

SPP-115 Structure Protection - Field Guide

General guidelines:

1. Position terminology:

- A structure protection crew normally consists of 1 crew leader/officer and 4 crew members/firefighters.
- Senior or more experienced officers may be elevated to fill task force leader or group supervisor positions, depending on size of the organization.

2. The decision to commit resources to structure and/or site preparation will be based on your assessment of:

- Amount of fire hazard (or fuels) existing on the property.
- The time required to reduce the existing fire hazard to an acceptable level.
- The time available till the fire is expected to arrive at the property.

3. Intelligence gathering:

The Fire Behaviour Analyst (on a large fire) will be able to provide information on Fire Behaviour and Fire Spread Rates to help determine which areas will be at risk and when, the FBAN will also be able to help determine trigger points to identify when it is appropriate to commence structure protection on different areas. If an FBAN is not on site, the WMB I/C will be able to get a Fire Behaviour Forecast from the Fire Centre.

4. Your Triage decisions for an area or a structure need to consider:

- *Firefighter safety*
- Structure characteristics
- Surrounding fuels
- Fire behaviour
- Available resources

5. Your objectives (for individual structures):

- Keep the radiant heat and convective heating of the structure below that required for ignition. (Primarily from Zone 1)
- Eliminate the “ember traps”. (By closing in to prevent entry or by wetting with sprinklers or foam)

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- Create a “humidity bubble” around the structure. (Using sprinklers)

6. Removal of trees or other live fuels:

Removal of any trees, shrubs, plants, etc. can only be done with owners written approval or if the “Emergency Powers” are in place within the “Declaration of a State of Local Emergency” by the local authority as follows:

“Cause the demolition or removal of any trees, structures, or crops if the demolition or removal is considered by the local authority to be necessary or appropriate in order to prevent, respond to or alleviate the effects of an emergency or disaster.”

These powers are not automatically approved and approval must be confirmed before removing any trees, shrubs, or plants.

Reference: Emergency Management BC (EMBC) website: www.pep.gov.bc.ca

Only a certified faller may fall any trees over 15 cm. (6 inches) in diameter.

Even with approval in place, consider owners reaction when they return to find “damage” to their property.

People are usually very supportive while the smoke is in the air – not so, after the smoke has cleared.

7. Retreat and return (Prep and leave)

This will be your most common strategy.

Use structure suppression crews only to suppress any structure fires (Normally not done outside of Fire Protection Areas).

Use structure protection or structure suppression crews (fire departments) to mop-up the areas close to structures that threaten any structures or that may be close to any hazardous materials, using appropriate agency procedures; use WMB crews to mop-up any forest fuels around the structures safe from any hazardous materials.

8. Water delivery:

Structure protection crews may use a variety of water delivery methods to conduct mop-up around structures, they may have portable tanks and pumps, or water tenders that could be in a variety of configurations, or they may only have the systems that were in place for structure protection (in this case it would be useful to carry extra lengths of hose and nozzles in their vehicles).

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9. The use of gel products:

BC – OFC structure protection crews will not be using gel.

The use of gel by other agencies is subject to the approval of the local jurisdiction.

10. Structure suppression:

WMB crews do not do structure suppression. OFC - structure protection crews (unless given specific approval by SPS and the I/C) do not do structure suppression. Structure suppression normally carried out by structure firefighters only inside Fire Protection areas.

11. Chainsaw use:

Other than certified fallers, only trained personnel may use chainsaws for bucking or falling trees under 15 cm. (6 inches) in diameter.

12. Burning out:

OFC – structure protection crews are not authorized to conduct burn outs. Inside a FPA – is at the discretion of the Local Authority. WMB crews would normally conduct any burning out outside of an FPA.

13. Ladders and roof access:

WMB crews do not use ladders or access roofs; OFC - structure protection crews only access roofs when specifically approved by the structure protection specialist.

14. Structure entry:

OFC - structure protection crews will not enter structures if they are locked.

You must be knowledgeable of your own agency's procedures, and those of the agency you are working for.

