Wildfire Sprinkler Guide

Home Ignition

Wildfires generally ignite buildings in two ways:

Wind thrown embers

A wildfire can throw embers up to one quarter of a mile, especially during high wind conditions. These embers fall on combustible material (decks, gutters, etc.) on or around the house and start a new fire. This is the most common method of home ignition.

Radiant heat

Nearby structures, trees or vegetation on fire can generate radiant heat onto the home. Even if the radiant exposure is not hot enough or long enough to ignite the home, the surfaces of the home can be pre-heated to a level that can make them more vulnerable to embers or direct flame contact. Radiant heat from nearby trees or structures on fire can also shatter windows and allow embers to then enter the home or building.

Design Concept

The exterior fire sprinkler system is designed to:

- Wet combustible material on and around the house to prevent it from catching on fire.
- Pre-wet the property prior to the advancement of a fire
- Create a dome of high humidity and lowered temperatures around the house.

The fire sprinkler system is not designed to:

- Extinguish a fire that has already ignited on or inside the building, although it can help to suppress or slow the progress of an existing fire.

Wetting of the Building

The system is designed to target different areas where fires may occur:

- Sprinklers mounted under the roof eaves or in the landscape can provide protection against:
    - Embers landing at the base of the house wall.
    - Embers landing on decks or combustible material adjacent to the house.
    - Radiant heat from nearby trees/building on fire.
- Roof sprinklers can provide protection against
    - Embers landing on the roof.
    - Embers landing in gutters where combustible material has accumulated.
    - Embers landing on decks or combustible material adjacent to the house.
    - Large trees adjacent to the building.

Humidity Dome

In addition to reducing the chance of ember ignition, the exterior fire sprinkler system can create a dome of high humidity and lowered temperature around the house. When a fire is moving through the area, this humidity island can counteract the radiant heat of the fire and reduce the chances of ignition through embers or direct flame contact.

Wetting Methods

The most common method to apply water is either through eave mounted or roof sprinklers. Sometimes sprinklers can also be installed in the landscape to spray the home or building.

Eave Sprinklers

These sprinklers are installed underneath the roof eaves and spray the walls, windows and the base of the house with the spray extending about 10 feet from the house. Eave sprinklers are typically the most effective sprinkler to prevent the home from catching fire. These sprinklers tend to be the most visible of all three options however.

Roof Sprinklers

These sprinklers are mounted on the roof and can provide coverage of the roof and spray combustible material like decks and fences that are adjacent to the house. Roof sprinklers can also target large trees adjacent to the building that the eave sprinklers 10 ft spray radius cannot reach.

Landscape Sprinklers

If eave sprinklers are not practical due to the visual impact, below ground “pop-up” sprinklers installed in the landscape can provide coverage of building walls and base of the building. The downside of below ground sprinklers is that the “pop-up” height is limited to 12” above ground level when active, with a water stream trajectory of 25 degrees. This means that vegetation height within a 4’ radius of the sprinkler must be kept below 2’ tall and within an 8’ radius must be kept below 4’ tall. This can place a limit on the plant material around the sprinkler location.

Water Source

Domestic Supply

The system uses the domestic water supply as it’s primary water source. A booster pump is installed to ensure a consistent flow and pressure is provided to the sprinklers even if the flow and pressure from the domestic supply varies.

Tank or Pool Option

During a wildfire, the domestic water supply to the building may be reduced if nearby hydrants are being used. As an option the system can use a water tank or pool as a secondary source to supply the fire sprinklers, with domestic water being the primary source. By having the pump draw from two water sources, water can be applied at a quicker rate to the building, and more water is available overall.

Sprinkler Zones

Ideally all sprinklers are on a single zone and run at the same time to provide complete coverage around the house and apply water as quickly as possible. In practice it may be very costly to have only 1-zone of sprinklers for a couple of reasons:

- A single zone of sprinklers may require a pumping system capable of delivery over 80 gallons per minute through a 3” supply pipe for a large single-family home. Properties with multiple buildings may require an even larger pumping system.
- The electrical draw for a large pumping system can be expensive if a battery or generator backup is installed for the pumping system.
- The domestic supply often cannot supply enough water, so a secondary water source such as a tank or pool is required.

In general, we propose multiple zone systems to provide a more affordable system. As an option we can provide costs for a single zone system, at your request.

System Configurations

There are two system configurations with multiple options available. Both systems can use a tank or pool as a secondary water source.

Basic System Configuration

The Basic System is an affordable option that allows for remote activation of the sprinkler system through a phone app and is connected to the home Wi-Fi system:

- Includes a booster pump to utilize domestic water as primary water source to supply multiple sprinkler zones
- An optional flow meter can be installed that allows for verification that the system is running. It can also be used to detect pipe breaks and leaks in the piping system.
- An optional sattelite connection for the controller can be installed. During a neighborhood wildfire event both power and internet may be shut off to the site, preventing the activation of the sprinkler system through Wi-Fi connection.

Smart System Configuration

The Smart System allows for intelligent real-time management of the system and faster delivery of water to the site. The system is remotely activated through a phone app and is connected to the home Wi-Fi system.

