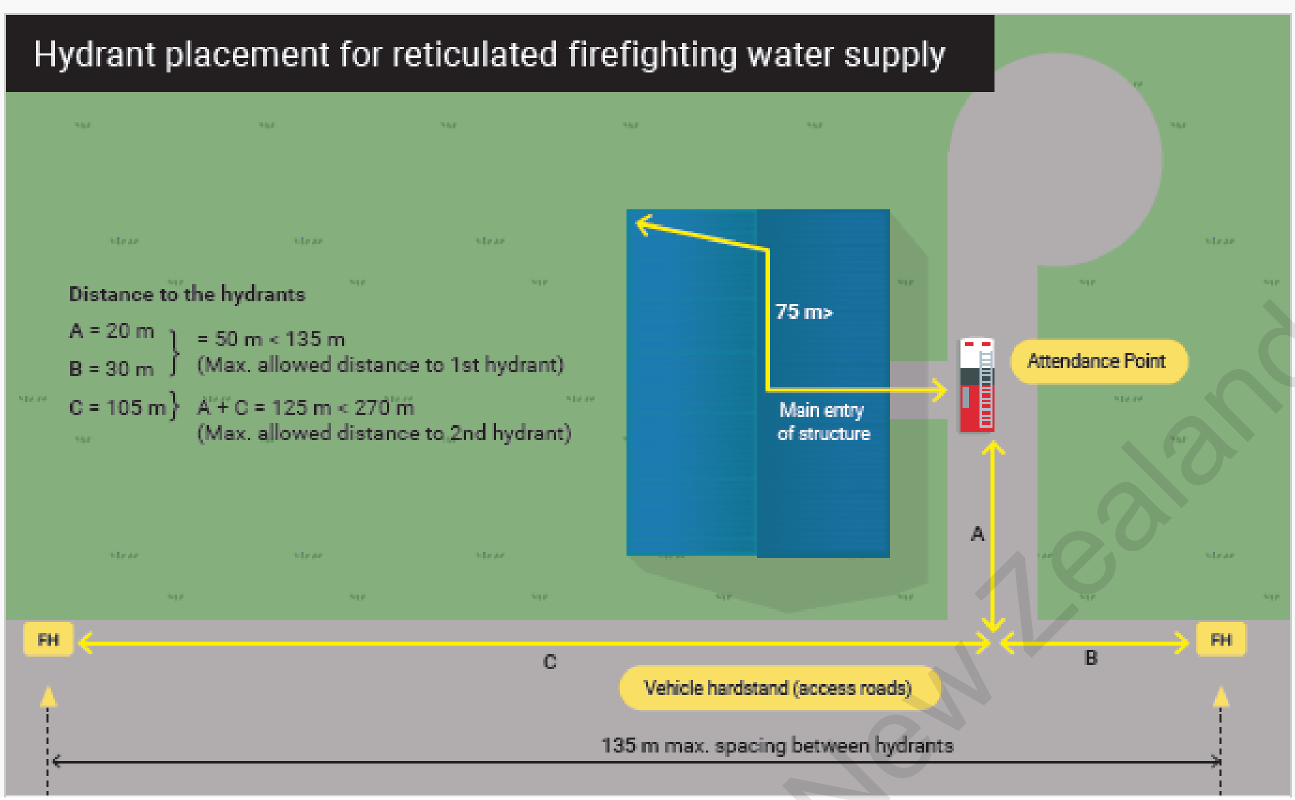


Figure 3 – Hydrant placement for reticulated firefighting water supply

The minimum number of firefighting hydrants required in Table 2 should be located within 135 m of the attendance point.

The remaining hydrants to satisfy the flow requirements of Table 2 should be within 270 m of the attendance point.

These distances may be measured in a straight line from the Fire and Emergency coupling or fire hydrant to the designated attendance point. However, where physical barriers are present or anticipated in the site design (for example streams, vegetation, fencing), alternative measurement methods should be used to reflect realistic hose runs to support deployment of hose from the rear locker(s) of the appliance while driving.

Refer Clause C5 of the Building Code.

Internally, the measurement should reflect the practical deployment path of firefighting hose within the building and be within 75 m of any point of the building from the attendance point.

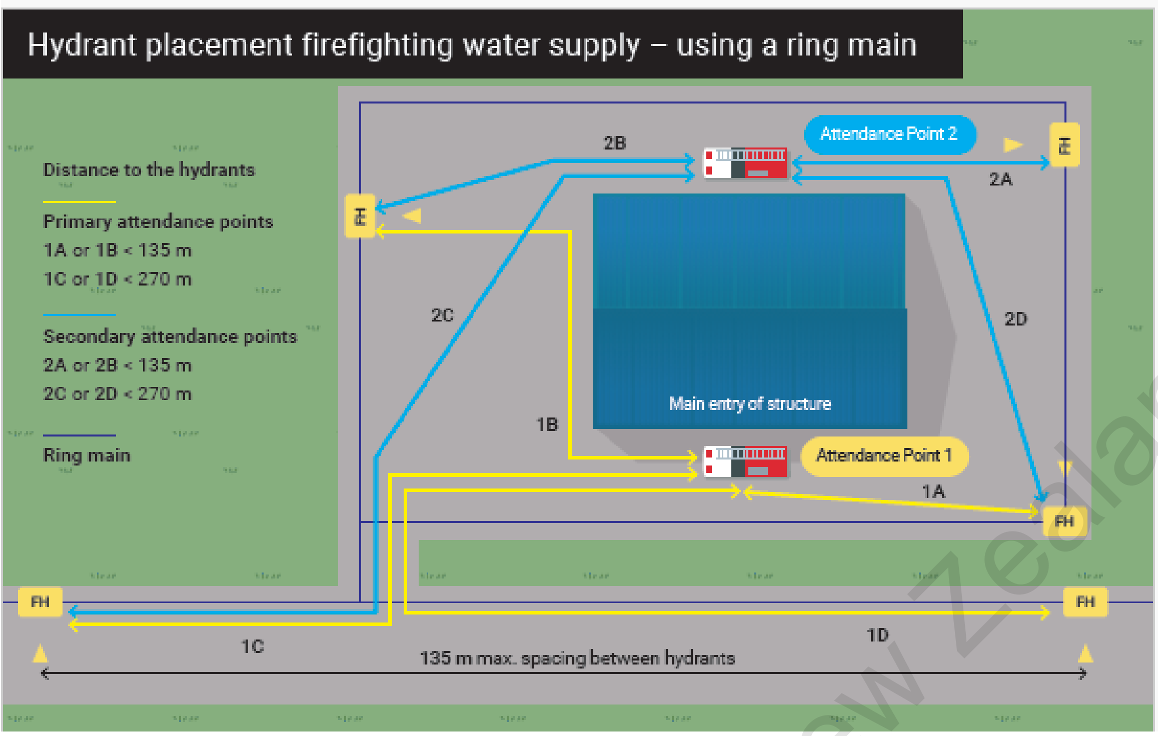


Figure 4 – Hydrant placement for firefighting water supply using a ring main

NOTE – Notwithstanding meeting the required and additional distances to a hydrant, hydrant-to-hydrant spacing should not exceed 135 m.

3.6.8 Marking of fire hydrants

3.6.8.1. Required markings

To comply with section 216 of the Local Government (Water Services) Act 2025, the position of every fire hydrant shall be identified by a combination of markings and indicators as set down in this Code. Fire hydrants should not be marked until the water main is commissioned. Markings must be removed if the water main is uncharged or abandoned. All underground fire hydrants should comply with these requirements, regardless of whether they are WSP-managed assets, or are non-WSP managed, or are contained within private properties or private road parcels.

Under s 26 of the Local Government (Water Services) Act, WSPs must notify the WSA, FENZ, and local authorities if the water main is temporarily uncharged or decommissioned.

Road controlling authorities must approve any devices or markings installed in a road reserve. This includes any markings on the roadway and any markers or other devices installed beside the roadway.

For all yellow markings, the paint must comply with Waka Kotahi NZ Transport Agency's *Specification for Road Marking Materials* NZTA M/07: 2022.

3.6.8.2. Underground fire hydrants located on or adjacent to sealed roads

The position of an underground fire hydrant should be identified by:

1. The lid of the fire hydrant box painted with yellow paint; and

2. An isosceles triangle of solid colour with 600 mm sides and 450 mm base, painted yellow, on or near the centre of the carriageway, with the apex pointing towards the underground fire hydrant; and

3. A circle of 1.2 m outside diameter with a line width of 100 mm painted yellow as concentrically as possible around the underground fire hydrant. This should be placed where access to the fire hydrant may be obstructed by parked vehicles (in the opinion of the person responsible to the WSP or non-WSP owner for the installation, maintenance and marking of fire hydrants).

See Figure 5.

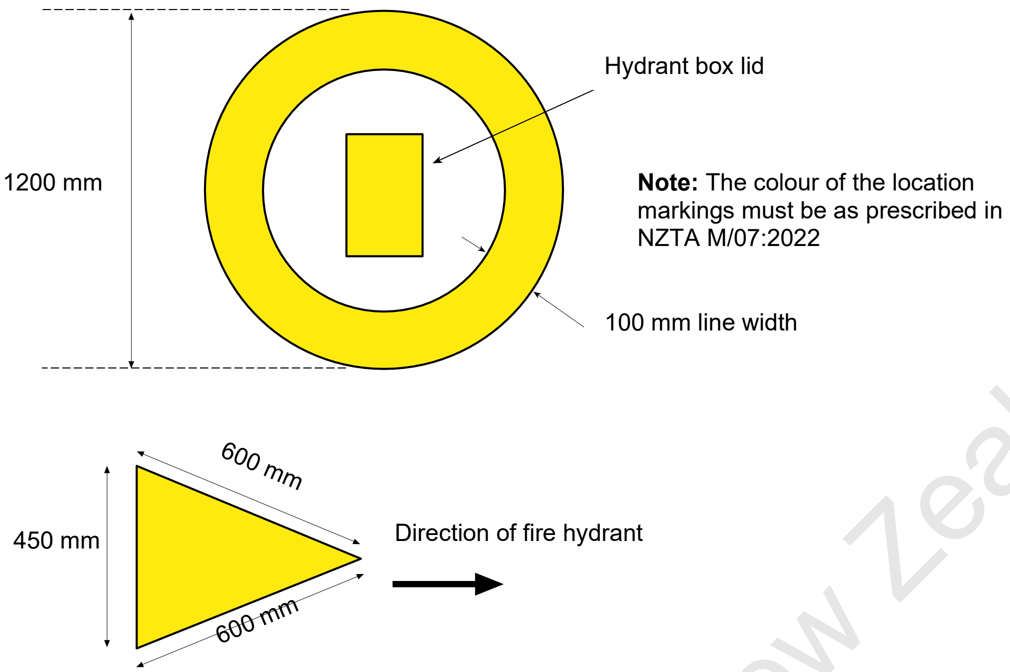


Figure 5 – Fire hydrant marking

3.6.8.3. Underground fire hydrants located on or adjacent to unsealed roads

The position of the underground fire hydrant should be identified by:

(a) The lid of the fire hydrant box painted with yellow paint; and

(b) An indicator plate or marker post in accordance with 3.6.8.

3.6.8.4. Outlets other than fire hydrants

Other pressurised water outlets used for firefighting water supplies must be marked to the satisfaction of FENZ.

Where the location of a non-pressurised water supply is not immediately visible, provide signage with an arrow to indicate the direction and approximate distance of travel for the fire appliance to get to the tank. Use additional signage to clearly indicate the location of the connection.

It is recommended to post clear reflective signage to indicate a tank as a firefighting water supply. It should be a sign no less than 280 mm wide and 380 mm high, with the words 'water supply' in red lettering on a white background.

Figure 6 – Reflective signage indicating a tank as a firefighting water supply.

NOTE – This sign should be reflective so it can be seen at night**.**

To help firefighters find a tank supply at night, install a blue cat's eye reflector on the access road.

3.6.8.5. Indicator plates or marker posts

Where the fire hydrant location may be difficult to identify, or where it may be obscured by snow or vegetation, an indicator plate or marker post should be used.

If an indicator plate is used, it must comply with the requirements of BS 3251, except that the background colour (specified in 8.2 of BS 3251) must be yellow and comply with NZTA M/07:2022.

The indicator plate must not be less than 600 mm and not more than 3 m above the road level and must be placed on or near a boundary line, wall or structure. Non-reticulated siting may be used in exceptional circumstances subject to the approval of FENZ.

If a marker post is used, it must comply with the dimensions specified for Type C edge marker posts in the Waka Kotahi NZTA's *Manual of Traffic Signs and Markings (MOTSAM) – Part 2: Markings*. The two yellow reflectors must be replaced with two blue reflectors, and these must be repeated on the reverse side of the post so it will be visible from both directions. The post must be located in the same manner as the standard edge marker posts in relation to the trafficable portion of the carriageway and in line with the fire hydrant.

NOTE – Road-controlling authorities must approve any installation of edge markers.

The road reserve between the carriageway and the indicator plate or marker post must be maintained so that the indicator plate or marker post is readily visible from the carriageway.

3.6.8.6. Additional markings

Any additional markings placed near an underground fire hydrant should not obliterate or confuse any of the markings set down in this Code of Practice; for example, markings to prohibit parking.

Where deemed necessary by FENZ or the WSP, the following additional markings may apply:

a) Standard yellow post with FH marking to indicate the location of the fire hydrant (FH)
b) Kerb marking in yellow.

Additional marks may indicate:

c) Fire hydrants installed on water mains with running pressure above 1050 kPa
d) Fire hydrant that is the last one on a dead-end water main
e) Fire hydrant that has activation-impeding monitoring equipment installed (see FENZ vehicle access to water supply section). To indicate this, a yellow hydrant box lid with centre blue dot greater than 8 cm diameter should be used.
f) Fire hydrant is temporarily inoperable for a significant period. A red hydrant box lid should be used to indicate this.
g) Fire hydrant is permanently inoperable or disused. All yellow markings should be removed or blacked out. Any raised reflective pavement markers should be removed.
h) Non-reticulated (hydrants requiring suction connection) – all previous yellow markings should be overpainted with red.

3.6.8.7. RRPM blue raised reflective pavement markers (RRPM)

RRPMs are recommended as additional means of identifying fire hydrant locations. However, the use of RRPM on roads is controlled by road-controlling authorities, so these markers must be used with their consent.

The NZTA has supported the use of blue RRPMs in recent editions of the Road Code and has issued Traffic Note 25 to all local authorities and other organisations involved with roads. This notice allows for the use of RRPM for marking fire hydrant locations. Where they are used, they must be located close to, and on the fire hydrant side of, the centre of the roadway at or near the base of any yellow triangle marked on the surface. Traffic Note 25 suggests that road-controlling authorities prohibit the use of these blue RRPM for any purpose other than indicating fire hydrants.

NOTE – Traffic Note 25 allows the use of the blue RRPM but does not make them compulsory.

3.6.9 Inspection and testing of fire hydrants

Section 74 of the Fire and Emergency New Zealand Act 2017 allows FENZ to check or require checks to be made on the adequacy of firefighting water supplies, including tests of water volume and pressure, as they consider necessary. In situations where the Code is not legally enforceable, it can be used as a benchmark or reference for the adequacy of water supply for firefighting purposes.

Water testing also enables FENZ to gather information about the water volume, flow and pressure of any water systems that may be necessary for fire protection systems to operate.

By agreement, testing and inspection of fire hydrants may be carried out by any of the following:

a) FENZ;
b) WSP;
c) Approved tester.

Representatives from the WSP may be present during testing.

FENZ personnel involved in water testing must follow their training note on flow testing of water mains and hydrant inspections. For other approved testers, provisions are advisory.

Fire hydrants should be tested during daily peak demand periods. The WSP must approve fire hydrant testing. Other legislative requirements may apply, such as the Health and Safety at Work Act 2015, Resource Management Act 1991, and WSP requirements.

When water from a hydrant is discharged onto land or into water (for example, a stormwater drain), a consent from the regional council may be required. Check with the regional council or local authority.

When carrying out fire hydrant tests, approved testers need to be aware that where large pressure-reducing valves (PRVs) are installed, at low flows the running pressure will drop as expected. However, where large flows occur, the running pressure may rise then fall as the PRV attempts to maintain a set pressure. Similar results could be expected where reticulated supplies use manual or automatic booster pumps to maintain pressure at high flows.

Although FENZ tests fire hydrants to check firefighting water supplies, water supply authorities and other users operate fire hydrants for other purposes, such as removing air or sediment.

A traffic management plan (TMP) should be approved by the road controlling authority (RCA) before conducting water testing on roadways.

3.6.10 Framework

Effective liaison and information exchange are vital to support the operational requirements of FENZ, WSPs/ local authorities. This process should consider both regional and local issues with potential regional impacts.

A framework for liaison at all levels and circumstances should be established to include the following:

a) Day-to-day operational liaison to enable a clear understanding of the roles and obligations of local authorities, WSPs, and FENZ in compliance with this Code
b) Council supply authorities must ensure that fire hydrants are tested in accordance with this Code
c) Routine liaison to address strategic and tactical considerations regarding flow and pressure for firefighting operations
d) Emergency liaison procedures, including protocols for increasing flows during emergencies
e) Liaison efforts to facilitate both routine and emergency performance.

3.6.11 Notifications

To minimise the risk of damage to a water system, a formal notification procedure should be agreed between testing parties and the WSP when planning to test firefighting water supplies. This procedure should include:

a) Notification to the WSP, using agreed means, of the intention to test (preferably during times of peak demand);
b) Notification to provide an agreed period of notice for testing;
c) Notification to specify all fire hydrants to be tested and the planned testing schedule;
d) Notification by the WSP if the system is not under normal operational control;
e) Advice from the WSP if there are reasons why the test cannot proceed as planned (for example, home haemodialysis, special commercial or industrial users);
f) Notification by agreed means to the appropriate authority of any intended disposal of water to drains;
g) Notification of results to the WSP through agreed means;
h) Statement to WSP indicating whether the water supplies are sufficient for firefighting;
i) Notification of abandonment or removal of hydrants, consideration of sufficient water for the risk in the area;
j) Confirmation that the hydrant to be removed is not on a supplementary or alternate supply zone.

3.6.12 Fire hydrant inspections

A risk assessment approach should be taken by the local authority, WSP, and FENZ to identify hydrants and agree how often they should be inspected. The environment the hydrant is in, such as heavy traffic flow, high and low points in the zone, and flow requirements for risks in the zones, may affect how often inspections are needed. A progressive inspection programme should be agreed between FENZ and the WSP, preferably of around 20% of assets per year. Any faults or leaks are to be reported to the WSP. Test results should be available to all interested parties.

A visual check to verify that the fire hydrant is marked correctly and that markings are still legible should include:

(a) A visual check of the condition of the fire hydrant box and lid, including fitting;
(b) Identification of any debris or soil build-up in the fire hydrant box that would affect the operation of the fire hydrant;
(c) Fitting a standpipe and flowing water to check the unobstructed flow of water and operation of the fire hydrant valve spindle;
(d) Using a blank cap in the open outlet of the standpipe and, when water is flowing, gradually shutting off the valve on the head of the standpipe so the standpipe is pressurised to the pressure in the mains to check the hydrant flange gasket for leakage;
(e) Recording the inspection date and results in kilopascals (kPa) and litres per minute(L/min);
(f) Before leaving the site, shutting down the fire hydrant and checking there is no leakage.

Private fire hydrants should be inspected in a similar manner.

3.6.13 Single fire hydrant flow tests

FENZ and the WSP are to take a risk-based approach to flow testing of hydrants and jointly agree on indexed or key hydrants that are representative of the zone in the network.

A key fire hydrant is one with flow characteristics that are representative of that part of the network.

The criteria to determine an indexed or key fire hydrant include:

(a) A selected number of fire hydrants between isolating valves;
(b) A selected number of fire hydrants on different pressure zones due to location or other agreed criteria;
(c) Any fire hydrant considered by FENZ or WSP as an indexed or key fire hydrant;
(d) Fire hydrants at high points of the reticulation, and any other locations where low supply pressures are to be expected due to conditions such as high industrial demand, pumping outage, reticulation valving, and so on;
(e) Consideration of a reduction in discolouring and disruption of water supplies.

To assess the minimum allowable pressure of 100 kPa in any part of the reticulation, identify fire hydrants that will experience the lowest supply pressure. This is important to avoid contaminating the drinking water supply. Also consider the pressure available to fire hydrants at high points in the reticulation when water is being drawn from lower levels, either from hydrants, large industrial users, or at times of peak domestic demand.