Water delivery:



Hydrant 38 mm. (1.5") set - Procedure

1. Remove 64 mm. (2 ½") NPSH hydrant cap(s).
2. Attach 64 mm. (2 ½") hydrant gate valve(s) to 64 mm. (2 ½") NPSH.
3. Open hydrant with wrench.
4. Attach 64 mm. (2 ½") NPSH female x 38 mm. (1 ½") NPSH male hydrant adapter.
5. Attach inline pressure gauge – 38 mm. (1 ½") Quick Couple (QC) x 38 mm. (1 ½") QC.
6. Attach 30.4 m. (100') or 15.2 m. (50') x 38 mm. (1 ½") QC hose to 38 mm. (1 ½") x 19 mm. (¾") GHT water thief.
7. Attach 10 m. (30') or 5 m. (15') x 16 mm. (5/8") econoflo hose c/w 19mm (¾") GHT couplers to sprinkler (L, S or B type).

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Hydrant 64 mm. (2.5") set – Procedure

For hydrant to 64 mm. (2 ½") sprinkler systems.

1. Remove 64 mm. (2 ½") NPSH hydrant cap(s).
2. Attach 64 mm. (2 ½") hydrant gate valve(s) to 64 mm. (2 ½") NPSH.
3. Open hydrant with wrench.
4. Attach 15.2 m. (50') x 64 mm. (2 ½") hose to 64 mm. (2 ½") x 38 mm. (1 ½") water thief.
5. Attach 30.4 m. (100') or 15.2 (50') x 38 mm. (1 ½") QC hose to 38 mm. (1 ½") x 19 mm. (3/4") water thief.
6. Attach 10 m. (30') or 5 m. (15') x 16 mm. (5/8") econoflo hose c/w 19mm (3/4") GHT couplers to sprinkler (L, S or B type).

Hydrant Set – General Points

- 690 kPa (100 psi) hydrant system (looped) can supply 25 x 13 mm. (½") sprinklers @ 345 kPa (50psi) on a 38 mm. (1 ½") hose lay
- Boost lower pressure hydrants with in-line pumping
- Don't pump into a fire hydrant hose lay, from a static source - water contamination issues

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Portable Hydrant set – Procedure

For hydrant to 64 mm. (2 ½") manifold to 64 mm. (2 ½") or 38 mm. (1 ½") sprinkler systems:

1. Remove high volume 102 mm. (4") or 127 mm. (5") caps from hydrant.
2. Attach high volume Storz (or alternate) connected hose line from hydrant to multi-outlet gated manifold.
3. Open hydrant with wrench.
4. Attach 15.2 m. (50') x 64 mm. (2 ½") hose lengths from manifold to 64 mm. (2 ½") x 38 mm. (1 ½") water thief.
5. Attach 30.4 m. (100') or 15.2 m. (50') x 38 mm. (1 ½") QC hose to 38 mm. (1 ½") x 19 mm. (3/4") water thief.
6. Attach 10 m. (30') or 5 m. (15') x 16 mm. (5/8") econoflo hose c/w 19mm (3/4") GHT couplers to sprinkler (L, S or B type).

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38 mm. (1.5") Pump set - Procedure

For single portable pump to 38 mm. (1 ½") sprinkler systems:

1. Set up Mark 3 or BB4 pump at water source consider pumping from both ends or loop hose lay.
2. Use extended operation pump setup as required - secure pump; establish multiple fuel tanks at pump.
3. Use full flow gated siamese or wye – restricted flow three ways should not be used in sprinkler operations.
4. Attach 30.4 m. (100') or 15.2 m. (50') x 38 mm. (1 ½") QC hose from pump to 38 mm. (1 ½") x (3/4") water thief.
5. Attach 10 m. (30') or 5 m. (15') x (5/8") econoflo hose c/w 19mm (3/4") GHT couplers to sprinkler (L, S or B type).



