Guide To Fire Sprinkler System
Water Saving
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1 EXECUTIVE SUMMARY

Victoria has thousands of fire sprinkler systems, they are a highly valuable part of the state’s fire protection framework and their operational readiness needs to be maintained.

Most of this maintenance occurs through periodic testing of the key components of the systems, such as alarms, pumps and water supply. The operational readiness of fire sprinklers also needs to be retained as much as possible when the systems are affected by building renovations, such as changes in the fitouts of offices or shops.

Current industry practices for maintaining fire sprinkler systems consume water though, and often more water is being used than is necessary or preferable. An estimated 500 million litres\(^1\) of drinking water is presently being discharged to drains annually in Victoria as a result of the procedures and equipment used for maintaining fire sprinkler systems.

The extent to which this consumption can be reduced depends ultimately on the amount of effort and funding committed to pursuing water-saving measures, but case studies have shown that a high proportion of the consumption can be cut through feasible and affordable methods. Accordingly, a saving of 450 million litres per year has been set as a target for this water conservation initiative.

This *Guide to fire sprinkler system water saving* is focussed on identifying the opportunities for cutting the amount of water used in maintaining fire sprinkler systems and the steps needed to adopt these opportunities. The information in the Guide is part of a larger multi-faceted project aimed at showing a path forward for the sprinklers water conservation and encouraging property owners and fire services firms to adopt the recommended water saving measures. The project has been funded primarily by City West Water, South East Water, Yarra Valley Water and the Department of Sustainability and Environment. The Plumbing Industry Commission is leading the project and the Building Commission is contributing technical and communications support\(^2\).

This Guide does not attempt to be fully exhaustive in identifying the opportunities for water saving; rather it concentrates on widely available opportunities that offer the best return for an

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\(^1\) This estimate draws on measurements and modelling carried out by the project team responsible for this Guide. It assumes Victoria has 500 to 750 large properties (high rise office and residential buildings, shopping centres and large industrial sites) consuming about 750,000 to one million litres per year on average to maintain their pump-boosted fire sprinkler systems. Fire sprinkler consumption varies widely per installation and is much higher than the average at some properties. One case study shopping centre site was consuming 7 million litres per year solely as a result of the weekly-testing component of its maintenance regime. Other fire sprinkler installations consume much less than the estimated average. There is no consolidated database allowing identification of the number and types of Victoria’s fire sprinkler systems, but an estimate of the number of pump-boosted, potentially high consumption fire sprinkler sites was developed with the cooperation of the fire services maintenance industry.

\(^2\) Other stakeholder organisations taking part in the project working group are the Fire Protection Association Australia, National Fire Industry Association, Communications Electrical & Plumbing Union and the Australian Institute of Building Surveyors.
affordable investment. All the opportunities adhere to the fundamental principle that water-saving changes must not compromise the effectiveness of fire protection for Victoria’s buildings.

The opportunities are measures for existing versus new buildings, because the main potential for water saving lies with the existing building stock. Most, if not all, new Victorian buildings with large sprinkler systems are now being designed to minimise consumption (discharge to drain) of fire sprinkler water for maintenance purposes.

The water saving opportunities vary depending on whether the consumption is occurring as a result of periodic testing regimes or as a result of draindowns and recharging of the systems during building renovations.

1.1 OPPORTUNITIES FOR WATER CONSERVATION

The fire sprinklers water conservation project team has identified seven main opportunities for reducing water consumption for the purpose of maintaining large pump-boosted fire sprinkler systems supplied by town mains:

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The solutions for fire sprinkler water saving need to be decided on an individual site by site basis. Some of the solutions preclude adopting other options and costs and benefits will vary

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3 See www.pic.vic.gov.au - PlumbSmarter - Fire Sprinklers water - for further discussion of these opportunities and other more specialised or higher cost options. The online Guide and related materials will be upgraded over time.

4 See www.pic.vic.gov.au for further discussion of fire sprinkler water conservation in new buildings.

5 The principal technical contractor in the project team was Integrated Fire Services Pty Ltd.

6 Initial investigations showed that the benefit-cost ratios of measures to conserve water use by large pump-boosted systems were much higher than measures for smaller systems without pump boosting. Large pump-boosted systems account for a high proportion of the total maintenance consumption of water by fire sprinkler systems in general.

greatly across different properties. The case study investigations leading to this Guide showed clearly that there is no one-size-fits-all solution.

### 1.2 OPPORTUNITY 1: PRESSURE SETTING ADJUSTMENT PROJECTS

Pressure setting adjustment (PSA) projects are a low cost and quickly achievable method for reducing ongoing water consumption by fire sprinkler systems at most pump-boosted installations.

PSA projects will typically include:

- increasing the pressure relief valve operating pressure to reduce the amount of water discharging to drain during testing
- increasing pressure reducing relief valve pressure in diesel pump raw water heat exchanger lines to reduce cooling water flow to drain
- in multi-pump installations, adjusting pump start pressure switches to ensure multiple pumps do not operate simultaneously during testing
- provision of a pressure gauge schedule.

The last item listed, providing a pressure gauge schedule, does not directly contribute to water saving but should be included as a risk management measure.

Most major fire service maintenance firms should be able to handle a PSA project at the request of a facility manager or property owner, with contributions as needed from specialist fire engineering resources. Excluding the time needed to gather information and produce the pressure gauge schedule for the site, these projects will typically require only about a day's labour time.

Proper adjustment of pressure settings can be regarded as simply being good practice for fire sprinkler system maintenance, but the projects, particularly the pressure setting analysis requirements, do require expertise and time beyond the scope of everyday fire sprinkler testing practices. The projects are likely to entail an additional charge by the site's fire system maintenance firm and/or a fire services engineering firm. The total cost should be low, say in the $1,000 to $4,000 range.

Of the estimated 500 to 750 target Victorian properties with large pump-boosted fire sprinkler systems, industry participants suggest that about half will be able to gain a substantial water saving through a PSA project, and that up to 90% will at least benefit by reducing use of cooling water in diesel pump raw water heat exchangers.

See [www.pic.vic.gov.au](http://www.pic.vic.gov.au) for copies of the case study reports and presentation summarising the findings and recommendations. The case study properties were a sample of high-rise buildings, shopping centres, large manufacturing sites and hospitals. Many properties with fire sprinkler systems do not have significant and affordable opportunities for water saving changes, such as most of the properties in which the systems are not pump-boosted. Some of the case study reports (such as the report for a small hospital property) did not recommend making changes.
Identification of properties with a high likelihood of water saving through a PSA project is possible through:

- onsite knowledge of facility managers
- major fire sprinkler maintenance firms
- the water authorities' WaterMap® programs and business account managers.

Accurately estimating the volume of water saving at a particular sprinkler installation will often not be possible prior to carrying out a PSA project, or at least not without incurring additional cost for a prior project specifically to measure water consumption (such as by use of an ultrasonic flowmeter).

At one case study site, water consumed during weekly testing\textsuperscript{10} was reduced by six million litres per year - an 85\% reduction - through a PSA project requiring basically a day's work by a fire services technician assisted by a specialist engineer\textsuperscript{11}.

This very high level of water saving at a particular property is not expected to be typical of most properties, either in volume or proportion\textsuperscript{12} of saving, but there is a high likelihood of substantial savings at many sites.

The fire sprinkler maintenance firm for a site may be able to give a sufficiently accurate estimate of water consumption before and after a PSA project, drawing on the firm's knowledge of flow rates, testing times, etc. at an installation and the models and estimates provided in this Guide. Alternatively, an ultrasonic flowmeter can provide a reliable one-off measurement if expertly used, or a permanent meter can be installed.

Over the course of the fire sprinklers water conservation project to date, leading commercial property owners and facility managers have shown a willingness to adopt fire sprinkler water saving measures as a matter of community responsibility in a time of ongoing drought, at least where a reasonable benefit-cost case can be made (and despite the lack of direct financial incentive).

Water retailers may be willing to support property owners and facility managers who decide to pursue PSA projects, as part of their efforts to improve efficiency of water use by Victoria's

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\textsuperscript{9}Victorian properties consuming more than 10 million litres per year are required to submit a 'WaterMap' to their water retailer, identifying major types of water use and plans for water efficiency gains. About 1,500 properties are engaged in the WaterMap programs to date. A number of these properties are expected to have pump-boosted fire sprinkler systems with high levels of water consumption, but this assumption needs to be confirmed through further investigation.

\textsuperscript{10}Measured with use of an ultrasonic flowmeter

\textsuperscript{11}The project also included provision of a pressure gauge schedule and an interface diagram for the installation.

\textsuperscript{12}At other case study sites with pressure relief valves, the estimated proportionate saving was between 30\% and 70\% of weekly testing water use.
business community.\textsuperscript{13}

If a PSA project costs $2,000 and produces a 500,000 litres per year saving over a 15 year life of a fire sprinkler installation, the cost per kilolitre is 27 cents, which is attractive compared to other demand management options available to commercial property owners and supported by water authorities. The fire sprinklers case study program suggests strongly that this type of benefit-cost outcome will be possible for many properties through a PSA project.

The typical project management steps for a property owner or facility manager to carry out a PSA project are summarised below.

1. obtain advice from a fire services firm or other informed source about the likelihood of substantial water saving at the property through a PSA project
2. estimate the current water consumption as a result of weekly testing, assuming this information is required for decision-making and project evaluation
3. obtain the site fire sprinkler system information needed to produce a pressure gauge schedule for the sprinkler installation
4. request that fire services maintenance and/or engineering personnel develop a plan, and provide a quote if required, to carry out this project
5. carry out the analysis and adjustment of the pressure settings onsite
6. provide pressure gauge schedules
7. estimate subsequent water consumption, if required for project evaluation

Detailed advice about carrying out these steps is provided in the body of the Guide.

1.3 OPPORTUNITY 2: AS1851-2005 AND MONTHLY TESTING

To date, most of the discussion about fire sprinkler water conservation in the fire services industry and in the broader community has focussed on obtaining widespread adoption of AS1851-2005 as the maintenance regime and switching now-weekly testing to monthly within this new maintenance framework.

The AS1851-2005 approach can be expected to cut weekly-testing consumption by 75% and total periodic testing consumption by over 50%. Compared to the prior suite of maintenance regimes, AS1851-2005 is more rigorous, comprehensive and cohesive as the basis for fire services maintenance at a property.

\textsuperscript{13} Cutting fire sprinkler water consumption will also reduce so-called ‘unaccounted-for’ supply by retailers. Melbourne’s three water retailers purchase the water supplied to fire services from Melbourne Water but the services are typically not metered in the existing building stock, and the retailers normally receive no revenue from water consumption by fire services. Cutting fire services water use will have the advantage of reducing retailers’ cost of providing this supply.
The potential increase in risk as a result of reducing the frequency of testing is counter-balanced in AS1851-2005 by increasing other safeguards compared to prior fire service maintenance Standards.

In other words, the additional security measures and rigor in AS1851-2005 are regarded as equipment prerequisites to adoption of monthly testing, if Victoria is to ensure that its current level of fire protection is not compromised.

In principle, this option for fire sprinklers water conservation is attractive for property owners and facility managers because:

- weekly testing regimes are pervasive across Victoria’s pump-boosted fire sprinkler systems, so a switch to monthly testing is likely to be a relevant water conservation option at most sites, whereas some other options (such as tanks) will often not be feasible
- this option holds the prospect of cutting weekly-testing water consumption by 75%, and overall sprinklers periodic maintenance water consumption by about 50%, without needing to find the money or space for major hardware changes in the sprinkler installation
- it entails adoption of a more rigorous, comprehensive and cohesive Australian Standard as the basis for fire services maintenance at the property, which has clear value in itself irrespective of water-saving implications
- the rigor, water-saving and other advantages of switching to AS1851-2005 and monthly testing can probably be obtained without incurring higher costs for the ongoing maintenance contract at a property – although there are differing views on this point.

For some properties with pump-boosted fire sprinkler systems these reasons will be compelling and there will be few, if any, barriers to pursuing this option. The AS1851-2005 path to fire sprinkler water conservation should be simple and low cost where:

- the sprinkler system’s equipment already complies with the equipment prerequisites for adoption of monthly testing stated in AS1851-2005
- a pressure gauge schedule and interface matrix diagram are provided
- the property is not subject to a regulatory mandate or insurance policy conditions

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14 Some fire services maintenance firms believe that ongoing costs may typically be higher for an AS1851-2005 monthly testing maintenance regime, because of the annual survey and other components. Detailed analysis of the stated requirements in AS1851-2005 versus those in prior commonly used Standards indicates that the cost should not be higher – if the current maintenance contracts are actually complying with the earlier Standards. Appendix B provides this detailed cross-comparison. At present though, maintenance contracts do not necessarily take into account all of the regulatory and Standard requirements. Consequently the cost of a new maintenance contract based on AS1851-2005 and monthly testing regime may be higher, but because the maintenance is fully in accord with the Standard and regulatory requirements rather than because AS1851-2005 is inherently more expensive.

15 The most likely type of regulatory mandate is an occupancy permit or a maintenance determination requiring adherence to one or more specific Australian Standards for maintenance of the building's essential safety measures. Other, less common, regulatory mandates could also apply: Alternative Solutions under the Building Code Australia; fire brigade requirements under Section 309 of the Victorian Building Regulations; building determinations by the Building Appeals Board; or special requirements under occupational health and safety or dangerous goods legislation.
requiring compliance with pre-2005 Australian Standard or other type of standard with respect to maintenance of its fire sprinklers (typically because the property was developed prior to July 1994\textsuperscript{16}) and building records are available that can prove this status.

- the property owner and the fire services maintenance firm for the property are able to agree on a contract based on AS1851-2005 and monthly testing.

The second criterion, mainly concerning regulatory mandates specifying pre-2005 Australian Standards for essential services, is potentially the most significant hurdle, but the case studies and associated investigation have shown that a high proportion of Victoria’s properties with pump-boosted fire sprinkler systems were developed before 1994 and are not subject to this possible difficulty.

Where these four criteria are believed to be met, the main project steps to switch to AS1851-2005 and monthly testing are straightforward:

1. estimate the volume of water presently being consumed as a result of fire sprinklers maintenance, assuming this information is wanted for decision-making or project evaluation - see section 6.3.1 in the Guide
2. investigate to confirm that the equipment prerequisites for monthly testing and requirements for AS 1851-2005 are in fact in place – see section 6.3.2 in the Guide
3. investigate to confirm there are no regulatory mandates or insurance company requirements that need to be addressed before AS1851-2005 and monthly testing can be adopted – see section 6.3.3 in the Guide
4. obtain a proposal from one or more firms to provide fire sprinkler maintenance services based on AS1851-2005 and monthly testing
5. agree on a contract and carry out maintenance accordingly
6. estimate the water saving, assuming this data is wanted for project evaluation.

As with PSA projects, detailed advice about performing these steps is given in the body of this Guide.

If one or more of the four conditions allowing straightforward adoption of AS1851-2005 are not in place, further steps will be required, as discussed below.

\textsuperscript{16} Pre-1994 properties will not have an occupancy permit or maintenance determination specifying adherence to a particular maintenance standard for its essential service measures unless they have subsequently been altered.
1.3.1 SHORTFALL IN EQUIPMENT

According to industry participants, most Victoria buildings with pump-boosted sprinkler systems already have all or most the equipment prerequisites\(^{17}\), with the exception of the requirement in AS1851-2005 for “low level fuel monitoring incorporating local aural and visual alarms at the pump controller”\(^{18}\). The pump standard mandated this equipment from 2002 onwards, but this fuel monitoring prerequisite from monthly testing will apply to all or most diesel powered pumps installed prior to 2002.

The cost of low fuel level alarms incorporating an aural alarm and a visual alarm can vary widely but a range between $3,000 and $8,000 is estimated. This costing includes installation, a Building Permit and professional advice.

If dual starting batteries and low charging voltage alarms (other key prerequisites) also need to be installed at a site, the combined package including low fuel monitoring is estimated to cost between $8,000 and $15,000.

The equipment prerequisites for monthly testing state in AS 1851-2005 are best practice for fire protection systems. Property owners may choose to address shortfalls compared to the new Standard irrespective of water saving aims.

1.3.2 NEED TO CHANGE REGULATORY MANDATES

If a regulatory mandate is a hurdle, the road to AS1851-2005 and monthly testing may be much more time consuming and expensive, although not necessarily.

Buildings constructed or altered since July 1994 will have been issued with an occupancy permit or maintenance determination specifying the mandated essential safety measures. Apart from very recent buildings developed since AS1851-2005 was issued and took effect in building projects, the essential safety measures will require adherence to a pre-2005 Standard for fire sprinkler system maintenance.

In this circumstance, in order to switch to AS1851-2005, the current occupancy permit or maintenance determination will need to be either:

- amended by a municipal building surveyor (the Building Act specifies that only a municipal – not private sector - building surveyor is able to perform this amendment), or
- superseded through new building works and associated building permit and occupancy permit applying to the building's fire sprinkler installation overall.

\(^{17}\)Unlike some other jurisdictions, Victoria has had long standing requirements concerning monitoring of fire sprinkler systems, which is one of the major prerequisites.

\(^{18}\)Amendment No.2 to AS 1851-2005 Maintenance of fire protection systems and equipment, Standards Australia, may 2008 Clause 2.2.2.3 ©.
1.3.2.1 AMENDMENT OF OCCUPANCY PERMITS

Key fire industry participants believe that the process of obtaining an amended occupancy permit from a municipal building surveyor (MBS) will be a major barrier to switching to AS1851-2005 and monthly testing. There is concern that an MBS will require a full investigation into all related aspects of the building’s essential service measures, and that these investigations will uncover shortfalls in regulatory compliance.

The investigations and submissions required to obtain an amendment may be expensive in themselves, but more critically they may lead to much more expensive requirements to upgrade a building’s fire services.

This Guide and the assessment report case examples are intended to supply a methodology for developing the information likely to be requested by an MBS. The assessment reports developed for the case study properties should be able to produce nearly all of the information wanted by an MBS to amend an occupancy permit allowing switching to AS1851-2005 and monthly testing.

Now that this methodology has been generated and made available publicly, the cost to carry out an investigation sufficient for amending an occupancy permit should be lower. The project team estimates that such investigation projects typically should be able to be completed for around $12,000. The cost will vary widely depending on factors such as the scale and complexity of the property’s essential service measures and the availability of records for the building.

The reports developed through the fire sprinklers case studies program generally include switching to AS1851-2005 and monthly testing as a preferred option in their recommendations. At least some of the case studies along with other properties are expected to pursue adoption of AS1851-2005 and monthly testing over the course of the next several months, and monitoring of these cases will provide further information about typical costs and implementation requirements.

These fears about an occupancy permit amendment process involving MBS approval may be exaggerated. The City of Melbourne has committed to facilitating applications to amend occupancy permits for water saving purposes. This in-principle commitment has not yet been tested in practice, but should be taken at face value. To our knowledge, no or very few occupancy permits have been amended by Victorian municipal building surveyors to allow a change to AS1851-2005 and monthly testing. Consequently case study evidence on whether or not the amendment process will be high or unsurmountable is not yet available.

The continuing uncertainty about this matter is one reason why pressure setting adjustment projects are being pursued as a first wave of water-saving projects in this fire sprinkler water conservation initiative, and why other types of sprinkler water saving measures also appear preferable to the AS1851-2005 option where
amendment of an occupancy permit is a necessary step.

1.3.2.2 NEW BUILDING PERMIT AND OCCUPANCY PERMIT

Instead of amending a current occupancy permit or maintenance determination, it may be possible and preferable to supersede the current regulatory mandate through a new building permit and a consequent new occupancy permit or maintenance determination.

Building works affecting an essential safety measure will require a building permit. While needed changes in fire sprinkler system components to meet the AS1851-2005 prerequisites for monthly testing are expected to be minor in most of the target properties, any works of this kind are likely to trigger a building permit requirement. In some cases, adoption of AS1851-2005 and monthly testing may be accompanied by other water-saving initiatives requiring a building permit, such as building works to achieve recycling of testing water or better zoning of draindowns.

Potentially, a new occupancy permit or maintenance arising from new building works could change the mandated maintenance regime to AS1851-2005.

In contrast to amendment of an occupancy permit, a new building permit and resulting specification concerning maintenance can be issued by a private sector building surveyor as well as a municipal building surveyor. Most of the sites with pump-boosted sprinkler systems are large commercial sector properties and often the owner or facility manager will have an ongoing working relationship with a building surveying firm. Surveyors in these firms will already be familiar with the sites, indeed they may have issued the current regulatory mandates, and this knowledge will facilitate gaining a building permit and a change in the maintenance regime.

This approach to changing from a pre-2005 Standard has a clear limitation though. The building permit will be specific to the works (such as installation of a new jacking pump) and an accompanying mandate about the maintenance regime will normally also be specific to the works. There may not be an opportunity to nominate a different maintenance standard for the sprinkler system as a whole.

Still, the relevant building surveyor for the permit will have discretion allowing nomination of AS1851-2005 in a number of circumstances involving approvals of changes to existing fire sprinkler systems. For example, this power may be exercised where an existing approval affecting the whole sprinkler system needs to be re-issued.
1.3.3 UNWILLINGNESS TO CONSIDER NEW CONTRACT

Properties with pump-boosted fire sprinkler systems may be unwilling to consider negotiating a new AS1851-2005 fire services maintenance contract, at least in the short to medium term, for reasons such as:

- some requirements in AS1851-2005 – requirements not directly related to testing or water saving may be seen as too onerous or unjustifiable
- the cost of adopting the Standard is seen as too high, either because it is more demanding or because components in the Standard are regarded as not justified.

Components of AS1851-2005 not directly related to testing practices and water consumption may well be an insurmountable barrier for a number of properties and owners will need to pursue other avenues for fire sprinklers water conservation. The difficulties and costs some properties would face in fully complying with AS1851-2005 are two of the reasons why legislation to mandate monthly testing for the existing building stock has not been pursued to date.

Nevertheless there may be a path forward even in these circumstances.

A building surveyor has discretion to mandate compliance with some parts of AS1851-2005 and not others. In principle, a building surveyor could nominate compliance with all of the parts of AS1851-2005 intended to ensure that lesser frequency of testing will not compromise levels of fire protection, but not include compliance with other AS1851-2005 parts that are a barrier. These other areas could continue to be covered by prior versions of AS1851-2005.