Key fire hydrants must be tested to measure flow and pressure on a risk-based approach agreed to by FENZ and local authorities. Where the flow and pressure from the fire hydrants under test do not meet the minimum values of Appendix D – Water Extinguishing Capability and Table D3, or the recorded calculated values, the WSP must be advised of the inadequacy.

Where the necessary firefighting water is supplied by more than one fire hydrant, the capacity of a water main may be estimated using the method described in Section 3.6.14 Graph of pressure/flow characteristics of a hydrant supply

3.6.14 Graph of pressure/flow characteristics of a hydrant supply

This method is suitable for single or multiple hydrant flow tests from single pipe or network systems on the same pressure zone.

A 1.85 semi-log graph is used for interpolating or extrapolating test results to establish expected pressure at a nominated flow. By using this type of graph, the pressure/flow characteristics of a hydrant supply can be represented by a straight line.

Steps:

(1) In addition to the static pressure, record two or preferably more readings of flow against pressure in the table at the bottom of the graph. The pressure is usually recorded in kPa, and the flow may be recorded in any convenient units, usually L/min or L/sec. These should include a static or no-flow pressure recording. The higher the test flows, the more accurate the graph will be.

(2) Plot these recorded values on the graph, recording the pressure on the y-axis and the flow on the x-axis. Establish the x-axis points by selecting a suitable divisor and applying this to the recorded flow values. The divisor should be selected to enable the desired flow/pressure point to appear in the graph.

NOTE – For example, if the required flow is 8400 L/min (140 L/sec) and the x-axis is numbered to 15, then a suitable divisor would be 10 and 8400 L/min (140 L/sec) would be represented by 14 along the x-axis. By selecting a suitable value for the divisor, the graph is suitable for all flows.

(3) Draw a line-of-best-fit through the recorded points and extend it to the x-axis. This line is the characteristic line for that particular pipe or network and represents a good approximation of residual pressure for any assumed flow.

NOTE – For example, 8400 L/min (140 L/sec) plotted on a graph numbered as in the above note would be represented by 14 on the x-axis. A vertical line from this point would intersect the characteristic line at the expected residual pressure for this flow.

3.6.15 Generating the 1.85 graph

A 1.85 graph can be constructed manually by establishing a series of 15 values (in the case of the example in the previous section 3.6.14) from a base measurement to the exponent of 1.85. Steps are as follows:

a) Select a base measurement for the desired size of the graph. A base measurement of 1.0 mm will produce a graph to 15 which is approximately 150 mm wide; a base measurement of 1.5 mm will produce a graph approximately 300 mm wide.

b) In the case of a 1 mm base measurement, the x-axis numbers will be the 1–15 series. In the case of a base of 1.5 mm, the numbers will be represented by the series: 1.5, 3.0, 4.5, 6.0, and so on for 15 values.

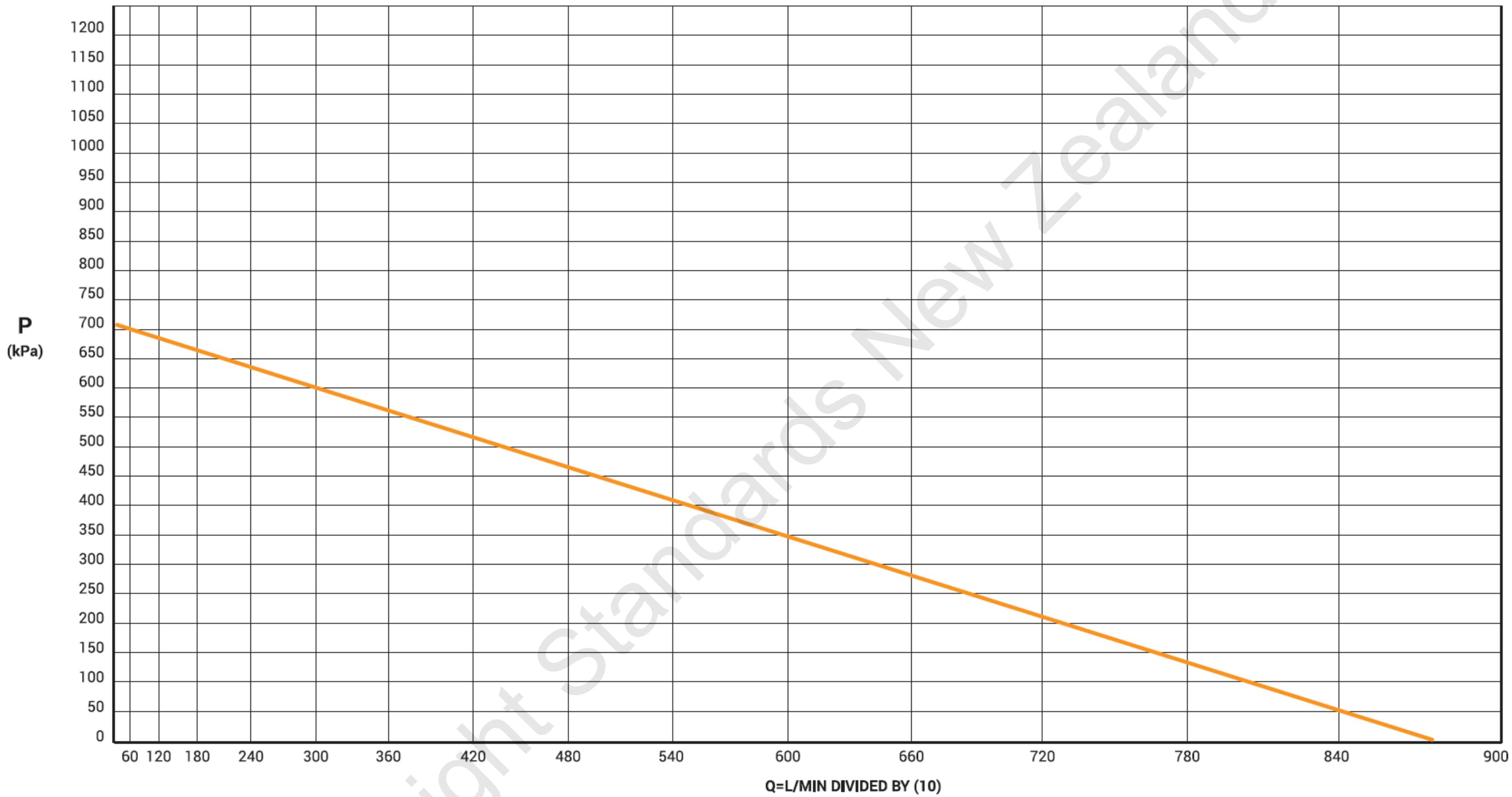
c) Construct a series of columns to the 1.85 exponent values measured from the zero point. The rows representing the pressure values are linear.

A good approximation of the above can be computer-generated by a spreadsheet program by entering a column width established from the exponential figures after subtracting the preceding value in each case. The column dimensions are displayed in the number of standard characters able to be accommodated in the column width, which is slightly inaccurate in linear dimension.

The figures below in Table 1 indicate the values for a graph based on mm. See Figure 7 – Example of pressure/flow characteristic of a hydrant supply.

Table 1 – Values indicative of a graph on a linear scale

Linear scale	Exponential value of linear values = linear values to 1.85 power	Column width = exponential value – preceding value
1	1	1
2	3.61	2.61
3	7.63	4.03
4	13.00	5.36
5	19.64	6.64
6	27.52	7.88
7	36.60	9.08
8	46.85	10.25
9	58.26	11.41
10	70.79	12.54
11	84.45	13.65
12	99.19	14.75
13	115.03	15.83
14	131.93	16.90
15	149.89	17.96



Estimated residual pressure at 800L/min (100kpa)

STREET	DATE	TIME	Q=L/min	0	4200	5400	
			P=kPa	700	520	400	

Figure 7 – Example of pressure/flow characteristic of a hydrant supply

3.6.16 Comprehensive flow testing

Carry out a comprehensive flow test if:

- the necessary firefighting water is supplied by more than one fire hydrant, or
- a dispute arises between the WSP and Fire and Emergency over the flow figures presented.

The flow test should be carried out in accordance with FENZ guidelines, or by an approved tester. It should involve a minimum of three hydrants, one static pressure and two flows, testing gauges to establish the mains (or network) capacity.

If this test cannot be conducted, use a single flow hydrant and extrapolate the results by using the straight-line method.

3.6.17 Recording test results

The results of the tests should be recorded in a manner agreeable to all parties.

The minimum details to be recorded are:

(a) Date;
(b) Time;
(c) Location/address/identifier of both the flowing hydrant(s) and the hydrant at which pressures are recorded at;
(d) Measured flow (L/min);
(e) Static pressure (kPa);
(f) Running pressure (kPa;)
(g) Diameter of water main (mm)
(h) Vertical height difference (approximate) between the flow and pressure hydrants.

From these details, it is possible to calculate water mains capacity as indicated in the previous section 3.6.16 Comprehensive flow testing

3.6.18 Computer modelling of water supplies

Where a computer modelling system has been assessed as accurate against ground tests, FENZ may accept the outputs from such modelling in place of testing of certain fire hydrants. This should not replace the testing of key fire hydrants. Any modelling results should be held against the asset ID of the hydrant or water main. The modelling area of analysis and the year of modelling should be retained, as the present extent of a water network may have changed since modelling was conducted. Modelled data can be useful for pre-determined attendance (PDA) planning, but modelled data does not supersede actual testing data and may not reflect water availability during firefighting operations.

4. BUILDING DESIGN AND DEVELOPING INDIVIDUAL ALLOTMENTS

4.1 General

This part of the Code of Practice covers the determination of water supply for individual buildings or activities within an allotment.

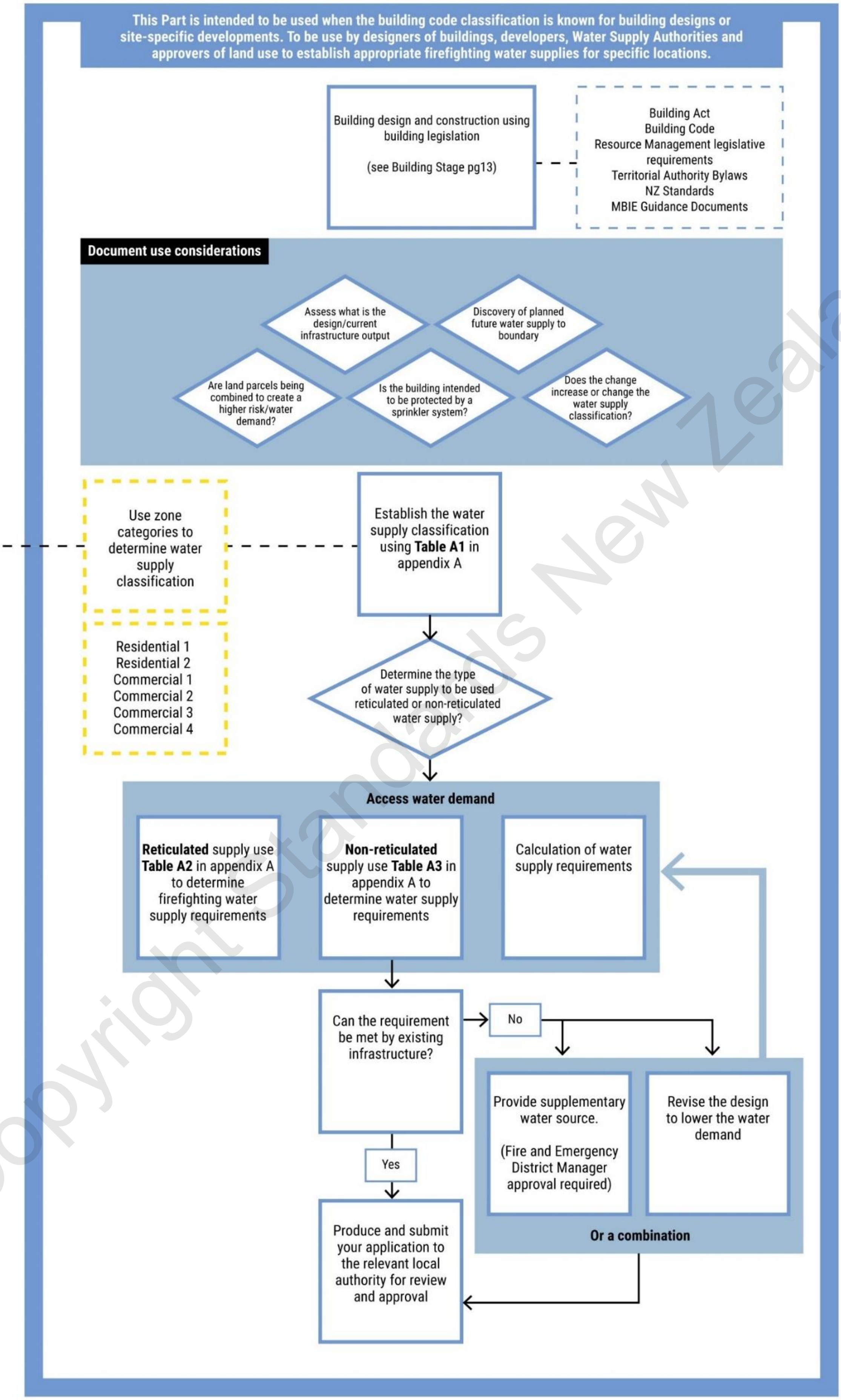

This Part is intended to be used when the building code classification is known for building designs or site-specific developments. To be use by designers of buildings, developers, Water Supply Authorities and approvers of land use to establish appropriate firefighting water supplies for specific locations.
Building design and construction using building legislation (see Building Stage pg13)
Building Act
Building Code
Resource Management legislative requirements
Territorial Authority Bylaws
NZ Standards
MBIE Guidance Documents
Document use considerations
Assess what is the design/current infrastructure output
Discovery of planned future water supply to boundary
Are land parcels being combined to create a higher risk/water demand?
Is the building intended to be protected by a sprinkler system?
Does the change increase or change the water supply classification?
Use zone categories to determine water supply classification
Establish the water supply classification using Table A1 in appendix A
Residential 1
Residential 2
Commercial 1
Commercial 2
Commercial 3
Commercial 4
Determine the type of water supply to be used reticulated or non-reticulated water supply?
Access water demand
Reticulated supply use Table A2 in appendix A to determine firefighting water supply requirements
Non-reticulated supply use Table A3 in appendix A to determine water supply requirements
Calculation of water supply requirements
Can the requirement be met by existing infrastructure?
No
Yes
Provide supplementary water source. (Fire and Emergency District Manager approval required)
Revise the design to lower the water demand
Or a combination
Produce and submit your application to the relevant local authority for review and approval

Figure 8 – Establishing water supplies for specific locations

4.2 Method of calculating firefighting water supply – Individual allotments

4.2.1 Using tables (classification and reticulated supply)

Use Appendix A Table A1 to find the required firefighting water supply classification. This is based on the land use, land parcel size and whether the building is sprinkler protected. Then, in Appendix A Table A2 ,find the required reticulated supply. If the reticulated water supply infrastructure was designed to comply with Part 3 of this Code, calculation of water supplies for an individual building may not be required.

For known structures, the required water supply can be calculated from Section 4.10 Calculation of maximum fire size and Appendix D – Water extinguishing capability.

FENZ recommends you engage an engineer with the appropriate skills for advice on determining the water supply requirements.

If the available firefighting water supply provided by the fire hydrants meets or exceeds the required classification of a structure as outlined in Appendix A Table A2, or by calculation using Appendix D and Section 4.10 Calculation of maximum fire size, then no further action is required.

If the infrastructure cannot meet the water demand for the particular building, then an alternate means of supply is required to meet the Code. This is normally met with tanks on site. See Appendix C – Examples of Water Supplies for how to proceed.

4.2.2 General basis of flow rate and storage requirements

As noted above, the approach taken for determining water supply flow rates and storage requirements in this document is based on principles of fire science. It has a level of conservatism built in to cover varying elements of uncertainty that often present themselves in the dynamic environment of the fireground.

This uncertainty includes:

- localised or temporary reductions in water supply, which occur from time to time
- decisions made on the fireground that make extinguishment or suppression with the water used less efficient
- pump or vehicle failure, or
- other events that might make the effects of water application and extinguishment less efficient than ideal.

It is important that the assessed water flow and storage requirements in this Code have sufficient conservatism built in so that if any of the above events do occur on the fireground, they will not result in a catastrophic or unsafe failure to mount firefighting operations because of a lack of water supply.

A more accurate calculation methodology might include:

- parameters around water cooling efficiency
- a fire size decay curve – a reduction in fire size (and therefore the amount of water needed to control it) from the point at which water is applied to the fire
- the actual water use by appliances and crews in the early stages of a fire and response.

While these matters are being explored, we currently lack good information on how such parameters can be validated. The intent therefore is to include them (where applicable) in future revisions of this Code.

4.2.3 Residential allotments

4.2.3.1. General

If the residential allotment is on a bore or tank supply for domestic use, use either a Residential 1 or Residential 2 water supply as determined in Appendix A Table A3 of this Code.

4.2.3.2. Approved sprinkler installed

As per Appendix A Table A2, a family residence with an approved sprinkler installed, irrespective of the Residential classification, requires one hydrant within a trafficable measured distance of 135 m from the main entrance. The total flow from this hydrant is 750 litres per minute (L/min) – see A2.4.3 Example 3.

NOTE – This flow of 750 L/mins is additional to the demand from the sprinkler system (approximately 250 L/min) so the total demand on the network is 1000 L/min.

4.2.3.3. No sprinkler installed

For a family residence in a reticulated low-density zone with no sprinkler installation, a classification of Residential 1 will apply. This requires up to two hydrants, one within 135 m and a second within a 270 m measured trafficable distance from the main entrance. The total water demand is 1500 L/min with a minimum flow from the nearest hydrant of 750 L/min (25 L/s). If the first hydrant is unable to supply the full 1500 L/min flow requirement, any shortfall can be drawn from the other hydrant.

If this supply meets or exceeds the supply required in Appendix A Table A2, provide FENZ with a to-scale site plan indicating the exact location and flow of the hydrants for approval (see Appendix C Example 1). The site plan should show the structure, the main entrance, and the measured distances and flows.

Engage an approved tester or seek advice from FENZ to determine flows.

4.2.3.4. Checklist for residential firefighting water supply approval

Use Appendix A Table A1 of the Code to determine firefighting water supply classification.

Use Appendix A Table A2 to determine the required flow.

Provide a ‘to-scale’ plan of the site showing:

(a) The structure to be built, showing the main entrance;
(b) The street hydrants’ locations and distances in metres from the main entrance – this distance must be trafficable for a vehicle hardstand;
(c) This distance must not exceed 135 m to the first fire hydrant and 270 m to the second hydrant;
(d) Hydrant flow in litres per minute (L/min) or litres per second (L/s).

Submit these to FENZ for approval. If water supplies are from static sources, the supplied documentation must specify the appropriate FENZ couplings to access any stored water suitable for FENZ connection. These are detailed in Section 4.9 Non-reticulated water supplies.

4.3 Special hazards

For special hazards where no New Zealand guidance exists, firefighting water requirements may be determined using international guidance, if available (for example, NFPA 30 Flammable and combustible liquids code for bulk storage tank farms).

4.4 Approvals

All calculations shall be submitted for approval to the person(s) nominated by FENZ. The nominated person(s) will approve these cases on confirmation that the method is appropriate, and the calculations have been correctly applied.

Non-reticulated methods will need to show that the calculated firefighting water supply makes allowances for tactical flow rates (that is, the amount needed above a theoretical amount to absorb the released heat for operational effectiveness).

Where the available water supply meets or exceeds the required firefighting water supply set out in this Code, the water supply may be assumed be sufficient and compliant with the Code for the purposes of section 74 of the Fire and Emergency New Zealand Act 2017. Where the Code is not legally enforceable, it can be used as a benchmark or reference for the adequacy of water supply for firefighting purposes.

Some examples can be found in Appendix C.

4.5 Hydrant requirements

Requirements for hydrants can be found in Section 3.6 Fire hydrants – Specification, location, marking, and testing.

Where a firefighting water supply is from private fire hydrants and water mains, an inspection and testing programme of fire hydrants should be agreed between the owner of the premises and the approved tester in accordance with Section 3.6.12 Fire hydrant inspections.

4.6 Vehicle hardstand requirements

For a fire appliance to be effective, it needs to be able to park in an area between the available water supply and the structure to be protected. This area is termed the vehicle hardstand. Clause C5.3 of the Building Code also has requirements for vehicle hardstands. For further information on good design practice for vehicle hardstands, refer to Fire and Emergency’s *Designers Guide to Firefighting Operations F5-02 Emergency vehicle access*.

