

# UPDATE TO THE NEDERLAND FIRE CISTERN REQUIREMENTS

## Current Requirements

- 1,800 gallons, based on Boulder County minimums (See: W/05 Emergency Water Supply).
- Provides little (if any) tactical benefit.
- OR \$2500 contribution to the Community Cistern Fund, based on over 20-year-old cost estimates. Updated estimates for an 1,800 cistern is over \$9k.
- Long overdue for update – What meets code? What are the accurate costs? What provides a solution for fire flow duration and tactical strategies?

## County Requirements (See: W/05 Emergency Water Supply)

- Minimum of 1,800 gallons capacity (note that some fire districts require a minimum of 2,400 gallons, and *the amount may be greater depending upon the total square footage of the structures*).
- Many fire protection districts prefer that individual homeowners make a *monetary contribution to a community cistern fund* in lieu of the placement of an individual fire cistern on site.

## International Fire Code 2018

### APPENDIX B FIRE-FLOW REQUIREMENTS FOR BUILDINGS

**TABLE B105.1(1)  
REQUIRED FIRE FLOW FOR ONE- AND TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS AND TOWNHOUSES**

FIRE-FLOW CALCULATION AREA (square feet)	AUTOMATIC SPRINKLER SYSTEM (Design Standard)	MINIMUM FIRE FLOW (gallons per minute)	FLOW DURATION (hours)
0-3,600	No automatic sprinkler system	1,000	1
3,601 and greater	No automatic sprinkler system	Value in Table B105.1(2)	Duration in Table B105.1(2) at the required fire-flow rate
0-3,600	Section 903.3.1.3 of the <i>International Fire Code</i> or Section P2904 of the <i>International Residential Code</i>	500	1/2
3,601 and greater	Section 903.3.1.3 of the <i>International Fire Code</i> or Section P2904 of the <i>International Residential Code</i>	1/2 value in Table B105.1(2)	1

For SI: 1 square foot = 0.0929 m<sup>2</sup>, 1 gallon per minute = 3.785 L/m.

*0 – 3600 sqft = 15,000 gallons (sprinkler systems required in all new dwellings). Estimated total cost of 15,000 gallon cistern is \$30k+.*

**NFPA 1142 - Calculating Minimum Water Supplies in Rural/Suburban Areas**

$$WS_{min} = \frac{VS_{tot}}{OHC}(CC) \times 1.5$$

$WS_{min}$  = minimum water supply in gallons

$VS_{tot}$  = total volume of structure in ft<sup>3</sup> (sq footage x 10)

$OHC$  = occupancy hazard classification number

$CC$  = construction classification number

1.5 = exposures

**Residences: CC is typically Type IV (1.0), OHC is 7, all of our residences have exposures (WUI)**

(See: NFPA 1142 Reference Page)

**Initial Arriving Gallonage (IAG)**

Future 5601 capacity (90%) = 750 (.9) = 675 gallons

5641 capacity (90%) = 3,000 (.9) = 2700 gallons

IAG = 3,375 gallons

1,575 square foot house. (round up to 1600)

$WS_{min} = [(1,575 \times 10)/7](1.5) = 3,375$  gallons

**Using NFPA 1142 formula, Initial Arriving Gallonage (IAG), and International Fire Code (IFC), dwelling sizes can be placed into 3 categories.**

*0-1600, 1601-3600, 3601 sq.ft. and greater.*

House size	Community Cistern Contribution	Cistern Size
min – 1,600 sq.ft.	\$10k (contribution preferred)	3,500 gallons (if required based on location)
1,601 – 3,600 sq.ft.	\$15k	7,000 gallons
3,601 – max	\$20k	NFPA 1142

**Cistern Size**

For most homes (1,601-3600 sq.ft.) 7,000 gallons @ \$17k, cistern plus labor, freight, and excavation OR \$15k contribution to Community Cistern Fund.

