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APPENDIX F: CASE STUDY – ELEPHANT HILL FIRE, BRITISH COLUMBIA, 2017

LOW-VOLUME, LOW-PRESSURE SPRINKLER DEPLOYMENT IN THE COMMUNITY OF SKEETCHESTN

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This case study is not restricted.

This case study contributes to the state-of-practice review of water delivery systems (sprinklers) in the wildland-urban interface. Funding for this review was provided by the Forest Resource Improvement Association of Alberta.

Sprinklers are used to protect structures from wildfire during wildland-urban interface events across Canada. Traditionally, standard forestry equipment has been used in conjunction with impact sprinklers. Agencies are trying to determine if the standard practices and equipment used in wildfire suppression operations are the most effective for community structure protection.

This case study documents the deployment of low-volume, low-pressure sprinklers in the First Nations community of Skeetchestn when threatened by the Elephant Hill fire in August, 2017.

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CASE STUDY

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- British Columbia Office of the Fire Commissioner
- Skeetchestn First Nations
- Nelson Irrigation Corporation
- WASP Manufacturing Ltd.
- British Columbia Wildfire Service
- First Nations Emergency Services Society of British Columbia

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1. INTRODUCTION

The use of forestry equipment (hose and pressure pumps) to support sprinkler systems is a common approach to protecting values at risk from wildfire in Canada. This case study is one in a series that explores the viability of various types of sprinkler systems for protecting residential and commercial structures from wildfire.

Common forestry equipment used, by wildfire agencies, during sprinkler deployments includes Waterax Mark-3 and BB4 pumps, portable water tanks, 38-mm (1.5-in.) and 16-mm (5/8-in.) hose, and impact sprinklers. An impact sprinkler is a type of irrigation sprinkler in which the sprinkler head is driven in a circle by the force of the water (Figure 1). These sprinkler systems can use almost any water source. Depending on the distance of the nearest water source, these systems can require many sections of hose and multiple pumps.

There has been very little innovation in equipment that could make sprinkler deployments more effective in the wildland-urban interface. WASP Manufacturing Ltd. in Port Coquitlam, British Columbia (B.C.) has adapted low-volume, low-pressure irrigation sprinklers (Figure 2) for the WUI. WASP is the first company in Canada to promote the use of low-volume, low-pressure sprinklers for structure protection during a wildfire. The sprinkler system is ideally used with a community's or homeowner's particulate-free, water supply system. Because these systems require less water (compared to systems comprised of common forestry equipment) and can be connected to a community's water supply system, the time to deploy them is greatly reduced. This case study examines the use of the WASP system in the small B.C. community of Skeetchestn during the 2017 wildfire season.

Figure 1. An example of an impact sprinkler

Figure 2. The WASP patented rain gutter mount sprinkler with a high-flow nozzle

2. SITE DESCRIPTION

Community of Skeetchestn

The community of Skeetchestn (Figure 3) is approximately 60 km west of Kamloops, B.C., in the Deadman River valley. The community is home to 300 people and consists of two settled areas that are 5 km apart: the village and the benchlands. There were approximately 45 structures in the village, 45 structures in the benchlands, and 15 structures between the two areas, for a total of 105 structures.

Skeetchestn's water supply consists of two reservoirs: one at the village (546 000 L or 144 230 U.S. gal.) and one at the bench lands (227 000 L or 60 000 U.S. gal.)[1]. Water for each reservoir is drawn from a well using an electric pump.

Figure 3. The Community of Skeetchstn looking west towards Elephant Hill

3. WILDFIRE THREAT

Elephant Hill fire

The Elephant Hill fire started on July 6, 2017 and burned throughout the summer. It consumed 191 000 ha of forest and affected several communities within the Thompson-Nicola Regional District. On August 4th, changing winds put the First Nations community of Skeetchestn under imminent threat. However, by August 6th, the fire had moved to the north and missed the community; therefore, the sprinkler system was not tested against the wildfire.

4. DATA COLLECTION

FPInnovations conducted interviews over the phone and in person with key individuals involved in the deployment of the WASP sprinkler system at Skeetchestn in the summer of 2017. We visited Skeetchestn in July 2018, but because the sprinkler system was no longer in place, we were unable to evaluate it. However, we gathered data on the sprinklers used in Skeetchestn from specifications published by Nelson Irrigation. We used a Google satellite image to determine distance between the two main areas of the community and the number of structures.

[1] Skeetchestn Water Technician, personal communications, November 28, 2018.

5. FINDINGS

Deployment logistics

During the 2017 fire season, Emergency Management BC – Office of the Fire Commissioner (OFC) was responsible for providing structure protection in British Columbia. The Emergency Operations Centre (EOC) in Kamloops coordinated the dispatch of resources for the province. On August 1, 2017, the EOC identified Skeetchestn as a community that was potentially needing structure protection based on the threat from the Elephant Hill fire. The EOC dispatched a member of the First Nations Emergency Services Society (FNESS) to work with community representatives in Skeetchestn. Together, they identified critical infrastructure and assessed resource needs. On August 4th, the OFC dispatched a Structure Protection Specialist, five engine crews (20 firefighters), and a three-person wildfire crew to install sprinklers in Skeetchestn. The FNESS member informed the community administration about what to expect and explained the deployment process to the crews. Sprinkler systems were installed on approximately 105 structures in 4.5 hours.

The Skeetchestn water system staff conducted a 1-hr flow test of the community system with the sprinklers activated, which resulted in a 25% drawdown of the reservoir. We have assumed that 95 sprinklers were deployed in the village, and the average flow per sprinkler is advertised to be 23.8 L/min. (6.3 gpm). Based on those results, the water system manager planned to stay and manually operate the hydrant zone valves so the water could be directed to the areas of highest need in order to conserve water and give the reservoir time to recharge.