4.7 Access to non-reticulated firefighting water supplies

Where a sufficient firefighting water supply cannot be obtained solely from a reticulated supply, this may be supplemented through the provision of non-reticulated firefighting water supplies. These provisions are set out in Appendix B – Non-reticulated firefighting water supplies.

4.8 Fire protection systems

Fire protection systems protecting premises should comply with approved Standards, including testing and maintenance regimes, if their use is to be included in the assessment of fire hazard as set out in Section 4.10 Calculation of maximum fire size. The standard must be one of the referenced standards.

4.9 Non-reticulated firefighting water supplies

4.9.1 General

Where reticulated water supplies are unavailable or insufficient, alternative firefighting water sources may be used to provide a firefighting water supply. Alternative sources can come from any combination of reticulated and static supplies provided by the property owner.

FENZ requires a sufficient water supply to safely enter the building and search for occupants who may need to be rescued.

For any non-reticulated water supply to be considered suitable for firefighting purposes, it must be proven reliable and accessible at all times.

Due to the longer response time in a rural setting, FENZ strongly recommends that a sprinkler system is installed to the appropriate standard. Sprinklers will contain the fire in the building. The sprinkler can also have external heads to assist with the protection of the property from wildfire if the property is near vegetation.

4.9.2 Adequacy of supply

For a water supply to be considered a compliant firefighting water supply, the owner must establish an acceptable means to reliably maintain any tank to a usable capacity.

Provision shall be made on all storage tanks and elevated tanks to:

(a) Automatically keep the tank topped up; or
(b) Manually refill the tank after emptying.

The outlet pipe connection size must be calculated to be able to provide the flow required – that is, a minimum of 1000 L/min (16. 5 L/s) at the coupling.

Water for an alternate supply for stand-alone low-density residential dwellings is generally provided for by tank supply. The amount of water required can vary from 5000 L for a sprinklered house up to 20,000 L for a larger property. These tanks can be above ground, underground or partly buried. To align with Building Code requirements, a tank supply can be used to protect other properties that are within 100 m of the outlet that a fire appliance would connect to. This allows for a range of locations to be used as attendance points to provide coverage for several sites and be compliant with the 75 m requirements of the Building Code and Acceptable Solutions documents. A tank can be set up with a system to allow for drinking water and contain an amount of firefighting supply. This allows for a continuous exchange of water to prevent stagnation.

For commercial properties, the required flow is expected to require a manifold with multiple connection points. In this set-up, space may be needed for multiple appliances to connect to the water supply. In general terms, this measurement should be the same size as FENZ coupling complying with the approved Standards in SNZ PAS 4505:2007 Firefighting waterway equipment. Where the distance between tank and coupling is significant, for example, more than 50 m, this distance will need to be considered in the calculation.

The use of the cam locking female couplings suitable for 75 mm rigid suction hose supply connections must comply with an Approved Standard. These are only permitted for Residential 1 classified properties in non-reticulated areas.

Ponds may also be used, but must contain an all-year-round depth of 1 m as a minimum for drafting. There are several other considerations, such as access for fire appliances, security of supply, signage and an approved coupling (see Table 2 – Residential Checklist below).

4.9.3 Water pressure, flow, and volume for non-reticulated firefighting water supplies

For calculation purposes, the pressure at a FENZ coupling must be assumed to be approximately 60 kPa for suction sources. This must be hydraulically calculated to give a minimum pressure of 100 kPa at the pump inlet for flooded sources at maximum design flow.

The required flow from a non-reticulated firefighting water supply can be determined from Appendix A Table A3, or calculated from Appendix D – Water extinguishing capability, taking into account any available reticulated supplies.

The adequacy of the flow from the non-reticulated firefighting water supply should be demonstrated to the satisfaction of the FENZ district manager.

The minimum available water storage volume must comply with Appendix A Table A3 or be calculated using 4.10.4.1.2 Step 2 – Calculate maximum fuel-controlled fire size and the calculated duration of the fire.

The diameter of the pipe that connects the tank or reservoir to a FENZ coupling (attachment point) must be sized to maintain the 100 kPa minimum pressure at the FENZ pump inlet.

The firefighting water supply may be water from any year-round source such as:
(a) Dams;
(b) Water tanks;
(c) Man-made pools and lakes (where the available water can be calculated);
(d) Industrial cooling water (in consultation with owner);
(e) Natural pools and lakes able to sustain a continuous accessible depth of at least 1 m;
(f) Flowing river or stream water able to sustain a continuous accessible depth of at least 1 m;
(g) Seawater able to sustain a continuously accessible depth of at least 1 m;
(h) Grey water and recovered firefighting water;
(i) Wells and bores;
(j) Fixed standpipes into shallow ground water aquifer.

Hardstands are considered portable pump access only, unless an appropriate vehicle hardstand as defined in Section 4.6 Vehicle hardstand requirements is provided.

4.9.4 Unacceptable quality of supply

For a water supply to be considered a compliant firefighting water supply, the owner must establish an acceptable means to ensure it is reliable and accessible at all times.

4.9.5 Suction sources

A suction source is an accessible, open body of water or a tank.

Water flow rates while draughting from suction sources diminish at heights over 3 m. For heights greater than 3 m from the pump inlet to the water surface, approval from the FENZ district manager is required. The draughting height must not exceed 6 m when the supply is exhausted.

A fixed, static pick-up pump fitted with a FENZ coupling complying with the approved standards may be permanently fitted to the source. The coupling must be located so that it is not compromised in the event of a fire.

See Appendix C Figure C2 for examples of how non-reticulated water supplies can be delivered to a hazard.

4.9.6 Flooded sources

A flooded source is a tank or supply more than 10 m above road level fitted with a FENZ coupling, see Figure 9.

There must be a vehicle hardstand for a fire appliance to set up as close as reasonably practicable to the Fire and Emergency coupling. This distance should not exceed 20 m – one hose length. The FENZ coupling should be within 100 m of the most remote point of the building(s) covered by that water supply, see Appendix C Figures C2, C4, C6 and C7.

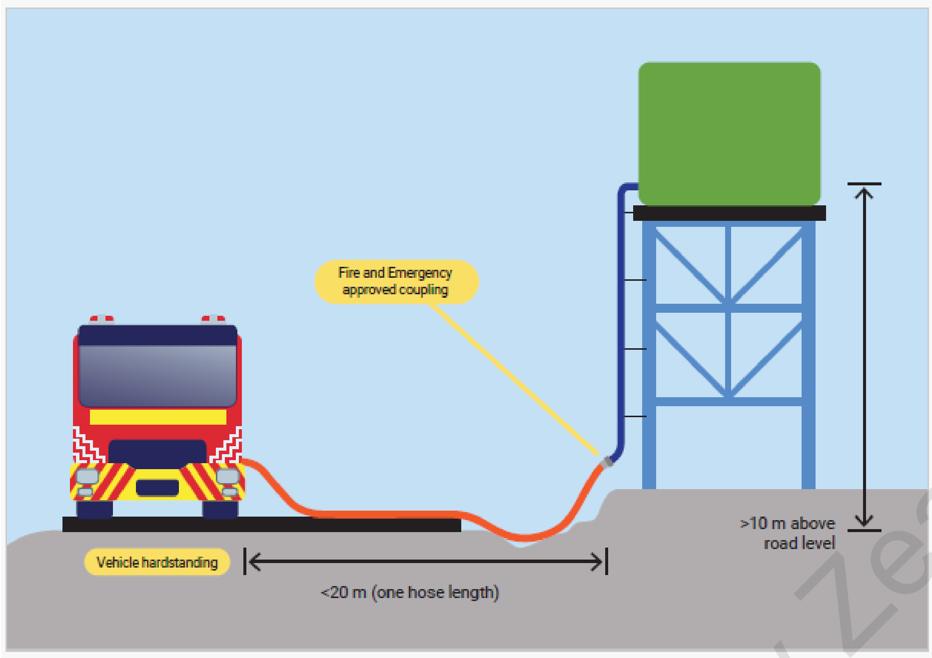


Figure 9 – Flooded sources – water supply above road level

FENZ coupling to a flooded source must be either a female instantaneous coupling or a fire hydrant coupling complying with the approved Standards in SNZ PAS 4505:2007 Firefighting waterway equipment. A FENZ coupling must be located so that it is not compromised in the event of a fire. The pipe work leaving the tank and just prior to terminating at a FENZ coupling must be properly supported and bracketed to be fit for purpose. Where a supply tank is intended to be used as a supply for firefighting water, the tank manufacturer or the manufacturer's instructions should be consulted for the fitting requirements of FENZ couplings and any associate pipework.

NOTE – Before committing to an installation, consult with the tank manufacturer on any restrictions to the size and type of fitting, and whether these are appropriate for the tank construction.

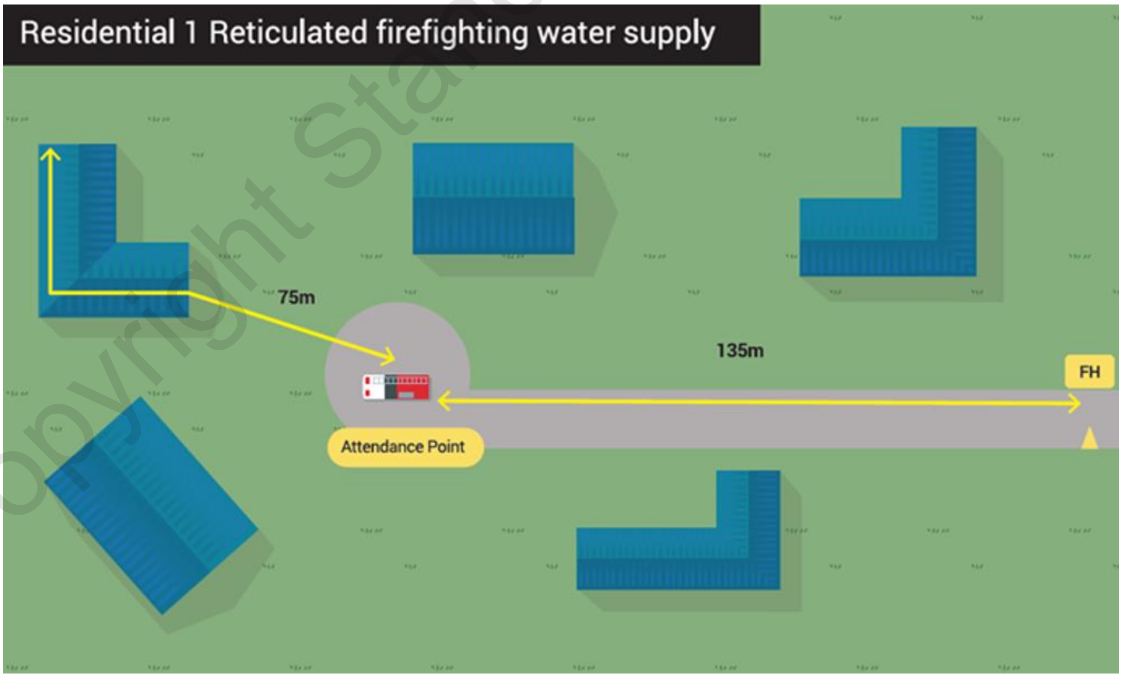


Figure 10 – Reticulated firefighting water supply

The closest hydrant(s) should be within 135 m of the attendance point. These distances may be measured in a straight line from the FENZ coupling or fire hydrant, to the designated attendance point. However, where physical barriers are present or anticipated in the site design (e.g. streams, vegetation, fencing), alternative measurement methods should be used to reflect realistic hose runs paths to support deployment of hose from the rear locker/s of the appliance while driving.

Internal building measurements should reflect the practical deployment path of firefighting hose within the building and be within 75 m of any point of the building from the attendance point.

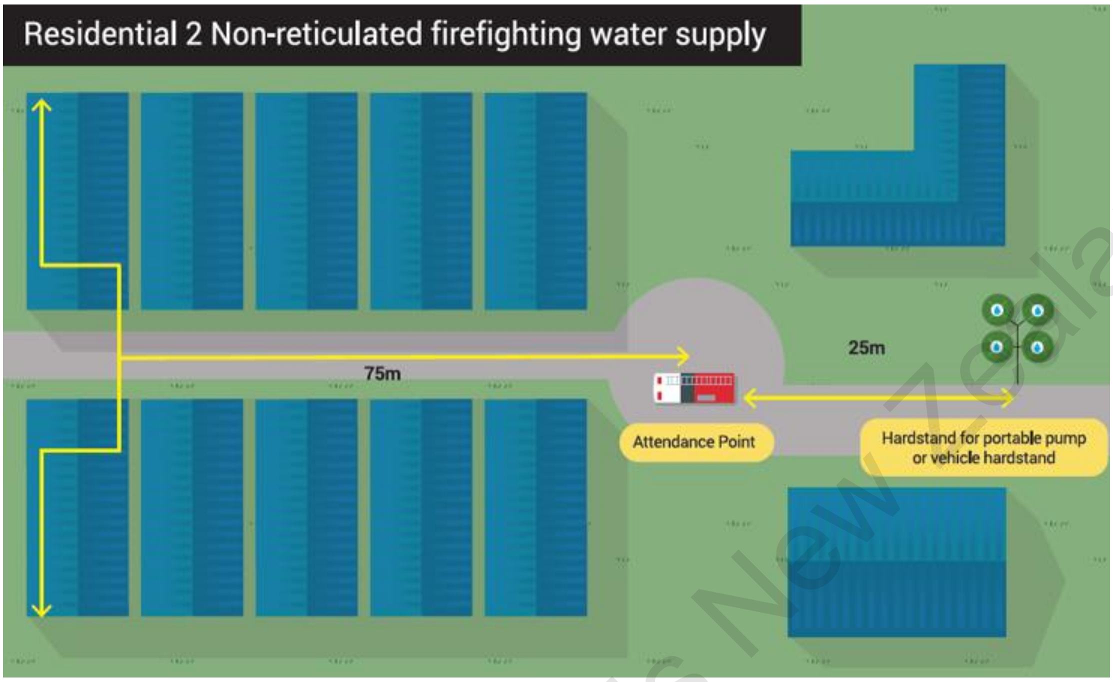


Figure 11 – Non-reticulated firefighting water supply

Firefighting supplies should be located within 100 m of the furthest point of the further building(s). Externally, this distance may be measured in a straight line from the FENZ coupling, via the designated attendance point to the entrance of the building.

Where physical barriers are present or anticipated in the site design (for example, streams, vegetation, fencing), alternative measurement methods should be used to reflect realistic hose runs. Internally, the measurement should reflect the practical deployment path of firefighting hose within the building.

Additional couplings, along with a hardstand or vehicle hardstand to accommodate extra pump connections, may be required to achieve the necessary flow rates. This may depend on available local resources.

For fighting fire in structures, volumes are not cumulative - 108,000 L for all non-sprinklered houses within 100 m of a firefighting supply; or 5,000 L for sprinkler-protected houses.

Wildfire volumes are cumulative for all houses shown - 120,000 L within 100 m of a fighting supply. Total volume required for scenario shown above is 120,000 L if wildfire threat is present.

4.9.7 Protection of tank supply and access

The area around the tanks should be kept clear of combustibles such as leaf litter to avoid the tank becoming involved in fire and potentially failing.

If the tank is above ground, of plastic construction, and within 10 m of the fire source, it will require protection with a non-combustible barrier to prevent damage from radiated heat.

Any connection to the tank should also be protected from fire conditions. Connection points to the water supply should be no closer than 10 m from the fire source.

The water supply may require protection from vandalism and tampering. Where easily accessible, tank lids should be secured to prevent unauthorised access. This impacts the tank's ability to be readily usable. Where security is provided, it should be done in such a way that access can be achieved in an emergency, for example, with a lightweight chain that can be cut with bolt cutters. Use of 'Fire service 197' keyed padlocks is recommended.

4.9.8 Firefighting access

There should be a trafficable roadway for a fire appliance to access the firefighting water supply at any time. The complete travel route should be considered, including accessway widths, entry and exit ways, room to manoeuvre, overhead obstructions (overgrown vegetation, hanging cables, building projections), gradients, gateways, and road surfaces. (See Table 2 – Residential Checklist).

For Residential 1 classified dwellings where vehicle access to the tank is not practical, the FENZ district manager may agree to the installation of a pump pad to support the siting of a portable pump and associated equipment.

See Section 3.6.8.4 Figure 6 for how to mark the location of any non-reticulated water supplies for firefighting.

When top access is the desired access for water supply, and a hatch opening is used for firefighter access, the tank may need to be partly buried so the height to access the hatch is no more than 1 m vertically from the pump pad used to position pumps.

4.9.9 Residential checklist

For residential properties, the supply would be considered reliable for firefighting if all the conditions on the below Table 2 – Residential Checklist are met:

Table 2 – Residential Checklist

Capacity: Section 4. 4 (See Tables A1, A2 and A3)	**Yes**	**No**	**N/A**
Residential properties with an installed sprinkler system require 5000 L of water dedicated for fire sprinkler operations	☐	☐	☐
Residential properties that do not have an installed sprinkler system require 20,000 L of usable water supply dedicated for firefighting	☐	☐	☐
Ponds, lakes, dams or waterways for firefighting purposes require a minimum of 20,000 L for firefighting, with a minimum depth of 1 m at the fire brigade access point	☐	☐	☐
Access: Section 3.6.6 Fire and Emergency vehicle access requirements	**Yes**	**No**	**N/A**
The accessway and vehicle hardstanding area must be trafficable in all weathers for a 25-tonne vehicle	☐	☐	☐
Any bridges over creeks or water races must be engineered to support a 25-tonne vehicle	☐	☐	☐
The accessway must be a minimum of 4 m wide	☐	☐	☐
The hardstanding area must have a minimum width of 4.5 m and a minimum length of 11 m	☐	☐	☐
Accessways must have a minimum 4-metre overhead clearance height (avoiding overhanging trees, utility cables, building eaves)	☐	☐	☐
The gradient of the accessway should not exceed 16% (rise of access/length of access x 100 = %)	☐	☐	☐
Access to the non-reticulated water supply should not pass within 10 m, unless shielded, of any part of any building (radiant heat risk)	☐	☐	☐
Access: Section 3.6.6 Fire and Emergency vehicle access requirements	**Yes**	**No**	**N/A**
Access to the water supply must always be trafficable and unimpeded	☐	☐	☐
The water supply/connection point must be within 100 m of the furthest point of the structure being protected	☐	☐	☐
Supply must always be suitable for firefighting purposes (not stagnant or containing a biological hazard)	☐	☐	☐
The water supply/connection point must not be within 10 m of any structure being protected	☐	☐	☐
Clearly identifiable signage with red lettering must be provided to indicate the water supply/connection point for responding firefighters	☐	☐	☐
The water supply/connection point must be no more than 6 m from the edge of the hardstand area	☐	☐	☐
Non-reticulated supplies and connections: Section 4.9 Non-reticulated firefighting water supplies	**Yes**	**No**	**N/A**
Ponds, lakes, dams or waterways require a safe working platform/area that is suitable for firefighters to insert suction hoses	☐	☐	☐
Tanks located beside the vehicle hardstand area (on the same or similar level) must have an approved connection fitted	☐	☐	☐
Partly buried tanks located within 5 m of the hardstanding area are to have a height from ground level to the top of the tank of no more than 1 m	☐	☐	☐
Partly buried tanks located within 5 m of the hardstanding area are to have either an appropriately sized accessible opening to access water or have an approved connection fitted	☐	☐	☐

Top access tanks with a hatch opening must be partly buried so the height of the hatch is no greater than 1 m vertically from the vehicle hardstand area	☐	☐	☐
Tanks located below the level of the hardstand area are to have an upstand connection at the hardstand area no greater than 6 metres (vertically) from the bottom of the tank	☐	☐	☐
Tanks located below the level of the hardstand area or between 1 and 9 m above the hardstand area are to have an approved upstand connection	☐	☐	☐
Tanks located 10 m or more above the hardstand area may have either a 70 mm female instantaneous coupling in place or be piped to an underground fire hydrant	☐	☐	☐
Underground fire hydrants supplied from an elevated tank must provide 1500 litres per minute of water flow at the connection point	☐	☐	☐
Connections consistent with:	**Yes**	**No**	**N/A**
NZS 4522:2010 Specification for underground fire hydrants and surface box frames and covers	☐	☐	☐
SNZ PAS 4505:2007 Specifications for Firefighting Waterway Equipment for approved and instantaneous coupling types For cam-lock type couplings, CID A-A-59326D General Specification for Coupling Halves, Quick-Disconnect, Cam-Locking Type EN 14420-7 Hose fittings with clamp units – Part 7: Cam locking couplings	☐	☐	☐

4.10 Calculation of maximum fire size

4.10.1 General

This section outlines a method to calculate the maximum fire size. The result of this calculation is used in Appendix D to calculate the firefighting water required. The required firefighting water quantity is then compared with the available firefighting water supply to determine if it is sufficient. If insufficient to comply with this Code, either the water supply must be increased, or the maximum fire size reduced.