Cistern Prices (Including labor, freight, excavation)

Size in Gallons	Total Cost
1,800	\$9k
2,400	\$10k
3,500	\$11.5k

7,000	\$17k
10,000	\$23k
30,000	\$60-65k

Estimates calculated using quotes from multiple local excavator companies and fire cistern manufacturers (Meyers Services, Grapes & Sons, FLXX, DARCO, and FRPC.)

### Strategic Cistern Placement

- Collected contributions to the Cistern Fund used to install, upgrade, maintain community cisterns or replace/maintain water tenders.
- Reduce water supply issues in areas with high wildfire risk.
- Greater impact in areas with high WUI concentrations (St Anton, Bonanza, Hummer).
- Remote areas with access issues (Fourth of July, Sherwood, CR103).

### Overall Water Supply Infrastructure Issues

A formula to calculate cistern size based on required fire flow creates a consistent solution to water supply issues.

- *Unincorporated Boulder County within our AHJ*  
Cisterns now meet fire flow duration.  
Tactically resolves water issues, less reliance on water shuttle, safer.
- *Town of Nederland*  
Serviced by a hydrant/main – \$10-15K to install hydrant within required distance (see FIRE CODE – HYDRANT SPACING). Plus, Town charges \$37k tap & PIF for water, \$20k tap & PIF for sewer.  
Not serviced by a hydrant – requires a variance from Town, still meets fire flow duration requirements.

### What are our neighbors doing?

Four Mile: 10,000 gallons requirement.

Timberline: budgeted \$150,000 for a single 30,000 gallon cistern replacement, nearly \$1 million set aside in future fees for cistern replacement.

Location	Capacity (gal)	Replacement Cost
Station 1	36,000	\$200,000
Station 1	9,000	50,000
Station 2	11,000	50,000
Station 3	30,000	150,000
Station 4	9,000	50,000
Station 5	12,000	100,000
Station 6	2,000	20,000
Station 7	18,000	75,000
Station 9	20,000	100,000
Taylor Drive	5,000	25,000
1600 Karlann Drive	10,000	50,000
Colorado Sierra Delta	10,000	50,000
322 Jankowski	10,000	<u>50,000</u>
<b>Total</b>		<b>\$970,000</b>

Source: Timberline Fire Protection District; Economic & Planning Systems





### What are we doing?

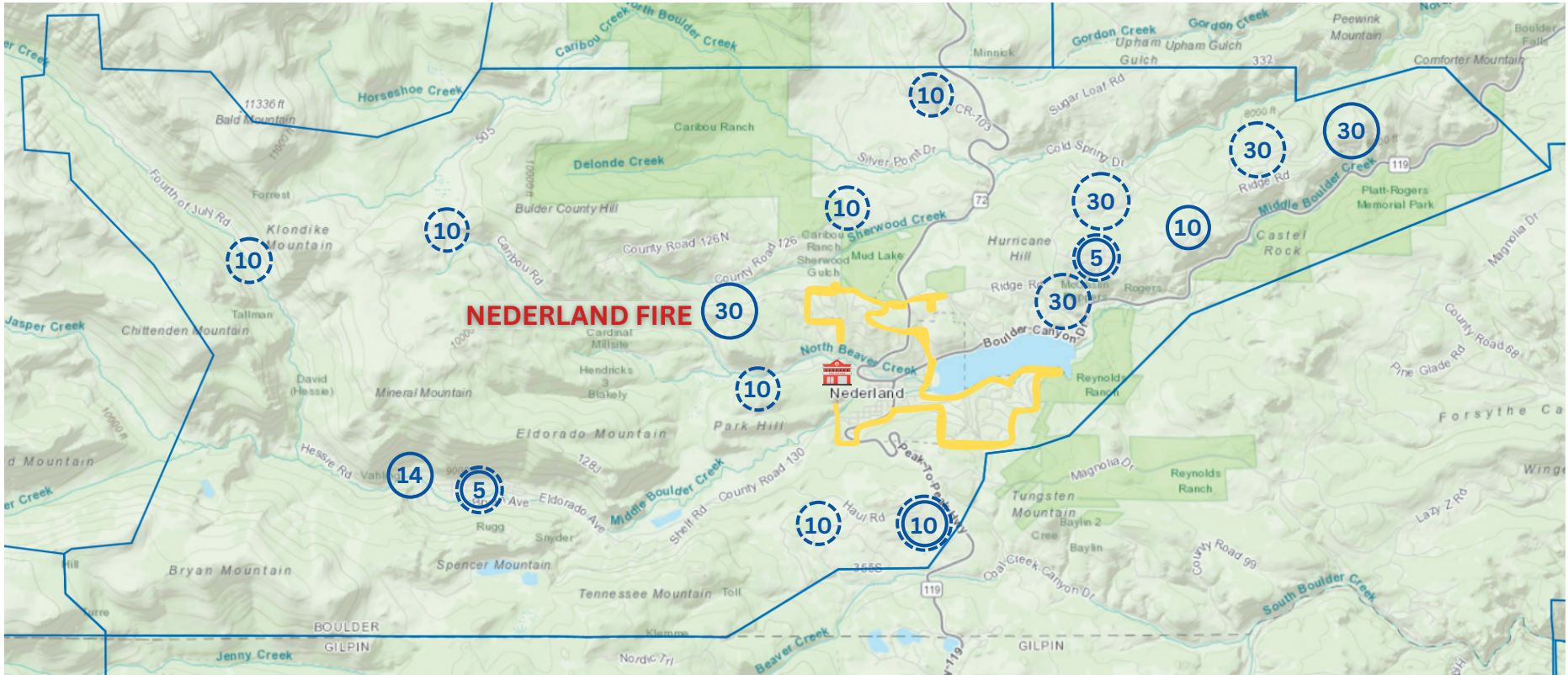
Minimum \$10k contribution, standard size requirement of 7,000 gallons.  
Adequately fight fires, plan useful cisterns.