64 mm. (2.5") Pump set – Procedure

For multiple portable pumps to 64 mm. (2 ½") sprinkler systems:

1. Set up Mark 3 or BB4 pumps in parallel at water source consider pumping from both ends or loop hose lay.
2. Use extended operation pump setup as required - secure pumps, establish multiple fuel tanks at pump.
3. Use full flow gated siamese or wye upstream from check valve – restricted flow 3 ways are avoided if possible in sprinkler operations.
4. Attach 15.2 m. (50') x 64 mm. (2 ½") hose - pump to 64 mm. (2 ½") x 38 mm. (1 ½") water thief.
5. Attach 30.4 m. (100') or 15.2 m. (50') x 38 mm. (1 ½") QC hose – 64 mm. (2 ½") x 38 mm. (1 ½") water thief to 38 mm. (1 ½") x 19 mm. (3/4") water thief.
6. Attach 10 m. (30') or 5 m. (15') x 16 mm. (5/8") econoflo hose c/w 19mm (3/4") GHT couplers to sprinkler (L, S or B type).



Standpipe Pump set – Procedure

For adaptation of low pressure / adequate volume standpipe to supply sprinkler system.

1. Attach hose to standpipe – lead / attach to small relay tank. Use looped hose lay.
2. Set up mini pump to draft from small relay tank.
3. Use extended operation pump setup as required - secure pump, connect large fuel tank to pump.
4. Attach 15.2 m. (50'), 10 m. (30') or 5 m. (15') x 16 mm. (5/8") econoflo hose c/w 19mm (3/4") GHT couplers to sprinklers (S or B type).

Basic Sprinkler Concepts:

- Sprinklers support structure protection operations
 - Structure + Zone 1 site prep, retreat + return
- Priority approach – ‘must do’ items only
 - Don't waste limited resources or time.
 - Conserve water
- Sprinkler sets – Rooftop, Zone 1, Zone 2
- Sprinklers supported by:
 - Portable Pump – 64 mm. (2 ½") or 38 mm. (1 ½") or econo hose

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- Hydrant – 64 mm. (2 ½”) or 38 mm. (1 ½”) hose
- Sprinklers are not supported by engines

Basic Sprinkler Set-up

- Plan to wet all structure vulnerabilities
 - Combustible roofs
 - Decks + under deck (unless tarped)
 - Untreated Zone 1 + Zone 2 fuels
- Beneficial wetting vs. structure damage
 - The objective is to “rain down” on the structure and create a “humidity bubble”.
 - Avoid soaking walls that could lead to water damage.
- Sprinkler system protection
 - Hose type, fuel bed

Large impact sprinklers



25 mm. (1”) x 6 mm. (7/32”) Buckner flows 35.5 lpm (7.8 gpm’s) @ 345 kPa (50 psi) => 17m (55’) wetted radius.

25 mm. (1”) x 5 mm. (3/16”) Buckner flows 26.4 lpm (5.8 gpm’s) @ 345 kPa (50 psi) => 16m (51’) wetted radius.

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Small impact sprinklers



13 mm. (½") x 4 mm. (5/32") Buckner flows 19.5 lpm (4.3 gpm's) @ 345 kPa (50 psi) => 13m (41)' wetted radius.

13 mm. (½") x 2 mm. (7/64") Buckner flows 9.1 lpm (2.0 gpm's) @ 345 kPa (50 psi) => 11m (36)' wetted radius.



Zone 1 / 2 Sprinkler Set

- Zone 1 + Zone 2 sprinklers set every 30.4 m. (100') on 38 mm. (1 ½") hose line.
- Zone 1 wet fuels within 20 – 30 m. of structure exterior

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- Zone 2 wet fuels 20 – 50 m. from structure exterior
- Sprinkler coverage adjusted to wet structures as required
- Where rooftop sprinkler coverage is provided – Zone 1 sprinkler coverage may not be required to the same degree as without rooftop sprinkler.

Rooftop sprinklers



Application:

- Small structure – 1 set
- Average structure – 2 sets

13 mm. (½") Nelson butterfly heads flows 19.5 lmp (4.3 gpm's) @ 345 kPa (50 psi) => 8m (26') wetted radius

- Rooftop sprinklers are set to wet combustible roof and Zone 1 fuels.
- Agency ladder SOG's followed.
- Consider using property hose bibs as pressure source.
- The size of sprinkler used may vary depending on objectives in Zone 1 as well as the structure itself.
- The water supply available may dictate the size and number of sprinklers used.

There is no one way to meet the objectives.

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- Incorporate any property owner's sprinklers, hose, or pumps into your prescription to conserve your equipment.