The methods outlined in this section determine the maximum fire size, and from this, the quantity of firefighting water required. These calculations can only be done once the details of the building are known.

4.10.2 Fire size

The maximum fire size occurs when:

(a) An approved installed automatic sprinkler system operates (which is assumed to control the fire to the size it was when activation occurred); or
(b) FENZ begins applying effective firefighting water to the fire; or
(c) The complete firecell is involved in fire.

In (a) the fire size and time of activation of the automatic sprinkler system are calculated by recognised fire engineering calculations. The fire size is then assumed to be controlled to this level. Thus, the total required water supply should be that required for the sprinkler system plus the remaining fire size, controlled by the sprinkler. For an example, see Figure 12.

In (b) the fire growth is assumed to continue until FENZ intervenes by applying water. The fire size is calculated using existing fire engineering methods. The derivation of time for FENZ involvement will require input from FENZ.

In (c) the ignition is assumed to have occurred, and the fire has grown till the fire is either constrained by the amount of ventilation or the quantity of fuel. Section 4.10.4 Calculation of maximum fire size provides a method to calculate the ventilation and fuel-controlled fire size for each firecell within a structure. The smaller value is the limiting figure. This is repeated for all the firecells. The firecell with the largest fire size is then modified by two coefficients. The result of this calculation is used as the input to the firefighting water calculations outlined in Appendix D – Water extinguishing capability.

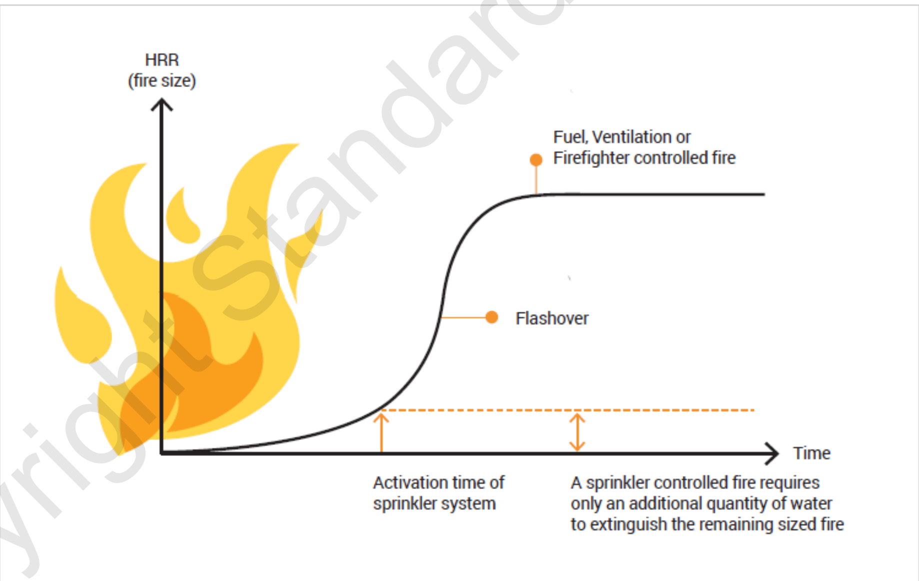


Figure 12 – Fire growth curve

4.10.3 Outcome

To find out whether sufficient firefighting water is available to treat the fire hazard, compare actual water quantities with required firefighting water quantities.

If the available water is insufficient, take remedial action to either reduce the hazard or improve the water supply. If no remedial action takes place, advise the structure owner or their agent.

Firefighters can only actively control or extinguish a fire if they arrive before it gets too large. FENZ has insufficient resources to control a large post-flashover fire. For this reason, early notification is essential – hence the importance of either fire suppression or detection systems. Another approach is to limit the maximum fire size using smaller firecells.

4.10.4 Calculation of maximum fire size

This analysis assumes that FENZ will arrive after the fire has become fully involved in the firecell of origin but prior to the failure of the bounding construction of the firecell. If the bounding construction (including the roof or ceiling, if applicable) cannot be demonstrated to remain intact to prevent ingress of air into the compartment, due to a no or low fire resistance rating or long brigade travel times, then calculation of the fire size must assume a fuel-controlled fire. See Section 4.10.4.2 Step 2 – Calculated maximum fuel-controlled fire size.

Any analysis should assume the worst-case scenario. For special hazards, such as stacked timber/pallets or tyre stockpiles out in the open, a fuel-controlled fire calculation must be used.

4.10.4.1. Step 1 – Calculate maximum ventilation-controlled fire size

4.10.4.1.1. Step 1.1 – Calculate ventilation openings for each large firecell

NOTE – For this calculation, a ventilation opening is any path that may contribute oxygen to the fire. It includes, but is not limited to, the following:

(a) Permanent openings, such as louvred portions of perimeter walls – use aerodynamic free area if available;
(b) Building leakage – use 0.5% of non-fire-rated wall area for unlined walls and 0.1% of non-fire-rated wall area for lined walls;
(c) Doors, both personal and roller doors;
(d) Non-fire-rated glazing and vertically oriented plastic panels;
(e) Skylights or plastic panels installed in the roof.

The maximum fire size from a ventilation-controlled fire is given by Eq. 1.

Heat release rate: $Q\_vent = 1.5\, A\_v \sqrt{(H\_v\,)}$ .... (Eq.1)

Where

- Q_{vent} is the rate of heat release from ventilation-controlled fire (MW)
- ΔH_c is the fuel calorific value (MJ/kg)

For this analysis assume:

- A_v is the area of vertical openings (m^2)
- H_v is the height of vertical openings (m).

NOTE – This method is only valid where FENZ can apply water on the fire before the passive fire protection of the firecell fails.

The following method is used to calculate the ventilation factors for a firecell containing multiple openings.

A_v is the sum of the total area of the openings and H_v is the weighted average height of all the windows and doors. This factor is calculated by:

(a) Adding the areas of an opening (
(b) Multiplying this sum by their height
(c) Dividing the total by the total area of the openings.

This can be achieved easily in tabular form as demonstrated in the example below.

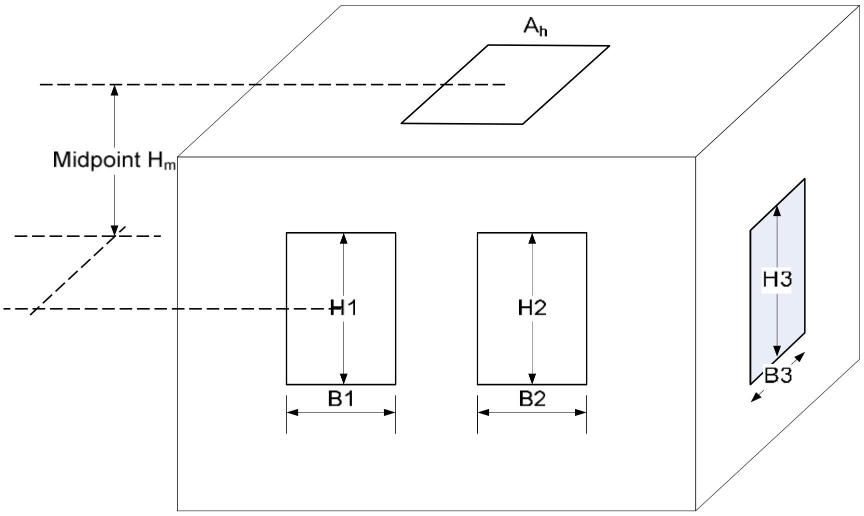


Figure 13 – Single firecell structure with three windows and one roof vent

Table 3 - Single firecell structure with three windows and one roof vent

	Height of opening **H_i**	**Width of opening** **B_i**	**Area** **$H_i B_i$**	**Height x Area** **$H_i A_i$**
1	H_1	B_1	$H_1 B_1$	H_1 2B_1
2	H_2	B_2	$H_2 B_2$	H2 $^2B_2$
3	H_3	B_3	$H_3 B_3$	H_3 $^2B_3$
L=			L A_i	L $H_i A_i$

where $A_v = ^{i=3}\sum_{i=1} A_i = H_1 B_1 + H_2 B_2 + H_3 B_3$ and $H_v = \frac{\sum H_i A_i}{\sum A_i}$ ------------------------ (Eq.2)

If the structure has both vertical and horizontal opening(s), use the calculation method below, as outlined in Buchanan, 2001, noting the limitations indicated. A simplified ventilation factor, $(A_v\sqrt{H_v})_{(fict)}$ may be calculated:

$$(A_v\sqrt{H_v})_{(fict)} = A_v\sqrt{H_v} + 2.33A_h\sqrt{H_m}$$ .... (Eq. 3)

where

A_v and H_v come from Eq. 2 above

A_h is the area of horizontal opening (m^2)

H_m is the vertical height from the mid-height of the window opening to the mid-height of the horizontal opening (m)

This is only valid if:

$$0.3 < \frac{A_h\sqrt{H_m}}{A_v\sqrt{H_v}} < 1.5$$

Check validity. If outside these limits, assume fuel-controlled fire and go to Section 4.10.4.3 Step 3 Select the smaller value of the ventilation or fuel-controlled fire size.

4.10.4.1.2. Step 1.2 – Calculate maximum fire size by selecting largest ventilation factor

Select the firecell with largest ventilation factor, that is $(A_v\sqrt{H_v})_{(fict)}$ ....(Eq. 4)

The rate of heat release Q_{vent} from the ventilation-controlled fire is calculated as $Q_{vent} = 0.12D\ A_v\sqrt{H_v}$. (Eq. 5)

4.10.4.2. Step 2 – Calculate maximum fuel-controlled fire size

The heat release rate from the fuel-controlled fire depends on the area of fuel burning and the heat release rate per unit area:

$$Q_{fuel} = A_{fuel}.”Q"_{fuel} \quad \text{(Eq. 6)}$$

Where:

Q_{fuel} = is the rate of heat release from the fuel-controlled fire (MW)

A_{fuel} = is the surface area of fuel (m^2)

$Q”_{fuel}$ = is the rate of heat release per unit area of fuel burning (MW/m^2)

Assume a 1:1 ratio of fuel surface area to floor area.

Table 4 below gives typical values for the heat release rate per unit area of fuel burning.

Table 4 – Typical heat release rates from fuel-controlled fires for various structure types

Fire Load Energy Density (FLED) (MJ/m²)	Typical examples – note 1	Q”fuel (MW/m²) – note 2
< 500	Schools, art galleries, auditoriums, gymnasiums, household units	0.25(2)
500 to 1000	Offices, restaurants	0.35
1000 to 1500	Maintenance workshops, boiler rooms, manufacturing and process activities with moderate fire load	0.5(2)
> 1500	Storage warehouses, bulk retail	1.0(2)
Notes (1) Based on Table 5 (2) Figures derived from AS 1668.3		

The fuel limited fire case assumes that the entire fuel area is burning with equal intensity. While this is appropriate for small firecells, as the floor area increases, this assumption can lead to overprediction of the fire size. Above a floor area of 500 m², the following approach may be used as an alternative methodology to estimate the fuel limited fire size, Q_{fuel}.

1. Calculate the total fuel load using the formula:

   Where:
   e_f = Fire load energy density (MJ/m^2), obtained from Table 5
   A_f = Floor area of the firecell (m^2).

Table 5 – Typical fire load energy densities

Activity in space/room	Example	Fire Load Energy Density (FLED) (MJ/m²)
Display or other large spaces with low fire load	Art galleries, auditoriums, bowling alleys, churches, community halls, courtrooms, gymnasiums, indoor swimming pools	400

Activity in space/room	Example	Fire Load Energy Density (FLED) (MJ/m^2)
Seating areas without upholstered furniture	School classrooms, lecture halls, museums, eating places without cooking facilities	
Sleeping spaces	Motels, hotels, hospitals, residential care institutions	
Working and storage spaces with low fire load	Wineries, meat processing plants, manufacturing plants	
Support activities of low fire load	Car parks, locker rooms, toilets and amenities, services rooms, plant rooms with plant not using flammable or combustible fuels	
Spaces for business and retail with normal fire load	Banks, personal or professional services, police stations (without detention), offices, exhibition halls, shops and other retail (non-bulk)	800
Seating areas with upholstered furniture	Nightclubs, restaurants and eating places, early childhood centres, cinemas, theatres, libraries	
Spaces for working and storage with moderate fire load	Manufacturing and processing moderate fire load. Storage up to 3 m high other than foamed plastics	1200
Workshops and support activities with moderate fire load	Maintenance workshops, plant and boiler rooms other than those described elsewhere	
Spaces for multi-level car storage	Car stacking systems –the design floor area over which the FLED applies is the total actual car parking area	400/tier of car storage
Spaces for working or storage with high fire hazard	Storage over 3 m high of combustible materials, including temperature-controlled storage Chemical manufacturing and processing, feed mills, flour mills	800/m height with a minimum of 2400
Spaces for display and sale of goods	Bulk retail (over 3 m high)	

2. The fire duration is estimated using the formula $t_{fire} = 60.e_f.k_b.w_f$

   Where:
   k_b = Conversion factor to account for the thermal properties of the construction, obtained from Table 6.

NOTE – t_{fire} is effectively determined by expressing the ‘equivalent fire severity’ as calculated using Eurocode 1 Actions on structures, Part 2-2 in seconds.

Table 6 – Values of kb

Typical Value for (K/m^{2}s$^{0.5}$K)	Construction Materials	k_b
400	Very light insulating materials	0.10
700	Plasterboard ceilings and walls	0.09
1100	Lightweight concrete ceilings	0.08
1700	Normal weight concrete ceilings	0.065

Typical Value for ($K/m^2s^{0.5}K$)	Construction Materials	k_b
> 2500	Thin sheet steel roof and any wall system	0.04

3. The fire size is determined using the formula $w_f \geq 0.5$

   Where:
   w_f = The ventilation factor as calculated below. When w_f is calculated to be less than 0.5, use a value of 0.5 for w_f

4.10.4.3. Step 3 – Select the smaller value of the ventilation or fuel-controlled fire size

For each firecell, the heat release rate of the fire Q_{fire} … (Answer Section 4.10.2 Fire Size is the smaller value of Q_{vent} (Section 4.10.1 General) or Q_{fuel} (Section 4.10.1).

4.10.4.4. Step 4 – Select firecell with largest value

Repeat Steps 1 to 3 for all firecells. Select cell with largest value of Q_{fire}. Use this figure in Step 5 – Modification of heat release rates.

4.10.4.5. Step 5 - Modification of heat release rates

4.10.4.5.1. Modify heat release (Q_{max})

The heat release rate Q_{fire} as determined from Step 3 may be reduced by a number of factors. To account for these factors, it is proposed to determine Q_{max}, the heat release rate required to be used for firefighting water supply purposes, as follows:

$$Q_{max} = K_1 . K_2 . Q_{fire} \quad \text{(Eq. 7)}$$

Proposed values for these coefficients are given in Tables 7 and 8. In particular cases, it may be feasible to develop more appropriate figures.

4.10.4.5.2. Step 5.1 – K_1 coefficient

The K_1 coefficient accounts for human intervention and first aid firefighting – see Table 7 – Human intervention.

Table 7 – Human intervention

	No facilities or structure unoccupied	Structure occupied and hand-operated firefighting equipment available	Structure occupant trained in firefighting and present 24 hours
K_1*	1	0. 9	0. 8
* This value can be further reduced upon documented agreement with FENZ that an industrial brigade is effectively resourced and available at all times to mitigate any fire to satisfaction of FENZ.			

4.10.4.5.3. Step 5.2 – K_2 coefficient

The K_2 coefficient to accounts for fire safety features – see Table 8 below.

Table 8 – Fire safety features

	No automatic detection or suppression system	Automatic smoke or heat detection system installed to approved Standard without direct connection to FENZ alarm-receiving equipment	Automatic smoke or heat detection system installed to approved Standard with a direct connection to FENZ alarm-receiving equipment
K_2	1	1	0. 8

The maximum heat release rate for firefighting water supply purposes, Q_{max}, is then used to determine the required firefighting water flow rate in accordance with Appendix D – Water extinguishing capability.

5. FIREFIGHTING WATER SUPPLIES FOR WILDFIRES

5.1 General

The fire risk that properties are exposed is very different across urban and rural settings. While this document focuses on water supply requirements for fighting building fires, rural properties also face threats from wildfires or unplanned fire involving vegetation, which can cause widespread damage to multiple properties and impact livelihoods.

Wildfires can start from various sources, including buildings, activities on the property, or fires spreading from surrounding lands. Proximity to wildfire fuel types, such as grass, forest and scrub, influences the risk associated with individual properties.

Urban areas, while still vulnerable to large fires, have access to a larger amount of firefighting resources due to risk posed to populated areas. These resources include reticulated water and urban firefighting capabilities, which significantly contribute to effective fire suppression, provided that the prevailing conditions are conducive. Conversely, rural areas may face greater challenges and consequences associated with the fire, for various reasons.

This section outlines key considerations for those living near vegetation and therefore at risk of wildfire, providing guidance on firefighting water supply for rural and remote dwellings. Users need to evaluate a property's individual needs and evaluate its relevant risk and associated water demands.

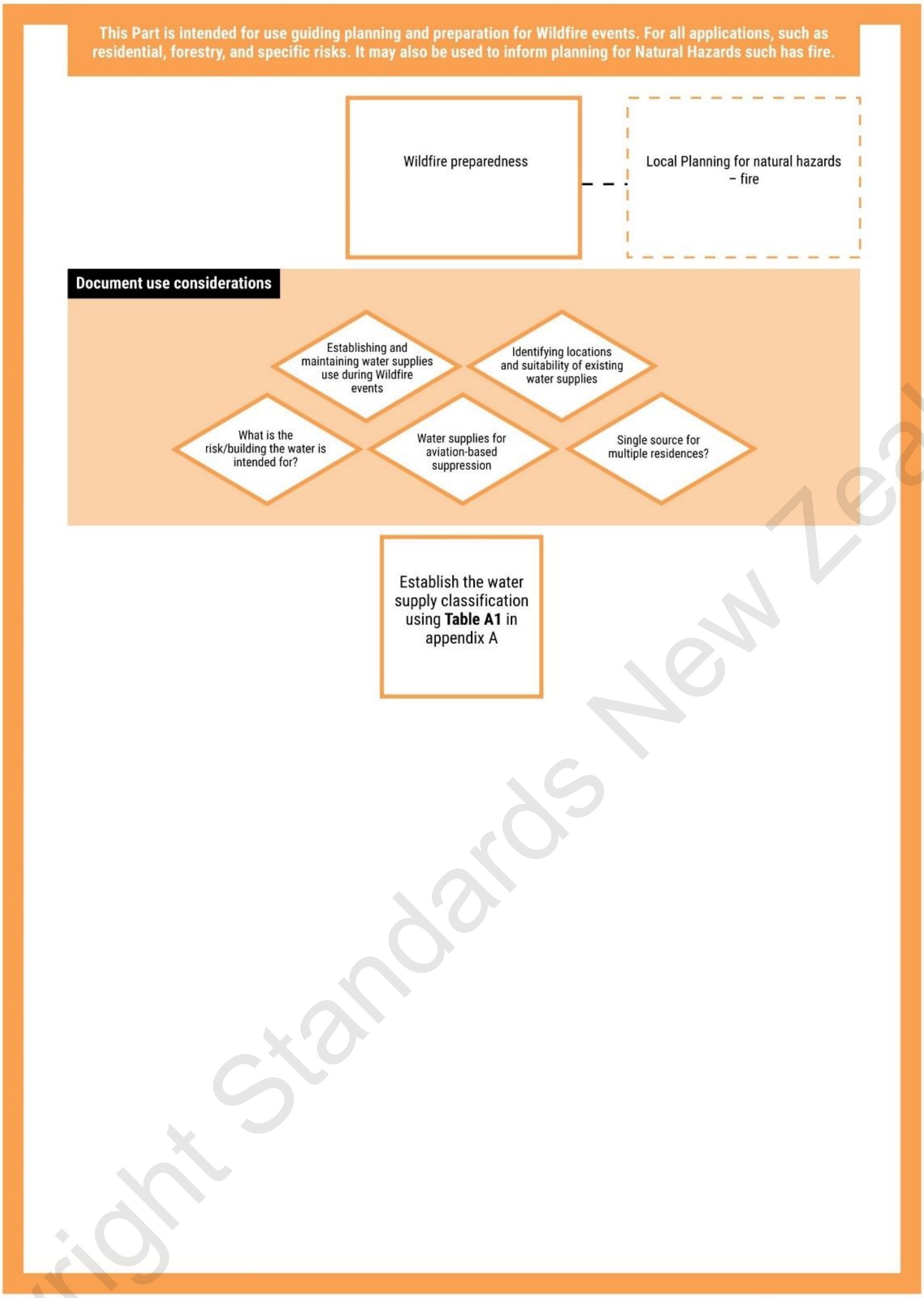


Figure 14 – Wildfire preparedness

5.2 Key considerations in rural areas

5.2.1 Water supply for structure fires

Regardless of location, any built structure is exposed to the potential of fires from many different causes. The water supply requirements to address this risk are covered in Parts 3 and 4 of this document.