As noted earlier there are differing views about the impact of AS1851-2005 and monthly testing on market-typical pricing of fire services maintenance contracts. A common view among fire services industry participants is that more complex properties may incur higher prices but that simpler properties will have lower prices. In complex properties, the stronger rigor of the Standard brings higher time demands. In simpler properties, the savings from a lower frequency of testing visits are expected to more than offset the requirements in the Standard that increase costs.

A detailed line-by-line cross comparison of AS1851-2005 time demands with earlier, commonly used Standards, produced as part of the fire sprinklers water conservation project...
project\textsuperscript{20}, indicates that the costs should be lower. The marketplace will ultimately decide whether or not cost is a barrier, but to date the takeup of AS1851-2005 has been too low to provide case study evidence on this question.

In summary, AS1851-2005 and monthly testing is an attractive option because of its wide applicability. In circumstances where the four criteria for a simple adoption are in place, this option should be at least investigated and should probably be pursued. Where existing regulatory mandates or major cost barriers stand in the way, this option may be more expensive and, especially, will be more time consuming compared to pressure setting adjustment projects and other water saving measures for sprinkler systems.

1.4 OPPORTUNITY 3: PRESSURE REDUCING PROJECTS

Reducing pressures from pumps that over pressurise can bring large reductions in the volume of water consumed by weekly testing of fire sprinkler systems.

One of the fire sprinkler project case study sites (a high rise residential tower) is estimated to be consuming 2.3 million litres per year through weekly sprinkler system testing, and approximately 1.7 million litres per year (74\%) can be saved through a pressure reducing (PR) project.

In another case study site (a large office-retail complex), its 3.1 million litres per year consumption for weekly testing can be cut by 2.2 million (71\%) by reducing pump pressures.

In some fire sprinkler installations, reducing pressures is a more certain path to producing a proportionately higher water saving in comparison to PSA projects. The project cost can be substantially higher but has a wide range from several thousand dollars for reducing diesel engine speeds to up to $50,000 range for installation of two pressure reducing valves.

If a PSA project is carried out and does not produce a proportionately high saving (say 25\% versus 75\%), a PR project may be justified at properties consuming high volumes of water for weekly sprinkler testing.

The project management steps needed to carry out a PR project are basically the same as those for a pressure setting adjustment project:

\textsuperscript{20}See \url{www.pic.vic.gov.au}
1. obtain advice from fire services firm or other informed source about the likelihood of substantial water saving through a PR project and consider:
   • engine speed reduction
   • pump impeller diameter reduction
   • installation of pressure reducing valves
2. obtain estimate or measure of current water use through weekly testing, assuming required for decision-making and evaluation
3. arrange for fire services maintenance firm and/or fire services engineering firm to review project requirements and provide a quote
4. carry out the modifications or new works
5. estimate or measure subsequent water consumption.

Again, detailed advice about these steps is in the body of the Guide.

1.5 OPPORTUNITY 4: RE-CIRCULATION PROJECT

Water needed for periodically testing the operational readiness of a fire sprinkler system can be drawn from a tank and recirculated during the test. Incorporating a tank and recirculation will be particularly effective when there are pressure relief valves in pumping systems and they discharge directly into drains.

The cost of a tank and other components of a recirculation system for fire sprinkler water will vary widely depending on circumstances. The project team estimates that installing a 10,000 litre recirculation tank with connections to the system will cost between $40,000 and $60,000.

1.6 OPPORTUNITY 5: CAPTURE AND REUSE WATER PROJECT

The water used in periodic testing of fire sprinkler systems cannot be treated as drinking water quality but it can be valuably re-used as a water supply for other purposes.

Potential uses include; toilets and other sanitary fittings; urban irrigation; cooling towers; car washing and carpark cleaning.

Recycling of fire sprinkler water can become part of a large water capture and re-use system for the property, which may also incorporate water supply from rainwater, stormwater or greywater.

In buildings in which there are frequent new fitouts or renovations requiring draindown and recharging of the water in fire sprinkler pipes, consumption can be cut greatly by capturing draindown water in a tank and then drawing on this water for recharging the system.

The quality of this water will often be poor, but this is not a barrier for use in recharging. The normal procedure of discharging draindown water into drains may be significantly adding to
pollution of the environment, although this possible issue has not been researched to our knowledge.

The project team did not develop an estimate of typical costs in this instance because individual site circumstances will vary so widely. As noted above, a 10,000 litre tank connected to the sprinkler system is expected to cost $40,000 to $60,000.

Where fire sprinkler water is re-used for purposes that would otherwise have drawn on mains-supplied water, the property owner will gain a financial benefit from this option. The payback period for retrospectively installing fire sprinkler water recycling in an existing building is likely to be long though, because of the low price of water.

If a site is able to draw on two million litres per year of fire sprinkler water as a substitute for mains-supplied water, the water cost saving will be about $4,000 per year assuming the cost per thousand litres reaches $2 for commercial properties over the next few years.

In any case, these types of projects will be motivated by a wish to demonstrate responsibility concerning use of the community’s water resources rather than by a narrow accounting viewpoint.

1.7 OPPORTUNITY 6: IMPROVED DRAINDOWN ZONING

Fire sprinkler water consumption can be cut through improved draindown zoning, with the options for change including:

- providing subsidiary isolation valves on each floor of a high rise building
- providing check valves and drains to zone sprinkler installations in horizontal buildings
- reviewing installations to limit zones to less than 3,000 m$^2$.

The Building Code Australia allows up to 9,000m$^2$ of fire sprinkler pipework per isolation valve. This network of pipe will typically contain about 9,000 litres, varying by type of installation. While not a large amount of water, consumption becomes high in types of properties where singular multiple zones are frequently drained and refilled.

Draindown consumption is a significant water saving opportunity for large to medium shopping centres, including centres that do not have pump-boosted systems, and for high rise office building renovation projects. Many shopping centres have a high ongoing rate of draindowns usage because:

- the buildings are subject to frequent change, because of changes in tenancies and because existing tenants renovate their fitouts
- the sizes of sprinkler systems zones are often large
• the level of risk requires recharging of the systems whenever possible
• the multiple steps within a fitout project can each trigger the need for a draindown
• even where the provision of isolation valves would allow a relatively small consumption of water in a draindown, in practice contractors often do not always fully utilise the valves and routinely drain down multiple zones.

As a rough approximation, carrying out a fitout in a single shop is likely to require two draindowns on average, consuming about 6,000 litres per draindown (assuming a 6,000m² draindown of typical pipework).

If a medium to large shopping centre has 50 fitouts per year, the annual draindown consumption will be 600,000 litres, or 15 million litres over a 25 year lifecycle for the building.

1.8 OPPORTUNITY 7: FIRE SPRINKLER DRAINDOWN MANAGEMENT

If zoning is not provided, better draindown management will be an effective tool in reducing water consumption at properties subject to frequent draindowns.

Building types that have frequent draindowns include large shopping centres and high rise buildings undergoing refurbishment.

The water saving recommendations here are straightforward:

• wherever a fire sprinkler installation has adequate provision of isolation valves, the management of the shopping centre should ensure that all draindowns fully utilise the valves to minimize water consumption
• contractors should be required to provide a draindown plan for approval by the facility manager
• alternative measures should be considered before requiring a draindown.

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21 Other parts of the building still operational, large number of building occupants, etc.
2 INTRODUCTION

Victoria has thousands of fire sprinkler systems, they are a highly valuable part of the state's fire protection framework and their operational readiness needs to be maintained.

Most of this maintenance occurs through periodic testing of the key components of the systems, such as alarms, pumps and water supply. The operational readiness of fire sprinklers also needs to be retained as much as possible when the systems are affected by building renovations, such as changes in the fitouts of offices or shops.

Current industry practices for maintaining fire sprinkler systems consume water though, and often more water is being used than is necessary or preferable. An estimated 500 million litres\(^{22}\) of drinking water is presently being discharged to drains annually in Victoria as a result of the procedures and equipment used for maintaining fire sprinkler systems.

The extent to which this consumption can be reduced depends ultimately on the amount of effort and funding committed to pursuing water-saving measures, but case studies have shown that a high proportion of the consumption can be cut through feasible and affordable methods. Accordingly, a saving of 450 million litres per year has been set as a target for this water conservation initiative.

2.1 PROJECT BACKGROUND

This Guide is part of a Victorian Government initiative project looking at water conservation in the maintenance and testing of fire sprinkler systems. The project, led by the Plumbing Industry Commission, is funded and supported by:

- City West Water
- South East Water
- Yarra Valley Water
- Department of Sustainability and Environment
- Building Commission.

\(^{22}\)This estimate draws on measurements and modelling carried out by the project team responsible for this Guide. It assumes Victoria has 500 to 750 large properties (high rise office and residential buildings, shopping centres and large industrial sites) consuming about 750,000 to one million litres per year on average to maintain their pump-boosted fire sprinkler systems. Fire sprinkler consumption varies widely per installation and is much higher than the average at some properties. One case study shopping centre site was consuming 7 million litres per year solely as a result of the weekly-testing component of its maintenance regime. Other fire sprinkler installations consume much less than the estimated average. There is no consolidated database allowing identification of the number and types of Victoria's fire sprinkler systems, but an estimate of the number of pump-boosted, potentially high consumption fire sprinkler sites was developed with the cooperation of the fire services maintenance industry.
The project is derived from initiatives by the fire industry and its stakeholders, including leading fire services maintenance firms, industry associations and the Victorian plumbers union, which represents sprinkler fitters. Leaders in the property and facility management industries have also supported this important water-saving initiative, as a matter of corporate social responsibility.

In addition to the funding organisations, the working group for the project include representatives from:

- Fire Protection Association Australia
- National Fire Industry Association
- Communication, Electrical and Plumbing Union
- Australian Institute of Building Surveyors.

The project includes a demonstration program, comprising of 15 case studies that demonstrate methods for reducing water consumption through periodic maintenance and alteration of fire sprinkler systems, and includes the benefits and associated costs of these methods.

The case study sites are spread across three water retailers regions in Melbourne and include properties ranging from high rise office buildings to shopping centres and major factories. Nearly all of the chosen sites have pump-boosted sprinkler systems with multiple control valves and do not employ the use of tanks or other methods for re-using or re-circulating the water used in maintaining and altering their sprinkler systems. These sites were chosen primarily because they offer the best opportunity for reducing the estimated 500 million litres of water that is consumed annually through fire sprinkler maintenance and system alteration. The case studies are presented as the following:

- A - High rise office 1
- B - High rise office 2
- C - High rise office 3
- D - High rise hotel
- E - High rise residential
- F - Shopping centre - large
- G - Shopping centre - medium
- H - Shopping centre - small
- I - Manufacturing - paper
- J - Manufacturing - printing
- K - Manufacturing - food products
- L - Manufacturing - Automotive
- M - Large office / retail
- N - Small hospital
This Guide has been produced based on the findings from case studies, research, expertise of the consultants working on the project and feedback from working groups and other relevant parties.

Standards Australia have also recently published a handbook (HB 233) of water conservation which looks at fire services in general. The handbook provides a broader approach than the this Guide and gives additional information on water savings in other areas.

2.2 OBJECTIVES

This Guide is focussed on identifying opportunities for cutting the amount of water used in maintaining existing fire sprinkler systems and the steps needed to adopt these opportunities.

This Guide does not attempt to be fully exhaustive in identifying all of the options available for water saving; rather it concentrates on typical opportunities that offer the best return for an affordable investment\textsuperscript{23}. All the opportunities adhere to the fundamental principle that water-saving changes must not compromise the effectiveness of the fire protection for Victoria's buildings.

More specifically, the aims of this Guide are to provide:

- a greater awareness of the current water usage in maintaining existing fire sprinkler systems
- an understanding of the quantity of water used in the testing, inspection and maintenance of existing fire sprinkler systems
- feasible and affordable water saving opportunities in existing sprinkler protected buildings
- an understanding of how to implement these opportunities and achieve the potential water savings
- an indication of the costs associated with increasing existing fire sprinkler system water conservation.

2.3 SCOPE

The opportunities vary depending on whether the consumption is occurring as a result of periodic testing regimes or as a result of draindowns and recharging of the systems during building renovations.

The opportunities are not measures for new buildings because the main potential for water saving lies within the existing building stock. Most, if not all, new Victorian buildings with large sprinkler systems are now being designed to minimise their consumption (discharge to drain) of

\textsuperscript{23} See www.pic.vic.gov.au for further discussion of these opportunities and other more specialised or higher cost options. The online Guide and related materials will be upgraded over time.
fire sprinkler water for maintenance purposes.

This Guide is organised under the following main chapters:

- case study findings and recommendations
- summary of water saving opportunities
- pressure setting adjustment project
- AS1851-2005 and monthly testing
- pressure reducing projects
- re-circulation projects
- capture and re-use of water project
- improved draindown zoning
- fire sprinkler draindown management.

2.4 ABBREVIATIONS

The following abbreviations have been used in this Guide.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>AS</td>
<td>Australian Standard</td>
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<tr>
<td>CV</td>
<td>Sprinkler installation control valves</td>
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<tr>
<td>ESFR</td>
<td>Early suppression fast response</td>
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<tr>
<td>FIP</td>
<td>Fire Indicator Panel</td>
</tr>
<tr>
<td>kL</td>
<td>kilo litre (thousand litres)</td>
</tr>
<tr>
<td>L</td>
<td>litre</td>
</tr>
<tr>
<td>MJC</td>
<td>Multiple jet control (control valve that uses sprinkler head technology)</td>
</tr>
<tr>
<td>ML</td>
<td>mega litre (million litres)</td>
</tr>
<tr>
<td>MBS</td>
<td>Municipal Building Surveyor</td>
</tr>
<tr>
<td>NFPA</td>
<td>National Fire Protection Association (of USA)</td>
</tr>
<tr>
<td>OH1</td>
<td>Ordinary Hazard group 1 (sprinkler design category for retail shops)</td>
</tr>
<tr>
<td>OH2</td>
<td>Ordinary hazard group 2 (sprinkler design category for car parks)</td>
</tr>
<tr>
<td>OH3</td>
<td>Ordinary hazard group 3 (sprinkler design category for offices)</td>
</tr>
<tr>
<td>PR</td>
<td>Pressure reducing</td>
</tr>
<tr>
<td>PRV</td>
<td>Pressure Relief Valve</td>
</tr>
<tr>
<td>PSA</td>
<td>Pressure setting adjustment</td>
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<tr>
<td>QA</td>
<td>Quality assurance</td>
</tr>
<tr>
<td>RBS</td>
<td>Relevant Building Surveyor</td>
</tr>
</tbody>
</table>

2.5 GLOSSARY

This glossary provides information on some of the technical terms used in this Guide and how they relate to water conservation in fire sprinkler systems.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>Alarm valve servicing</td>
<td>Servicing of alarm valves requires the main gasket to be replaced and the installation water supply drained</td>
</tr>
<tr>
<td>Alteration</td>
<td>The sprinkler system is isolated and not able to operate as designed. Normally means the water is drained so modifications can be undertaken on dry pipework</td>
</tr>
<tr>
<td>Alternative solution</td>
<td>A building solution that departs from the deemed to satisfy requirements of the BCA and instead uses the performance requirements. These are prepared by fire safety engineers and may have specific maintenance determinations in the design that require weekly testing.</td>
</tr>
<tr>
<td>Building Life cycle</td>
<td>The period over which the cost benefit analysis is undertaken, assumes a 25 year period until end of useful life.</td>
</tr>
<tr>
<td>Community cost of water</td>
<td>In most cases property owners do not pay for the water used in sprinkler systems. However, there is still a deemed community cost associated with the use of water which has been assumed to be $4.00 per kL.</td>
</tr>
<tr>
<td>Deemed to satisfy provisions</td>
<td>The (typically prescriptive) provisions in the Building Code of Australia which are deemed to comply with mandatory performance requirements.</td>
</tr>
<tr>
<td>Draindown</td>
<td>Refers to the process of draining water from the installation for servicing or alterations.</td>
</tr>
<tr>
<td>Engineer</td>
<td>A professionally qualified engineer registered with the Building Commission and practising in fire services design.</td>
</tr>
<tr>
<td>Fire safety engineer</td>
<td>An engineer qualified to provide alternative solutions.</td>
</tr>
<tr>
<td>Flow switch</td>
<td>Item that electrically detects the flow of water in a pipe.</td>
</tr>
<tr>
<td>Height of building</td>
<td>Height measured from the lowest car park to the highest level of the building.</td>
</tr>
<tr>
<td>High Hazard</td>
<td>Type of sprinkler system utilising diameter pipe sizes with typical 50 to 65 mm ranges and 150 to 200 mm mains.</td>
</tr>
<tr>
<td>Installation Check Valve</td>
<td>A non return valve located downstream of the installation control valves which is used to divide the sprinkler installation into draindown zones. This reduces the volume of water drained during draindowns.</td>
</tr>
<tr>
<td>Installation control valves</td>
<td>Those valves used to control a single sprinkler installation and are used for testing and alarm indication.</td>
</tr>
<tr>
<td>Impairment</td>
<td>Refers to the isolation, disconnection or other means by which the fire service can not operate as designed.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>--------------------------</td>
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</tr>
<tr>
<td>Light hazard</td>
<td>Describes the type of sprinkler system utilising small diameter pipe sizes with typical 25 to 32 mm ranges and 65 to 100 mm mains.</td>
</tr>
<tr>
<td>Non return valve</td>
<td>Valve that allows water to flow in a single direction only. Used in sprinkler systems downstream of pumps and town main water supply connections. May also be used in sprinkler installation to prevent portions of pipework from draining back to the main drain valve during draindowns.</td>
</tr>
<tr>
<td>Occupancy permit</td>
<td>Permit issued at the end of building works that provides information on the requirements of the essential safety measures.</td>
</tr>
<tr>
<td>Ordinary hazard</td>
<td>Describes the type of sprinkler system utilising medium size diameter pipe sizes with typical 32 to 40 mm ranges and 80 to 150 mm mains</td>
</tr>
<tr>
<td>Periodic Maintenance</td>
<td>Maintenance and testing activities that are undertaken on a weekly, monthly or three monthly basis.</td>
</tr>
<tr>
<td>Pressure relief valve</td>
<td>Valve provided downstream of the sprinkler pumps used to relieve pressure by wasting water to low pressure. As the downstream pressure reduces this valve will close until the downstream pressure reaches the PRV set point. For example if the valve is set to 1000 kPa the PRV will divert water to waste while the down stream pressure remains above 1000 kPa. The size and set point of a pressure relief valve is to be carefully engineered to achieve maximum water saving.</td>
</tr>
<tr>
<td>Pressure reducing valve</td>
<td>A valve that is used to reduce downstream pressure to a set point. The valve will trap the pressure upstream until down stream pressure drops below the set value and slowly open to allow down stream pressure to increase to the set point. These valves do take some time to equalise over a period of 10s of seconds and are best used with pressure relief valves.</td>
</tr>
<tr>
<td>Pressure switch</td>
<td>Device used to sense pressure in the pipe and provide an electrical signal at a predetermined setting. Pressure switches are used throughout sprinkler systems to start pumps and send brigade alarms.</td>
</tr>
<tr>
<td>Pump churn</td>
<td>A condition where a pump operates without flow, the water in the pump casing can not escape and will rotate and heat up. If allowed to continue for several hours the water will boil and evaporate causing damage to the pump.</td>
</tr>
<tr>
<td>Pump - duty flow rate</td>
<td>The flow rate a pump is expected to provide to meet the design requirements of the sprinkler installation. Sprinkler installations will have a number of duty characteristics that include pressure and flow requirements. The available water supply is required to exceed the required duty characteristics. The pump duty flow rate can be determined from the installation block plan. This information is sourced from the engineering calculations of the sprinkler system design.</td>
</tr>
</tbody>
</table>
2.7 Pump - nominal flow rate

The maximum flow rate a sprinkler pump is expected to operate at and can be sourced from the system design calculations (if available). This is determined from the intersection of the maximum water supply characteristic and the most favourable square law curve. It can be estimated by multiplying the highest required duty flow rate by 1.2.

Remote drain valve test

Simulates the flow of a sprinkler head, and is undertaken annually on each alarm valve to activate the fire brigade alarm and local water motor gong. The primary pumps, if present, will operate during this test.

Servicing

Works to a sprinkler system that are scheduled and usually require draining part or all of the sprinkler installation.

Site

A property that is controlled by a water supply that feeds a number of sprinkler installations.

Sprinkler installation

A network of pipes that feed sprinklers within a building, controlled by a single set of installation control valves.

Subsidiary valve

An isolation valve located downstream of the installation control valves. Used to zone sprinkler installations in draindowns. These must be supervised with valve monitoring devices.

Test valve

Valve used to test the operation of sprinkler system equipment. The test valve is opened to allow water to drain from the system to test the operation of a part of the sprinkler installation.

Zoning

Division of areas controlled by a sprinkler installation into smaller sections by the use of a monitored isolation valve or check valve.

2.6 BIBLIOGRAPHY

2.6.1 AUSTRALIAN STANDARDS

The following standards have been referenced in this document:

- AS 2118 Automatic Fire Sprinkler Systems (all years considered)
- AS1851.3 -1997 Maintenance of Fire Protection Equipment PART 3: Automatic Fire Sprinkler Systems (all years considered)
- AS1851-2005 Maintenance of Fire Protection Systems and Equipment
- AS 2941-2002 Fixed fire protection installations—Pumpset systems
- AS4029.2 Stationary batteries—Lead-acid Valve-regulated type
- AS4029.3 Stationary batteries—Lead-acid Pure lead positive pasted plate type
- AS3731.1 Stationary batteries—Nickel-cadmium Vented type
- AS3731.2. Stationary batteries—Nickel-cadmium Valve-regulated type
2.6.2 VICTORIAN BUILDING COMMISSION

The following Building Commission publications have been referenced in this document:

- Practice Note 2007-23 *Maintenance of Essential Safety Measures*
- Practice Note 2008-32 *When is a building permit required?*
- Practice Note 2007-61 *Water saving options available when testing fire safety systems*

2.6.3 FIRE PROTECTION ASSOCIATION OF AUSTRALIA

The following Fire Protection Association of Australia publications were reviewed in compiling this Guide:

- Workshop report - *National workshop on conservation of water in fire protection systems November 19-20 2007*
- Discussion paper - *Conservation and Sustainable use of water in fire protection systems*
3 CASE STUDIES OVERVIEW

The case study findings revealed water saving opportunities that became foundational to providing this Guide. The case studies also gave the project team an opportunity to visit sites and measure water loss in real situations. The interviews conducted with service providers, facility managers, building surveyors, insurance companies, equipment providers, designers and installers have provided a wealth of information that has been organised into this Guide.