- Includes a booster pump to utilize domestic water as primary water source to supply multiple sprinkler zones. When pressure and flow rates are sufficient (or if a pool/tank is included) the controller will run multiple zones at the same time to maximize the amount of water applied. This is most helpful when a fire is on the property.
- If a pool/tank is included, the controller automatically adjusts the run times of the sprinkler zones based upon the water levels in the tank to ensure the system does not run out of water.
- An optional online dashboard can be installed where all the information from the Smart Controller (tank levels, pressure sensors, flow meter) is uploaded to an online custom dashboard for real-time viewing. Alarms are programmed into the system and emails/texts are automatically sent out if the system is operating outside of it's normal range.
- An optional Foam Injection System can be installed. The Foam acts as a wetting agent that allows combustible material to absorb the water 3-4X quicker than normal and coats the material to inhibit oxygen at the surface to suppress fire.
- An optional sattelite connection for the controller can be installed.

System Activation

The fire sprinkler controller requires the user to remotely activate the system using a mobile device or web browser. The system does not have an auto-detection/activation feature and instead requires a user to activate the system for the following reasons:

- Flame detectors and other fire detection sensors are typically intended for indoor or enclosed spaces (warehouses, yards, etc.). As such it's impossible to provide 100% detection coverage when sensors are oriented toward open spaces with many possible obstructions (trees, other structures, play equipment, etc.).
- With less than 100% coverage, auto-detection & activation systems provide a false sense of security to the owners.
- Flame detection sensors generally require a fire to be 1'x1' size before detection. On highly combustible material the fire can grow rapidly in size before the wetting action of sprinklers takes effect.
- Heat detection sensors are not able to reliably detect fires in all the different locations that a fire could occur on a building (roof, gutters, base of building, deck, etc.).

System Operation

The system controller is pre-programmed with three different activation settings or "Threat Levels" that can be activated by the user depending upon how close the fire is. For the Smart System, the controller constantly monitors the system pressure and water levels in the tank/pool and changes the output of water to optimize the water usage to ensure that water does not run out during a multi-day fire threat. For the Basic System the controller does not monitor pressure or water levels but simply runs on the preset schedule for each threat level.

Red Threat (use all water as fast as possible)

The red threat level should be activated when the house is under immediate threat from a wildfire. For example:

- The owners are on the property and
- the fire is immediately on the property or
- embers are observed being thrown on or near the property.
- The owners are not on the property but have good evidence of immediate threat (video cameras, fire locator app, neighbor confirmation)

The controller may run multiple zones at the same time if water pressure is sufficient (Smart System). If pressure is not sufficient the controller will cycle through the zones watering each zone for 5 minutes before continuing to the next zone. Once it has cycled through all the zones, it will restart with the first zone and continue watering until all the available water runs out in the tank or pool, or the system is deactivated by the user.

Orange Threat (apply water more slowly over 2 days)

The yellow threat level should be activated when the house is not under immediate threat but may come under threat within 48 hours (2 days). For example:

- The owners are on the property and
- Fire is miles away but advancing in the direction of the house.
- The owners are not on the property but have good evidence of a 2-day threat (video cameras, fire locator app, neighbor confirmation)

The system will start a Cycle and Soak program and cycle through the zones watering each zone for a set time (typically 20 minutes), the sprinkling will stop and enter a Soak period. The system will continue to cycle and soak so that all the available water in the tank or pool is applied over 2 days (Smart System), before running out or the system is deactivated by the user.

Yellow Threat (apply water more slowly over 4 days)

The yellow threat level should be activated when the house is not under immediate threat but may come under threat within 96 hours (4 days). For example:

- The owners are required to evacuate and
- The owners don't have a method of remote detection (no cameras, fire locator app, neighbors)
- The owners are not on the property but have good evidence of a 4-day threat (fire locator app, neighbor confirmation)
- There is a perceived threat of fire, but the owners are unsure what level of threat it is.

The system will initiate the same program as the 2-day Threat Level, except all the available water in the tank or pool is applied over 4 days (Smart System), before running out or the system is deactivated by the user.

Independent Operation

If a loss of internet connection occurs while the system is activated, the local controller will continue to operate and manage the application of water based upon the available supply. Once coming back online the system will automatically initiate any changes that were applied through the app or browser while the internet connection was lost.

Recommended Additions

In addition to the work proposed by WaterSprout, we recommend that other work be performed by others to make the system more resilient in the event of a wildfire. During a neighborhood wildfire event both power and internet may be shut off to the site, preventing the sprinkler system from working correctly. We recommend:

Backup Power System

Installing a backup power system to the sprinkler system so that the sprinklers can continue to operate during a neighborhood power failure. The backup system can be either generator or battery based.

Additional Resources for Wildfire Detection

Watch Duty Fire App

This app can provide you with a warning if a fire incident has been reported near your house.

Exterior Security Cameras

Many home monitoring systems offer security cameras that allow real-time viewing of the conditions around your home. These can be helpful for spotting approaching fire especially if the owner is not in the home or has been evacuated.