Rural properties are largely non-reticulated in terms of water supply and there is a heavy reliance on bores, tanks, swimming pools, ponds, dams and waterways within the property to provide the necessary firefighting water. These alternative water supplies are also likely to be required to support fire suppression, extinguishment, and to undertake wetting down of vegetation in the immediate area, in an effort to protect structures from an approaching wildfire.

5.2.2 Response capability

While structure fires exhibit similar characteristics wherever they occur, there are key differences between rural and urban areas in terms of the response of FENZ. While there is an expectation that a fire appliance will be able to respond to properties within urban areas within a relatively short timeframe, this may not be realistic in rural areas. The distance from the nearest firefighting resource could result in fires having time to build up considerable energy and already have caused significant damage to a structure or spread through a large area of vegetation by the time the emergency services arrive. For this reason, FENZ recommends installation of home sprinkler systems for internal protection and treatment of areas surrounding structures to reduce the likelihood of them being affected by wildfire.

5.2.3 Vegetation fires

In addition to the risk posed by fires that start within structures in rural areas, there is also an increased risk of the fire spreading to surrounding vegetation and starting a wildfire. This is due in part to the proximity to surrounding vegetation, which is a key factor in rural environments, and the potential delays in response to any structure fire as outlined in Section 5.2.2 above.

While the spread of fires from structures to vegetation is a very real risk on rural properties, the greatest risk is possibly posed by fires spreading through surrounding vegetation, whether from wildfires started within the property or spreading in from adjacent land. These fires can be devastating for the landscape and individual properties, destroying structures, equipment, and valuable productive land, whether for forestry, agriculture or horticultural purposes. They can also damage key conservation, biodiversity, and cultural values. The impact on livestock can be devastating, as well as the ever-present danger of serious harm or death to any people unable to escape an approaching wildfire.

As such, considerations for wildfires in terms of access to adequate water supplies are very important for anyone living remotely, especially in areas that are prone to drying out and have a history of damaging vegetation fires.

5.3 Establishing water supplies for rural properties

5.3.1 General

Water demands for firefighting in rural areas can be separated into two categories:

(a) Structure fires – primary dwelling or other significant buildings;
(b) Wildfire.

5.3.2 Structure fires

Firefighting water requirements for structures in non-reticulated areas are already outlined within Part 4 and Appendix B – Non-reticulated firefighting water supplies. As such, any need for water for internal fire suppression is not addressed in this section.

5.3.3 Wildfires

During wildfires, the greatest challenge for fire suppression operations is getting enough water. Even where there is a reticulated water supply, such as in areas along the rural-urban interface, there may not be sufficient water in the mains to fight a major wildfire threatening lives and property. In these situations, alternative water supplies such as bores, tanks, swimming pools, ponds, dams, and waterways become vital sources of water for firefighters.

For the purposes of firefighting or training, section 48 of the FENZ Act 2017 permits all FENZ personnel to use, free of charge:

(a) All hydrants and control valves installed in any water mains;
(b) Any water in the water mains;
(c) Water from any water supply or any source of water.

Unlike for structure fires, the water demands for vegetation fires are very difficult to determine. They are influenced by a combination of external factors that contribute to how a fire will behave, including current and preceding weather conditions, the type and dryness of surrounding fuels, and the topography or general lie of the land. These combine in ways that can limit or exacerbate the potential impacts of a wildfire.

Water demands for the express purpose of protection from a wildfire need to be determined on a property-by-property basis, and there is no formula that can be used with confidence to support this process.

When considering potential water supply needs for individual properties for the express purpose of wildfire protection, this can be further broken down into two additional categories:

(a) Water for protection of key structures and assets;
(b) Water for vegetation firefighting.

The demands for these are quite distinct, with very different primary purposes as well as ways they will be utilised. The following section provides some further explanation of each of these.

5.3.4 Water for protection of key structures and assets

Often, structures ignite due to ember transport resulting in embers landing on flammable material near or on part of the structure. It is therefore recommended that water supplies should be established so external sprinkler systems can operate in the immediate vicinity of key assets such as homes, workshops or important storage facilities. They will allow the property occupier to wet down the area around these structures to minimise the immediate threat posed by a fire. The situations where this might be used include when attempting to prevent a fire inside a structure from spreading to the surrounding vegetation, or when a wildfire approaches the structure from the surrounding vegetation.

Approaching wildfire risk
Where the risk is associated with an approaching wildfire, external sprinklers may also provide sufficient time to allow the occupants to safely leave the property. The water available to an occupant to wet down an area of vegetation in preparation for an advancing wildfire should be separate to the 20,000 L reserved for use by FENZ to undertake structural firefighting. For example, in a situation where 30,000L of firefighting water supply has been provided for fires in a structure, only 10,000 L would be available to wet down surrounding vegetation.

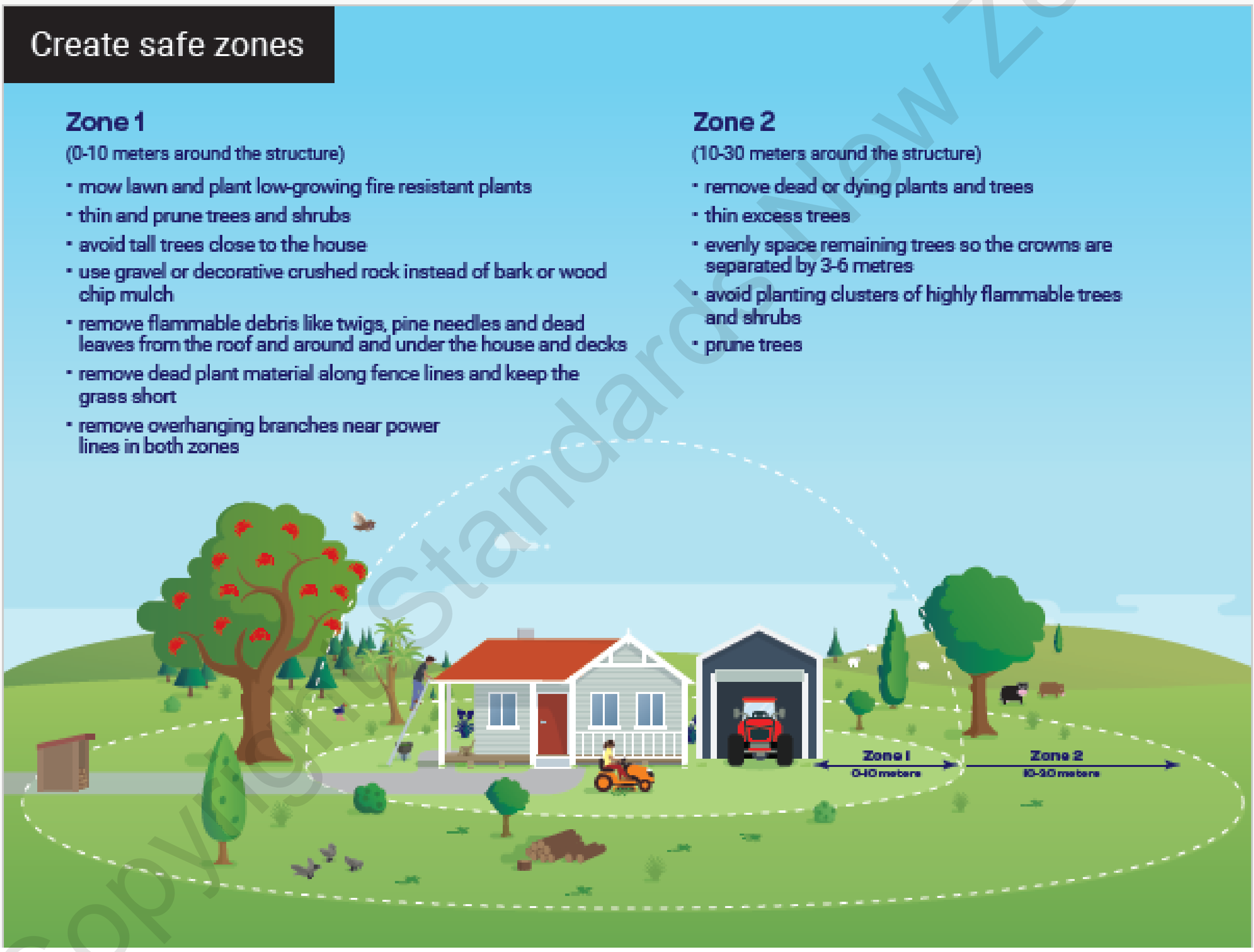


Figure 15 – Creating safe zones around structures

The intent of external sprinklers around structures is to wet down the vegetation, making it less likely to burn upon exposure to heat and flame contact from an approaching fire. Time is required to drive the moisture off before the vegetation can become involved in the fire, meaning that the energy from an approaching fire may have dissipated sufficiently to reduce the threat to the structure, or from the structure to surrounding vegetation in a building fire. There is also the added value of increasing the relative humidity, or the amount of moisture in the air, in the immediate area surrounding a structure, which is likely to alleviate the risk posed by embers.

Added value of external sprinklers
While the primary purpose in this context is for fire protection, establishing an external sprinkler system has

the added value of providing for water supply to support establishment and maintenance of plantings around the structures. Where these plantings involve low-flammability species there is even further benefit in terms of preventing wildfire impacts. (Visit the FENZ public website for guidance on low-flammability planting https://www. checkitsalright.nz/reduce-your-risk/low-flammability-plants)

There are many options for establishing external sprinklers, so it is impractical to provide any specific guidance around the required water supply. Sprinkler heads could be commercial-grade irrigator heads through to garden-variety hose attachments, or even simple soak hoses. Deluge systems, which essentially provide a curtain of water on the exterior of buildings, have been used in wildfire-prone areas around the world to help protect dwellings and critical structures. The key thing with any external sprinkler system is that they need to be activated and then left, enabling occupants to get away while having done the best they can to prevent a fire from causing further damage.

Sprinkler location
In terms of location, external sprinklers should at the very least be established on the side of the structure that is most likely to be impacted by a wildfire. This would typically be on the downhill side of structures on sloping ground, or in the direction of the prevailing warm wind (such as the northwest in Canterbury and Hawke's Bay or the southwest in Tasman). Where a property is surrounded by vegetation on multiple sides and is exposed to the potential of wildfires from more than one direction, it would be prudent to set up a sprinkler system that can be activated by sections. This would enable activation depending on the threat posed in any given situation. Vegetation on a particular side or sides of the structure can be wet down while conserving water by not having the sprinklers activated on the side away from the fire. In terms of preventing a fire spreading from a structure, the sprinklers are best set up on the side where the vegetation is closest, or, once again, establish a system that can be operated by section. In this situation, a moveable lawn sprinkler may be adequate and can be positioned and then left operating.

The exception to the one-side only guidance would be where there is an additional risk posed by embers or firebrands. While having a sprinkler operating on the side away from an approaching fire is not always necessary, where there is a risk of embers or firebrands causing spot fires it would be beneficial to have the ability to activate sprinklers on that side as well. This is because embers tend to accumulate on the sheltered sides of structures where they often encounter piles of accumulated debris such as leaf litter and other combustible material or vegetation that could be ignited as a spot fire. By activating a sprinkler on the sheltered side of the structure, this reduces the potential for embers to successfully ignite any material they happen to land in.

5.3.5 Establishing a temporary sprinkler system
Key considerations in establishing a temporary sprinkler system around structures to protect it from a wildfire include:

(a) Reliable water supply – this should be established away from the likely direction of an approaching wildfire, and far enough away from the structure so as not to be exposed to high levels of radiant heat. If not practical, consider shielding it by partly burying or erecting a barrier such as a concrete block wall;
(b) Mechanism for pumping – a dedicated pump that is either permanently in place or can be quickly set-up to supply water under pressure to the sprinkler system. In hilly country, it may be possible to establish the water supply sufficiently far uphill of the structures to enable the sprinklers to operate by gravity alone;
(c) Reliable power supply – in the absence of a gravity-feed system, pumps need to remain operational to maintain the supply of firefighting water. This could either be supplied by a sufficient electricity source or through liquid fuel at the pump using a combustion engine. An alternative power supply to mains is recommended, however, as this may not be reliable in the event of a fire, which then compromises the ability to wet down the surrounding vegetation. If relying on generators or liquid-fuel pumps, make sure they are fully topped up and ready to operate at any time, with regular pump running for testing;
(d) Protected water delivery lines – the pipework that supplies water from the source to the sprinkler heads should be protected from heat exposure to maintain the integrity of the system, as this is another potential point of failure. This may require the delivery line to be buried or at least positioned to minimise potential exposure;
(e) Remote activation – fires don't always happen when people are at home. This is especially the case for wildfires, which are most likely to occur during the day when people may be at work or school. Having the ability to remotely activate the sprinkler system should be considered in areas at high risk of wildfire.

If there is a need to activate an external sprinkler system, it is a matter of turning them on and leaving them to operate. The system can be shut down if it is safe to do so once the risk of a fire is no longer an issue. Otherwise, they will continue to run as long as the available water supply lasts or until loss of power at the pump. This will ensure the best possible chance of a structure surviving or of reducing the risk of a fire spreading from the structure through the surrounding vegetation. Where water preservation is important for other purposes, such as maintaining stock water from the same supply, it may be appropriate to have a timer on the sprinkler system to enable automatic shut-off. Care needs to be taken with this approach, though, because depending on the duration and timing of the sprinklers, they may not have the desired effect as evaporation may occur before the wildfire arrives.

It is important to note that while this initiative will help reduce the potential for fire spread around structures, this is not guaranteed to work: in the case of fast-moving wildfires or very intense structure fires, it may not be effective. However, it will give occupants time to escape safely, provided they have an escape plan and do so early enough. The effectiveness of external sprinklers will be increased when used in combination with a suite of other risk-reduction initiatives, which are outlined in Section 5.5 Wildfire risk mitigation below.

5.3.6 Water for vegetation firefighting

The rural environment is very different from urban settings because it has large areas of continuous vegetation. This means that firefighting efforts on individual properties are highly likely to require large volumes of water to prevent or suppress wildfires. Such water demands are not realistically supplied through water tanks or pressurised systems, and alternative supplies need to be considered. These include water supplies such as swimming pools, ponds, dams, and waterways such as water races, canals, streams, and rivers. Nearby large bodies of water, such as lakes, oceans or estuaries, may also be accessible options, especially if firefighting efforts involve aircraft.

5.3.7 Types of water source

Not all water sources are suitable for firefighting. Some may contain contaminants that would expose firefighters or communities to unacceptable health risks. Other sources may not be suitable due to the potential to compromise public health through the extraction process, such as water supply catchments where any contamination by firefighting chemical additives needs to be avoided. The preference will always be for fresh clean water, though the decision about which water source to use during a wildfire response ultimately sits with operational firefighting crews.

Given the array of potential water sources for vegetation firefighting, it is best to consider them in terms of how they will be potentially used. This will help to determine the minimum depths and respective dimensions for the water source and will help identify any specific maintenance requirements.

The primary use of water sources can be grouped into three broad use classifications:

(a) Heli-dipping – these can be used by helicopters with underslung helicopter buckets;
(b) Belly-tank filling – these can be used by helicopters fitted with belly tanks;
(c) Filling point – these can be used to support operations involving portable pumps, fire appliances and aircraft.

The proximity of the water source to the fire is a key consideration, both in terms of practicality and safety. The preference for filling points is that they be relatively close to the fire, provided they are not compromised by the fire or smoke. Helicopters and fixed-wing aircraft can access water further away from the fire, and it may be that the best water sources are on neighbouring properties. As a property owner it is important to understand what other water sources might be available in the wider area.

5.3.8 Helicopter operations

Heli-dipping and belly-tank filling can be collectively considered as helicopter operations.

The vast majority of aerial firefighting is done by heli-dipping involving helicopter buckets – belly-tanks are far less common. The aircraft configurations are quite distinct in terms of the depth of the water source they can operate from, with helicopter buckets needing considerably deeper water than belly-tanks.

There are also differences in terms of the site with regard to approach and departure paths, given that belly-tanks need to descend low over the water source, whereas helicopter buckets are carried on strops at a distance below the helicopter and therefore can get into tighter spaces.

Safe and efficient operation of aircraft should always be the overarching objective, primarily by enabling a smooth transition into and out of water sources. Figure 16 outlines aerial approach and departure angles for landings during helicopter operations, which should be used as a proxy for setting up ponds for safe use. These parameters enable clear access for helicopters with belly-tanks, which essentially need to hover immediately above the pond, as well as for those with helicopter buckets, which still need to be able to lift the underslung load clear of the pond and any surrounding hazards.

To maximise usefulness for firefighting purposes, any pond being considered for helicopter operations should ideally be set up for multiple prevailing wind directions so the pond can be accessed under different weather conditions. This requires tree and other flight hazards to be cleared from the approach and departure pathways.

There should also be an area close to the helicopter water source where the aircraft can be put down safely if it encounters any issues with its equipment. This should be flat ground that is clear of tall vegetation and other flight hazards to facilitate a safe landing.

5.3.9 Heli-dipping

The water source should have a minimum useable water depth of 1.5 m, allowing for buckets to be submerged and take on a full load.

Where the refresh rate on the water source is good, such as by direct infill from a stream, this depth of water should be able to sustain helicopter operations over a reasonably sustained period. Once the water level is less than this minimum level, aircraft may not be able to fill their buckets. While this may be adequate under the circumstances, and could continue to be used until a more reliable water source is established, it is not cost effective for long-term aviation operations.

Where the refill rate on ponds is slow or limited, it would be better to have a minimum depth of 3 m when full to enable multiple loads to be drawn before an alternative source needs to be found.

In terms of the physical footprint of a heli-dipping water supply, bigger is best but as a minimum it should have a surface area of 5 m x 5 m. In terms of the depth of the water supply, it is preferable to have 1.5-2 m of water depth to maintain efficiency. In all situations, it is particularly important that there are no snags under the water that could tangle in helicopter buckets and compromise the safety of the aircraft and its pilot.