3.1 WATER SAVING OPPORTUNITIES

The findings from the case studies showed that the following water savings opportunities could be achieved in a cost effective and practical manner:

- adjusting pressure settings
- changing to monthly testing
- installing pressure reducing valves
- changing to monthly testing and installing pressure reducing valves
- installing a tank to capture and reuse or recirculate water.

3.2 WATER SAVING OPTIONS AND OUTCOMES

The water savings that can be achieved by each of the building types has been summarised in the following tables based on the five water saving opportunities.

Each opportunity is considered independently and is not in combination with others. The percentage shown in the tables is the proportion of water saving relative to the total water usage i.e. both the testing and draindown usage.

The building types covered are:

- high rise buildings
- shopping centres
- manufacturing sites
- other buildings.

3.2.1 HIGH RISE BUILDINGS

The following case studies show the volume of water that can be saved in high rise buildings. Each building was supplied by a town main that was pump boosted. Two of the sites had pressure relief valves that operated during testing which accounted for the large volumes of water discharged to drain.
### Site Name | Total water usage (kL/pa) | Water Saving kL/pa (%)
---|---|---
|  | Adjusting pressure settings | AS1851-2005 and Monthly | Installing PRV | AS1851-2005 + PRV | Use water tank |
| **A- Office 1** | 694 | 0 | 365 (53) | 0 | NA | NR |
| **B- Office 2** | 1283 | 836 (65) | 798 (62) | 836 (65) | 1054 (82) | NR |
| **C- Office 3** | 2490 | 1880 (75) | 1700 (68) | 1880 (75) | 2148 (86) | NR |
| **D- Hotel** | 1500 | 280 (19) | 673 (45) | 0 | NA | NR |
| **E- Residential** | 2300 | 1600 (70) | 1490 (64) | 1600 (70) | 2000 (86) | NA |

Abbreviations:
- **NA:** Not applicable to this sprinkler system
- **NR:** Not recommended in this instance due to building characteristics, water savings or adoption costs

#### 3.2.2 SHOPPING CENTRES

The following case studies show the water usage in sprinkler systems installed in shopping centres. All sites were supplied with pump boosted town mains. The large volume of water used by the medium size shopping centre was due to the simultaneous operation of two diesel pumps and two pressure relief valves during testing.

### Site Name | Total water usage (kL/pa) | Water Saving kL/pa (%)
---|---|---
|  | Adjusting pressure settings | AS1851-2005 and Monthly | Installing PRV | AS1851-2005 + PRV | Use water tank |
| **F- Large** | 1866 | 0 | 584 (31) | NA | NA | 800 (43) |
| **G- Medium** | 9336 | 7100 (76) | 6574 (70) | 7100 (76) | 8410 (90) | NR |
| **H- Small** | 242 | 0 | 62 (25) | 0 | NA | NR |

#### 3.2.3 MANUFACTURING SITES

The following case studies show large manufacturing sites where pumps draw water from large water tanks. For these cases no water was consumed by pressure relief valves, the main water usage came from pump cooling and weekly testing.
3.2.4 OTHER SITES

The following case studies are those that did not fit into any of the above classifications. The large office / retail site is a combination of both high rise and retail, while the hospital is more indicative of a smaller site. The large office / retail case study shows a large volume of water used by pressure relief valves. The small hospital provides a case study for a building with a sprinkler system with town main only water supply and only a few l number of sprinkler installation control valves.

<table>
<thead>
<tr>
<th>Site Name</th>
<th>Total water usage (KL/pa)</th>
<th>Adjusting pressure settings</th>
<th>AS1851-2005 and Monthly</th>
<th>Installing PRV</th>
<th>AS1851-2005 + PRV</th>
<th>Use water tank</th>
</tr>
</thead>
<tbody>
<tr>
<td>I- Paper</td>
<td>1279</td>
<td>0</td>
<td>88 (7)</td>
<td>NA</td>
<td>NA</td>
<td>936 (73)</td>
</tr>
<tr>
<td>J- Printing</td>
<td>993</td>
<td>0</td>
<td>438 (45)</td>
<td>NR</td>
<td>NR</td>
<td>715 (70)</td>
</tr>
<tr>
<td>K- Food</td>
<td>2762</td>
<td>1800 (65)</td>
<td>1200 (40)</td>
<td>NR</td>
<td>NR</td>
<td>1800 (80)</td>
</tr>
<tr>
<td>L- Automotive</td>
<td>3026</td>
<td>1730 (57)</td>
<td>2198 (70)</td>
<td>NR</td>
<td>NR</td>
<td>1732 (57)</td>
</tr>
<tr>
<td>— Large Office/ Retail</td>
<td>3424</td>
<td>2200 (65)</td>
<td>2160 (63)</td>
<td>2200 (65)</td>
<td>2671 (80)</td>
<td>2750 (83)</td>
</tr>
<tr>
<td>— Small Hospital</td>
<td>115</td>
<td>0</td>
<td>28 (28)</td>
<td>0</td>
<td>NA</td>
<td>NR</td>
</tr>
</tbody>
</table>

3.3 GENERAL COMMENTS

The case studies shared the following common features:

- insurance company feedback
- maintenance requirements
- risk management.

3.3.1 INSURANCE COMPANY FEEDBACK

The adoption of a new maintenance standard and the move to monthly testing may bring consequences from insurance companies. Feedback from insurance companies was obtained for some of the sites and generally concluded that there was no objection to moving AS 1851-2005 and monthly testing.
However the insurance company for the large paper manufacturing company accepted monthly alarm valve testing but still required weekly pump running and testing. The need for weekly testing of pumps at this site was considered necessary in light of the risk / hazard profile and the reliance on this key component.

3.3.2 MAINTENANCE REQUIREMENTS

The maintenance requirements for the sprinkler systems in the case studies revealed the following:

- some of the buildings constructed after 1994 that were subject to an occupancy permit needed the municipal building surveyor to change the maintenance determination before monthly testing could be adopted
- some buildings had special design requirements which identified weekly testing for the sprinkler system and would require a suitable professional to be engaged to change to monthly testing
- all sites needed to provide a pressure gauge schedule and interface diagram as prerequisites for monthly testing
- most sites already had the monthly testing prerequisites hardware installed.

3.3.3 RISK MANAGEMENT

From the case studies the following observations were made on risk management:

- few of the sites used an incumbent fire sprinkler contractor to manage draindowns
- few of the sites had prepared comprehensive system information and specifications that managed the testing, servicing and alterations of sprinkler systems
- no site had any formal contractor training system in place to educate service providers of the correct system operation.
4 SUMMARY OF WATER SAVING OPPORTUNITIES

The project team have identified the main opportunities for saving water as a result of their work conducting the case studies and investigating water conservation.

These opportunities are listed below in order of ease of application, cost effectiveness and greatest water saving potential. These water saving opportunities do not compromise the reliability of fire protection systems nor the health, safety and amenity of building occupants.

The principal water saving opportunities are:

• Opportunity 1: Pressure setting adjustment project
• Opportunity 2: AS1851-2005 & Monthly testing
• Opportunity 3: Pressure reducing projects
• Opportunity 4: Re-circulating project
• Opportunity 5: Capture & reuse water project
• Opportunity 6: Improved draindown zoning
• Opportunity 7: Fire Sprinkler draindown Management.

4.1 OPPORTUNITY 1: PRESSURE SETTING ADJUSTMENT PROJECT

Many fire sprinkler systems draw large quantities of water from the town main and then discharge it straight to stormwater drains during testing. This testing is needed to measure the operational readiness of this essential service. The volume of water lost to drain is substantially greater if the sprinkler system has pumps with large active relief valves. A typical loss for this situation has been shown to be well in excess of one million litres each year.

Saving water can often be achieved by the simplest of means. Findings from the case studies showed that by adjusting the pressure of key operating parameters substantial water savings can be achieved at low cost.

Immediate water savings or ‘quick wins’ can achieve a reduction in water loss by:

• installing pressure relief valves on pump discharge
• installing pressure reducing valves on diesel pump raw water heat exchanger lines
• changing pump start pressure switch settings.

Substantial water savings can be achieved to over 90% of sprinkler protected buildings that are provided with a pump-boosted water supply drawing from the town main. Sprinkler systems have traditionally been commissioned with little or no regard for water consumption. The technicians who set pressure relief valves and pressure reducing valves (in diesel pump cooling water lines) have allowed for high water consumption because of conservative settings.
Of the pump-boosted sites reviewed in the case studies it was found that the sites fitted with pressure relief valves typically flowed millions of litres per year to stormwater drains. Substantial water savings could be achieved by adjusting the pressure settings to allow for higher pressures to reduce the discharge of excess water during normal pump operation. Another significant water saving can be achieved by reducing the cooling water usage, it was found to consume hundreds of thousands of litres per year. A third opportunity is to ensure that during testing only one fire pump operates.

Correctly adjusting pressure settings in a sprinkler system and providing a pressure gauge schedule provides the following benefits:

- the pressure gauge schedule offers ongoing guidance to practitioners on properly maintaining the sprinkler system to optimal design standards
- fulfilling community expectation in water conservation
- reasonable cost-benefit case provides substantial water savings.

4.2 OPPORTUNITY 2: AS1851-2005 & MONTHLY TESTING

Sprinkler system testing is traditionally undertaken on a weekly basis to check the systems operational readiness. Building owners of larger sites can save hundreds of thousands of litres per year of test water by taking advantage of AS1851-2005 as the test standard for their fire sprinkler system and adopting the monthly option.

The properties that will benefit most from the change to monthly have:

- pump boosted water supplies drawing from town mains
- water supplies that operate relief valves while pumps are running
- diesel driven pumps that use raw water cooling
- more than 12 sets of installation control valves.

The properties that can most easily adopt AS1851-2005 and monthly testing have:

- no special maintenance requirements that require weekly testing
- sprinkler systems installed before 1994
- provided with interface matrix diagram and pressure gauge schedule
- AS1851-2005 monthly testing equipment prerequisites already installed.

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25 It was found that millions of litres of water were being consumed in one of the demonstration sites due to the operation of two pumps during the weekly testing.
AS1851-2005 is an important step forward from the earlier versions of the AS1851 suite of standards. The newer standard has the following benefits:

- provides a consistent approach for the maintenance of fire safety and protection systems across all systems
- adopts a more quality assurance approach through better documentation
- ensures better systems reliability through provision of improved documentation
- eliminates the scope for ‘corner cutting’ by some maintenance practitioners by providing clearer instructions
- provides more comprehensive functionality and performance testing instructions
- enables a move to monthly testing of the sprinkler installation if certain risk processes are managed.

In addition to the water saving benefits from adopting AS1851-2005 and monthly testing owners can also expect:

- a reduction of life cycle costs through greater clarity of maintenance requirements and accountability by maintenance providers
- increased accountability for risk management, corporate governance and insurance through annual statements of system conditions
- improved future planning based on clearer and more comprehensive system information
- greater confidence in system performance in the event of a fire
- greater transparency of processes by using better recording and documentation processes
- a quality assurance check on maintenance that can be easily incorporated into a corporate quality assurance plan.

4.3 OPPORTUNITY 3: PRESSURE REDUCING PROJECTS

If engineering analysis requires the pressure relief valves to operate after conducting a PSA project millions of litres of water can be still be lost. Pump boosted sites which have been over designed can operate pumps at destructive pressures which is often managed by discharging to drain through the pressure relief valves.

Building owners can still achieve substantial water savings by reducing these pump pressures. The following options area available:

- decreasing the pump speed
- decreasing the size of the pump impellor
- consider the installation of pressure reducing valves to reduce this volume to near zero.
The buildings best suited to reducing sprinkler water consumption and applying a pressure reducing projects are:

- have sprinkler system water supplies pump boosted from town mains and exceed operating pressures in the pipework
- the pressure gauge schedule adjustment project is not able to substantially reduce the flow drained to the pressure relief valve
- water from the pressure relief valve can not be captured for reuse
- recirculation is not considered the best option.

The benefits of installing a pressure reducing valve include:

- substantial water savings
- they do not take up valuable space (which tank solutions will)
- some solutions are easy to maintain and once set need only be tested annually
- do not require any additional procedures during testing
- costs can be low.

4.4 OPPORTUNITY 4: RE-CIRCULATION PROJECT

As an alternative to draining thousands of litres of valuable drinking water building owners have the opportunity to instead recirculate the fire sprinkler test water. This opportunity is a ‘best fit’ for sprinkler systems if:

- the system has a pump boosted town main
- the sprinkler pump operates a pressure relief valve
- test water is discharged to a drain that is located close to the pumps
- sprinkler installation valves can be tested without the use of a town main.

The advantages of the recirculation option include:

- a formal application is not required to change the testing regime
- the existing pumps are used to circulate water for testing
- if tanks are provided then some water can be captured for use by another system.

4.5 OPPORTUNITY 5: CAPTURING WATER FOR REUSE

The water discharged after sprinkler testing is usually clean and can be captured for reuse, either in the sprinkler system or for another purpose.

The following water can be effectively captured and reused:
• draindown water
• installation control valve and flow switch test water
• diesel pump cooling water
• other test water, subject to sufficient volumes.

This opportunity can best be applied to sprinkler systems that have:

• a diesel pump of over 100 kW that uses raw water cooling (see chapter 5 for more details)
• pumps and pressure relief valves that are required to discharge to drain
• frequent draindowns due to regular refurbishment and or alterations.

Clean water captured from a sprinkler system (other than draindown water) can be reused in a number of ways within a property, including:

• toilets and other sanitary fittings
• urban irrigation
• cooling towers
• car washing
• carpark cleaning.

In some circumstances clean water used in fire sprinkler maintenance at a site may be able to be captured and reused at another site such as a public sporting ground. Generally though, transport costs, associated greenhouse gas emissions, and other factors are a difficult barrier. The feasibility and justification of this option vary depending on the type of fire sprinkler maintenance, and consequently quality and volume of water involved.

There are three main variations:

• draindown water
• regular test water
• flow test water.

DRAINDOWN WATER

The benefits of capturing and reusing the draindown water include:

• the draindown water which is typically black, deoxygenated and putrid, will not pollute storm water systems
• less or no need for zoning of sprinkler installations
• less or no need to manage sprinkler draindowns.
CAPTURING WEEKLY / 3 MONTHLY TEST WATER

The benefits associated with capturing and reusing weekly / 3 monthly test water include:

- no need to go to monthly testing to achieve water savings
- water is likely to be good quality
- water can be used for other services
- implementation cost is often low
- storage of the water for several months is possible
- there are many options available for providing a tank or vessel to capture the water.

CAPTURING FLOW TEST WATER

During the annual flow test and pump load tests the volume of water drained can be considerably large, this is due to flow rates that exceed 3,000 L/min for over 30 minutes. The challenge in capturing and reusing this water is that because of the high volume large tanks or vessels are required.

The advantages of capturing annual flow test water include:

- water is likely to be good quality
- water is under pressure and can be transferred some distance from the source
- water can be used in a wide variety of applications
- it can be stored for long periods
- the opportunity to use off site via water tanker

4.6 OPPORTUNITY 6: IMPROVED DRAINDOWN ZONING

Any modification to a sprinkler system will require all the water from the installation to be drained, when it is refilled it takes in fresh drinking water and sends out to drain black, putrid water that may contain metals. Reducing draindowns not only saves drinking water but reduces pollution to storm water.

Building owners can achieve substantial water savings by improving zoning for:

- shopping centres
- high rise buildings
- large public buildings
- buildings that are constantly modifying sprinkler systems

26The water is not drinking quality but will have been supplied to the fire service as potable water and will have only passed through a number of valves during testing which normally will not significantly pollute the water.
• horizontal buildings where sprinkler installations are over 5,000 m²
• buildings that are to undergo a major refurbishment.

Improved draindown zoning provides the following benefits:

• saves thousands of litres of water which would otherwise be lost to drain in retail and high rise office buildings
• reduces the volume of undesirable deoxygenated and polluted water draining to stormwater
• reduces the draindown time for modifications of sprinkler systems
• enables portions of the sprinkler system to be isolated while major refurbishment is being undertaken and eliminating the need for constant draindowns (if the risk is satisfactorily covered)
• is easily applied so that sprinkler fitters can be trained to isolate zones to save draindown water
• reduces the risk to the building by not having the whole sprinkler installation isolated.

4.7 OPPORTUNITY 7: FIRE SPRINKLER DRAINDOWN MANAGEMENT

Facility managers have the opportunity to save water and reduce pollution by efficiently managing sprinkler installation draindowns. This may supplement and / or replace the need to install valves to zone sprinkler installations as detailed in Opportunity 6.

The buildings that will particularly benefit from better draindown management include:

• shopping centres
• high rise buildings
• large public buildings
• buildings that are constantly modifying sprinkler systems
• buildings undergoing major refurbishment
• any building which has on average more than one draindown per week
• buildings where subsidiary stop valves have already been provided but are not used because they are not fitted with suitable drains.
The benefits of providing a strong drain management system include:

- reduced pollution from draindowns to the storm water
- reduced risk of the building being unprotected by sprinklers during a period where it is most vulnerable (during construction activities)
- improved management of sprinkler modifications
- greater responsibility from sprinkler contractors
- development of new and improved methods for carrying out sprinkler system modifications.
5 OPPORTUNITY 1: PRESSURE SETTING ADJUSTMENT PROJECT

In many buildings the required testing of fire sprinkler system testing draws large quantities of water from the town main and then discharges straight to storm water drains. While this testing is needed to measure the operational readiness of this essential service millions of litres per year can be saved if the testing involves pumps operating pressure relief valves.

Saving water can often be achieved by the simplest of means. Findings from the case studies showed that by adjusting the pressure of key operating parameters substantial water savings can be achieved for low cost.

This chapter provides a guide on how property owners, facility managers and maintenance firms can achieve cost effective water savings quickly and efficiently through the pressure setting adjustment (PSA) project.

5.1 IDENTIFYING OPPORTUNITIES

Immediate water savings or ‘quick wins’ can be achieved through reducing water loss to:

- pressure relief valves on pump discharges
- pressure reducing valves on diesel pump raw water heat exchanger lines
- pump start pressure switches.

Substantial water savings can be achieved to over 90% of sprinkler protected buildings provided with a pump boosted water supply drawing from the town main. The evidence from the case studies indicates that sprinkler systems were traditionally commissioned without regard for water consumption. Technicians set pressure relief valves and pressure reducing valves (in diesel pump cooling water lines) to discharge water to drain and in being conservative allowed for high water consumption.

Of the pump boosted sites reviewed in the case studies it was found that the sites fitted with pressure relief valves flowed millions of litres per year to storm water drains. The greatest water savings could be achieved by adjusting the pressures to reduce or stop water flow to drain during normal pump running. The second most significant water saving is to reduce the cooling water usage which was found to consume hundreds of kilolitres per year. A third opportunity is to ensure that only one fire pump operates during testing²⁷.

²⁷ It was found that millions of litres of water was wasted in one of the demonstration sites due to the operation of two pumps during the weekly testing.
5.2 BENEFITS & CHALLENGES

Correctly adjusting pressure settings in a sprinkler system and establishing a pressure gauge schedule ensures the following benefits:

- the pressure gauge schedule provides ongoing guidance to practitioners for maintaining the sprinkler system to optimal design
- fulfilling community expectation in water conservation
- low cost high water conservation opportunity that can be simply applied, without involving regulatory procedures
- potential deemed cost saving of over $20,000 of water saved per installation control valve in a 25 year life cycle.

Adjusting pressure settings provides the following challenges:

- the need to engage experienced professionals to provide a pressure gauge schedule
- water savings may not be maximised if the pressure relief is still required to operate due to excessive installation pressures\(^28\)
- an experienced technician is required to adjust the settings and check the system preforms satisfactorily in all areas, not just in water saving.

5.3 PROJECT STEPS

To adjust the pressure settings in a sprinkler system and obtain water savings the following steps are required to be undertaken:

- engage a fire services engineer to provide an assessment of water usage in the sprinkler system (using site measurement or the supplied guide tables)
- the fire services engineer to undertake an evaluation of the sprinkler system and produce a pressure gauge schedule
- engage a suitably experienced commissioning technician to work with the fire services engineer to adjust the pressure settings
- estimate or measure subsequent water consumption, if required for project evaluation.

\(^{28}\)If it is found that pressure relief valves are required to operate other water saving opportunities can be considered. Refer to later chapters in this Guide
5.3.1 ESTIMATING WATER USAGE

A methodology for estimating water usage has been developed for assessing the following equipment that discharges water to drain:

- pump discharge pressure relief valves
- diesel pump cooling water
- two pumps running during the test.

5.3.1.1 PUMP DISCHARGE PRESSURE RELIEF VALVES

Many pump boosted water supplies for sprinkler systems incorporate pressure relief valves to prevent over pressure downstream in the supply main and sprinkler installations. If these valves operate to relieve pressure during testing then thousands of litres of water can be drained unnecessarily.

An understanding of the system operating parameters and a few hours work on site is all that is required to help mitigate this loss. Increasing the operating pressure by as little as 50 kPa can reduce the outflow to drain by over 1,000 litres per minute which can save as much as 1.5 million litres each year.

Learning from the project showed that the following flow rates of water were drained with an operating pressure relief valve.

Table 5.3.1.1: Water discharged through an open pressure relief valve based on pipe size

<table>
<thead>
<tr>
<th>Relief Valve size (DN)</th>
<th>Flow rate of discharge (L/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>1000</td>
</tr>
<tr>
<td>65</td>
<td>1500</td>
</tr>
<tr>
<td>80</td>
<td>1800</td>
</tr>
<tr>
<td>100</td>
<td>2000</td>
</tr>
<tr>
<td>150</td>
<td>3000</td>
</tr>
</tbody>
</table>

In many sprinkler system designs the pressure relief valves were acting as a safety device and were only required to operate if the pumps over revved and caused over pressures. In most cases pipework was designed to withstand the maximum normal pressure and the relief valve was not needed to operate over such a small range, if at all.
An analysis of the system is needed to determine the critical pressure settings so that the pressure relief valve can be set to operate with a minimal discharge to drain. This analysis is provided in the work conducted to prepare a pressure gauge schedule.