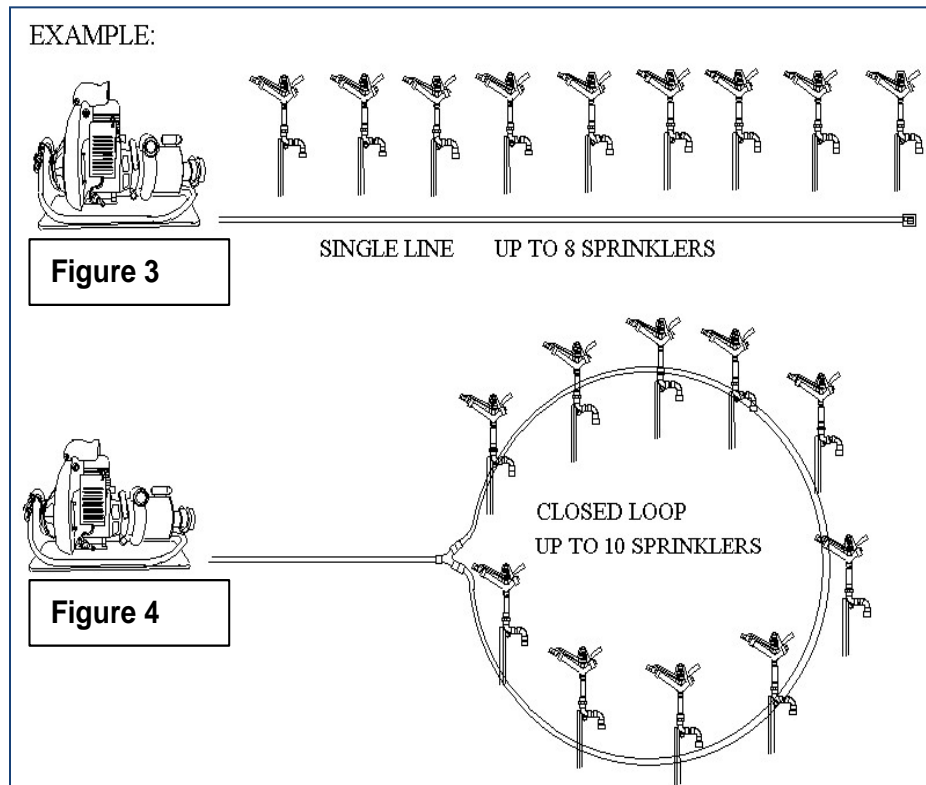
Sprinkler Performance Factors

- Pumps - number + condition
- Sprinklers – number, head + nozzle size
- Hose Lay - length, diameter + type (friction loss), leaks + kinks
- Sprinkler coverage increases with sprinkler head elevation above ground
- Pressure varies along the hose line
- Sprinklers work best at 276 – 483 kPa (40 – 70 psi)
- After 483 kPa (70 psi) - increase in reach is marginal
- Ideal operating pressure is 345 kPa (50 psi)
- Most sprinklers won't work at < 83 kPa (12 psi)
- Larger nozzle orifice = larger coverage
- Orifice size affects rotation

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- Larger nozzle = slower rotation
- Keep sprinklers vertical for best results

Looped System Advantage



Closed loop hose lay:

- Maintains constant pressure to all sprinklers
- 20% increase in sprinklers supported

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Sprinkler Performance Factors (cont'd)

Sprinkler Utilization - Mark-3 pump with 1 ½" hose on flat terrain

Sprinkler Nozzle tip Size	A. # of sprinklers	B. # of sprinklers	C. # of sprinklers	D. #of sprinklers
¼" tip	7	4	3 – 4	2 – 3
7/32" tip	9	5	4	3
3/16" tip	14	7	6	4

A = Sprinklers start 100' from pump - 100' intervals

B = Sprinklers start 1,000' from pump - 100' intervals

C = Sprinklers start 2,000' from pump - 100' intervals

D = Sprinklers start 3,000' from pump - 100' intervals

Conversion factors for tables:

¼ " = 3 mm.

7/32" = 4 mm.

3/16" = 5 mm.

100' = 30.4 m.