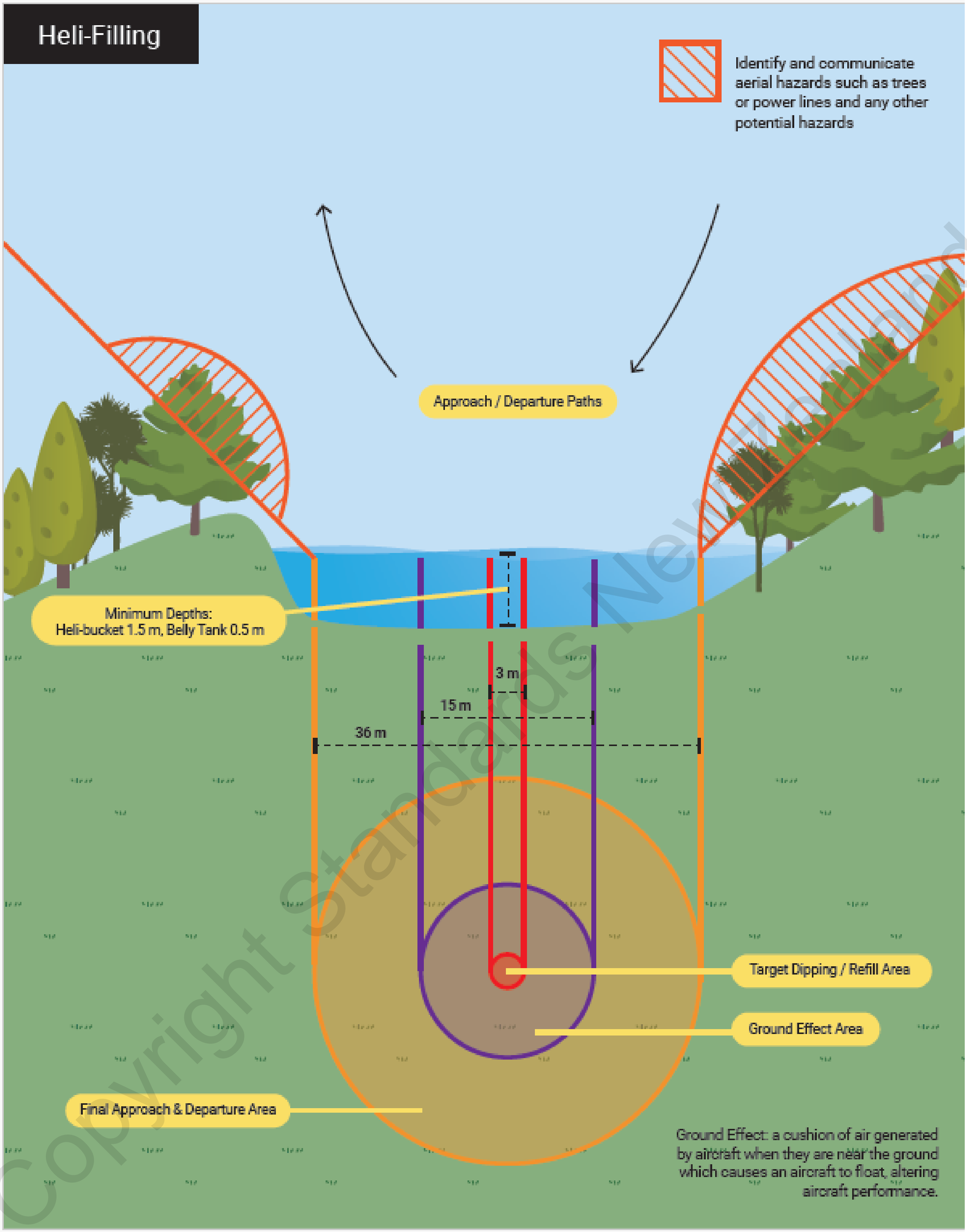


Figure 16 – Heli-dipping – landing and lift-off area for helicopter operations

5.3.10 Belly-tank filling

Helicopters operating this system can use shallower water sources, provided it is safe for them to get down close to the surface and exit safely. This requires the water source to be free of tall vegetation and flight hazards, with pilots determining the suitability for use under the prevailing conditions on any given day. The water should be clear of weeds and floating debris, and the bottom preferably not silty or muddy, as these can cause blockages at the intake. It is acknowledged that this is hard to achieve, but it comes down to the pilot’s discretion about the suitability of a water supply, as they can manage in most circumstances.

The depth of the water simply needs to cover the snorkel pump that extends below the helicopter. The width of the water supply can be as narrow as 1–2 m, though a wider source is preferable to support easy targeting for the pilot. These reduced dimensions make belly-tanks a very flexible firefighting resource to access a wide range of water sources. They still need sufficient water available to efficiently fill the tank and clear operating areas to enable them to hover immediately over the water.

Figure 17 – Helicopter filling belly-tank from portable dam

As previously mentioned, belly-tanks are still the minority among aerial firefighting capabilities, and there should not be any reliance on them being available on any given day.

With any filling operation involving open water sources and helicopters, the pilot is always in command – it is up to them to decide on the appropriateness of a water source. On any given day, the prevailing conditions may render a normally good water source unusable.

5.3.11 Filling points

This term is used to represent ground-based access to water sources for the purposes of running portable pumps or filling appliances and aircraft. It can also be a critical component in determining the suitability of airstrips for supporting firefighting water supply. Filling points can be quite flexible in terms of the water sources used, with many different options for how water will be delivered from the source. The primary requirements are having a good flow rate and a constant water depth of at least three times the diameter of the suction hose to prevent air being drawn into the pump.

A firm, flat area, referred to as a hardstand, is required to operate pumps from. The requirements for this pump-operating platform vary depending on whether the water source is being accessed by portable pumps or directly by a firefighting appliance or tanker. For direct filling of vehicles, there needs to be a suitable flat area of vehicle hardstand within 6 m of the water source that can be easily accessed with no risk of the bank collapsing under the weight of the fully laden vehicle. The requirements for portable pumps are simpler, requiring clear access to the water and a flat working platform no smaller than 1.5 m x 1.5 m and less than 2 m in vertical height from the lowest working water level.

Other key considerations for filling points:

(a) Preferably clean, flowing fresh water, though other water sources will be considered where it does not compromise the health of firefighters;
(b) Clear of weed, floating debris and suspended material that may block suction strainers;
(c) Good access to the water source for personnel who need to carry portable pumps into position;

(d) Pump operating platforms or hardstands need to be clear of scrubby fuels to prevent the trapping and build-up of exhaust fumes and minimise the risk of fires starting from radiant heat or direct contact with hot pump exhausts;
(e) Where using natural water sources as filling points, identify if these are likely to retain water through a drought or if they dry up – this provides an indication of reliability.

If a water source can provide the necessary requirements in terms of access, water flow, and a suitable operating area, there are many different approaches that firefighters take to use water extracted from a filling point for firefighting. These include:

(a) Direct firefighting, where the water is pumped directly onto a fire either through firefighting nozzles or sprinkler systems;
(b) Filling helicopter buckets or fixed-wing water carriers (firefighting planes) using high-volume pumps at the source and a manual filling attachment such as a gooseneck or loader hopper;
(c) Filling portable dams either to enable direct helicopter filling by heli-dipping or belly-tanks or supporting hose lays to provide water to multiple firefighting nozzles;
(d) Filling tanks on firefighting vehicles and tankers where they cannot get close enough to the water source to do so directly.

The key point is that firefighters have multiple options available for accessing water. Even where the source is far away from where the water will be used, or from where it can be delivered into a portable dam or firefighting vehicle, there are options to set up long hose lays with relay pumps to transfer the water. However, relays are limited in terms of operating pressures of the pumps and pressure losses over distance. Ideally, water sources should be identified close to where they are likely to be used, which will reduce the burden on firefighting resources, freeing up firefighters to fight the fire.

Figure 18 – Helicopter at helicopter bucket filling point

5.3.12 Fixed wing operations

In addition to aerial firefighting operations involving helicopters, fixed-wing aircraft may also be used for any wildfire response. These are typically managed out of airfields but can also use airstrips on private property, such as those used for aerial topdressing. Given the speed, range and versatility of fixed-wing aircraft, they can operate at greater distances from any wildfire, which enables them to access water sources not feasible for rotary aircraft (helicopters).

Access to suitable and sufficient water supply is critical to whether airfields and airstrips are appropriate. Available water may be accessible directly from the site through ponds, lakes, dams or waterways from which portable pumps can be established to supply aircraft. Alternatively, water may be supplied from tanks at the site, once again requiring the establishment of portable pumps. In the absence of these, water will need to be carted to the airstrip in tankers to either fill portable dams or fill the aircraft directly. Where water needs to be carted, take care to prevent heavy vehicles compromising the integrity of the runway and taxiways for aircraft, or the main access routes to the airfield.

The identification of suitably maintained and useable airstrips is important, as fixed-wing firefighting resources may not be familiar with the local area. Ensuring that the airstrips are aircraft accessible is also critical to ensuring potentially short notice use to support firefighting efforts. Ultimately, the final decision regarding the suitability of any particular airstrip or landing strip lies with the pilot, who will work in conjunction with any assigned lead pilot appointed as part of an incident response.

There are hundreds of informal airstrips on private land that are suitable and regularly used by fixed-wing fertiliser operators. To use these airstrips, it is important that a good relationship is established between landowners/managers and local FENZ staff to understand any limitations and make appropriate decisions during an emergency response within the wider area.

Figure 19 – Fixed-wing aircraft at an airfield filling point

5.3.13 Establishing and maintaining water sources

To support responding emergency services during a wildfire, there are several things that the landowner or manager should implement to facilitate prompt access to reliable water sources.

It is up to the landowner to determine if the proximity to the nearest water is adequate. These include the following:

5.3.14 Identify suitable water sources

Suitable water sources may be on the property itself or on neighbouring properties. They should be sufficient to provide a reliable source of water over a sustained period. However, limited supplies that may be exhausted quickly but are close to the fire may still be appropriate to provide some firefighting capability while other sources are established. Unlimited water supplies, such as the sea, lakes, and rivers, provide water volumes far in excess of the likely demands of firefighting efforts, provided they are close enough to support suppression operations. While not always possible, when selecting a suitable site for supplying water to pumps, it is preferable that it is clear of mud, silt, vegetable matter, fines gravels or debris that could block the strainer of suction hoses.

5.3.15 Maintain access to the water source

When using portable pumps, it is important to provide clear access to the water so personnel can safely carry portable pumps into position. Pump-operating platforms or hardstands also need to be clear of scrubby fuels to prevent the trapping and build-up of exhaust fumes, as well as minimising the risk of fires starting from radiant heat or direct contact with hot pump exhausts.

5.3.16 Maintain an adequate depth

The required depth of water depends on its primary use. Water sources should have a minimum operating depth of three times the diameter of the suction hose to prevent air being drawn into portable pumps. For operations involving heli-dipping, the depth should be 1.5–2 m of water depth to maintain efficiency. When the source is shallow, consider digging a deeper hole or creating a dam to capture or divert the flow and increase the available volume of water to create a sufficient depth to be considered an effective firefighting supply. This may need to be regularly maintained as significant rain events or flushes may infill any holes constructed.

NOTE – local planning rules need to be considered when undertaking this activity in natural water sources.

5.3.17 Establish a hardstand area

Firm level ground near the water source is needed to either place a portable pump or park a vehicle. Consider the requirements of Section 4.9 Non-reticulated firefighting water supplies. Where the water level is well below the surrounding ground, such as in a deep-cut stream bed or below a pond berm, it may require a flat platform to be created partway up the bank to place the pump to enable sufficient lift to be generated.

If creating a hardstand from which to operate a vehicle, this should be large enough to park a fire appliance and situated so that bank collapse on the edge of the water source does not compromise the vehicle. There also needs to be easy access to that location. While rural fire appliances are typically four-wheel drive and can go offroad to access the site, a formed road will be required to enable two-wheel-drive vehicles to gain access.

For portable pumps, a minimum clear level area of 1.5 m x 1.5 m is required to allow space for placement and a working area. As noted above, consider how easy it would be to safely carry a pump into that location.

NOTE – the pump may be brought to the site by a vehicle or flown in by helicopter, but final positioning will be done by hand and typically requires at least a two-person lift.

5.3.18 Clearly mark the site

Identify or mark specific access points to water sources to help emergency responders find them. This includes identifying the best routes to the site, as well as the specific location of any created hardstand for pumping purposes or deep holes that will maximise pumping efficiency. Marking key water sources on maps for FENZ is also helpful, as well as making local aviation operators aware of suitable ponds on the property that could be accessed for aerial firefighting.

5.3.19 Ongoing maintenance of the water source

While wildfires are most likely in the period from late spring until early autumn, they can occur at any time of the year, especially in areas of scrub, such as mānuka/kānuka, gorse, and tussock. It is therefore important that maintaining water sources becomes a normal part of property maintenance so the water is accessible and reliable when you most need it. Several key actions need to be undertaken, depending on the water source. These include:

(a) Clear scrub and other vegetation from around the water source access points to enable unimpeded access and safe pump operating. This includes cutting back flammable material near the hardstand to prevent fires starting through contact with hot exhausts or the build-up of discharged gases.
(b) If a pond is being maintained for helicopter operations, keep in mind the key specifications identified above in terms of minimum clearances for approach and departure paths.
(c) Consider options to prevent people or vehicles from accidentally falling into the water source, especially near deep water – this may include creating a bund wall or installing a fence.
(d) Regularly check the depth and flow of water into the water source, as well as keeping it clear of vegetation and floating debris, ensuring that it remains suitable for firefighting purposes.
(e) For helicopter-accessible ponds, remove submerged material that could become entangled in helicopter buckets, creating a hazard for aerial operations.
(f) For airfields accessible by fixed-wing firefighting aircraft, checks regularly that onsite water supplies are available and suitable, or that access is maintained where water needs to be carted in to support filling operations.

5.3.20 Identifying water sources

As with any firefighting operation, it is important to start suppression activities as soon as possible upon arrival. If arriving crews can identify the water source easily, this will greatly enhance firefighting operations and improve the likelihood of a successful outcome in terms of reducing the impact of the fire.

In the absence of any ability to accurately determine the exact water needs for a wildfire response, the most important action is to clearly identify the water source. Clear signage indicating the location of a firefighting water supply should be posted in a highly visible location. The recommended signage is red lettering on a white background, stating: Water Supply. It should be no less than 280 mm wide and 380 mm high and made of reflective material. See Section 3.6.8.4 Outlets other than fire hydrants Figure 6 – Reflective signage indicating a water supply.

5.3.21 Regulatory considerations when constructing water sources

If constructing a water source such as a pond or dam to store water for firefighting, consider local planning rules and regulations. Depending on the water depth, construction method and mechanism for filling, the following may apply:

(a) District plan rules – tanks and ponds;
(b) Natural waterway rules – earthworks and waterway health;
(c) The Building Act 2004 and Building Code – construction and earthworks;
(d) Building (Dam Safety) Regulations 2022;
(e) NZSOLD New Zealand Dam Safety Guidelines 2024.

5.4 Wildfire risk mitigation

The provision of and easy access to water for firefighting does not in itself prevent fires from causing significant damage to property. The complexity of the fire environment means that a fire may not be easily suppressed, despite the best efforts of firefighting operations. Firefighters may not even be able to respond in a timely manner. In the event of a major wildfire, firefighters are likely to be responding to multiple properties at the same time and resources will be stretched. Roads could also be compromised, which prevents access. It is therefore important that the provision of firefighting water is considered as only part of a suite of fire risk reduction initiatives on a property to maximise the potential for a favourable outcome in the event of a fire.

Additional fire risk mitigation initiatives include, but are not limited to, the following:

(a) Remove highly flammable plants from close to structures – these can create corridors for fire to travel through or support high-intensity burning that could help spread the fire;
(b) Keep grass short around structures – slows the spread of fire by reducing the amount of fine fuels available to burn;
(c) Establish low-flammability plantings – creates a screen that may significantly slow the spread of a wildfire;
(d) Maintain clear accessways – these need to be wide enough for emergency response vehicles to gain access to structures and other key assets (4 m wide x 4 m high);
(e) Clear gutters, areas around decks and any other place where debris accumulates – these are the places where embers are likely to land so it is important to remove any potential fuel;
(f) Avoid storing firewood and other flammable material close to structures – these should be stored at least 10 m away, or within an enclosed shed that is not likely to be breached by embers;
(g) Create a clear zone around the immediate edge of structures – a strip of stone, cement or tiles can reduce the chance of a surface fire reaching the structure;
(h) Have an escape plan that is well understood by all – know how to get away from the property and where to go in a fire, including how to reconnect if separated for any reason;
(i) Know your neighbours – the best water sources, as well as the most appropriate safety zones and escape areas, may be on their property.

For more guidance, go to the FENZ website at https://www. fireandemergency.nz/outdoor-and-rural-fire-safety/.

The more that can be done to reduce the risk of damage around a property and to ensure that people can safely get out of harm's way, the better the outcomes for all involved.

APPENDIX A – TABLES FOR CLASSIFICATION, FLOW RATES, AND VOLUME OF FIREFIGHTING WATER SUPPLY

(Normative)

A1 General

Tables A1 to A3 have been developed to determine firefighting water requirements for individual buildings within planning zones. However, the flow rates and storage volumes that the entire reticulated water supply systems should be designed for should be assessed on the range of fire risks that can be present in any one reticulation zone. The purpose of this appendix is to guide water supply system designers in determining the design of firefighting flow rates and storage volumes for reticulated water supplies.

It is important to note that firefighting water requirements are in addition to domestic/commercial/industrial water supply needs. When water for firefighting is provided from hydrants, it must be at a pressure of not less than 100 kPa.

Table A1 – Method for determining required water supply classification

Category	**Water supply classification (see Tables A2 and A3)**
Residential zones	
General rural	(R1) Residential 1 – Note 2
Rural production	
Rural lifestyle	
Large lot residential	(R1) Residential 1
Settlement zone	
Low-density residential	
Medium-density residential	(R1) Residential 1– Note 3
General residential	
High-density residential	(R2) Residential 2– Note 3
Commercial, retail and industrial activities	
Neighbourhood centre	(C1) Commercial 1
Commercial	(C2) Commercial 2
Mixed use (< 2000 m^2)	
Town centre	
Light industrial	
General industrial	
Large-format retail	(C3) Commercial 3
Mixed use (> 2000 m^2)	
Metropolitan centre	
City centre	
Heavy industrial	(C4) Commercial 4
If commercial category is not determined, then use land parcel size[9]	Water supply classification
< 500 m^2	(C1) Commercial 1
Between 500 and 2000 m^2	(C2) Commercial 2
Between 2001 and 5000 m^2	(C3) Commercial 3

Category	Water supply classification (see Tables A2 and A3)
5001 m² or more	(C4) Commercial 4
Open space zones	
Buildings within open space zones shall be covered by water supply for the expected structure size	Varies – see Note 4
Special zones[5]	
Corrections	(C2) Commercial 2
Future urban	
Hospital	
Stadium	
Tertiary education	
Māori purpose	See Note 5
Port	(C3) Commercial 3
Airport	
Other	
Special hazards not covered above.	By specific calculation – see Note 6

NOTES

1) Table A1 lists the method for determining the required water supply classifications. The zone and activity categories are based on the criteria outlined in the National Planning Standards.
2) Reticulated water supplies are not required in rural zones by this Code of Practice. If reticulated water supplies are to be provided for residential purposes, then Residential 1 category is recommended.
3) While 'high density' housing is not clearly defined, for the purposes of this Code it is defined to include the following:
   (a) Single houses on lots of less than 400 m² and/or where the district planning rules allow building coverage to be greater than 45% of the net site area;
   (b) Developments including multiple household units such as townhouses and apartments.
4) Within open space zones, water distribution should be provided to within the distances from buildings as specified in Table A2 Note 8. It is not expected to provide water for firefighting throughout the open space zone.
5) Within special zones, consider the intended buildings within the zone and apply the water requirements of the appropriate commercial activity. For example, many airports contain significant hangers or warehouses within the airport zone. The water requirements for those activities would be either Commercial 3 or Commercial 4 as applicable.
6) Examples of special or isolated hazards may include bulk fuel installations, solar farms, timber yards, tyre dumps, wood chip stockpiles, recycle depots, and marinas.
7) In all zones, while fires may occur in outbuildings, this Code does not require provision of firefighting water for such buildings.
8) For isolated fire hazards in an area with a lower water supply classification, an assessment should be carried out to determine measures to mitigate the hazard or increase the water supply (see Methodology for calculating FF water supply).
9) If the land parcel size and category require different water supply classifications, then use the higher classification assessed.

Table A2 – Water supply requirements – Reticulated systems

	Reticulated water supply flow rate			Number of hydrants to achieve flow	
Classification	Sprinklered L/min (L/s)		Non-Sprinklered L/min (L/s)	Minimum	Maximum
	Hose Flow	Sprinkler Flow			
Residential 1	750 L/min (12.5 L/s)	250 L/min (4.2 L/s)	1500L/min (25 L/s)	1	2
Residential 2	750 L/min (12.5 L/s)	250 L/min (4.2 L/s)	3600 L/min (60 L/s)	1	3
Commercial 1	1500 L/min (25 L/s)	500 L/min (8.3 L/s)	3000 L/min (50 L/s)	1	3
Commercial 2	1500 L/min (25 L/s)	1500 L/min (25 L/s)	6000 L/min (100 L/s)	2	4
Commercial 3	1500 L/min (25 L/s)	3000 L/min (50 L/s)	9000 L/min (150 L/s)	3	6
Commercial 4	1500 L/min (25 L/s)	4500 L/min (75 L/s)	12,000 L/min (200 L/s)	3	8

Notes

1) Tables A2 and A3 list the minimum requirements for firefighting water supplies. In developing towns' main reticulation systems, a WSP needs to cater for domestic/industrial water use in addition to the above. This procedure is outlined in 'General procedure for establishing classifications for water supply reticulations', below
2) The sprinklered flow rate includes the demand for firefighting operations and the sprinkler system demand separately. Water infrastructure should be designed to consider both flow rates simultaneously.
3) The indicated sprinkler demand may not be sufficient to accommodate all sprinkler designs. For example, at the date of preparation of this Code, many warehouse developments required a sprinkler design flow approaching 10,000 L/min.
4) If the sprinklered flow rates are to be used, then it is expected that all buildings within the development are sprinkler protected as a resource consent condition.
5) For single isolated risks where it is not cost effective to upgrade water supply infrastructure, local authorities may consider requiring sprinkler protection of buildings as a non-reticulated approach to comply with this Code.
6) The minimum residual or running pressure at the flow rates described above is 1 bar (100kPa).
7) The minimum flow from a single hydrant must exceed 750 L/min (12.5 L/s), except for sprinklered residential zones, in which case the minimum is 450 L/min (7.5 L/s), while the maximum design flow, for safety reasons, is limited to 2100 L/min (35 L/s). Refer to Clauses 3.6.9 to 3.6.17.
8) For commercial activities, at least 50% of the required minimum flow shall be available from hydrants within 135 m of the attendance point, either notional or actual. All remaining flow shall be from hydrants within 270 m.
9) To maximise future development flexibility, it is recommended that bulk water transfer mains be designed based on non-sprinkler-protected water flow rates.
10) If the water volumes given in Section 4.9 Non-reticulated water supplies are not available in the reticulated system, water can be sourced from an appropriate non-reticulated supply. This non-reticulated water supply must meet the requirements of Table 3 below.