5.3.1.2 DIESEL PUMP COOLING WATER

The running of diesel driven pumps in sprinkler systems have been shown to consume over 300,000 litres per annum on cooling water alone. Diesel driven fire pumps require constant cooling while operating and it is common to use the cold water from the pump supply to flow through a heat exchanger to cool the internal circulating water of the motor. This is known as raw water cooling. The flow rate of raw water used is set up by the pump commissioning technician at the time of installation and generally never altered.

The water measuring undertaken as part of the water conservation project discovered that the flow rate of all raw water cooling systems exceeded the requirements of the engine manufacturers. Lowering the cooling rate by just 100 L/min can save over 150,000 litres per year.

Findings from the case studies showed that fire pump cooling water rates (based on actual flow measurements) were as follows:

Table 5.3.1.2: Observed diesel pump cooling water outflow rates based on pump power

<table>
<thead>
<tr>
<th>Pump properties</th>
<th>Large</th>
<th>Medium</th>
<th>Small</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump power (kW)</td>
<td>&gt;150</td>
<td>100-150</td>
<td>&lt;100</td>
</tr>
<tr>
<td>Flow rate (l/min)</td>
<td>320</td>
<td>200</td>
<td>100</td>
</tr>
</tbody>
</table>

5.3.1.3 TWO PUMPS RUNNING DURING THE TESTING

During testing only one pump is required to be operational at any one time. If the second pump starts automatically as a result of the pressure drop in the system additional water will be consumed during the test. If the second pump is diesel driven and operates a relief valve this additional consumption of water is to be calculated and added to the total consumption for the first pump. Refer to the above table for estimates on water flow from pressure relief valves and cooling water.

5.3.2 PREPARING A PRESSURE GAUGE SCHEDULE

A pressure gauge schedule is a specification of the pressures at which the sprinkler system components are required to operate, and at want point pumps are to operate. The schedule will include the following:
• start pressure to operate a booster pump
• start / stop pressure to operate pressure maintenance pump and jacking pump
• pressure setting to operate pressure relief valves
• maximum and minimum supply and installation pressures.

An understanding of the system pressure requirements, available pressure sources and mechanical limits of the system components is essential before preparing the pressure gauge schedule. In order to create a pressure gauge schedule the following steps should be undertaken:

• collect the required information
• use a pressure gauge schedule guide to determine pressure settings of various components
• create pressure gauge schedule.

5.3.2.1 REQUIRED INFORMATION

The required information consists of the following:

• water supply characteristics
• pumps characteristics
• system requirements
• flow test results and pump curves
• relative levels.

Refer to Appendix A for a request for information form that is used to gather the relevant information. Once this information has been obtained a pressure gauge schedule can be developed.

5.3.2.2 CREATING THE PRESSURE GAUGE SCHEDULE

Pressure gauge schedules should be undertaken by appropriately experienced and qualified professionals. The process of preparing a pressure gauge schedule is detailed in Appendix A and includes the following steps:

• develop a pressure gauge schedule for the key operating devices (See Appendix A2 Guide for a Sprinkler System Schedule Appendix A4 Pressure Diagram)
• produce the pressure gauge schedule (See Appendix A3 and A4).

In developing a pressure gauge schedule we recommend the following:
• allow 100 kPa between settings
• start at the normal pressure in the sprinkler installations to be no more than 1200 kPa and work backwards
• jacking pumps / pressure maintenance pumps should have a range of 200 kPa between in and out
• the jacking pump / pressure maintenance pump should be able to deliver a minimum pressure of at least the difference between the supply main minimum and the jacking pump out pressure (otherwise the jacking pump will never cut out under minimum conditions)
• where possible ensure the pump pressure relief valve remain closed during normal operation
• each sprinkler manifold and pump set should be provided with a pressure gauge schedule plaque
• if sprinkler manifolds are operating on different levels then a pressure gauge schedule for each level is required
• schedules to be printed on water proof, fade resistant and durable media and securely fastened
• separate schedules are required for installation control valves and pumps if they are on different levels.

5.3.3 ADJUSTING THE PRESSURES

Appropriately trained technicians can adjust the pressures of pressure relief valves, pressure reducing valves and pressure switches once the pressure gauge schedule has been developed.

5.3.3.1 ADJUSTING THE PUMP PRESSURE RELIEF VALVE

The pressure gauge schedule provided by the designer or the fire services engineer specifies the pressure at which the pressure relief valve should open. Ideally this would be above the pump shut head so that no water is drained during normal operation.

The commissioning technician will be able to increase the operating pressure of the valve to the set point determined by the pressure gauge schedule.

5.3.3.2 ADJUSTING THE PRESSURE REDUCING VALVES ON PUMP COOLING WATER

Water savings can be achieved by reducing the flow rate through the diesel engine cooling system. The heat exchanger is able to operate effectively if the increase in water temperature does not exceed 60°C. If the water temperature is kept below a
20°C increase then the following table applies:

Table 5.3.5.1: Recommended diesel pump cooling water outflow rates based on pump power:

<table>
<thead>
<tr>
<th>Diesel engine max horsepower kW</th>
<th>Recommended raw water cooling flow rate L/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>100</td>
<td>80</td>
</tr>
<tr>
<td>125</td>
<td>100</td>
</tr>
<tr>
<td>150</td>
<td>120</td>
</tr>
<tr>
<td>190</td>
<td>125</td>
</tr>
<tr>
<td>200 +</td>
<td>Refer manufacturer or undertake on site trials</td>
</tr>
</tbody>
</table>

If the flow rate cannot be determined or measured then the cooling water rate can be reduced by the following method:

- run the pump for 30 minutes at maximum flowrate to achieve maximum operating temperature (best done after a flow test or load test to save water)
- note the normal operating temperature on the diesel engine control panel
- measure the temperature of the water discharging to drain from the heat exchanger
- if the temperature is below 60°C reduce the water flow to the heat exchanger by adjusting the cooling line flow rate and observe the temperature rise
- run the engine for a further few minutes to determine if the engine running temperature is still operating within normal range
- adjust the flow rate accordingly to keep the engine temperatures within normal working range
- stop the engine and observe if the engine cooling water continues to heat up due to local heating issues (particularly with turbo charged engines).

Upon completion the practitioner must check the characteristics of the sprinkler system for satisfactory operation. Checks include the following:
the sprinkler alarm valves do not activate on starting of the main fire pumps
pressure maintenance pumps and jacking pumps have sufficient range to operate under minimum conditions
pump start conditions are tested by gradually decreasing the pressure in the main and not just the test loop
that the pipework and fittings are designed to withstand any increase in downstream pressures.

Only experienced practitioners should be engaged to undertake this work as there are many interacting requirements. The complexity of a sprinkler system varies according to the numbers and sources of water supply as well as any changes in elevation.

5.3.3.3 PUMP START PRESSURE SWITCHES

During testing only one pump is required to operate, running the second pump running must be stopped to save water. This simple measure is regarded as a ‘quick win’ for water conservation and can be achieved by one of the following methods:

- the service provider is to turn the second pump off before undertaking the test
- adjust the pressure switches to avoid automatic start of the second pump.

The first item is a management practice which can be achieved by instructing service providers of the procedure. Instructions can be provided on wall plaques as reminders to services providers and other technicians.

Adjusting the pressure settings of the pressure switches should be undertaken as part of the complete PSA project. The pressure settings should be adjusted in accordance with a professionally produced pressure gauge schedule. Refer above for the details on preparing a pressure gauge schedule.

5.4 COSTING

The costs associated with the implementation of this ‘quick win’ water conservation opportunity will require the following steps:

- allocating time to provide the relevant information
- engaging a suitably qualified person to undertake an analysis of the pressure gauge schedules and produce a schedule that will reduce the flow rate of water draining to the pressure relief valve and diesel engine cooling water
- engaging a suitably qualified commissioning technician to adjust the pressure settings of the various components of the fire sprinkler system
producing a permanent pressure gauge schedule plaque that is attached to a wall near the pumps and the installation control valves.

An estimate of these cost will be in the following range (sprinkler systems vary in complexity and accurate costing will need to be undertaken individually)

<table>
<thead>
<tr>
<th>Cost item</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility managers time to gather information</td>
<td>$150.00</td>
<td>$300.00</td>
</tr>
<tr>
<td>Engaging professional to provide pressure gauge schedule</td>
<td>$500.00</td>
<td>$1,200.00</td>
</tr>
<tr>
<td>Engaging commissioning technician to undertake settings with professional</td>
<td>$1,000.00</td>
<td>$2,000.00</td>
</tr>
<tr>
<td>Providing pressure gauge schedule plaque</td>
<td>$200.00</td>
<td>$500.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$1,850.00</strong></td>
<td><strong>$4,000.00</strong></td>
</tr>
</tbody>
</table>

The above costing is a guide to the investment in completing the task as recommended. If maintenance budgets are stretched then water savings can still be achieved by obtaining assistance from the service provider to adjust settings where they are obviously incorrect. This will still provide water savings but will not have all of the other benefits of having a pressure gauge schedule.

### 5.5 CASE STUDY WATER SAVINGS

The findings of the case studies showed that significant water savings could be achieved by PSA projects. These savings were calculated on an annual basis over the building life cycle and are shown in the table below.

<table>
<thead>
<tr>
<th>Case Study</th>
<th>kL savings pa</th>
</tr>
</thead>
<tbody>
<tr>
<td>B - High Rise Office 2</td>
<td>836</td>
</tr>
<tr>
<td>C - High Rise Office 3</td>
<td>1,880</td>
</tr>
<tr>
<td>D - High Rise Hotel</td>
<td>280</td>
</tr>
<tr>
<td>E - High Rise Residential</td>
<td>1,600</td>
</tr>
<tr>
<td>G - Medium Shopping Centre</td>
<td>7,100</td>
</tr>
<tr>
<td>K - Manufacturing Food</td>
<td>1,800</td>
</tr>
<tr>
<td>L - Manufacturing Automotive</td>
<td>1,730</td>
</tr>
<tr>
<td>— Large Office/Retail</td>
<td>2,200</td>
</tr>
</tbody>
</table>
6 OPPORTUNITY 2: AS1851 - 2005 and MONTHLY TESTING

Service providers traditionally test fire sprinkler systems on a weekly basis to check its operational readiness. The building owners of larger sites can save hundreds of thousands of litres per year of test water by taking advantage of AS1851-2005 as the test standard for their fire sprinkler system and adopting the monthly option.

This chapter provides a guide on how owners and managers can achieve water savings through changing maintenance standards to monthly under AS1851-2005.

6.1 OPPORTUNITIES IN ADOPTING MONTHLY TESTING

Adopting monthly over weekly testing provides substantial water savings in sprinkler systems. The properties that will benefit most from the change to monthly have:

- pump boosted water supplies drawing from town mains
- water supplies that operate relief valves while pumps are running
- diesel driven pumps that use raw water cooling
- more than 12 sets of installation control valves.

The properties that can most easily adopt AS1851-2005 and monthly testing have:

- no special maintenance requirements that require weekly testing
- sprinkler systems installed before 1994
- AS1851-2005 requirements and monthly testing equipment prerequisites are installed.

6.2 BENEFITS & CHALLENGES

AS1851-2005 is an important step forward from the earlier versions of the AS1851 suite of standards. The newer standard has the following benefits:

- provides a consistent approach for the maintenance of fire safety and protection systems across all systems
- adopts a more quality assurance approach through better documentation
- ensures better systems reliability through provision of improved documentation
- provides clearer instructions to eliminate the scope of ‘corner cutting’ by some maintenance practitioners
- provides more comprehensive functionality and performance testing instructions
- enables a move to monthly testing of the sprinkler installation if certain risk processes are managed.
In addition to the water saving benefits from adopting AS1851-2005 and monthly testing owners can also expect:

- a reduction of life cycle costs through greater clarity of maintenance requirements and accountability by maintenance providers
- increased accountability for risk management, corporate governance and insurance through annual statements of system conditions
- improved future planning based on clearer and more comprehensive system information
- greater confidence in system performance in the event of a fire
- greater transparency of processes by using better recording and documentation processes
- a quality assurance check on maintenance that can fit straight into a corporate quality assurance plan.

AS1851-2005 is a significant change from earlier versions of the AS1851 suite of standards. The newer standard has the following features:

- provides a consistent approach for the maintenance of fire safety and protection systems across all systems
- adopts a more quality assurance approach through better documentation
- ensures better systems reliability through provision of improved documentation
- eliminates “corner cutting” by maintenance practitioners by providing clearer instructions
- provides more comprehensive functionality and performance testing instructions
- enables a move to monthly testing of the sprinkler installation if certain risk processes are managed.

6.3 STEPS REQUIRED TO ADOPT MONTHLY TESTING

Facility managers wanting to save water and move to monthly testing should implement the following steps:

- engage a suitably experienced professional to estimate the water savings that monthly testing can achieve
- engage the service provider to determine if the equipment prerequisites have been met and issue a quote for any missing elements
- engage a fire services engineer to determine the steps to move to monthly testing and provide a project budget to undertake the work
- management to decide on the cost benefit of moving to monthly
6.3

- proceed with monthly testing when all prerequisites are in place and monthly testing is permitted in the maintenance determinations
- if a new maintenance determination is required engage the appropriate professionals to amend the maintenance of the sprinkler system to monthly under AS1851-2005.

6.3.1 CALCULATION OF WATER USAGE DURING TESTING

Suitably experienced professionals will be able to provide estimates of water usage for the following tests:

- alarm valve tests
- flow switch tests
- pump running during the test
- circulation relief valve
- three monthly testing
- pump performance testing.

Note: Pump boosted sites will use substantially more water than non pumped water supplies.

6.3.1.1 ALARM VALVE TEST

The discharge flow-rate for each alarm valve is dependant on the installation pressure as shown in the table below. By recording the length of time that water is discharged to drain and multiplying this figure by the flow rate, a test volume can be calculated. Follow the same procedure to calculate each alarm valve set then sum the total of each alarm valve test to calculate the total water lost to drain.
Table 6.3.1.1  Estimated alarm valve flow-rate to drain based on installation pressure

<table>
<thead>
<tr>
<th>Pressure (kPa)</th>
<th>Flow (L/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2250</td>
<td>340</td>
</tr>
<tr>
<td>2000</td>
<td>320</td>
</tr>
<tr>
<td>1800</td>
<td>305</td>
</tr>
<tr>
<td>1600</td>
<td>285</td>
</tr>
<tr>
<td>1400</td>
<td>266</td>
</tr>
<tr>
<td>1200</td>
<td>254</td>
</tr>
<tr>
<td>1000</td>
<td>225</td>
</tr>
<tr>
<td>800</td>
<td>200</td>
</tr>
<tr>
<td>600</td>
<td>173</td>
</tr>
<tr>
<td>400</td>
<td>141</td>
</tr>
<tr>
<td>200</td>
<td>96</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

6.3.1.2  FLOW SWITCH TEST

The water flow triggers the flow switch alarm before discharging to drain. The volume of water used will vary depending on system parameters, just as indicated with the alarm valve test.

The discharge flow-rate for each flow switch is dependant on the installation pressure as shown in Table 6.3.1.1 above. A test volume can be calculated by timing the discharge of water to drain and multiplying this figure by the flow rate. Follow the same procedure to calculate each flow switch test then sum the total of each of the flow switch tests to calculate the total volume of water lost to drain.

6.3.1.3  RUNNING OF THE FIRE PUMPS

Operating the fire pumps consumes water during both alarm valve and flow switch tests and again during the 60% load tests.

6.3.1.3.1  ALARM VALVE TESTING

Water use is estimated by multiplying the flow rate of water discharging to waste with the length of time for which the pumps run.
Discharge flow rate:

Pump discharge is estimated based on the following table:

<table>
<thead>
<tr>
<th>Type of discharge</th>
<th>Flow rate of discharge (L/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure Relief Valve - pump over pressure</td>
<td>Use Table 5.1.1</td>
</tr>
<tr>
<td>Pressure Relief Valve - circulation relief</td>
<td>Use Table 6.3.1.1 based on operating pressure</td>
</tr>
<tr>
<td>Diesel engines using raw water cooling</td>
<td>Use Table 5.3.1.2</td>
</tr>
</tbody>
</table>

Pump run time:

The length of time for which the fire pump runs during the alarm valve test is timed starting from when the first alarm valve test automatically starts the pump until the pump is manually shut off. Testers may also choose to operate the pump manually before the first alarm valve test and cycle between the pumps (e.g., electric for the first half of the test and then diesel for the remainder of the test).

6.3.1.3.2 FLOW SWITCH TESTING

Water use estimates for the flow switch testing are calculated using the same methodology as was used for the alarm valve. The testing of the flow switch should only use the electric pump which will continue to operate until the test is over and then turned off.

6.3.1.4 CIRCULATION RELIEF VALVE

Circulation relief valves will only discharge to drain if the main pump is churning at zero flow and not opening the main pump pressure relief valve. Circulation relief valves are normally only used in conjunction with electric pumps as diesel pumps use the cooling water to circulate a small amount of water which prevents churning.

The estimate of water use is determined by multiplying the pump run time with the flow rate of the alarm valve test. Refer to Table 6.3.1.1.

6.3.1.5 THREE MONTHLY TESTING

In addition to the water estimates of above, the three-monthly test requires the diesel driven pump to operate at least 60% load for a duration of 30 minutes, and the electric pump for 3 minutes.
The flow rate is taken to 60% of the pump’s nominal flow-rate which can be estimated as being 1.2 times the duty flow-rate. The duty flow-rate can be taken from the block plan system requirements.

The volume of water used will be site specific but can be estimated as the total volume of the load test and cooling water.

If the pressure relief valve operates in excess of the 60% load flow-rate, then this additional test becomes redundant and is not required.

### 6.3.1.6 PUMP PERFORMANCE TESTING

Pump performance testing is undertaken annually and requires the water supply pressure to be tested for a number of different flow rates.

To estimate water usage it is assumed that a flow test takes 10 minutes and during this time the flow rate will be 70% of the highest system requirement. The test is repeated for every pump and every source of water (town main).

Only one performance test is needed for each of the above combinations as pressures can be recorded for the town main and pump delivery (all stages) for each flow rate. For example, a combination of two pumps and two town main connections will require a maximum of four test, each lasting the 10 minutes.

### 6.3.2 ADOPTING AS185 2005 AND MONTHLY TESTING

The benefit of adopting AS1851-2005 and monthly testing can be achieved if the following conditions are met:

- an interface matrix diagram is provided (see AS 1851-2005 clause 2.2.2)
- a pressure gauge schedule\(^\text{29}\) is provided
- the sprinkler system equipment prerequisites are provided (see AS 1851-2005 clause 2.2.1.1) for all commercial systems
- the pumpset equipment prerequisites are provided (see AS 1851-2005 clause 2.2.1.3)

Under AS1851-2005 the default frequency for testing the reliability of fire sprinklers continues to be weekly, as in pre-2005 1851 Standards, but the standard now states that weekly inspection and testing may be omitted where:

- the main stop valve and subsidiary valves are Grade B status monitored, in

\(^{29}\)A pressure gauge schedule is not defined in AS 1851-2005 but is referred to 21 times. The schedule is introduced in AS 2118.1-2006 in clause 8.6 which is not a BCA referenced document. Best practice provides a pressure gauge schedule so that the AS 1851-2005 tests can be undertaken and verified against the design requirements.
accordance with AS 2118.1

- water supply valves, except underground key-operated valves, are secured in the open position, with the main stop valve strapped and padlocked and all other valves chained and padlocked
- control assemblies are located in a locked room or enclosed in a locked cabinet or cage, and
- where required, systems incorporate an automatic installation jacking pump or retard chamber, whichever is appropriate.

These conditions address the issue of control valve security - a key factor that can compromise a sprinkler system. The enhanced security requirements are aimed at maintaining reliability in a maintenance regime in which the alarm testing and pump start device testing takes place monthly.

AS1851-2005 further states that weekly testing of diesel engine-driven pumpsets may be omitted where:

- they comply with AS2941-2002 and the engine-starting batteries are replaced after a maximum period of two years, irrespective of condition, or
- they do not comply with AS2941-2002, but are equipped with:
  - dual engine-starting batteries
  - low voltage monitoring facilities
  - low fuel level monitoring facilities, and
  - the engine-starting batteries are replaced after a maximum of two years irrespective of condition.

This sub section provides specific information on the following control measures to move to monthly testing under AS1851-2005:

- main stop valve and subsidiary valve monitoring
- water supply valves locked open
- locked installation control valve enclosures
- automatic jacking pump or retard chamber
- interface diagram
- pressure gauge schedule
- diesel pump batteries to comply with AS2941-2002 or dual starting batteries
- pump status alarms.

### 6.3.2.1 VALVE SUPERVISION
Moving to monthly testing will require all main stop valves and subsidiary stop valves to be supervised. Valves are to be provided with valve monitoring devices and connected to control and indicating equipment.

The standard requires Grade B status monitoring which is defined in AS 2118.1 clause 3.4 as a device that shall transmit a signal upon a change of status for the monitored component and any attempt to tamper with or bypass the connection back to the receiving centre (ie fire brigade receiving centre).

6.3.2.2 WATER SUPPLY VALVES LOCKED OPEN

Under monthly testing requirements water supply valves must be secured open. The main stop valve is to be secured in the open position with a rivetted strap and then padlocked in place. While it is common practice for main stop valves to be locked with a chain instead of a strap this is not in accordance with the standards. However, other water supply valves can be locked with chains. Industry practices require the padlocks to be coded Lockwood 003 pattern.

6.3.2.3 CONTROL VALVE ASSEMBLIES ENCLOSED & LOCKED

Monthly testing requires the additional security of having the sprinkler control valve assemblies secured. These requirements can be fulfilled by supplying either a locked room, cabinet or cage. These items must be used for no other purpose than securing the control valve assemblies.

Exceptions to this requirement include:

- a combined hydrant/sprinkler system control valve assembly in a fire isolated stairway (applicable to high rise buildings)
- where building and site security provide controlled access.

It is common practice to have the room, cabinet or cage locked using a key or padlock with a coded Lockwood 003 pattern (fire industry padlocks).

6.3.2.4 AUTO JACKING PUMP / RETARD CHAMBER

Monthly testing may also require the use of additional measures to reduce nuisance fire calls. Building owners and or managers will want the occurrence of false alarms to be minimised or eliminated as they attract a fine from the fire brigade. It is highly recommended that any system with a pumped water supply have jacking pump measures fitted, it is also recommended that all control valve assemblies have either an automatically operated jacking pump or a retard chamber.