Because of the potential to lose power during the wildfire, two 25 kWh power plants mounted on separate trailers were brought in to provide backup power for the reservoirs pumps.

Sprinkler deployment

The structure protection crew arrived on August 4th, with enough WASP sprinklers equipment to outfit 105 structures. WASP sprinkler systems use either a Nelson Irrigation R2000LP or R10T sprinkler. The operating pressure for these sprinklers is between 207 and 414 kPa (30 and 60 psi), and the spray radius is between 10 and 12.8 m (33 and 42 ft.). At 344 kPa (50 psi), a R2000LP sprinkler can move 18.9 L/min. (5 gpm) and a R10T sprinkler can move 9.4 L/min. (2.5 gpm). A sprinkler specification comparison is provided in Table 1. WASP also has a patent for a rain gutter mount that can be used to quickly and safely place the sprinklers on the roof (Figure 2).

For structures that were close to a hydrant, a 38-mm (1½-in.) mainline was established from the nearest hydrant to the building. A water thief was installed to connect the main line to a 16-mm (5/8-in.) hose that then carried water to two R2000LP sprinklers. Smaller R10T sprinklers were connected directly to the hose bibb[2] of a residence, using 16-mm (5/8-in.) hose, if it was deemed impractical to run a fire hose from a hydrant to the structure.

The WASP system was deployed on all the structures in the community and in the benchlands. Two sprinklers were placed on each structure; therefore, each water reservoir supported 90–100 sprinklers. In addition, an existing irrigation system was modified to provide water to the church and community centre; however, the details of this configuration could not be obtained. Finally, a fourth configuration using Mark-3 pumps and 38-mm (1.5-in.) hose was used to supply river water to impact sprinklers for 15 structures between the community and the benchlands.

6. DISCUSSION

The sprinkler deployment at Skeetchestn was the first time the OFC had used a WASP sprinkler system as the primary system for structure protection. Only a few firefighters were familiar with the system. Nevertheless, the system was deployed quickly. The rain gutter mount was not widely used at Skeetchestn because few buildings had rain gutters, but this quick deploy feature would further reduce set-up time by eliminating the need to nail the sprinklers to the roof. The quick deployment of the WASP system was also possible because of the scouting and liaison work carried out by FNESS before the Structure Protection Unit arrived.

Low-volume, low-pressure sprinklers use less water, than other commonly available impact sprinklers but are considered to be just as effective at protecting structures. Table 1 compares WASP sprinklers (Nelson R10T and R200LP) with other commonly used impact sprinklers.

Table 1. Comparison of the various sprinklers used in the wildland urban interface

SPRINKLER	Nozzle		Cast Distance		Pressure		Volume		90 Sprinklers		Water source connection
	mm	in.	m	ft.	kPa	psi	L/min.	gpm	L/min.	gpm	
Nelson R10T	#102 Yellow		10.0	33	344	50	8.0	2.1	726	192	hose bibb
Nelson R2000LP	#20 DK Brown		12.8	42	344	50	18.9	5.0	1703	450	hydrant or pump
Rain Bird 20JH 13mm (½-in.)	3.6	9/64	12.2	40	344	50	15.3	4.1	1380	365	pressure pump
Rain Bird 30H 19-mm (¾-in.)	4.7	3/16	15.3	50	344	50	27.3	7.2	2453	648	pressure pump
Rain Bird 70CH 25-mm (1-in.)	5.6	7/32	18	59	344	50	34.5	9.9	3373	891	pressure pump

[2] A hose bib is the spigot, or faucet, on a building's exterior. It is also referred to as a garden hose spigot.

The second-to-last column shows the volume of water moved by 90 sprinklers (arbitrary example) and the water savings that can be achieved by using low-volume, low-pressure sprinklers. A pressure of 344 kPa (50 psi) was used for all the sprinklers in the table. However, 344 kPa (50 psi) is the upper operating range for Nelson rotator sprinklers; these sprinklers could effectively operate at lower pressures with lower flow rates.

The community of Skeetchestn was fortunate that it had time to source backup generators for its reservoir pumps and already had the necessary switches and wiring installed. Maintaining power to the water supply would have been of critical importance had the fire moved through the community.

Skeetchestn has a supervisory control and data acquisition (SCADA) water system, which allows staff to monitor the pressure and volume in both reservoirs using a smart phone or computer. However, several of the Structure Protection Specialists we interviewed believed that having a water manager on-site to monitor pressures and manage the reservoir is essential in these situations to prevent serious damage to the reservoir and contamination of the community water supply.

One concern voiced by our interviewees was the potential for the small sprinkler nozzles to become plugged if they are used with a natural, unfiltered water source. However, this potential is very low when a community water supply is used.

Another concern was that volumes and recharge rates of community water reservoirs can vary considerably, which could affect the system's ability to provide an adequate amount of water during times of peak need. Although the OFC coordinated this deployment with structural firefighters from other B.C. communities, local fire departments could be trained to carry out this role. This would reduce the demand on provincial structure protection resources during critical times and enable the community to be prepared and self-sufficient.

7. CONCLUSION

A low-volume, low-pressure system connected to a community water supply appears to be a viable option for protecting community infrastructure. These systems can be quickly connected to a community water supply, and because they use less water than the traditional forestry set-up, they can operate longer. Future evaluations of low-volume, low-pressure systems should include investigating the effect of wind on the systems performance. Wind will affect the sprinkler radius due to the steep trajectory of the sprinklers' water stream. A reduced radius could produce dry areas near the structure.