1,000' = 305 m.

2,000' = 610 m.

3,000' = 915 m.

When to use 65 mm. (2 ½") hose

- Single 38 mm. (1.5") hose lay exceeds 610 m. (2,000 feet) on flat ground.
- 450 lpm (100 gpm) flow cannot be maintained.
- Dual lines or relay pumping is impractical.

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Sprinkler Utilization - Mark-3 pump with 1 1/2" hose on flat terrain

Sprinkler Nozzle tip Size	A. # of sprinklers	B. # of sprinklers	C. # of sprinklers	D. #of sprinklers
1/4" tip	7	4	3 - 4	2 - 3
7/32" tip	9	5	4	3
3/16" tip	14	7	6	4

Sprinkler Utilization - Mark-3 pump with 2 1/2" hose on flat terrain

Sprinkler Nozzle tip Size	A. # of sprinklers	B. # of sprinklers	C. # of sprinklers	D. #of sprinklers
1/4" tip	10	10	9	8
7/32" tip	12	10	9	9
3/16" tip	15	15	14	13

A = Sprinklers start 100' from pump - 100' intervals
B = Sprinklers start 1,000' from pump - 100' intervals
C = Sprinklers start 2,000' from pump - 100' intervals
D = Sprinklers start 3,000' from pump - 100' intervals

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The 64 mm. (2½") hose advantage

- Will deliver pressure and volume to sprinklers at great distances
- Reduce the number of pumps required and simplify the system



2 x Mark 3 pumps will supply:

- 20 sprinklers 6 mm. (7/32") over 1463 m. (4,800 feet) of 64 mm. (2 ½") hose.
- 5 sprinklers 6 mm. (7/32") over 1463 m. (4,800 feet) of 38 mm. (1 ½") hose.

4 x Mark-3 pumps will supply:

- 40 sprinklers 6 mm. (7/32") over 1463 m. (4,800 feet) of 64 mm. (2½") hose.

Testing the Sprinkler System

- Charge sprinkler system to test / wet area
- Check that:
 - Heads rotate + nozzles flowing as required
 - All structural vulnerabilities wetted
 - Combustible roofs
 - Decks + under deck (unless tarped)

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- Untreated Zone 1 + Zone 2 fuels
- Streams overlap slightly - consider wind effect
- Sprinkler system protection effective
- Shutdown until re-wetting required

Property Conservation Considerations



- Water stream 'rains' onto structure
- Avoid impact on doors / windows
- Water application limit +-2 hours per day
- Ensure streams are not going to create water damage or erosion
- Cover roof vents, chimneys + electrical weather heads with plastic when possible
- Watch for seepage at doors, windows + other openings
- Log structures can be vulnerable to leaks



Documentation:

- Complete documentation of structure protections operations is essential.
- Ensure structure triage form with site map is completed – note all equipment left on site.
- Possible that other crews will demob.

Demobilization / Retrieval:

- With removal of threat (Evac Alert) retrieval of all on-site equipment should begin promptly.
- Note damaged or missing equipment – tag at SPU.
- Pumps tagged 'serviceable' if running well.
- Any equipment tagged U/S (with explanation if known) if not working.

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Field Cheat Sheet:

- Optimum operating pressure for sprinklers is 345 kPa (50 psi).
- Minimum operating pressure for sprinklers +/- 83 kPa (12 psi).

- Large impact sprinklers cover 16 > 17 m (51 > 55 ft) wetted radius.
- Small impact sprinklers covers 11 > 13 m (36 > 41 ft) wetted radius.
- Butterfly heads cover +/- 8 m (26 ft) wetted radius.

- Wajax Mark 3 Pump – tested to minimum of 1172 kPa (170 psi) with a 9.5mm 3/8” nozzle.

- 38 mm (1 ½”) forestry hose:
 - Lined hose will lose 14 kPa (2 psi) per 30.4 m (100 ft) length.
 - Unlined hose will lose 28 kPa (4 psi) per 30.4 m (100 ft) length.

- Elevation loss of 10.5 kPa per metre (1/2 psi per ft).
- Each backcheck valve or 3-way valve will create a loss of 35 kPa (5 psi).