A sprinkler fitter can easily install these items to existing valves assemblies if recommended by a suitably qualified engineer or technician.
6.3.2.4.1 JACKING PUMP

The automatic jacking pump is the preferred option from a reliability point of view. The disadvantage is that they require an electric power source. The pump is operated by a pressure switch that monitors each installation pressure and operates when the pressure in the installation falls below a predetermined value (see pressure gauge schedule).

A single jacking pump can be attached to a group of control valve assemblies, as long as they share the same pressure gauge schedule.

It is recommended that jacking pumps be hard wired to the electrical supply with the switch locked in the open position. This helps prevent the pump from being inadvertently turned off and exposing the system to false alarms.

A sprinkler fitter can install this item to a valve assembly or group of assemblies. Service providers can recommend an assembly to provide the required pressure of about 400 kPa above the normal supply main pressure. The flow rate is not required to be very high and we recommend that a 3 mm orifice be provided to limit the pump flow rate and increase fire brigade alarm response time.

6.3.2.4.2 RETARD CHAMBER

A retard chamber can be used as a filter for false alarms in instances where the fire signal is generated from the alarm port of a sprinkler alarm valve. Each sprinkler installation control valve assembly will require one retard chamber which can be fitted without draining water from the system.

6.3.2.5 DUAL STARTING BATTERIES

Moving to monthly testing will require dual engine starting batteries to be provided for all pump sets. In the case studies, many pumps were found to have this feature already in place as it has been industry practice since 1987 to comply with AS2941-1987.

If the pump sets do not comply with AS2941-1987 then managers and or owners can contact a fire pump vendor to have the following fitted.

- 4 batteries, leads and stand
- 2 battery chargers
- 2 start solenoids
- over ride start switches
- battery charger supply failure indication
- fitting and installing new cabling and equipment
- commissioning and connecting to fire indicator panel (if installed).
Batteries must comply with one of the following standards:

- AS4029.2
- AS4029.3
- AS3731.1
- AS3731.2.

AS1851-2005 also requires the pump starting batteries to be replaced every two years irrespective of their condition.

If this facility is not provided the service provider or pump vendor can be contracted to fit these items.

6.3.2.6 PUMP STATUS ALARMS

For a pump to be tested on a monthly basis the following status alarms shall be provided:

- starting battery charging circuit monitoring
- low fuel level for diesel powered pumps.

6.3.2.6.1 STARTING BATTERY CHARGING CIRCUIT MONITORING

The pump set control system should provide a local alarm in the event of low or no voltage to the battery charging circuit. The pump control panel is to provide an aural and visual indication. As with the dual starting batteries this facility should be provided with pumps installed to AS 2941-1987 or later.

6.3.2.6.2 LOW FUEL LEVEL FOR DIESEL POWERED PUMPS

Monthly testing will also require the diesel fuel level to be either monitored at the control panel and provide:

- local aural and visual alarm generated by a low fuel level sensor

Note: A probe assembly maybe fitted to the fuel filler cap with visual indication of fuel level and connected to the pump control panel to provide the aural and visual alarms. This allows for the diesel tank to remain filled and the indicator to be retrofitted.

The installation of a low fuel level indication was first required in AS 2941-2002 and was probably not installed to fuel tanks and pump control panels prior to this date.

6.3.2.7 INTERFACE DIAGRAM
The system interface diagram describes the interconnections between the sprinkler systems and the other fire safety features. It needs to be located in the fire control room or near the fire indicator panel in the form of a permanent chart that is water and fade resistant. The interface diagram shall include the following information where relevant:

<table>
<thead>
<tr>
<th>System</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sprinkler Installation</td>
<td>•</td>
</tr>
<tr>
<td>Detection systems</td>
<td>•</td>
</tr>
<tr>
<td>Smoke/heat alarm system</td>
<td>•</td>
</tr>
<tr>
<td>Gaseous Systems</td>
<td>•</td>
</tr>
<tr>
<td>Aerosol Systems</td>
<td>•</td>
</tr>
<tr>
<td>Water Mist Systems</td>
<td>•</td>
</tr>
<tr>
<td>Hydrants</td>
<td>• •</td>
</tr>
<tr>
<td>Hose Reels</td>
<td>•</td>
</tr>
<tr>
<td>Kitchen Suppression</td>
<td>•</td>
</tr>
<tr>
<td>Other (nominate)</td>
<td>•</td>
</tr>
</tbody>
</table>

Note: These values are for illustration purposes only.

Each of the above functions A to F may include such items as:

- stair pressurisation
- door releases
- roof vents
- sound systems (nominate zones)
- plant shutdown (nominate plant)
- fuel isolation
- elevator override
- alarm monitoring
- smoke exhaust fans
- smoke spill fans
- HVAC shutdown (nominate zones)
- damper closure (nominate)
- other operations (specify)
- fire pump

6.3.2.8 PRESSURE GAUGE SCHEDULE

Each set of installation control valves and pump sets shall be provided with a pressure gauge schedule if AS1851-2005 sprinkler testing is to be adopted.

For more information on pressure gauge schedules refer to chapter 5.3.
6.3.3 CAN THE SPRINKLER SYSTEM MOVE TO MONTHLY TESTING?

For a property owner to benefit from changes in the new standard and obtain water savings a fire services engineer or other suitably qualified professional needs to be able to answer the following questions:

- does the sprinkler system contain the equipment prerequisites, interface diagram and pressure gauge schedule (see above)?
- what is the applicable maintenance determination for the sprinkler system?
- what is the applicable maintenance standard?
- are there any special design or insurance company conditions that prevent the testing from being undertaken on a monthly basis?
- is the risk suitably managed for monthly inspections?

6.3.3.1 APPLICABLE MAINTENANCE DETERMINATION FOR A SPRINKLER SYSTEM

Sprinkler systems are required to be installed or altered in accordance with the applicable building regulations. The maintenance of the sprinkler system is determined based on the regulations which can be divided into the following categories:

- buildings designed or installed prior to July 1994
- buildings designed post June 1994.

6.3.3.1.1 PRE JULY 1994

Pre July 1994 buildings are typically referred to as Division 2 buildings under the maintenance of essential safety measure provisions of Part 12 of the building regulations 2006. Most buildings constructed prior to the 1st July 1994 did not have essential safety measures mandated by a building surveyor.

The implication is that for sprinkler systems installed prior to this date AS1851-2005 is suitable for adoption as the new maintenance standard without applying a formal regulatory process to vary the existing maintenance standard.

6.3.3.1.2 POST JUNE 1994

The relevant building surveyor is required to issue an occupancy permit or a

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30 Under the transition provisions of the Building Act 1993 and Building Regulations 2006 essential services or safety measures, fittings and equipment approved under previous building regulations are deemed to be essential safety measures.

maintenance determination for all buildings constructed or altered after 30 June 1994. These documents list the essential safety measures and become a formal statutory determination, they require the sprinkler system to be serviced on a weekly basis in accordance with a specified Australian Standard or other specified maintenance regime.

If a change is required then a formal regulatory process must be followed to vary the maintenance standard. There are a number of options for this process and these are described below.

There are some exceptions for pre 1994 and post 1994 buildings; buildings on Crown land and Commonwealth land. Refer to Appendix F for further details.

6.3.3.2 IDENTIFICATION OF THE APPLICABLE MAINTENANCE STANDARD

Evaluation of the suitability of migration to AS1851-2005 as the maintenance standard for a sprinkler system requires identification of the maintenance standard at the time of installation. Buildings fall into a number of categories which determine how the maintenance standard is identified. The following categories apply:

- no maintenance standard applies
- maintenance standard applies because of a post June 1994 determination.
- non AS2118 installation standard.

6.3.3.2.1 NO MAINTENANCE STANDARD APPLIES

Where it is established that no maintenance standard applies, then subject to meeting the relevant prerequisites in AS1851-2005 for adoption of the maintenance standard, no formal regulatory process is required for migration to AS1851-2005.

6.3.3.2.2 POST JUNE 1994 DETERMINATION

Where it is established that a specific maintenance standard applies because of a post June 1994 determination then a formal regulatory process is required for migration to AS1851-2005.

Refer to below on the process of changing the maintenance standard.

6.3.3.2.3 NON AS2118 INSTALLATION STANDARD

Where the sprinkler system is a non AS2118 series sprinkler system e.g. FM Global, or NFPA 13 or NFPA 13R sprinkler systems there maybe specific maintenance processes and procedures referenced by these installation standards.
The use of AS1851-2005 is considered appropriate for these systems and the one of the above two methods apply. Additional design requirements may also apply to these installations - refer to 6.3.3.3.

6.3.3.3 ADDITIONAL DESIGN REQUIREMENTS

Understanding the applicable maintenance regime must also consider the following additional requirements as part of the design of the sprinklers:

- fire brigade reports
- alternative solutions
- building determinations
- other statutory requirements.

6.3.3.3.1 FIRE BRIGADE REPORTS

The building may have been designed with an application to the fire brigade to vary the deemed to satisfy requirements. This design solution may have additional maintenance provisions included that should be reflected in the occupancy permit.

Before moving to monthly testing a review of the brigade determinations should be undertaken to clear this item. Experience from the case studies show that the brigades did not provide any determinations for maintenance.

If a maintenance determination was issued that did not allow monthly testing then an application to the municipal building surveyor can permit this be changed. The municipal building surveyor may also require further consultation with the brigade to obtain their opinion before issuing a new determination.

6.3.3.3.2 ALTERNATIVE SOLUTIONS

If the design of the building is based on an alternative solution and this solution prescribes a maintenance regime this should be reflected in the occupancy permit. If monthly testing is not included in the option then an application to the municipal building surveyor can permit this be changed.

The municipal building surveyor may require a suitably qualified and experienced fire safety engineer to review the maintenance requirements set out in the alternative solution. The fire safety engineer will investigate the key fire safety matters and make a judgement on the maintenance requirements. The municipal building surveyor can then issue a change to monthly testing through a new occupancy permit.
6.3.3.3 BUILDING DETERMINATIONS

Maintenance determinations approved by the building appeals board and the former building referees may specify particular maintenance standards e.g. ‘High Rise Awards’ for buildings in the City of Melbourne of height greater than 40.0 m. These require specific review, investigation and evaluation to enable the relevant matters to be considered.

If a determination does not allow monthly testing then application to the building appeals board is required to obtain a new determination.

6.3.3.4 OTHER STATUTORY REQUIREMENTS

Other statutory requirements need to be considered, such as those typically administered by the Victorian Workcover Authority e.g. Section 28 duties of the designer, major hazard facilities, dangerous goods etc.

Special maintenance determinations may not be have been included in the occupancy permit but still need to be considered from a duty of care perspective. Such considerations may include:

- Victorian Workcover Authority
- Dangerous Goods Act
- others.

For further information on these topics refer to Appendix G.

6.3.3.4 MANAGING THE RISK OF MOVING TO MONTHLY TESTING

When adopting monthly testing, facility managers need to consider the increased risk of having the sprinkler system inspected on a less regular basis. The standard helps mitigate many of the risks with the monthly prerequisites, but the following impairment scenarios also need to be managed:

- impairment of water supply valves after alterations or testing
- impairment of essential equipment after alterations or testing.

6.3.3.5 WATER SUPPLY VALVES

Whilst it is required to monitor water main stop valves and subsidiary valves not all valves are provided with electronics to monitor the fully open position. Electronics can be overridden and unmonitored supply valves (sluice valves) can be left closed or partially closed.

This risk can be successfully managed by listing all essential valves and checking these on each monthly visit. Valves without visual indication will need
to be partially operated (eg sluice and non rising valves) as there are no other reliable methods. These valves will also need to be locked and labelled as required in the installation standards.

6.3.6 EQUIPMENT

Equipment may also be left in a position that will impair sprinkler operation. Fire pumps and jacking pumps can easily be left offline impairing sprinkler operation. Not all functions are monitored and even then can be easily overridden.

This risk can be successfully managed by providing permanent labels to indicate the normal operating position and ensuring it’s locked in this condition. Check lists should also be provided to enable inspection of equipment in a methodical manner.

6.3.4 PROCESS FOR CHANGING TO MONTHLY TESTING

The change to AS1851-2005 and adoption of monthly testing must follow one of the following processes:

- automatic adoption of AS1851-2005
- obtaining a building permit for building works (if major works are required)
- amendment of the occupancy permit or maintenance determination.

In varying the relevant maintenance standard to monthly testing under AS1851-2005 consideration needs to be given to additional design requirements which may have varied either the original installation standard and/or the maintenance standard. Examples of these additional and other design requirements are given below and should be considered. In addition to these requirements the sprinkler system must provide the AS1851-2005 monthly prerequisites as stated above.

These additional and other design requirements may affect the processes usually followed to vary the maintenance standard.

6.3.4.1 ADOPTION OF AS1851-2005

The change to AS1851-2005 can be implemented without a formal regulatory process when if the following applies:

- a record search that finds no occupancy permit or determination is in place
- there is no alternative maintenance standard or special requirement for maintenance
- the AS2118 suite of standards is the installation standard
Appendix C1 provides a flow diagram showing the adoption of AS 1851-2005

6.3.4.2 OBTAINING A BUILDING PERMIT

Building owners undertaking building works need to engage a building surveyor to issue a building permit if any modifications are made to the sprinkler system. For the building permit to change the existing maintenance determination for the sprinkler system the works need to be substantial enough for designers to reconsider the design parameters for the whole system. On completion of the works, subject to a satisfactory final inspection, an occupancy permit or maintenance determination can be issued that lists AS1851-2005 as the relevant maintenance standard.

Maintenance determinations are only applicable to the actual equipment effected by the building works and for existing systems this approach is considered to be limited in its application as it does not change the maintenance standard for the whole of the system.

6.3.4.3 AMENDMENT OF THE OCCUPANCY PERMIT OR MAINTENANCE DETERMINATION

The municipal building surveyor is the only person permitted to amend the maintenance standard for the existing occupancy permit or maintenance determination where there is:

- a regulatory determination specifying an alternative maintenance standard; or
- a building constructed or altered after 30 June 2004 and no records are available; or
- an alternative solution (or other determination see 6.3.x.x) specifying a different maintenance standard or frequency.

Applicants can applying to a Municipal Building Surveyor using the proforma template included in Appendix E. This will provide a process to assist with the application.

6.3.4.4 MANAGING THE RISK OF MOVING FROM WEEKLY TO MONTHLY TESTING

The benefits of adopting monthly testing also need to be considered along with the risk of having the system inspected on a less regular basis. The major risks are associated with the following:

- on reinstatement after an impairment water supply valves may not be reinstated to their correct operating position
- on reinstatement after servicing or an impairment equipment may not be
reinstated to their correct operating positions.

6.3.4.5 WATER SUPPLY VALVES

The risk of having water supply valves closed is critical to the effective operation of a sprinkler system. Whilst it is a requirement to monitor water supply valves in sprinkler installations not all valves are required to be monitored with electronics to sense that valve is not fully open. Electronics can be overridden.

Having a reliable process for checking that all valves are maintained in the open position is considered to be much more critical when moving from weekly to monthly inspections.

6.3.4.6 EQUIPMENT

As with isolation valves equipment may also be left in a position that will compromise the effective operation of the sprinkler system. Fire pumps and jacking pumps can be left offline.

This risk must be considered and managed if monthly testing is to be adopted.

6.4 COSTS ASSOCIATED WITH ADOPTING AS1851-2005

The costs associated with moving from weekly to monthly include the following:

- professional fees
- one off capital cost items
- engaging service providers
- costs associated with repair and maintenance.

6.4.1 PROFESSIONAL FEES

Altering or changing the design of an essential safety measure requires professional involvement from one or more of the following parties:

- fire services engineer
- fire safety engineer
- registered building surveyor
- municipal building surveyor.

6.4.1.1 FIRE SERVICES ENGINEER

The Facility Manager will engage a Fire Services Engineer to provide design services, assessment analysis and documentation which will include:
6.19

- provision of pressure gauge schedules and interface diagrams
- documentation for provision of system changes, prerequisites and new equipment associated with new building works
- preparation of a building permit application with all necessary documentation including the maintenance specification to monthly testing
- certification of building works
- DVD and documentation to provide specific instructions as to the impairment and management of the sprinkler system.

Fire Services Engineers will typically be in the following cost range:

<table>
<thead>
<tr>
<th>Service</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface diagram</td>
<td>$800</td>
<td>$1,200</td>
</tr>
<tr>
<td>Pressure gauge schedule</td>
<td>$200</td>
<td>$2,000</td>
</tr>
<tr>
<td>Design report and documentation for a building permit</td>
<td>$600</td>
<td>$1,500</td>
</tr>
<tr>
<td>Certification of building works</td>
<td>$400</td>
<td>$1,000</td>
</tr>
<tr>
<td>Contractor DVD which provides instructions specific to the sprinkler system impairments and operation</td>
<td>$3,000</td>
<td>$5,000</td>
</tr>
</tbody>
</table>

6.4.1.2 FIRE SAFETY ENGINEER

The facility manager will engage a fire safety engineer to review the alternative solution and other fire safety matters concerned with the design of the building solution. The engineer will issue a new report that enables monthly testing to be undertaken.

Fire Safety Engineers will typically charge somewhere in the following cost range:

<table>
<thead>
<tr>
<th>Service</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review of an alternative solution to determine if monthly testing will be available</td>
<td>$300</td>
<td>$500</td>
</tr>
<tr>
<td>Rewriting of the alternative solution report to allow for monthly testing in the sprinkler system</td>
<td>$1,500</td>
<td>$3,000</td>
</tr>
</tbody>
</table>

6.4.1.3 REGISTERED BUILDING SURVEYOR

The facility manager will engage a registered building surveyor if a building permit is required for new building works. The surveyor will issue a completion certificate nominating the essential safety measures relevant to the building works only.

Registered building surveyor professional fees will typically charge somewhere in
the following cost range:

<table>
<thead>
<tr>
<th>Service</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide a building permit</td>
<td>$600</td>
<td>$1,200</td>
</tr>
</tbody>
</table>

### 6.4.1.4 MUNICIPAL BUILDING SURVEYOR

The facility manager will engage a municipal building surveyor to change an occupancy permit that has a maintenance determination that does not allow for monthly testing. Refer above for when this will be required.

Registered Building Surveyor professional fees will typically be in the following range:

<table>
<thead>
<tr>
<th>Service</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Municipal Building Surveyor</td>
<td>$900</td>
<td>$2,500</td>
</tr>
</tbody>
</table>

### 6.4.2 ONE OFF CAPITAL COST ITEMS

Moving to monthly testing may require the sprinkler installation to be provided with the additional features known as the prerequisites. The following is the cost range for providing these items:

<table>
<thead>
<tr>
<th>Prerequisite Item</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve monitoring device per valve</td>
<td>$700</td>
<td>$1,100</td>
</tr>
<tr>
<td>Locking a water supply valve</td>
<td>$50</td>
<td>$100</td>
</tr>
<tr>
<td>Locking a control valve assembly</td>
<td>$100</td>
<td>$5,500</td>
</tr>
<tr>
<td>Automatic jacking pump (per manifold)</td>
<td>$3,000</td>
<td>$7,000</td>
</tr>
<tr>
<td>Retard chamber (per installation control valves)</td>
<td>$500</td>
<td>$700</td>
</tr>
<tr>
<td>Fuel filler probe and connection to the control panel</td>
<td>$500</td>
<td>$1,000</td>
</tr>
<tr>
<td>Upgrading the pump control panel to take dual starting batteries, dual solenoids, charging circuit, battery charger supply failure</td>
<td>$5,000</td>
<td>$15,000</td>
</tr>
<tr>
<td>Upgrading the pump control panel to low level fuel alarm</td>
<td>$2,000</td>
<td>$10,000</td>
</tr>
</tbody>
</table>

### 6.4.3 ENGAGING SERVICE PROVIDERS

Facility managers know the cost of current maintenance agreements and need to know what will be the result of changing to a new regime. Consideration has been given to comparing this standard with earlier AS1851 sprinkler system maintenance standards.

This section provides the following information:
• a parallel analysis between the sprinkler system maintenance standards AS1851.3 1997 and AS1851-2005 Section 2
• a parallel analysis between the pump sets maintenance standards AS1851.14 1996 and AS1851-2005 Section 3.

6.4.3.1 SPRINKLER SYSTEM PARALLEL ANALYSIS

An analysis of AS1851-2005 chapter 2 and 3 was compared with AS1851.3 1997 and AS185.1-1996 to determine the difference in service time. The analysis matched every clause under the new standards with its appropriate routine in the earlier standards where applicable.

A hypothetical sprinkler system was used for the analysis to represent a typical large building. The main assumptions for the analysis were:

• building size of 45,000 m²
• 16 levels
• 9 sets of sprinkler installation control valves
• all valves and equipment were accessible and able to be serviced during normal business hours
• all monthly prerequisites were in place
• use of a standard sprinkler system.

The extent of the data collected can be found in Appendix B under the following three hypothetical examples:

1. AS1851.3 1997 VS AS1851-2005 weekly testing chapter 2, sprinklers
2. AS1851.3 1997 VS AS1851-2005 monthly testing chapter 2, sprinklers
3. AS1851.3 1997 VS AS1851-2005 monthly testing chapter 3, pumps

Each example was also analysed for systems provided:

• with a pump suction tank
• without a tank.

The analysis is shown in the following graphs.

1. AS1851.3 1997 VS AS1851-2005 WEEKLY TESTING SPRINKLERS
The newer standard requires additional routines to be undertaken if weekly testing is only adopted, this would result in approximately 50% more maintenance hours.

2. **AS1851.3 1997 VS AS1851-2005 MONTHLY TESTING SPRINKLERS**

Moving to monthly shows a 25% decrease in time spent maintaining the sprinkler systems.
3. AS1851.3 1997 VS AS1851-2005 MONTHLY TESTING PUMPS

Monthly testing of sprinkler pumps shows a decrease in time required to maintain the sprinkler system by over a 50%.

Facility Managers will need to contact their service providers to determine if any cost savings will be passed on in moving to monthly testing under AS1851-2005.

6.4.4 COST OF MAINTAINING THE SPRINKLER SYSTEM
Maintaining the sprinkler system to a monthly testing regime in comparison to a monthly regime will provide the following cost savings:

- reduction in fuel and electricity to run the fire pumps and associated equipment
- less wear on the moving parts of the pump set providing a longer life cycle for replacement
- lower replacement cost on valves and accessories due to less operations
- lower cost to facility management due to lower contractor traffic (providing access and other support functions to the contractors)

### 6.5 CASE STUDY WATER SAVINGS

The findings of the case studies showed that significant water savings could be achieved by adopting monthly testing. These savings were calculated on an annual basis and is shown in the attached table.