Table A3 – Total water supply volumes and non-reticulated systems

	Firefighting Duration (minutes)		**Non-Reticulated Water Supply (L)**	
Category	Sprinklered	Non-Sprinklered	Sprinklered	Non-Sprinklered
Residential 1	20	30	5000 – Note 2	20,000
Residential 2	20	30	5000 – Note 2	108,000
Commercial 1	60	60	81,000	180,000
Commercial 2	60	90	81,000	540,000
Commercial 3	60	120	312,000	1,080,000
Commercial 4	60	180	720,000	2,160,000

Notes

Special hazards (as described in Table A1) and buildings located in areas with existing water supplies that are inadequate require specific calculations to determine water supply requirements and mitigation options.

For individual buildings, refer to Section 4 Building design and developing individual allotments for guidance.

For other structures such as bulk storage tanks, specific calculations may be drawn from international guidance, for example, NFPA 30.

Water demand for sprinkler system shown – 10,000L minimum is recommended for wildfire protection per residential unit/dwelling.

If the minimum water storage requirement as listed in the above table is not available from the reticulated supply (reservoir), supplementary water can be sourced from a 'non-reticulated supply' as approved by the FENZ district manager. This non-reticulated water supply shall meet the requirements of Section 4.9 Non-reticulated firefighting water supplies.

A2 Commentary to Tables A1 to A3

A2.1 General procedure for establishing classifications for water supply reticulations

The capacity of existing water supplies to store and deliver water for firefighting can be measured by comprehensive flow testing or estimated through computer modelling. Water supply authorities should undertake this work in partnership with FENZ If necessary, the WSP can establish water classification zones after consultation with FENZ so that the minimum storage and flow requirements in the zones are clearly defined. Due to the capital-intensive nature of water reticulations, long lead times may be required to make improvements. Strategies should therefore be put in place in consultation with FENZ that clearly describe how any known deficiencies in the water supply are managed and how they will be remedied. Any consultations with FENZ should occur at the FENZ district manager level.

To determine the firefighting capacity for new water supplies in greenfield areas, the WSP should assess the developments that are likely to occur in that area and design the water supply system for the average fire risk. They should use Tables A1 and A2 to determine the required water supply classification section, take account of other factors such as future growth, and consult with FENZ Any new developments should be assessed against the capacity of the water supply system, so that developers design within the reticulated supply capacity. In cases where the required fire water exceeds the reticulation capacity, remedy the effects by providing additional onsite storage or increasing the reticulated capacity.

A2.2 Storage

The volume of storage that is reserved for firefighting purposes must not be used for normal operational requirements – see Figure A2.2 1. Additional storage must be provided to balance diurnal peak demand, seasonal peak demand and normal system failures, for instance, power outages. This is to ensure there is always sufficient volume of water available for firefighting, except during civil defence emergencies or by prior arrangement with the FENZ district manager.

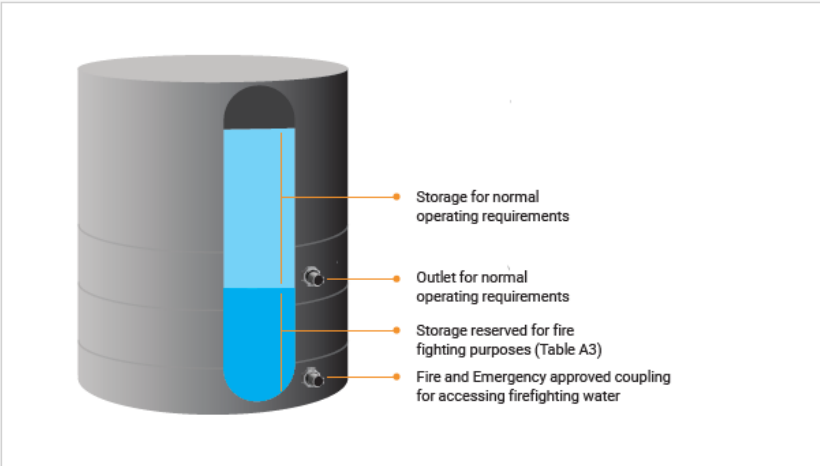


Figure 20 – Water storage allocations

A2.3 Flow

The flow rate available for firefighting from hydrants can be measured by undertaking comprehensive flow tests or estimated through network modelling.

Comprehensive flow tests should be carried out at times of reasonably high consumer demand (domestic, industrial, and commercial water use) so the results will reflect the effects of any reduced reticulation pressure at such times. The timing for such tests must be determined in consultation with the WSP to manage any discolouration and reduced pressures that may result.

When the available firefighting flow rates are estimated by running computer models, it is necessary to include background consumer demand concurrently with the fire water flows from hydrants. As a guide, two-thirds of the annual peak consumer demand should be used consecutively with fire flows from hydrants, with resulting reticulation pressures not less than 100 kPa. The annual peak demand varies from zone to zone, but as a guide, in residential areas, can be estimated as follows:

Zones less than 1000 dwellings	$Q_{peak} = 0.596D^{0.632} L/s$
Zones larger than 1000 dwellings	$Q_{peak} = 0.0467D\ L/s$

where

Q_{peak} = Peak annual demand (L/s)

D = Number of dwellings

Individual water suppliers may use different formulae particular to their jurisdiction, based on observed peak flow rates.

In most cases, several modelling runs would be needed to assess the impact of different fire scenarios at different locations, but scenarios should allow for only one fire at a time.

Where structures are fitted with compliant fire sprinkler systems, NZS 4541:2020 requires the fire sprinkler flows to be delivered concurrently with a flow of 1500 L/min (25 L/s) from the nearest fire hydrants at the pressure determined as part of the sprinkler system design and flow tests. Generalised sprinkler demands plus the 1500 L/min (25 L/s) firefighting flows are given in Table A2. By default, a flow test should be available that considers the effect of reduced pressure due to consumer demand and the actual required sprinkler flow.

Computer modelling can be used to verify that the level of consumer demand at the time the flow test was conducted was at least two-thirds of peak annual demand. In cases where the modelled pressure is less than the observed pressure, further work should be carried out to determine the appropriate available reticulation pressure that the fire sprinkler system should be designed for.

A2.4 Examples

A2.4.1 Example 1

A subdivision is planned for the provision of light industrial buildings all on individual 1000 m^2 sections as zoned in the council's district plan. What firefighting water supply (for the purposes of sizing the water main) is required to be provided to these vacant sections, assuming that none of those buildings are intended to be sprinkler protected?

Solution: As a light industrial zone with a 1000 m^2 lot size, the level of risk is Commercial 2. The minimum recommended water flow rate is 3000 L/min (or 50 L/s) for a sprinkler-protected building according to Table A2.

This flow rate needs to be able to be supplied by either three or four hydrant outlets, at least two of which are to be within 135 m of each lot.

The local authority or WSP thus decides that the installed inground reticulated water main must supply 3000 L/min (or 50 L/s) for the purposes of firefighting alone.

Developers then choose to either sprinkler protect their buildings or provide water tank(s) for the remaining 3000 L/min (50 L/s) for 90 minutes of 270,000 litres.

A2.4.2 Example 2

A new large retail building is proposed in an area with a reticulated water supply of 4500 L/min (or 75 L/s). What firefighting water supply is required for this building?

Solution: Large retail is risk level Commercial 3 according to Table A1. This building requires firefighting water supply of 9000 L/min (150 L/s) for a non-sprinklered building or 4500 L/min (75 L/s) for a sprinklered building by Table A2. The fire duration is 120 minutes by Table A3.

The developer decides to either sprinkler protect the building (with associated water supply for this system) or provide additional 75 L/s for 120 minutes, that is, a 540,000-litre tank.

A2.4.3 Example 3

An owner combines two sites, each of 1500 m^2, to form a single site of 3000 m^2 for the construction of a bulk retail outlet. The land is currently zoned for commercial activity, which specifies a Commercial 2 water supply classification (6000 L/min or 100 L/s). According to Table A1, this building would require a Commercial 3 classification (9000 L/min or 150 L/s). Options to assess and mitigate the increased risk include:

a) Check with the WSP to confirm the actual water capacity of the network within this zone. If the actual capacity has been enhanced to satisfy the Commercial 3 classification for any reason, then no additional mitigation is required.

b) Calculations could be undertaken to determine the actual water demand for firefighting purposes. This approach considers the geometry of the building and adjacent risks and may show that the actual water demand is within the capacity of the existing infrastructure, and no additional mitigation would be required.

c) The building could be sprinkler protected to reduce the water demand. The sprinklered case is likely to be within the capacity of the existing system.

d) The fire risk and water demand could be reduced by subdividing the building into multiple firecells. For this project, fire separation of the storage and service areas may be sufficient to reduce the water demand, and this could be readily confirmed by calculation.

e) Provide a firefighting water tank to make up any shortfall in water requirements. The volume of the tank should be determined based on the non-reticulated water volume requirement from Table A3 less the actual capacity from the reticulated system.

APPENDIX B – LEGISLATIVE REQUIREMENTS: SUBPART 8 LOCAL GOVERNMENT (WATER SERVICES) ACT 2025 – OTHER OPERATIONAL MATTERS (FIRE HYDRANTS)

(Normative)

B1 Section 215 Water service providers must install fire hydrants

In every part of a WSP's service area where the provider is responsible for providing water supply services, the provider must attach fire hydrants to the main pipes of the water supply network other than trunk mains.

The WSP must:

(a) Attach the fire hydrants at the most convenient places for extinguishing fires as determined by the provider with the approval of FENZ; and
(b) Determine, with the approval of FENZ, how far apart to attach the fire hydrants; and
(c) Maintain the fire hydrants in effective working order.

If more than one WSP is responsible for providing water supply services in a territorial authority's district, the WSPs may agree that one of those providers is responsible for attaching the fire hydrants in all or part of the district.

If the WSP is a water organisation, it must consult the territorial authority in whose district the water organisation is operating before seeking the approval of FENZ under subsection (2)(a) or (b).

If a WSP is dissatisfied with any decision by FENZ under subsection (2), it may, within one month after receiving notice of the decision, appeal that decision to the district court, whose decision is final.

In this section, 'trunk main' means a main used for the purposes of:

(a) Conveying water from a source of supply to a filter or reservoir; or
(b) Conveying water from one filter or reservoir to another filter or reservoir; or
(c) Conveying water in bulk from one part of the limits of supply to another part of those limits; or
(d) Giving or taking a supply of water in bulk.

B2 Section 216 Territorial authority must place notice or mark near fire hydrants

(1) A territorial authority must place a notice or mark near each fire hydrant in its district to show the location of the fire hydrant.

(2) The notice or mark—

  (a) must be of a kind approved by FENZ; and

  (b) must be conspicuous; and

  (c) may, if the territorial authority considers it appropriate, be placed on a building.

B3 Section 217 Water service providers must ensure water in pipes and available for extinguishing fires

(1) A WSP must, at all times, keep the pipes, to which fire hydrants are attached under section 215, filled with water.

(2) However, subsection (1) does not apply—

  (a) in the case of an unusual drought, an accident, or a shortage of the water supply from any cause; or

  (b) during necessary repairs, connections, or inspections; or

  (c) during a state of emergency declared under the Civil Defence Emergency Management Act 2002.

(3) A WSP must allow any person to take and use water, free of charge, from any waterworks or water race for the purpose of extinguishing a fire.

(4) However, subsection (3) is subject to the overall requirements of a controller while a state of emergency exists under the Civil Defence Emergency Management Act 2002.

(5) In this section—

water race has the meaning set out in section 5(1) of the LGA 2002

waterworks includes—

(a) rivers, streams, lakes, waters, and underground waters, and rights relating to them; and

(b) land, watershed, catchment, and water collection areas; and

(c) if vested in a WSP, or acquired, constructed, or operated by, or under the control of, a WSP:

  (i) reservoirs, dams, bores, tanks, and pipes; and

  (ii) buildings, machinery, and appliances.

APPENDIX C – EXAMPLES OF WATER SUPPLIES

(Normative)

C1 Example 1 – Residential 1: Reticulated firefighting water supply

The closest hydrant(s) should be within 135 m of the attendance point. These distances may be measured in a straight line from the Fire and Emergency NZ coupling or fire hydrant to the designated attendance point.

However, where physical barriers are present or anticipated in the site design (for example, streams, vegetation, fencing), alternative measurement methods should be used to reflect realistic hose runs paths to support deployment of hose from the rear locker(s) of the appliance while driving.

Internal building measurements should reflect the practical deployment path of firefighting hose within the building and be within 75 m of any point of the building from the attendance point.

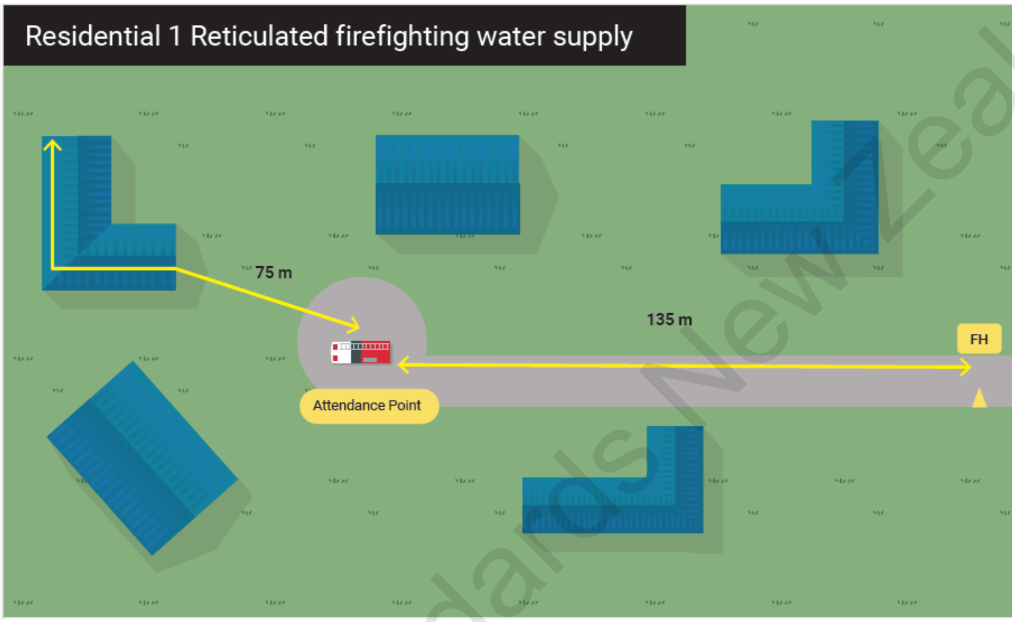


Figure C1 – Residential 1: Example of a reticulated firefighting water supply

C2 Example 2 – Residential 1: Non-reticulated firefighting water supply

Firefighting water supplies should be located within 100 m of the furthest point of the buildings.

Externally, this distance may be measured in a straight line from the FENZ coupling via the designated attendance point to the entrance of the building.

Where physical barriers are present or anticipated in the site design (for example, streams, vegetation, fencing), alternative measurement methods should be used to reflect realistic hose runs. Internally, the measurement should reflect the practical deployment path of firefighting hose within the building.

For fighting fire in structures, volumes are not cumulative, that is, 20,000 L for all non-sprinklered houses within 100 m of a firefighting supply.

Wildfire volumes are cumulative for all houses shown, that is, 50,000 L within 100 m of a fighting supply.

Total volume required for all buildings shown is 50,000 L if wildfire threat is present. If no wildfire threat is present, then 20,000 L is acceptable.

In most rural situations a wildfire risk should be assumed.

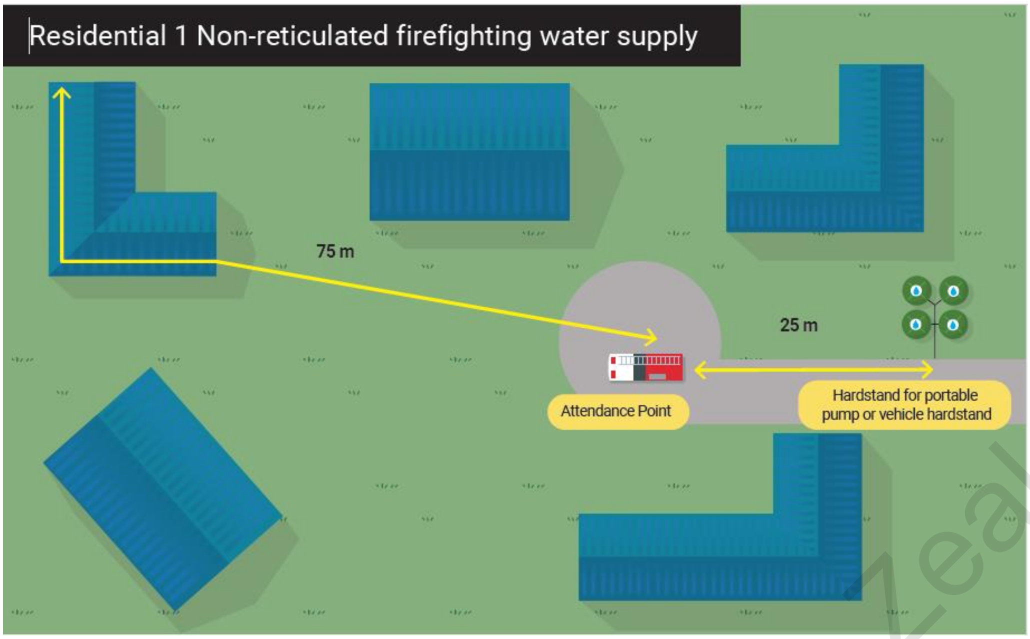


Figure C2 – Residential 1: Example of a non-reticulated firefighting water supply

NOTE – This example shows how a single firefighting water supply could be used for multiple residences and allows for a portable pump to be placed at B to supply water to a fire appliance located at C. The configuration of B and C may be changed within the 100 m requirement by agreement. Water volumes for multiple residential coverage are by agreement with the District Manager. In these instances, wildfire risk is likely to be the primary driver (10,000 L per residence).

C3 Example 3 – Residential 2: Reticulated firefighting water supply

The minimum number of firefighting hydrant(s) required in Table A2 should be located within 135 m of the attendance point.

These distances may be measured in a straight line from the FENZ coupling or fire hydrant to the designated attendance point. However, where physical barriers are present or anticipated in the site design (for example, streams, vegetation, fencing), alternative measurement methods should be used to reflect realistic hose-run paths to support deployment of hose from the rear locker(s) of the appliance while driving.

Internal building measurements should reflect the practical deployment path of firefighting hose within the building and be within 75 m of any point of the building from the attendance point.