Table 6.5  Water savings for the case studies under monthly testing

<table>
<thead>
<tr>
<th>Case Study</th>
<th>kL savings pa</th>
</tr>
</thead>
<tbody>
<tr>
<td>A - High rise office1</td>
<td>365</td>
</tr>
<tr>
<td>B - High rise office 2</td>
<td>798</td>
</tr>
<tr>
<td>C- High rise office 3</td>
<td>1,700</td>
</tr>
<tr>
<td>D- High rise hotel</td>
<td>673</td>
</tr>
<tr>
<td>E- High rise residential</td>
<td>1,200</td>
</tr>
<tr>
<td>F- Shopping centre - large</td>
<td>584</td>
</tr>
<tr>
<td>G- Shopping centre - medium</td>
<td>6,574</td>
</tr>
<tr>
<td>H- Shopping centre - small</td>
<td>62</td>
</tr>
<tr>
<td>I- Manufacturing - paper</td>
<td>88</td>
</tr>
<tr>
<td>J- Manufacturing - printing</td>
<td>438</td>
</tr>
<tr>
<td>K- Manufacturing - food</td>
<td>1,200</td>
</tr>
<tr>
<td>L- Manufacturing - automotive</td>
<td>2,198</td>
</tr>
<tr>
<td>— Large Office/Retail</td>
<td>2,160</td>
</tr>
<tr>
<td>– Small hospital</td>
<td>28</td>
</tr>
</tbody>
</table>

It can be seen from the table that a substantial volume of water is saved on sites that have pumped water supplies, and when combined with pressure relief valves there is an even greater potential for savings.
7 OPPORTUNITY 3: PRESSURE REDUCING PROJECTS

A substantial quantity of water is consumed testing the operational readiness of sprinkler systems. This volume is even more significant if the sprinkler system pumps use large active relief valves.

Building owners can achieve substantial water savings from the pressure setting adjustment project (see chapter 5 - Opportunity 1) but engineering analysis may show that because of excessive pressures from the operating pumps the pressure relief valves are still required to operate. Facility managers should consider the following to reduce this volume to near zero loss:

• installation of pressure reducing valves
• reduction of engine speed in diesel engines
• smaller impellor in the pump.

This chapter provides a guide on how owners and managers can achieve cost effective waters savings through the pressure reducing projects.

7.1 WHEN TO APPLY PRESSURE REDUCING PROJECTS

Building owners can achieve substantial water savings through pressure reducing projects when:

• sprinkler system water supplies consist of pump boosted town mains and exceed operating pressures in the pipework (need to operate pressure relief valves)
• the pressure gauge schedule adjustment project is not able to substantially reduce the flow drained to the pressure relief valve
• water from the pressure relief valve can not be captured for reuse or recirculation
• two diesel pumps have been installed
• pumps are delivering too much pressure (more than 20% above required pressure).
7.2 BENEFITS & CHALLENGES

The benefits of installing a pressure relief valve include:

- substantial water savings
- they do not take up valuable space (which tank solutions will)
- most solutions are easy to maintain and test
- costs are lower than providing tanks for re-circulation
- do not require any additional procedures during testing
- easy to reduce diesel engine speed
- cost benefits when considering deemed cost of water over a buildings life cycle.

Proving pressure reducing projects includes the following challenges:

- need to gain expert advice to implement an appropriate solution
- requirement to modify main pipe lines to install pressure reducing valves
- difficulty of setting up and maintaining pressure reducing valves
- need to also install pressure relief valves upstream if pressure reducing valves are installed
- need to remove the pump impellor from site to reduce the impellor diameter for the smaller impellor solution.

7.3 STEPS IN PROVIDING PRESSURE REDUCING PROJECTS

The steps associated with installing pressure reducing valves include the following:

- ensure that the pressure setting adjusting project has been undertaken and that the pressure reducing valve has been adjusted as required
- engage a fire services engineer to assess water usage and report to management
- compare this opportunity with other opportunities for a ‘best fit’
- engage a qualified and experienced fire services engineer to provide a design and document the opportunity
- engage a building surveyor to provide a building permit of the proposed design (only if new work is proposed)
- engage a suitable contractor to instal or modify the equipment
- engage the fire services engineer to certify the installation and provide completion documentation
- provide additional maintenance requirements if needed (for pressure reducing valves)
- receive a Completion Certificate from the building surveyor.
7.3.1 ASSESSMENT OF WATER USAGE

Water estimates should be been undertaken for the following parts:

- pressure relief valve drain
- cooling water loss
- circulation relief valve loss

7.3.1.1 PRESSURE RELIEF VALVE LOSS

The fire services engineer or designer can estimate water loss through the relief valve by plotting the town main characteristics and pump characteristic onto a graph and determining the flow rate the pressure relief has been set to under the PSA project.

7.3.1.2 COOLING WATER LOSS

Estimating cooling water loss can be determined by using the table in 5.3.3.2 to estimate the flow rate loss to drain and multiplying by the pump run duration.

7.3.1.3 CIRCULATION RELIEF VALVE LOSS

Estimating circulation relief valve loss can be determined by using the following table to estimate the flow rate loss to drain and multiplying by the pump run duration.

Table 7.3.1.3 Estimated circulation relief valve flow-rate to drain based on installation pressure

<table>
<thead>
<tr>
<th>Pressure (kPa)</th>
<th>Flow (L/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2250</td>
<td>340</td>
</tr>
<tr>
<td>2000</td>
<td>320</td>
</tr>
<tr>
<td>1800</td>
<td>305</td>
</tr>
<tr>
<td>1600</td>
<td>285</td>
</tr>
<tr>
<td>1400</td>
<td>266</td>
</tr>
<tr>
<td>1200</td>
<td>254</td>
</tr>
<tr>
<td>1000</td>
<td>225</td>
</tr>
<tr>
<td>800</td>
<td>200</td>
</tr>
<tr>
<td>600</td>
<td>173</td>
</tr>
<tr>
<td>400</td>
<td>141</td>
</tr>
</tbody>
</table>

7.3.2 CONSIDER THE OPPORTUNITIES
The fire services engineer should consider the following opportunities to determine which is the best fit for the building:

- Capture and reuse
- Recirculation project
- Installation of pressure reducing valves
- Reduction of engine speed
- Reduction of pump impellor diameter

### 7.3.2.1 CAPTURE AND REUSE

Refer to opportunity 5 chapter 8.

### 7.3.2.2 RECIRCULATION PROJECT

Refer to opportunity 4: chapter 9.

### 7.3.2.3 INSTALLATION OF PRESSURE REDUCING VALVES

Pressure reducing valve can be installed to prevent overpressure in the sprinkler installations. They are to be installed in the supply mains immediately down stream of each of the fire pumps. The valve reduces the pressure down stream of the pumps enabling the pressure relief valves to be adjusted above the pressure of the pressure reducing valves to have zero flow to drain.

**Note:** Contractors can use the existing pressure relief valves or provide new valves down stream of the pressure reducing valves. The relief valves will operate for a few seconds to allow for equalisation of the pressure reducing valve.

**Caution:** The design and installation of pressure reducing valves should be undertaken by appropriately qualified and experienced designers, installers and commissioning technicians.

### 7.3.2.4 REDUCTION OF ENGINE SPEED

Lower engine speed means lower water pressure which means less waste to drain via a pressure relief valve. Any reduction in speed will mean a lower output pressure and this still must be tested to determine that the system requirements are still being met. A full flow test and report will need to be issued after reducing the engine speed.

Reducing engine speed options are available for:

- diesel driven pumps
- electric prime movers

7.3.2.4.1 DIESEL DRIVEN PUMPS

When diesel engines are provided the available pressure can be reduced by decreasing the engine speed. It may be possible to reduce pressure to such an extent that the pressure relief valves will no longer need to operate.

7.3.2.4.2 ELECTRIC PRIME MOVERS

Decreasing the speed of an electric pump will require the pump motor to be replaced with a lower speed motor. The following motor speeds are typically available:

- 2900 rpm (standard)
- 1440 rpm
- 960 rpm

A fire services engineer can examine the pump characteristic curves from pump vendors for the various speeds to determine best fit.

7.3.2.5 REDUCTION OF PUMP IMPELLOR DIAMETER

If pressure reduction can not be achieved through reducing engine speed or if the pump is driven by an electric motor excessive pressure can be reduced by decreasing the size of the pump impellor.

A fire safety engineer first needs to undertake an appropriate analysis to determine the reduced pressure requirement. A specialist pump technician can then determine the reduced impellor size. Pump impellors will need to be removed from the pump and sent to a specialist work shop to machine the impellor to the required smaller diameter.

Upon reinstatement of the impellor into the pump a test undertaken to determine the new reduced pump performance. The volume of water being discharged to drain should be significantly reduced or completely stopped.

7.3.3 DOCUMENTATION

It is also important to document and provide instructions on how to save water in this opportunity. Engage the fire services engineer to provide the following:

- operational instructions on how to pressure reducing valve (if installed)
- pressure gauge schedule (updated if already provided)
- labelling of valves and equipment
- completion report to advise that work was satisfactorily completed including results
of pump performance tests
  • updating the pump identification plate with the new impellor size (if reduced) or engine speed (if changed)
  • maintenance requirements.

If building works are provided the building surveyor will also need to provide a completion certificate once the engineers documentation has been satisfactorily completed.

7.4 COSTINGS

The costs associated with providing pressure reducing valves include:

  • professional fees
  • one off capital cost items.

7.4.1 PROFESSIONAL FEES

Altering or changing an essential safety system requires professional involvement from one or more of the following parties:

  • fire services engineer
  • registered building surveyor.

7.4.1.1 FIRE SERVICES ENGINEER

The facility manager will engage a fire services engineer to provide design services and documentation services which include:

  • provision of a pressure gauge schedule
  • documentation for provision of system changes and new equipment associated with new building works
  • preparation of a building permit application with all necessary documentation

Fire Services Engineers will typically be in the following cost range:

<table>
<thead>
<tr>
<th>Service</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure gauge schedule</td>
<td>$1,000</td>
<td>$2,000</td>
</tr>
<tr>
<td>Design report and documentation for a building permit</td>
<td>$2,000</td>
<td>$4,000</td>
</tr>
<tr>
<td>Engineering and pump analysis (include flow test)</td>
<td>$1,000</td>
<td>$2,000</td>
</tr>
<tr>
<td>Certification and commissioning</td>
<td>$500</td>
<td>$1,000</td>
</tr>
</tbody>
</table>

7.4.1.2 REGISTERED BUILDING SURVEYOR
The Facility Manager will engage a registered building surveyor to issue a building permit for the new building works. The surveyor will issue a completion certificate & maintenance determination upon satisfactory completion of the works.

Registered building surveyor professional fees will typically be in the following range:

<table>
<thead>
<tr>
<th>Service</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide a building permit</td>
<td>$500</td>
<td>$1,000</td>
</tr>
</tbody>
</table>

### 7.4.2 ONE OFF CAPITAL COST ITEMS

The capital cost of providing the hardware will include some or all of the following items which have been provided with a low / high range:

<table>
<thead>
<tr>
<th>Capital Item</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provision of two off pressure reducing valves fitting into the main discharge line of the pumps</td>
<td>$20,000</td>
<td>$30,000</td>
</tr>
<tr>
<td>Provision of new pressure relief valves to work with the pressure reducing valves (if existing valves can be used then these only need to be reset)</td>
<td>$6,000</td>
<td>$12,000</td>
</tr>
<tr>
<td>Shaving of the pump impellor of a pump (includes removal and installation)</td>
<td>$1,000</td>
<td>$15,000</td>
</tr>
<tr>
<td>Engage a mechanic to undertake diesel engine speed reduction</td>
<td>$400</td>
<td>$600</td>
</tr>
<tr>
<td>Provide an new electric motor that operates at 1440 rpm or 960 rpm</td>
<td>$6,000</td>
<td>$9,000</td>
</tr>
</tbody>
</table>

### 7.5 CASE STUDY WATER SAVINGS

The findings of the case studies showed that considerable water savings could be achieved by the installation of pressure reducing valves. These savings were calculated on an annual basis together with the community value of the water over the building life cycle and are shown in the attached table.

Whilst the case studies indicated that the following water use savings could be achieved by installed pressure reducing valves a pressure reduction project (engine speed reduction or impellor diameter reduction) would achieve the same results with a lower capital investment.
Table 7.5  Water savings for the case studies using pressure reducing valves and monthly testing

<table>
<thead>
<tr>
<th>Case Study</th>
<th>kL savings pa</th>
</tr>
</thead>
<tbody>
<tr>
<td>B- High rise office 2</td>
<td>836</td>
</tr>
<tr>
<td>C- High rise office 3</td>
<td>1,880</td>
</tr>
<tr>
<td>D- High rise residential</td>
<td>1,600</td>
</tr>
<tr>
<td>F- Shopping centre - medium</td>
<td>7,100</td>
</tr>
<tr>
<td>I- Large office / retail</td>
<td>2,200</td>
</tr>
</tbody>
</table>

The lessons from the case study showed that if large volumes of water are lost via pressure relief valves and the pressure adjustment project is not successful in reducing this volume the application of pressure reducing projects will provide substantial water saving.
8 OPPORTUNITY 4: RECIRCULATION PROJECTS

When sprinkler systems are connected directly to town mains and incorporate booster pumps the test water is drawn from the public main and discharged directly to drains. This testing is needed in order to measure the operational readiness of the sprinkler system but consumes a substantial volume of valuable drinking water.

Building owners have an opportunity to break this cycle and provide an alternative measure for testing the operational readiness. The volume lost to drain can be greatly reduced by recirculating test water as described in this opportunity.

This chapter provides a guide on how owners and managers can achieve cost effective water savings through the recirculation of test water.

8.1 OPPORTUNITIES FOR RECIRCULATION

Building owners will benefit from reduced water loss by recirculating test water in sprinkler systems if:

- the system has a pump boosted town main
- the sprinkler pump operates a pressure relief valve
- test water is discharged to drain that is located close to the pumps
- sprinkler installation valves can be tested without the use of a town main (see note).

This project is a best fit for buildings that have the installation control valves and pumps in the same room.

Note: In most instances the pump will be able to provide enough pressure to operate the required tests. If the elevation between the pump and the control valves exceeds the ability of the pumps to generate enough head this test will not be possible, such a scenario involves high rise buildings where installation valves are located on various levels.

8.2 BENEFITS & CHALLENGES

The benefits of providing a recirculation system include:

- does not require formal application to change the testing regime
- can save a substantial volume of water
- uses the existing pumps to circulate water for testing
- if tanks are provided then some water can be captured for use by other system (eg from flow testing).
Challenges for the use of recirculation include:

- the annual flow test will still need to draw from the town main draining (total volume of 60 to 120 kL)
- a tank may need to be provided with the following challenges of:
  - providing room
  - ensuring the structure is capable of supporting the load of water in the tank
- additional pipe work is required
- additional training is required to operate the system.

**8.3 STEPS FOR RECIRCULATION**

Recirculation of water can be achieved through the following steps:

- engage a fire services engineer (or other suitably trained professional) to estimate water loss in sprinkler testing and provide recommendations to management
- compare this opportunity with other opportunities for best fit
- if management accepts to fund the opportunity engage a fire services engineer to design and document the solution
- engage a building surveyor to provide a building permit
- engage a suitable contractor to undertake the works
- engage the fire services engineer to work with the contractor to commission and approve the testing system
- obtain a completion certificate from the building surveyor
- engage the fire services engineer to provide an operations manual
- train service providers on the method of undertaking testing.

**8.3.1 ASSESSMENT OF WATER USAGE**

Water use estimates should be undertaken for the following testing:

- alarm valve testing
- flow switch testing
- pump running during testing.

The details of how these estimates can be provided are found in Opportunity 2 - chapter 6.
8.3.2 CONSIDER OTHER OPPORTUNITIES

The fire services engineer should consider the following opportunities to determine if there are greater benefits in adopting any of the following:

• Opportunity 5: Capture and reuse
• Opportunity 7: Pressure reducing valves

8.3.3 INSTALLATION OF HARDWARE

The fire services engineer is responsible for designing a system that will include the following features:

• pipework from the drains to a suitable location upstream of the pumps
• valves to isolate the water supply and divert drains to the inlet of the pumps
• tank if necessary to provide an adequate volume of water in the circulation.

8.3.4 TRAINING & DOCUMENTATION OF THE ALTERNATIVE TEST METHODS

The fire services engineer should also be responsible for providing instructions and documenting procedures for the alternative test method. The engineer should also provide training of service providers or provide an instructional DVD with the relevant content.

Documentation should be thorough to ensure service providers understand their role in testing. Valve labels and instructions should be provided on wall mounted plaques.

8.4 COSTINGS

The costs associated with providing recirculation include:

• professional fees
• one off capital cost items.

8.4.1 PROFESSIONAL FEES

Altering or changing an essential safety system requires professional involvement from one or more of the following parties:

• fire services engineer
• registered building surveyor.
8.4.1.1 FIRE SERVICES ENGINEER

The facility manager will engage a fire services engineer to provide design services and documentation services which include:

- documentation for provision of system changes and new equipment associated with new building works
- preparation of a building permit application with all necessary documentation

Fire services engineers fees will typically be in the following cost range:

<table>
<thead>
<tr>
<th>Service</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost benefit analysis</td>
<td>$750.00</td>
<td>$1,200.00</td>
</tr>
<tr>
<td>Design report and documentation for a building permit</td>
<td>$4,000.00</td>
<td>$6,000.00</td>
</tr>
<tr>
<td>Certification and commissioning</td>
<td>$500.00</td>
<td>$1,000.00</td>
</tr>
<tr>
<td>Operating and Maintenance documentation and training</td>
<td>$1,200.00</td>
<td>$2,000.00</td>
</tr>
</tbody>
</table>

8.4.1.2 REGISTERED BUILDING SURVEYOR

The facility manager will engage a registered building surveyor to issue a building permit for the new building works. The Surveyor will issue a completion certificate & maintenance determination upon satisfactory completion of the works.

Registered Building surveyor professional fees will typically be in the following range:

<table>
<thead>
<tr>
<th>Service</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide a building permit</td>
<td>$500.00</td>
<td>$1,000.00</td>
</tr>
</tbody>
</table>

8.4.2 ONE OFF CAPITAL COST ITEMS

The capital cost of providing the hardware will include some or all of the following items which have been provided with a low / high range:

<table>
<thead>
<tr>
<th>Capital Item</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provision of a 10 kL indoor tank complete with valves and pipework</td>
<td>$40,000.00</td>
<td>$60,000.00</td>
</tr>
<tr>
<td>If the engineer determines that a tank is not required - provide pipework and valves</td>
<td>$7,000.00</td>
<td>$15,000.00</td>
</tr>
</tbody>
</table>
9 OPPORTUNITY 5: CAPTURE AND REUSE WATER PROJECT

The testing of sprinkler systems in buildings uses large quantities of water to measure the operational readiness of this essential service. The water is usually very clean as it comes directly from the town main via pipe and valves. This water can easily be captured and reused back into the sprinkler system or used somewhere else in the building for non sprinkler activities.

The following water may be effectively captured:

- draindown water
- installation control valve and flow switch test water
- diesel pump cooling water
- other test water (limited by volume).

This chapter provides a guide on how owners and managers can achieve cost effective water savings through the capture and reuse of sprinkler system water.

9.1 OPPORTUNITIES FOR CAPTURE & REUSE

Building owners should consider applying water savings in sprinklers systems by capturing out flows and reusing when:

- a diesel pump of over 100 kW has been installed and uses raw water cooling (see chapter 5 for more details)
- pumps have been installed and pressure relief valves are required to discharge to drain
- frequent draindowns occur due to refurbishments and or alterations.

9.2 BENEFITS & CHALLENGES OF CAPTURING WATER FOR REUSE IN THE BUILDING

Water captured from the sprinkler system can be reused in the following ways (with the exception of draindown water):

- toilets and other sanitary fittings
- urban irrigation
- cooling towers
- car washing
- carpark cleaning.
The benefits and challenges of capturing sprinkler system water have been considered for the following three cases:

- draindown water
- regular test water
- flow test water.

9.2.1 CAPTURING DRAINDOWN WATER

The benefits of capturing the draindown water include:

- draindown water (which is black, deoxygenated and putrid) is not polluting storm water systems
- no need for zoning of sprinkler installations
- no need to manage sprinkler draindowns
- no loss of water to draindowns
- opportunity to save water is easily applied.

Challenges associated with capturing draindown water include:

- need for a tank to be located in a suitable area
- having the available room for the tank
- ensuring the structure is capable of supporting the new load of water
- providing drain and return piping from the tank to the sprinkler installations.

9.2.2 CAPTURING TEST WATER

The benefits associated with capturing test water include:

- no need to go to monthly testing to provide water savings
- water is regarded as good quality\(^{32}\)
- water can be used for other services
- can be very cost effective and easily implemented (see note below)
- can be held for longer periods than grey water\(^{29}\)
- there are many options available for providing a tank or vessel to capture the water.

Note: A building permit will be required for a tank if the weight of the water exceeds the allowable limits of the floor loading. If the tank or vessel is installed outside then a building permit will not be required but a planning permit may be.

\(^{32}\) as it is fresh from the source and only passed through some valves even though it is not considered potable for drinking
9.2.3 CAPTURING FLOW TEST WATER

During the annual flow test and pump load tests the volume of water drained can be in the order of several thousands of litres due to flow rates exceeding 3,000 L/min for over 30 minutes. Capturing this water and reusing it can be challenging as the high volume requires large tanks or vessels.

The advantages of capturing flow test water include:

- water is good quality
- water is under pressure and can be transferred some distance from the source
- water can be used in a variety of applications that do not require drinking
- can be held for long periods without problems

The disadvantages of capturing the flow test water include:

- the high total volume of water captured requires large tanks (usually over 100 kL for some larger sites)
- water from these tests is only available from the three monthly pump loading or the annual performance tests.

9.3 STEPS IN CAPTURING AND REUSING WATER

Capturing sprinkler water can be achieved through the following steps:

- engage a fire services engineer (or other suitably trained professional) to estimate or measure water loss in sprinkler draindowns and testing and provide recommendations to management
- compare this water saving opportunity with other opportunities for best fit
- if management agrees to finance the opportunity engage a suitably experienced fire services engineer to design and document a solution
- engage a suitable contractor to install the documented system
- engage the fire services engineer to provide instructions and information on the completed system.

---

33 Water Retailers do not see in problems associated with storing water in tanks for several months
9.3.1 WATER LOSS CALCULATIONS

The methodology for calculating water loss has been provided in opportunities 1 to 4 and should include the following:

- all test water (refer Opportunity 3 chapter 7 items in section 7.3.1 for estimating test water)
- all draindown water (refer opportunity 6 chapter 10 section 10.3.1)

9.3.2 INSTALLING A TANK

Capturing sprinkler water requires the following:

- a tank of at least 10 kL to capture the water
- a space suitable for installation of the tank that can support the weight of the water
- ability to capture the water via pipe work using gravity feed or low head pressure (does not apply to test water or pressure relief valve water)
- engage a building surveyor to provide a building permit and completion certificate.

9.3.3 DOCUMENTATION OF THE SYSTEM

It is also important to document and provide instructions on how to save water in this opportunity. Engage the fire services engineer to provide the following:

- block plan of the system installed on a wall plague
- written instructions on how to use the system
- labels on valves and equipment
- training for the facility managers and service providers (this may include an instructional DVD)
- maintenance program to ensure the system continues to operate satisfactorily.

9.4 COSTINGS

The costs associated with providing recirculation include:

- professional fees
- one off capital cost items.
9.4.1 PROFESSIONAL FEES

The facility manager will engage a fire services engineer to provide design services and documentation services which include:

- documentation for provision of system changes and new equipment
- providing operations and maintenance manuals.

Fire services engineers fees will typically be in the following cost range:

<table>
<thead>
<tr>
<th>Service</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost benefit analysis</td>
<td>$750</td>
<td>$1,200</td>
</tr>
<tr>
<td>Design report and documentation</td>
<td>$2,000</td>
<td>$4,000</td>
</tr>
<tr>
<td>Operating and Maintenance Manual and training</td>
<td>$1,000</td>
<td>$5,000</td>
</tr>
</tbody>
</table>

The facility manager will also need to engage a registered building surveyor to issue a building permit for the new building works. The surveyor will issue a completion certificate & maintenance determination upon satisfactory completion of the works.

Registered Building Surveyor professional fees will typically be in the following range:

<table>
<thead>
<tr>
<th>Service</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide a building permit</td>
<td>$500</td>
<td>$1,000</td>
</tr>
</tbody>
</table>

9.4.2 ONE OFF CAPITAL COST ITEMS

The capital cost of providing the hardware will include some or all of the following items which have been provided with a low / high range:

<table>
<thead>
<tr>
<th>Prerequisite Item</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provision of a 10 kL indoor tank complete with valves and pipework</td>
<td>$30,000</td>
<td>$60,000</td>
</tr>
</tbody>
</table>
10 OPPORTUNITY 6: IMPROVED DRAINDOWN ZONING

A fire sprinkler system can store up to 9,000 litres of water depending on the installation area and pipe size. During building alterations sprinkler heads may need to be relocated, added or removed. Any modification to a sprinkler system will require the water from the installation to be drained and may need to be drained several times to achieve the finished works.

Draindowns of sprinkler systems normally provides two challenges. Not only is fresh drinking water taken to refill the sprinkler installation but the draindown water is black in colour, emits unpleasant odours and may contain metals. Reducing draindowns not only saves drinking water but reduces pollution to storm water.

This chapter provides a guide on how owners and managers can achieve cost effective water savings through improved zoning of sprinkler systems.

10.1 OPPORTUNITIES FOR IMPROVED DRAINDOWN ZONING

Building owners can achieve substantial water savings by improved zoning for:

- shopping centres
- high rise buildings
- large public buildings
- buildings that are constantly modifying sprinkler systems
- buildings undergoing refurbishment or renovation.

Shopping centres with their typically high frequency of alterations should be considered a prime target for zoning. High rise buildings also lend themselves to zoning on a floor by floor basis (if sprinkler installations cover a number of floors). Large horizontal buildings where sprinkler installations are over 5,000 m² zoning can be considered if sprinkler mains feed separate areas.

10.2 BENEFITS & CHALLENGES

The benefits of improved draindown zoning:

- saves millions of litres of water lost to drain in retail and high rise office buildings
- reduces the volume of undesirable deoxygenated and polluted water draining to storm water
- reduces the draindown time for modifications of sprinkler systems
- enables portions of the sprinkler system to be isolated while major refurbishment is being undertaken and eliminating the need for constant draindowns (if the risk is satisfactorily covered)
- instructing sprinkler to isolate zones can easily save draindown water
- reduces the risk to the building by not having the whole sprinkler installation isolated.
Challenges for the use of zoning include:

- finding a suitable location to fit a subsidiary valve
- finding a suitable location to fit a drain valve and pipework to a suitable location
- providing wiring from the valve to the fire detection system
- having ready access to zoning valves.

10.3 STEPS IN PROVIDING IMPROVED ZONING

The steps to improving zoning in draindowns are provided for both new and existing sprinkler installations.

Zoning is best implemented when sprinkler systems are being installed or refurbished. Designers should include the following features:

- high rise buildings to have subsidiary stop valves on all levels and 50 mm drains and drain valves down stream of all subsidiary drain valves
- sprinkler installation should be zoned into a maximum of 3,000 m² where the occupancy is expected to have frequent draindowns
- large horizontal buildings should consider zoning of sprinkler installations using check valves at high level (inaccessible) and drain valves in accessible locations.

For existing sprinkler installations that do not already have subsidiary valves the following steps can be followed to reduce water loss by improving zoning for draindowns:

- engage a fire services engineer (or other suitably qualified professional) to estimate or measure water loss due to draindowns
- compare this water saving opportunity with other opportunities for best fit
- if management agrees to finance the opportunity engage a suitably experienced fire services engineer to design and document a solution
- engage a building surveyor to provide a building permit
- engage a suitable contractor to install the documented system
- have the work approved by the fire services engineer and a completion certificate issued by the building surveyor
- engage the fire services engineer to provide instructions and information on the completed system
- instruct service providers to follow procedures and save draindown water.
10.3.1 CALCULATING THE VOLUME OF WATER LOST IN DRAINOWNS

Calculating the volume of water lost to draindowns provides a basis for determining if value can be achieved by zoning the sprinkler installations. This sub sections provide a guide to the volume of water that can be stored in a sprinkler installation and lost to drain on an average annual basis. This is determined by considering:

- draindown volume
- draindown frequency.

10.3.1.1 DRAINDOWN VOLUME

The volume stored within the fire sprinkler system can be estimated using the following tables which provide volumes for pipework within the sprinklered area and the volume of water in the main leading to the sprinklered area.

Table 10.3.1.1a Volume of stored water in a sprinklered areas based on the hazard classification

<table>
<thead>
<tr>
<th>Hazard Occupancy</th>
<th>Estimated stored volume kL/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>0.0005</td>
</tr>
<tr>
<td>Light Hazard</td>
<td>0.0007</td>
</tr>
<tr>
<td>Ordinary Hazard Group 1</td>
<td>0.0010</td>
</tr>
<tr>
<td>Ordinary Hazard Group 2</td>
<td>0.0011</td>
</tr>
<tr>
<td>Ordinary Hazard Group 3</td>
<td>0.0012</td>
</tr>
<tr>
<td>High Hazard</td>
<td>0.0020</td>
</tr>
<tr>
<td>Special Hazard (ESFR, large drop)</td>
<td>0.0025</td>
</tr>
</tbody>
</table>

Table 10.3.1.1b Volume of stored water in pipework leading to the sprinklered area based on the pipe size

<table>
<thead>
<tr>
<th>Pipe DN</th>
<th>Volume of water kL per m length</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>6.3</td>
</tr>
<tr>
<td>100</td>
<td>10.4</td>
</tr>
<tr>
<td>150</td>
<td>21.7</td>
</tr>
</tbody>
</table>
10.3.1.2 DRAINDOWN FREQUENCY

Each time a sprinkler system is modified (even for a single sprinkler head replacement), the installation is to be drained. The expected frequency for draindowns has been estimated using the following table:

Table 10.3.1.2 Sprinkler system draindown frequency based on occupancy.

<table>
<thead>
<tr>
<th>Occupancy Description</th>
<th>Period between draindowns (years)</th>
<th>Size of the area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car Park</td>
<td>20</td>
<td>per sprinkler installation</td>
</tr>
<tr>
<td>Office (per tenant)</td>
<td>10</td>
<td>Every 200 m²</td>
</tr>
<tr>
<td>Retail (per tenant)</td>
<td>5</td>
<td>Every 200 m²</td>
</tr>
<tr>
<td>Residential (per tenant)</td>
<td>10</td>
<td>Every 100 m²</td>
</tr>
<tr>
<td>Storage</td>
<td>20</td>
<td>per sprinkler installation</td>
</tr>
</tbody>
</table>

If the sprinkler modification requires the fitting of sprinklers to a false ceiling it is likely that two or more draindowns are required. Offices, retail and residential usually have false ceilings and require an average of three draindowns before works are complete.

For example: In a large building where each tenant is expected to change independently of the other tenants. Assuming 20,000 m² of let-able area (100 offices) it would be expected that sprinkler installations will be drained an average of 10 times per year resulting in 120 kL lost to drain.

10.3.2 ZONING SPRINKLER INSTALLATIONS

The water lost to draindowns can be reduced by zoning the sprinkler installations and can occur in the following locations:

- on each level of a multistorey building
- within levels of a multi-storey building (for buildings with floor areas exceeding 2,000 m²)
- at the junction of a sprinkler main that supplies different sprinklered areas.

Zoning can be achieved by providing one of the following valves and associated pipework downstream of the sprinkler installation valves:

- monitored subsidiary valve with no associated drain
- non return valve with a drain
- monitored subsidiary valve with a drain.
10.3.2.1  MONITORED SUBSIDIARY VALVE WITH NO ASSOCIATED DRAIN

The first method is considered the most cost effective, but sprinkler fitters will require additional time on site to undertake the draindown. This method will use the main drain located at the sprinkler control valves and trap the water in those areas not affected by the modifications.

In the case studies it was found that some high rise buildings were fitted with isolation valves on individual floors that were not provided with 50 mm drains. Sprinkler fitters could have saved 60% of the draindown water by isolating the two other floors that did not require draining and then draining only the floor where modifications were being undertaken.

The additional time taken by the fitters was considered to be only a few minutes as the draindown time would have reduced weighing against the additional time to isolate the two other floors.

10.3.2.2  NON RETURN VALVE WITH A DRAIN

Providing a non-return valve is the next most cost effective option as this does not require a valve monitoring device to be fitted to an subsidiary valve. Additional cost is associated with providing a drain downstream of the check valve to enable the draindown to occur.

The use of a check valve is considered to provide a level of risk to the installation if the unit fails. Additional risk measures (such as remote tet drains) should be provided to ensure the valve is operating correctly. Normal testing should cover this risk but installers must provide the remote test valve.

10.3.2.3  MONITORED SUBSIDIARY VALVE WITH A DRAIN

All subsidiary valves located downstream of the alarm valve are required to be fitted with a valve monitoring device as part of the required risk management set out in the design standard.

10.3.2.4  DRAINING DOWNSTREAM OF SUBSIDIARY AND NON RETURN VALVES

Sprinkler installation drains can be piped to a suitable location if it is preferred that the water be captured and reused as stated in the subsequent chapter.

This method has the added benefit of not having to drain the sprinkler main pipework upstream of the valve. In high rise buildings and large horizontal buildings this volume could be 20% of the total installation draindown volume (the volume of water contained in 50 m of 150 mm pipe can be 1000 litres).
10.3.3 DOCUMENTATION

It is also important to document and provide instructions on how to save water in this opportunity. Engage the fire services engineer to provide the following:

- block plan of the system installed on a wall plague (showing all subsidiary stop valves, check valves and test valves)
- written instructions on how to use the system
- labels on valves and equipment
- completion report to advise that work was satisfactorily completed
- training for the facility managers and service providers.

In addition the building surveyor will also need to provide a completion certificate once the engineers documentation has been satisfactorily completed.

10.4 COSTINGS ASSOCIATED WITH ZONING

The costs associated with zoning a sprinkler system in an existing building where valves and or drains are to be provided include:

- professional fees
- one off capital cost items
- potential cost due to lost water.

10.4.1 PROFESSIONAL FEES

Altering or changing an essential safety system requires professional involvement from one or more of the following parties:

- fire services engineer
- registered building surveyor.

10.4.1.1 FIRE SERVICES ENGINEER

The facility manager will engage a fire services engineer to provide design services and documentation services which include:

- evaluation of sprinkler system draindown volume and review cost benefit analysis
- documentation for provision of system changes and new equipment associated with new building works
- preparation of a building permit application with all necessary documentation
• documentation of procedures and instructions & updating block plans and as-installed drawings.

Fire services engineers fees will typically be in the following cost range:

<table>
<thead>
<tr>
<th>Service</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost benefit analysis</td>
<td>$750</td>
<td>$1,200</td>
</tr>
<tr>
<td>Design report and documentation for a building permit</td>
<td>$2,000</td>
<td>$8,000</td>
</tr>
<tr>
<td>Documentation, certification and commissioning</td>
<td>$2,000</td>
<td>$3,500</td>
</tr>
</tbody>
</table>

10.4.1.2 REGISTERED BUILDING SURVEYOR

The facility manager will engage a registered building surveyor to issue a building permit for the new building works. The surveyor will issue a completion certificate & maintenance determination upon satisfactory completion of the works.

Registered building surveyor professional fees will typically be in the following range:

<table>
<thead>
<tr>
<th>Service</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide a building permit</td>
<td>$500</td>
<td>$1,000</td>
</tr>
</tbody>
</table>

10.4.2 ONE OFF CAPITAL COST ITEMS

The capital cost of providing the hardware will include some or all of the following items which have been provided with a low / high range:

<table>
<thead>
<tr>
<th>Perquisite Item</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provision of monitored subsidiary valve and 50 mm drain to 3.0 m to existing pipework</td>
<td>$2,500</td>
<td>$4,000</td>
</tr>
<tr>
<td>Provision of non return valve and 50 mm drain to 10.0 m</td>
<td>$2,000</td>
<td>$3,000</td>
</tr>
</tbody>
</table>
11 OPPORTUNITY 7: FIRE SPRINKLER DRAINDOWN MANAGEMENT

As stated in chapter 10 a substantial loss of water results from frequent modifications to sprinkler systems. Facility managers have the opportunity to save water and reduce pollution by implementing draindown management.

This opportunity looks at the management of sprinkler system impairments and resulting draindowns. This may supplement and or replace the need to install hardware to zone sprinklers installation as detailed in chapter 10.

This chapter provides details of the opportunity for facility managers to save sprinkler water in simple and effective ways using draindown management.

11.1 OPPORTUNITIES TO MANAGE DRAIN Downs

Those buildings that will benefit from draindown management include:

• shopping centres
• high rise buildings
• large public buildings
• buildings that are constantly modifying sprinkler systems
• buildings undergoing refurbishment or renovation
• any building which has on average more than 1 draindown per week
• buildings where subsidiary stop valves have already been provided but are not used because they are not fitted with suitable drains.

11.2 BENEFITS

The benefits to providing a strong draindown management system include:

• reduced pollution from draindowns to the storm water
• reduced risk of the building being unprotected by sprinklers during a period where it is most vulnerable (during construction activities)
• improved management of sprinkler modifications
• greater responsibility from sprinkler contractors
• new and improved methods of carrying out sprinkler system modifications will be developed.
11.3 STEPS TO MANAGING DRAINOWNS

The recommended steps for managing draindowns include:

- management to develop and implement impairment procedures
- management have in place a formal procedure to review and accept all draindowns
- provide a procedure for reinstating the system back to normal
- obtain a draindown plan from contractors undertaking refurbishment works.

11.3.1 IMPAIRMENT NOTICE

The case studies showed a lack of management systems associated with draindowns. One example had a detailed impairment management system in place which required draindown planning but even this system did not consider water conservation.

Facility managers should insist on a 'Notice of Impairment' to be prepared which will include the following information:

- justification for draindowns
- details of the draindown including the areas affected
- risk management & work plan
- job safety analysis
- communication with relevant parties (those who may be affected by the impairment).

Once the notice has been issued this needs to be approved. Contractors completing the impairment notice should also be asked to consider any alternatives to the draindown. Such solutions may include:

- capturing and reusing water
- zoning the areas
- isolating the areas (following appropriate risk management)
- freezing of pipework
- modifying pipework under pressure.

11.3.2 DRAINOWN ACCEPTANCE

Each time a sprinkler system is impaired, the building is under an increased level of risk. Management should accept draindowns only if they believe this is the best fit for the situation. The impairment notice should be examined and accepted for each application.
Property managers reduce impairment risks by:

- using approved contractors
- providing clear instructions to contractors (e.g., use of a DVD or procedures manual)
- documenting procedures and providing checklists
- providing relevant system information (e.g., pressure gauge schedule, interface diagram, equipment labels, valve list, valve numbering)
- approving impairments on all fire systems.

11.3.3 REINSTATEMENT PROCEDURE

There are also a number of concerns that valves and equipment may not be returned to their required automatic status and this must be managed. These risks can be managed by the processes indicated above and also include:

- contractors providing a reinstatement notice after the sprinkler system has been filled back up
- contractors completing a check list that covers the essential ingredients
- communicating with the relevant parties to indicate the impairment has been completed
- documents to be kept on file for reference.

11.3.4 DRAINDOWN PLAN

Planning draindowns provides an opportunity to plan modifications to the sprinklered areas and reducing the need to drain down as frequently.

- contractors to provide a program of draindowns for refurbishment works
- determine if draindowns can be rationalised.
11.4 COSTING

The costing associated with managing draindowns cannot be easily determined. The following will need to be considered and may have cost implications to various businesses:

- time associated with completing a form and submitting it for approval
- additional time spent planning activities
- time spent in developing and operating a procedure
- cost of implementing innovative solutions (may have cost benefits if contractors have the right equipment).

11.5 CASE STUDY FINDINGS

Only one case study was able to demonstrate a comprehensive impairment management system that was tailored specifically for the site. Some of the other case study sites did however rely on a system provided by their insurance companies. Other sites did have some guidance on draindown management but this appeared to be loosely applied and not followed by contractors.

In one of the case studies a building was provided with subsidiary valves on each floor but no drain valves were provided downstream to enable draining of the floor. Contractors would still drain all three floors ignoring the potential to isolate the floors that did not need to be drained and saving 2/3rds of the draindown water.

Facility Managers should instruct sprinkler fitters to use the subsidiary valves in draindowns where they are fitted. This step can be easily applied and benefits achieved immediately. Educating facility managers and service providers so that they recognise this lost opportunity is key. People “don’t know what they don’t know”.

---

34 The procedure may become part of an impairment notice or a job safety analysis and will just be a few additional steps.
PRESSURE GAUGE SCHEDULE GUIDE

This appendix provides the following:

- Appendix A1 - site assessment form
- Appendix A2 and A3 provide guides to using the pressure gauge schedule and setting pressures
SITE ASSESSMENT FORM

The data gathered from this site assessment form will be transferred into the final assessment report. The data gathered includes the following topics:

- General Information
- System Information
- Control Valve Information
- Pumps Information
- Tank Information
- Water Supply Information

1 GENERAL INFORMATION

This section is for the collection of general site contact information

<table>
<thead>
<tr>
<th>Site (Name/address)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Client</td>
<td></td>
</tr>
<tr>
<td>Water Authority</td>
<td></td>
</tr>
<tr>
<td>Facility Manager</td>
<td></td>
</tr>
<tr>
<td>Fire Contractor Company</td>
<td></td>
</tr>
<tr>
<td>Tester</td>
<td></td>
</tr>
<tr>
<td>Site Visit Date</td>
<td></td>
</tr>
</tbody>
</table>

2 SYSTEM INFORMATION

Is the system a combined Sprinkler/ Hydrant system ?

Is there a system interface diagram presented in the pump room?

Is there a pressure schedule presented in the pump room?

Are the main stop valves monitored?

Are there isolation valves on each level?

What is the number of flow switches in the system?

What is the number of pump start pressure switches in the system?

What is the number of Installation pressure switches in the system?

What is the number of Alarm pressure switches in the system?


## 3 CONTROL VALVE INFORMATION

How many groups of control valves? 

What is the total number of control valves? 

<table>
<thead>
<tr>
<th>Control Valve No and RL$^{35}$</th>
<th>Floor Levels</th>
<th>Size (mm)</th>
<th>Control Valve Pressure (kPa)</th>
<th>Flow Time (seconds)</th>
<th>Drain Size (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$^{35}$RL = relative floor level above pumps
4 PUMPS INFORMATION

This section will present information regarding
- Diesel Pump
- Electric Pump
- Pressure maintenance Pump
- Jacking Pump

4.1 DIESEL PUMP

What is the number of Diesel pumps onsite?

What is the relative floor level of the diesel pump?

Is it a multi stage pump?

How many stages are there?

Is there a Pressure Relief Valve present?

What is the size of the Pressure Relief Valve?

Where does the Pressure Relief Valve drain to?

Does the Pressure Relief Valve open during pump run?

Is there a Pressure Reducing Valve upstream of the Pressure Relief Valve?

Are there Dual Starting Batteries present?

Is there a low fuel level alarm?

Is there a battery charger supply failure alarm?

Is it a raw water cooling pump?

What is the pump power (kw)?

What is the cut in pressure of the pump?

What is the churn pressure of the pump?
What is the total pump run time during weekly testing?

4.2 ELECTRIC PUMP

What is the number of Electric pumps onsite?
What is the relative floor level of the electric pump?
Is it a multi stage pump?
How many stages are there?
Is there a Pressure Relief Valve present?
What is the size of the Pressure Relief Valve?

Does the Pressure Relief Valve open during pump run?
Where does the Pressure Relief Valve drain to?
Is there a Pressure Reducing Valve upstream of the Pressure Relief Valve?

What is the pump power (kw)?
What is the Cut in Pressure of the pump (kPa)?
What is the churn pressure of the pump?
What is the total pump run time during weekly testing?

4.3 PRESSURE MAINTENANCE PUMP

What is the number of Pressure Maintenance Pumps onsite?
What is the relative floor level of the pressure maintenance pump?
What is the cut in pressure of the pressure maintenance pump?
What is the cut out pressure of the pressure maintenance pump?
What is the churn pressure for the pump?