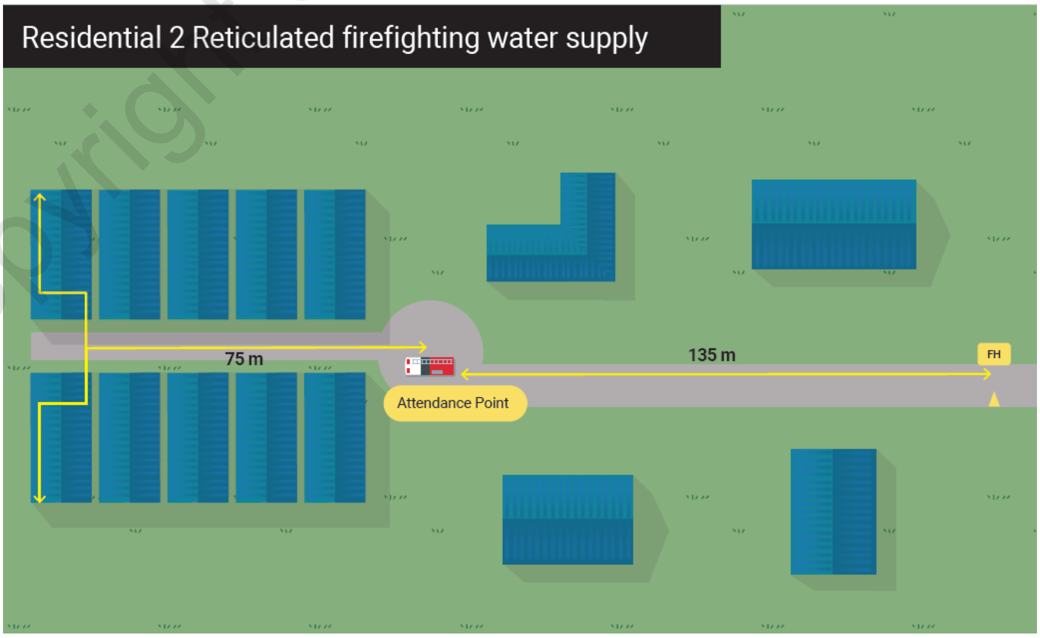


Figure C3 – Residential 2: Example of a reticulated firefighting water supply

C4 Example 4 – Residential 2: Non-reticulated firefighting water supply

Firefighting supplies should be located within 100 m of the furthest point of the building.

Externally, this distance may be measured in a straight line from the FENZ coupling via the designated attendance point to the entrance of the building.

Where physical barriers are present or anticipated in the site design (for example, streams, vegetation, fencing), alternative measurement methods should be used to reflect realistic hose-run paths.

Internally, the measurement should reflect the practical deployment path of firefighting hose within the building.

Additionally, couplings, along with a hardstand or vehicle hardstand to accommodate extra pump connections, may be required to achieve the necessary flow rates. This may depend on available local resources.

For fighting fire in structures, volumes are not cumulative, that is 108,000 L for all non-sprinklered houses within 100 m of a firefighting supply, or 5000 L for sprinkler-protected houses.

Wildfire volumes are cumulative for all houses shown, that is, 120,000 L within 100 m of a fighting supply.

Total volume required for the scenario shown is 120,000 L if wildfire threat is present.

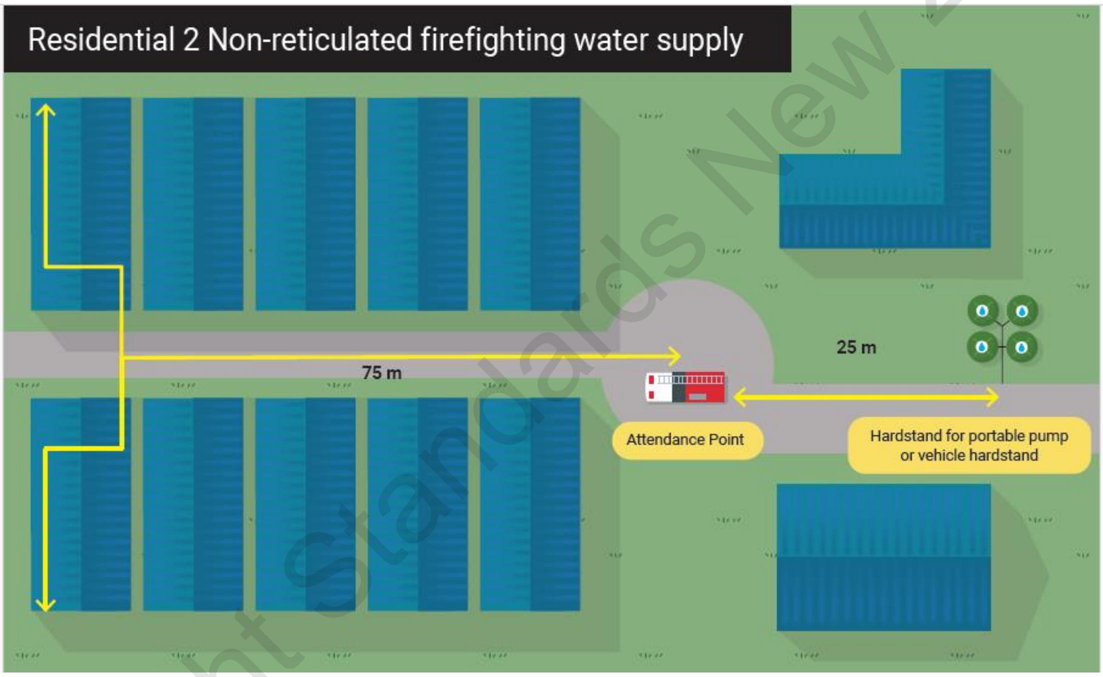


Figure C4 – Residential 2: Example of a non-reticulated firefighting water supply

C5 Example 5 – Commercial 1–4: Reticulated firefighting water supply

The minimum number of firefighting hydrant(s) must be located within 135 m of the attendance point.

Measurement may be taken as a direct line from the firefighting water supply. Where physical barriers are present or anticipated in the site design, orthogonal measurement methods should be applied to reflect realistic hose deployment paths.

Where there are external barriers, such as fences or walls, use an orthogonal measurement method to assess firefighting hose deployment.

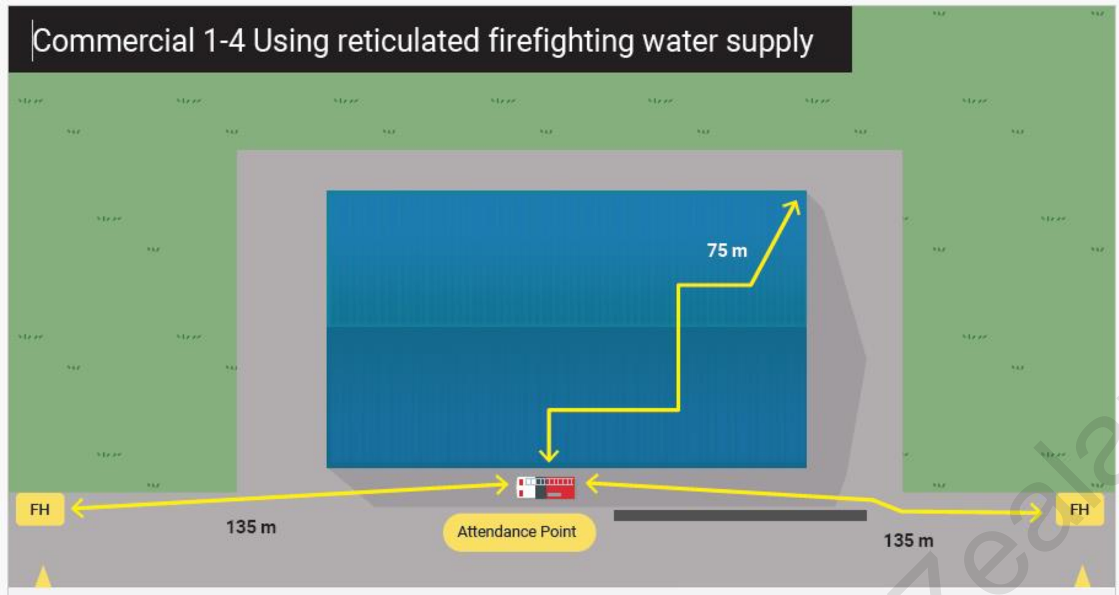


Figure C5 – Commercial 1–4: Example of using a reticulated firefighting water supply

C6 Example 6 – Commercial 1–4: Non-reticulated firefighting water supply

Firefighting water supplies must be located within 90 m of the attendance point. This distance may be measured in a straight line from the FENZ coupling or fire hydrant to the designated attendance point. Where physical barriers are present or anticipated in the site design (for example, streams, vegetation, fencing), alternative measurement methods should be used to reflect realistic hose runs to support deployment of hose from the rear locker(s) of the appliance while driving.

Internally, the measurement should reflect the practical deployment path of firefighting hose within the building and be within 75 m of any point of the building from the attendance point. Refer clause C5 of the Building Code.

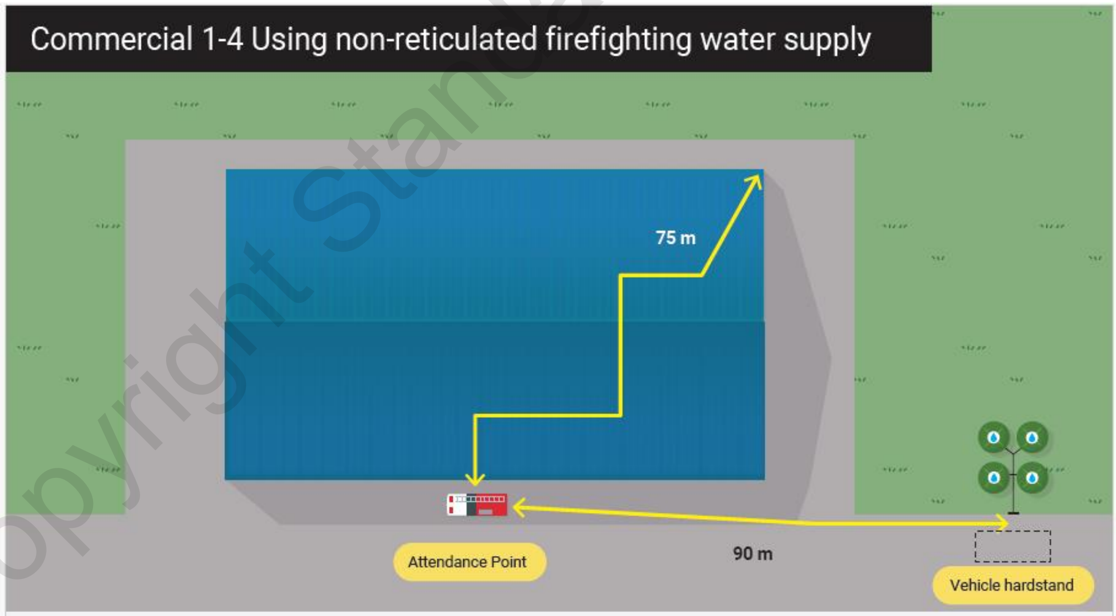


Figure C6 – Commercial 1-4: Example of using a non-reticulated firefighting water supply

NOTE – The placement of inlets for building safety systems should be coordinated with non-reticulated water supply connections and integrated into the overall emergency response strategy to ensure firefighting resources are deployed efficiently.

C7 Example 7 – Commercial 1–4: Reticulated firefighting water supply with supplementary non-reticulated supply

Fire hydrant(s) should be located within 135 m of the attendance point. FENZ couplings for non-reticulated supplementary supplies should be within 90 m of the attendance point.

Where a non-reticulate supply is used to meet the shortfall in flow from a reticulated supply, the Fire and Emergency coupling should be within 90 m of the attendance point.

These distances may be measured in a straight line from the FENZ coupling or fire hydrant to the designated attendance point. However, where physical barriers are present or anticipated in the site design (for example, streams, vegetation, fencing), alternative measurement methods should be used to reflect realistic hose-run paths to support deployment of hose from the rear locker(s) of the appliance while driving.

Internal building measurements should reflect the practical deployment path of firefighting hose within the building and be within 75 m of any point of the building from the attendance point. Refer clause C5 of the NZ Building Code.

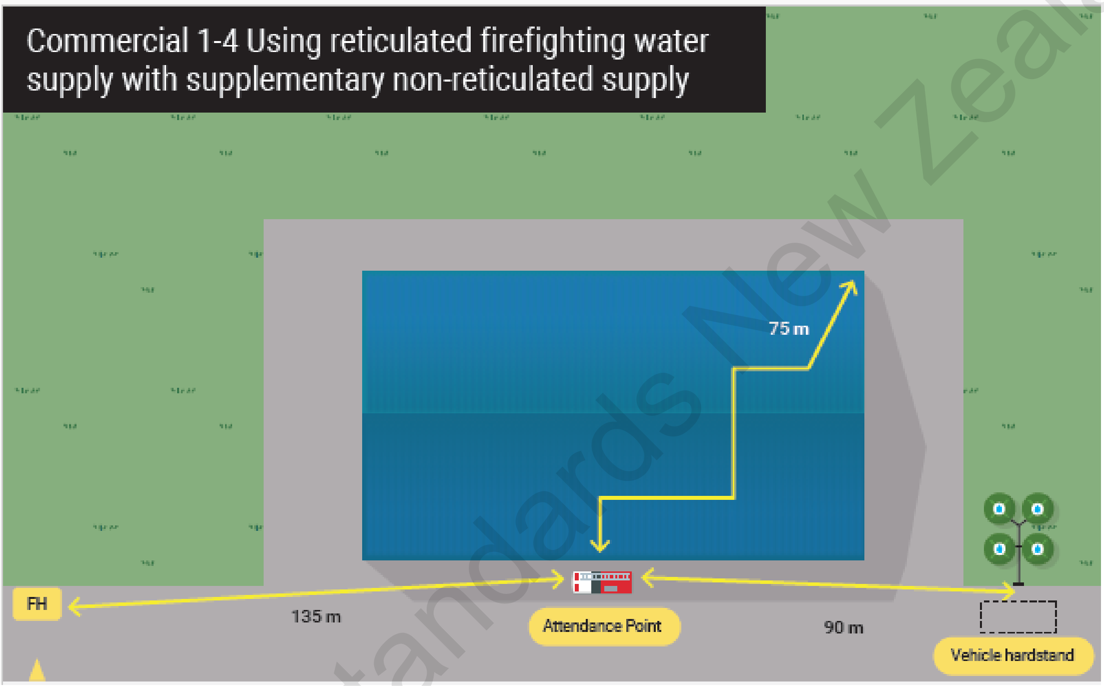


Figure C7 – Commercial 1–4: Example of using a reticulated firefighting water supply with supplementary non-reticulated supply

NOTE – The placement of inlets for building safety systems should be coordinated with non-reticulated water supply connections and integrated into the overall emergency response strategy to ensure firefighting resources are deployed efficiently.

If the reticulated supply can only supply 50% of the flow required, then 50% of the correlating non-reticulate volume should be provided with the appropriate type and number of couplings to provide adequate flows.

Example: Commercial 2, a non-sprinkler-protected building, has only 3000 L/min of the reticulated flow available, or 50%. To meet the shortfall, 270,000 L (50% of 540,000) is provided in tanks using two 100 m couplings placed 10 m apart to accommodate two fire appliances.

APPENDIX D – WATER EXTINGUISHING CAPABILITY

(Normative)

D1 General

This appendix outlines the method of calculating the extinguishing capability of the available water and hence the required firefighting water supply. For information on capped fire size, see Figure 12 – Fire growth curve.

D2 Step 1: Maximum fire heat release

Take value for Q_{max} derived from Section 4.10 – Calculation of maximum fire size.

D3 Step 2: Calculate water flow required for firefighting

The below is used to calculate the water flow required for firefighting:

$$M_{water} = 0.58\, Q_{max}\, (L/s) \quad \text{(Eq. D1)}$$

where

Q_{max}	is the maximum rate of heat release from fire (MW). . . (D4 – Step 3: Calculate exposure protection)
M_{water}	is the water flow rate required for firefighting (L/s)

D4 Step 3: Calculate exposure protection

Additional water is required to protect other structures from a fire in the structure under consideration. This is called exposure protection. It's necessary to calculate exposure protection where any exposed surface on an adjacent structure can be affected by radiation and/or ember transfer.

An exposed surface is defined as any external cladding on an adjacent structure that is combustible or has a combustible coating. An exposed surface should be considered to be affected by radiation where the surface is within the following distances:

(a) 10 m from a fire in a residential building;
(b) 15 m from a fire in a commercial or retail building;
(c) 20 m from a fire in an industrial or storage building.

As these distances have been derived for timber cladding, where plastic cladding and substrates have been used, add another 10 m to the distances derived above.

$$M_{exp} = A_{exp}.\, \phi\, (L/s) \quad \text{(Eq. D2)}$$

where

M_{exp}	is the required water flow rate to protect the exposure (L/s)
A_{exp}	is the surface area of adjacent firecell(s) and/or structure(s) exposed to a firecell involved in fire (m^2)
f	is known as the water wetting rate and = 0.1 ($L/s/m^2$)

D5 Step 4: Calculate total water flow required

The total water flow rate required M_{tot} is therefore

$$\boldsymbol{M_{tot} = M_{water} + M_{exp}(L/s)} \quad \text{(Eq. D3)}$$

$$M_{tot} = (Answer\ from\ Eq. D1 + Answer\ Eq. D2) = Answer\ Eq. D3$$

If the total water demand exceeds 12,000 L/min (200 L/s), use 12,000 L/min as the water flow demand. The following conclusions are reached:

(a) Without additional fire safety features being provided, the fire can readily grow to a size beyond FENZ ability to effectively manage it;
(b) Total loss of the building should be expected irrespective of firefighting intervention;
(c) There is an increased risk of fire spread beyond the building;
(d) The building owner and their designers should also consider the environmental consequences of a fire in the building.

In such cases, the firefighting water is still required. However, building owners should understand that the water is likely to be used to minimise the risk of fire spread rather than to 'protect' the fire-affected structure.

D6 Step 5: Assess the adequacy of the available firefighting water

$M_{measured}$ is the measured flow rate recorded from flow tests conducted in accordance with Section 3.6 Fire hydrants: Specification, location, marking and testing. The total firefighting water available, $M_{available}$, may be sourced from reticulated and/or static supplies. To reflect the difference in accessibility and reliability of different sources of water supply, divide the measured flow rate from the source by the appropriate coefficients from Table D1 to obtain the available water flow, $M_{available}$.

$$M_{available} = M_{measured} / C_1 . C_2 \quad \text{(Eq. D4)}$$

In the case of firefighting water supplies from several different sources, add the individual available supplies together to come up with a cumulative value for $M_{available}$.

Table D1 – Water accessibility coefficient C1

	Reticulated fire hydrants marked	**Static supply, flooded instantaneous coupling**	**Static supply, flooded suction**	**Static supply, no coupling suction**	**Tanker or relay (no supply within 270 m)**
C_1	1	1.15	1.25	1.5	2

Table D2 – Water reliability coefficient C2

	Networked gravity	**Dual system static/pump**	**Pump with emergency back-up**	**Pump with no emergency power backup**
C_2	1	1.1	1.1	1.5

If:	**Then:**
If $M_{tot} > M_{available}$ = Failure	it is necessary to reassess the fire safety features of a structure or improve the water supply
If $M_{tot} < M_{available}$ = Pass	there is a sufficient firefighting water supply

D7 Access to firefighting water

Where the required firefighting water supply is available from fire hydrants, these must be located as given in Table D3. Where firefighting water supply is available from non-reticulated firefighting water supplies, FENZ access to the non-reticulated firefighting water supply must comply with Section 4.9 Non-reticulated firefighting water supplies.

D8 Duration of fire

If the fire duration has not already been determined (for example, via the alternative methodology), the fire duration may be estimated conservatively from

$$T_{fire} = (\Delta H_c . M_{fuel})(H * M)/Q_{max}$$ ……………………………………………………………………(Eq. D5)

where

t_{fire}	is the fire duration (s)
M_{fuel}	is the mass of fuel in the firecell (kg)

This time is used to estimate the firefighting water supply storage volumes.

Table D3 – Water flows from fire hydrants

<table>
<tr><th>Calculated firefighting water supply
L/min (L/s)</th><th>Water flow required in a distance of 135 m L/min (L/s)</th><th>Additional water flow required in a distance of 270 m L/min (L/s)</th><th>Maximum number of fire hydrants to provide flow</th><th>Water storage volume in reservoir and/or from non-reticulated water source (L)</th></tr>
<tr><td>50 (12.5)</td><td>Calculated flow</td><td>Not applicable</td><td>1</td><td rowspan="5">Water flow (Answer from Eq. D3 x fire duration = Answer from Eq. D5)</td></tr>
<tr><td>750–1500
(12.5–25)</td><td>750 (12.5)</td><td>Remainder of flow</td><td>2</td></tr>
<tr><td>1560–3000
(26–50)</td><td>1500 (25)</td><td>Remainder of flow</td><td>2</td></tr>
<tr><td>3060–6000
(51–100)</td><td>Half of calculated flow</td><td>Half of calculated flow</td><td>4</td></tr>
<tr><td>6000–12,000
(101–200)</td><td>Half of calculated flow</td><td>Half of calculated flow</td><td>8</td></tr>
</table>