4.4 JACKING PUMP
### 5 TANK INFORMATION

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the number of tanks onsite?</td>
<td></td>
</tr>
<tr>
<td>What is the capacity of each tank?</td>
<td></td>
</tr>
<tr>
<td>When was the last time the tank was drained?</td>
<td></td>
</tr>
<tr>
<td>What is the tank’s low water level?</td>
<td></td>
</tr>
<tr>
<td>What is the tank’s high water level?</td>
<td></td>
</tr>
<tr>
<td>Returns to tank</td>
<td></td>
</tr>
<tr>
<td>Pressure Relief Valves</td>
<td>Yes</td>
</tr>
<tr>
<td>Cooling Water</td>
<td>No</td>
</tr>
<tr>
<td>Annubar line</td>
<td></td>
</tr>
</tbody>
</table>

### 6 WATER SUPPLY INFORMATION

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>How many Town’s main supplies are there?</td>
<td></td>
</tr>
<tr>
<td>What is the maximum pressure level reached in the last 6 months?</td>
<td></td>
</tr>
<tr>
<td>What is the minimum pressure level reached in the last 6 months?</td>
<td></td>
</tr>
</tbody>
</table>
PRESSURE DIFFERENCE SETTINGS GUIDE

Jacking Pump

IN

OUT

100kPa

200kPa

JACKING PUMP REGION

Pressure Maintenance Pump

IN

OUT

200kPa

PRESSURE MAINTENANCE PUMP REGION

Booster Pump

\( \leq 400\text{kPa} \)

Town Main

Max

Min

Booster Pump

\( \leq 400\text{kPa} \)

Town Main
SPRINKLER SERVICING ROUTINES

Sprinkler systems are serviced generally in accordance with one of the following Australian Standards:

- AS1851-3 1985
- AS1851-2005 chapters 2 and 3

These two standards have been compared for water use. The following information provides a list of activities involved in water use for both of these standards.

AS1851-3 1985 ACTIVITIES

Sprinkler system testing in accordance with AS1851.3 1985 is undertaken in accordance with the following periodic routines:

- Weekly routines (level 1)
- Quarterly routines (level 2)
- Annual routines (level 3)
- 3 yearly (level 4)
- six yearly (level 5)
- greater levels

Note: This is not an exhaustive list of required maintenance and testing of a sprinkler installation, rather it provides only those routines requiring water to be used in testing and or maintenance.

The following table provides a description of the routine and the period in which it is to be performed:

<table>
<thead>
<tr>
<th>Routine</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4 5 Other</td>
</tr>
<tr>
<td>Alarm Valve test</td>
<td>● ● ● ●</td>
</tr>
<tr>
<td>Flow Switch test</td>
<td>● ● ●</td>
</tr>
<tr>
<td>Non-return Valve test</td>
<td>● ● ●</td>
</tr>
<tr>
<td>Pressure Reducing Valve flow-test</td>
<td>● ● ●</td>
</tr>
<tr>
<td>Water supply flow test</td>
<td>● ●</td>
</tr>
<tr>
<td>Remote Test Valve test</td>
<td>● ●</td>
</tr>
<tr>
<td>Pressure Switch test</td>
<td>● ●</td>
</tr>
<tr>
<td>Water tank drainage</td>
<td>●</td>
</tr>
</tbody>
</table>
Sprinkler Pump-set routines in accordance with AS1851.14 1996

<table>
<thead>
<tr>
<th>Routine</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Pump run (electric 3 minutes)</td>
<td>●</td>
</tr>
<tr>
<td>Pump run (diesel 10 minutes)</td>
<td>●</td>
</tr>
<tr>
<td>Pump run (diesel 30 minutes)</td>
<td>●</td>
</tr>
<tr>
<td>Pump run (electric 30 minutes)</td>
<td>●</td>
</tr>
<tr>
<td>Pressure Relief Valve maintenance</td>
<td></td>
</tr>
</tbody>
</table>

MONTHLY TESTING IN ACCORDANCE WITH AS1851-2005

Water usage can be reduced by providing a testing schedule in accordance with AS1851-2005. This subsection provides information on changing the testing and maintenance schedule to the current Monthly testing standard under AS1851-2005 and provides for the following routines:

Note: This is not an exhaustive list of required maintenance and testing of a sprinkler installation, rather it provides only those routines requiring water to be used in testing and or maintenance.
The following table provides a description of the routine and the period in which this could be performed:

```
<table>
<thead>
<tr>
<th>Routine</th>
<th>Weekly</th>
<th>Monthly</th>
<th>6 Monthly</th>
<th>Yearly</th>
<th>3 Yearly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm Valve test (see note)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Flow Switch test</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Non-return Valve test</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Pressure Reducing Valve flow test</td>
<td></td>
<td></td>
<td></td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Water supply drain test</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Water supply flow test</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Remote Test Valve test</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Pressure Switch test</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Water tank drainage</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Alarm Valve service</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Alarm interface functional testing</td>
<td></td>
<td></td>
<td></td>
<td>•</td>
<td></td>
</tr>
</tbody>
</table>
```

Sprinkler Pump-set routines in accordance with AS1851-2005

```
<table>
<thead>
<tr>
<th>Routine</th>
<th>Weekly</th>
<th>Monthly</th>
<th>6 Monthly</th>
<th>Yearly</th>
<th>5 Yearly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump run (electric 3 minutes)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Pump run (diesel 10 minutes)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Pump run (diesel 30 + minutes)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Pump run (electric 10 + minutes)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Pressure Relief &amp; Isolating Valve maintenance</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

Note: Weekly testing is assumed based on the meeting the prerequisites of AS1851-2005.
PARALLEL ANALYSIS

An analysis was undertaken to compare the service routines noted in chapters 2 and 3 of AS1851-2005 with those clauses found in earlier standards. The analysis provides an estimate of the time to undertake each routine for both standards base on a hypothetical case as noted in 6.4.3.1. The details can be found in the following tables on the project website on www.pic.vic.gov.au - PlumbSmarter -

<table>
<thead>
<tr>
<th>Table</th>
<th>Hypothetical study</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>Sprinkler system servicing chapter 2 of AS185-2005 with no tank - weekly testing</td>
</tr>
<tr>
<td>B2</td>
<td>Sprinkler system servicing chapter 2 of AS185-2005 with tank - weekly testing</td>
</tr>
<tr>
<td>B3</td>
<td>Sprinkler system servicing chapter 2 of AS185-2005 with no tank - monthly testing</td>
</tr>
<tr>
<td>B4</td>
<td>Sprinkler system servicing chapter 2 of AS185-2005 with tank - monthly testing</td>
</tr>
<tr>
<td>B5</td>
<td>Pump servicing for sprinkler system chapter 3 of AS1851-2005 with no tank</td>
</tr>
<tr>
<td>B6</td>
<td>Pump servicing for sprinkler system chapter 3 of AS1851-2005 with tank</td>
</tr>
</tbody>
</table>
ADOPTING AS1851-2005 FOR SPRINKLER SYSTEMS

Flow charts are provided as a guide to understand how to adopt AS1851-2005.

<table>
<thead>
<tr>
<th>Flowchart</th>
<th>Description</th>
<th>When to use</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Adoption of AS 1851-2005 for sprinkler systems (chapters 2 &amp; 3)</td>
<td>Guide into the steps required in adopting AS1851-2005 as the maintenance determination for the sprinkler system</td>
</tr>
<tr>
<td>C2</td>
<td>Records Search</td>
<td>This flowchart describes the process recommended for where to look for records of a building’s sprinkler installation and maintenance standard. By following these steps an owner or agent is able to demonstrate they have taken all reasonable steps to identify the installation and maintenance standard for the building (and probably discovered the applicable records along the way)</td>
</tr>
</tbody>
</table>
Adoption of AS1851-2005

1. Pre 1 July 1994?
   - No
     - Occupation Certificate issued?
       - Yes
         - Occupancy Permit displayed in building?
           - Yes
             - Records available from owner?
               - Yes
                 - Refer Flowchart "Records Search" Appendix C2
               - No
                 - Records available?
                   - Yes
                     - Amend Occupancy Permit
                   - No
                     - Amend determinations if appropriate
           - No
             - Are there any special maintenance determinations?
               - Yes
                 - Make application to Municipal Building Surveyor
               - No
                 - Amend determinations if appropriate
     - No
       - ESM determination?
         - Yes
           - Amend Occupancy Permit
         - No
           - Are there any special design requirements? see 6.3.3.3

ESM = Essential Safety Measures
Records Search

This flowchart describes the process recommended for where to look for records of a building's sprinkler installation and maintenance standard. By following these steps, an owner or agent should be able to demonstrate that they have taken all reasonable steps to identify the installation and maintenance standard for the building (and probably discovered the applicable records along the way).

1. **OFF SITE**
   - Obtain a copy of title/plan of subdivision from www.land.vic.gov.au
   - Make application to relevant Council for copy of plans and permits
   - Make application to Fire Brigade(s) for fire protection reports
   - Make application to Building Appeals Board for details of modifications to the regulations (and installation standard)

2. **ON SITE**
   - Review block plan at control valves for installation standard
   - Review block plan at booster connection
   - Review information at Alarm Signaling Equipment at Fire Indicator Panel

3. **Records Available?**
   - Review and evaluate available information

4. **See Flowchart "Adoption of AS1851:2005"**

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E:\WORK\2008/52 Water Conservation Guide\GUIDE\ISSUE E\Guide to Fire Sprinkler System Water Saving Issue E.wpd
IS A BUILDING PERMIT REQUIRED?

In many of the water saving opportunities alterations or modifications to the sprinkler system will be required. These works may require a building permit and hence the engagement of a building surveyor and other professionals. This appendix answers the question if a building permit is required.

Where building works are carried out to a sprinkler system for water saving a building permit may be required. The owner, or the agent, must establish whether the proposed works are building works. Advice should be sought from a suitably qualified and experienced building surveyor as to whether the works are building works.

The following categories of works have been identified where the works may not be building works:

- Works that are not part of the building;
- Alterations; and
- Repairs and Maintenance.

Where the works are building works an application for a building permit is required.

Detail

The Building Act 1993 (The Act) requires a building permit application for works which are “building works”. The Act defines “building work” as:

   “work for or in connection with the construction, demolition or removal of a building”;

There may be some works as part of water saving in a fire sprinkler system which may not form part of the sprinkler system and therefore were not regarded as building works.

Works that are not part of the building

To illustrate this category the following example is provided. An external tank which collects water discharged from the sprinkler system e.g. from end of line test valves or from the pump discharge to waste, where the water is re-circulated in the sprinkler system, may not be considered as part of the sprinkler system. Provided the tank did not adversely affect the structural soundness of the subject building it may not be considered as building works. The Building Commission refers to this as “water reticulation infrastructure”.

Such a tank may require planning approval and may be plumbing works that should be carried out by a licensed plumber. The use of the discharge water may also require other approvals e.g. trade waste.

36 S16 of the Building Act 1993

37 S3 of the Building Act 1993
Alterations

Alterations to a building, including a sprinkler system and its components are considered to be building works.

The Building Regulations 2006\(^{38}\) exempts building work from a building permit as follows:

Alterations to a building, if the building work;

© will not adversely affect the safety of the public or occupiers of the building; and
(d) is not work carried out on, or in connection with, a building included on the Heritage Register within the meaning of the Heritage Act 1995; and
(e) is not work in relation to, and will not adversely affect, an essential safety measure within the meanings of Subdivisions 1 and 2 of Division 1 of Part 12.

It is considered that alterations to an essential safety measure are always “work in relation to” an essential safety measure and therefore such building works would always require a building permit.

Repairs and Maintenance

The Building Regulations 2006\(^{39}\) exempts building work from a building permit as follows;

Repair, renewal or maintenance of a part of an existing building, if the building work—

(b) is done using materials commonly used for the same purpose as the material being replaced; and
© will not adversely affect the safety of the public or occupiers of the building; and
(e) will not adversely affect an essential safety measure within the meanings of Subdivisions 1 and 2 of Division 1 of Part 12.

This exemption is not considered relevant to building works to sprinkler systems for water saving. The works to be carried out to sprinkler systems to permit water saving measures to be implemented are largely considered to be alterations or works that are not part of the building.

\(^{38}\) Clause 4 of Schedule 8 of the Building Regulations 2006

\(^{39}\) Clause 3 of Schedule 8 of the Building Regulations 2006
APPLYING TO MODIFY THE OCCUPANCY PERMIT

If a modification to the occupancy permit is required so that monthly testing can be adopted to conserve water an application to the Municipal Building Surveyor is required. This appendix provides a form that can be completed to assist with the process.
APPLICATION FOR AMENDMENT OF AN OCCUPANCY PERMIT

To (Municipal Building Surveyor)

Shire or Council:

From

Owner*/Agent of owner*

* delete if inapplicable

Postal address:

Address for serving or giving of documents: as above

Indicate if the applicant is a lessee or licensee of Crown land to which this application applies o †

† tick if applicable

Contact person: Telephone:

Ownership Details (only if agent of owner listed above)

Owner:

Postal address:

Contact person Telephone

Property details

Name of property:

Number Street/road City/suburb/town Postcode

Lot/s

Volume: Folio:

Crown allotment Section Parish County

Municipal district: Allotment area (for new dwellings only) m²

Land owned by the Crown or a public authority o †

† tick if applicable
Application for amendment of an occupancy permit

Nature of request:

Error in OP o *
Change / delete Essential Safety Measure (ESM) o *
Change to installation standard o *
Change to maintenance standard o *
Change to frequency of maintenance o *
Other o *

* tick box for yes or leave blank for no or don’t know

Proposed use of Building:
________________________________________________________
________________________________________________________
________________________________________________________
________________________________________________________

Reason for the Application:
________________________________________________________
________________________________________________________
________________________________________________________
________________________________________________________

Are works associated with the proposed change to the ESM: o *

Are there alternative solutions for the building that either affect the ESM or rely on the ESM for compliance for the alternative solution? o *

* tick box for yes or leave blank for no or don’t know

Details of proposed works:
________________________________________________________
________________________________________________________

Is / has a building permit to be / been issued for the proposed works o *

Are the works considered to be repairs and maintenance or works not requiring a building permit o *

Is a record search from Council’s archives required to obtain the necessary documents to support the application (refer separate Council application form) o *

* tick box for yes or leave blank for no or don’t know

Signature
________________________________________________________

Signature of owner or agent Date

NOTES

Refer checklist of documents to be included with the application attached:

____________________
Application for amendment of an occupancy permit

Checklist of documents to be included with the application:

**Mandatory documents to accompany all applications:**

- Copy of Occupancy Permit (OP) in full
- Annual Essential Safety Measure (ESM) Report
- Records of maintenance of ESM (inspection, testing, preventative maintenance, survey) for at least the previous 12 months
- Copy of certificate of title
- Owner’s consent in writing for the application for amendment of OP
- Site plan showing the location and description of buildings
- Floor plan showing the space(s) within the building

Where variations to the installation standard have been identified:

- Fire brigade reports that vary the ESM installation or maintenance standard
- Building Appeals Board (or Referees Board) determinations that vary the ESM installation or maintenance standard
- Alternative Solutions for compliance with the performance requirements
- Determinations of partial compliance or exemptions from the Building Regulations of the day for the ESM installation or maintenance standard

Report in support of the proposed change to the ESM

# Tick to confirm that you have included this information with the application. An application that does not contain this information may be refused.

**Documents that will assist review of the application:**

- As built drawings for the ESM to be changed
- Operation and Maintenance Manuals for the ESM to be changed
- Photos of the subject buildings
- Building permit for the construction of the building
- Copy of plan of subdivision
- Compliance certification for the installation of the ESM
- Installer’s statement for the ESM
- Commissioning data for the ESM
- Compliance certification for the relevant performance requirement for the ESM and/or performance requirements IP1.1 and IP1.2

**Notes to the checklist above**

1. Site and Floor plans are to contain the information as described in Regulation 302 of the Building Regulations 2006. The approved drawings accompanying the building permit for the construction of the building will contain this information. An extract of Regulation 302 is included below for information.

2. A report checklist is attached for an application to delete or change an ESM.

3. This information is not mandatory, but will assist in processing your application.
Application for amendment of an occupancy permit

Report checklist for an application to delete or change an ESM

*A written report in support of an application to delete or change an ESM must contain the following information as a minimum:*

Details of the Essential Safety Measure(s) (ESM) (to be changed)

- Existing installation standard (Performance requirement(s) / BCA DTS Clause(s) and Australian Standard)
- Existing maintenance standard and frequency of maintenance
- Proposed installation standard (where works being done)
- Proposed maintenance standard and frequency of maintenance

Explanation and validation of why the change is appropriate for the ESM (referencing the supporting Information provided with the application)

Details of proposed works

Where works are proposed to the ESM explain why the works are proposed

*Documents that will assist review of the application:*

Compliance certification for the relevant performance requirement for the ESM and/or performance requirements IP1.1 and IP1.2

*Extract of regulation 302 of the Building Regulations 2006*

(1) An application for a building permit to construct a building must be accompanied by—

- (a) 3 copies of drawings showing the plan at each floor level, elevations, sections, dimensions, the sizes and locations of structural members to a scale of not less than 1:100, together with any details that are necessary to show compliance to a scale of not less than 1:20, or other approved scales; and
- (c) 3 copies of allotment plans to a scale of not less than 1:500 or other approved scale showing the matters set out in subregulation (2); and
- (d) a statement of the use or intended use of all buildings shown on allotment plans; and
- (e) a copy of any computations or reports necessary to demonstrate that the building will, if constructed in accordance with the computations and reports, comply with the Act and these Regulations.

(2) The matters to be shown on an allotment plan are—

- (a) the boundaries and dimensions of the allotment and any relevant easements; and
- (b) the distance to the nearest intersecting street; and
- (c) the position and dimensions of the proposed building and its relationship to—
  - (i) the boundaries of the allotment; and
  - (ii) any existing building on the allotment; and
  - (iii) any part of a building or land on an adjoining allotment where necessary to show compliance with the Act and these Regulations;
BUILDINGS ON CROWN AND COMMONWEALTH LAND

This appendix provides information on the case where a maintenance determination is required for special cases outside of the building regulations. This includes:

- buildings on crown land
- building on commonwealth land.

BUILDINGS ON CROWN LAND

The Building Act 1993 requires that buildings on Crown land comply but buildings on Crown land prior to this date may not have had an occupancy permit or maintenance determination.

The following process can be used to determine the applicable maintenance:

- carry out a record search of the relevant council, fire brigade and building appeals board records
- where no such determination is identified and the AS2118 suite of standards is the installation standard, migration to AS1851-2005 is appropriate as the maintenance standard without a formal regulatory process.

The flow chart "Records Search" in Appendix C2 clarifies the recommended process for record searches.

Land owned by the Crown is not under the jurisdiction of the Municipal Building Surveyor for the relevant municipality. Under Section 221 of the Building Act 1993 the Crown or a public authority may appoint a building surveyor to exercise the (administrative) functions under the Building Act 1993 for amending an Occupancy Permit. There is currently no documented process in the Building Act or Regulations for amending an Occupancy Permit. A pro-forma template is provided for an application to a municipal building surveyor or a building surveyor appointed by a minister of the Crown in the Appendices.

Alternatively, where a building permit can be issued for building works to an existing sprinkler system and the system then meets the mandatory criteria in AS1851-2005 for adoption of the maintenance standard, then the maintenance determination issued for the work can reference AS1851-2005 as the required maintenance standard. This process is described below.

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40 Refer Clause 2.2.1.1 and 3.2.1 of AS1851-2005 for details of the prerequisites for implementation of AS1851-2005.
BUILDINGS ON COMMONWEALTH LAND

This is an unusual category and due to the policy of the Commonwealth leasing out buildings this is becoming less and less common, but may still be applicable to Defence Department property. It is Commonwealth policy to comply with state building regulations, but the Building Act 1993 does not apply to Commonwealth land. Therefore the Building Regulations 2006 and the provisions relating to essential safety measures do not apply. The case study for Project A illustrates such a scenario, although the land has subsequently been sold to a non-government institution.
ADDITIONAL STATUTORY REQUIREMENTS

This appendix provides information on additional statutory requirements that should be considered as part of a review of the fire sprinkler system design to determine suitability of adopting AS 1851 - 2005 and monthly testing. These include:

• Victorian Workcover Authority
• Dangerous Goods Act
• Other design requirements

VICTORIAN WORKCOVER AUTHORITY

It is possible that because of the designer’s duties under Section 28 of the Occupational Health and Safety Act 2004 a higher maintenance standard may be applicable due to the nature of the work place. A risk assessment process may identify this as part of the risk controls necessary to reduce the acceptable risk to the occupants. A major hazard facility is an example of where this is applicable. No specific case study was identified in this project.

DANGEROUS GOODS

Under the relevant provisions for fire protection of dangerous goods it may be identified through risk assessment that additional maintenance risk controls are applicable to the fire protection installation. Under the fire brigade reporting process the brigade(s) may also identify additional requirements for maintenance of fire protection equipment.

OTHER DESIGN REQUIREMENTS

Other design requirements which may impact on the maintenance standard include:

• insurance company requirements
• common law duties
• funding agency requirements e.g. Department of Human Services - DHS Fire Safety Standards, Department of Education and Training - PRMM’s

INSURANCE COMPANY REQUIREMENTS

Insurance company requirements have been identified as a special case for design where the insurer identifies a risk profile for the occupancy requiring a higher standard and/or frequency of maintenance than AS1851-2005 may apply. The case study for Project I is an example where the frequency of pump testing is determined by the insurer because of their extra requirements to ensure the operational reliability of the pump set.

COMMON LAW DUTIES

Common law duties exist for both the owners and occupiers of buildings. No specific
obligations have been identified as applicable to projects for water saving in fire sprinkler systems. It has been suggested that a common law responsibility exists for owners to adopt the latest Australian Standards which would include AS1851-2005.

FUNDING AGENCIES

Accreditation and funding agencies administering service agreements for government funding may have specific requirements for documentation of safety systems in the buildings. The Department of Human Services Fire Risk Management Guidelines\textsuperscript{41} require Fire Safety Strategies to be documented, in the form of Fire Safety Plans, for each of the safety measures in the building. Changes to installation or maintenance standards may require changes to the documentation of the strategy.

\textsuperscript{41} Capital Development Guidelines Series 7