# CISTERN PLANNING

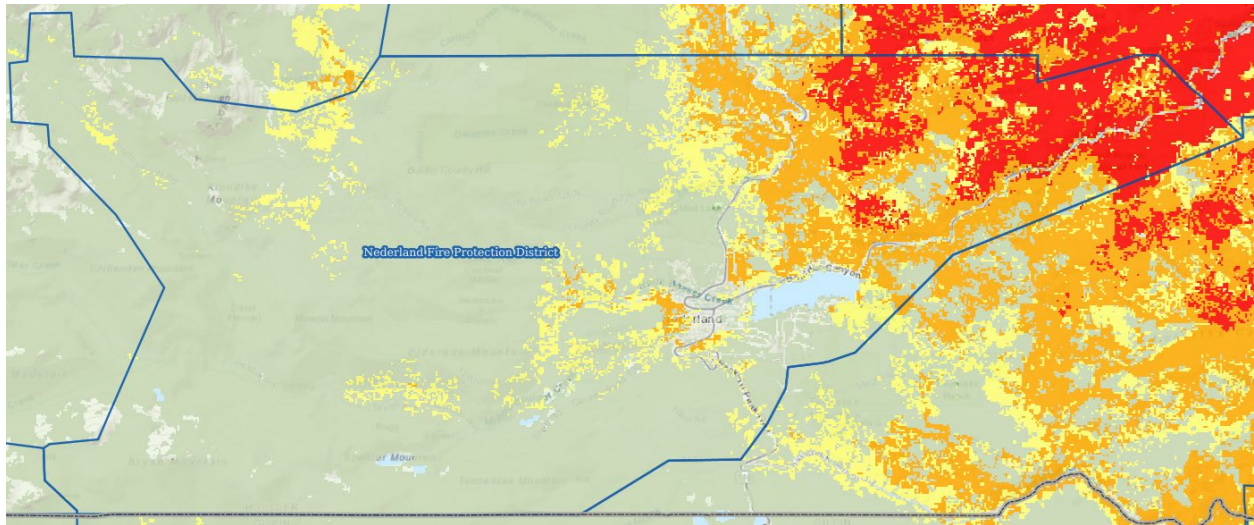
**KEY**

	Existing Cistern	<b>10</b>	Gallorage (Kgal)
	Future Cistern		Hydrant Area
	Upgrade Cistern		

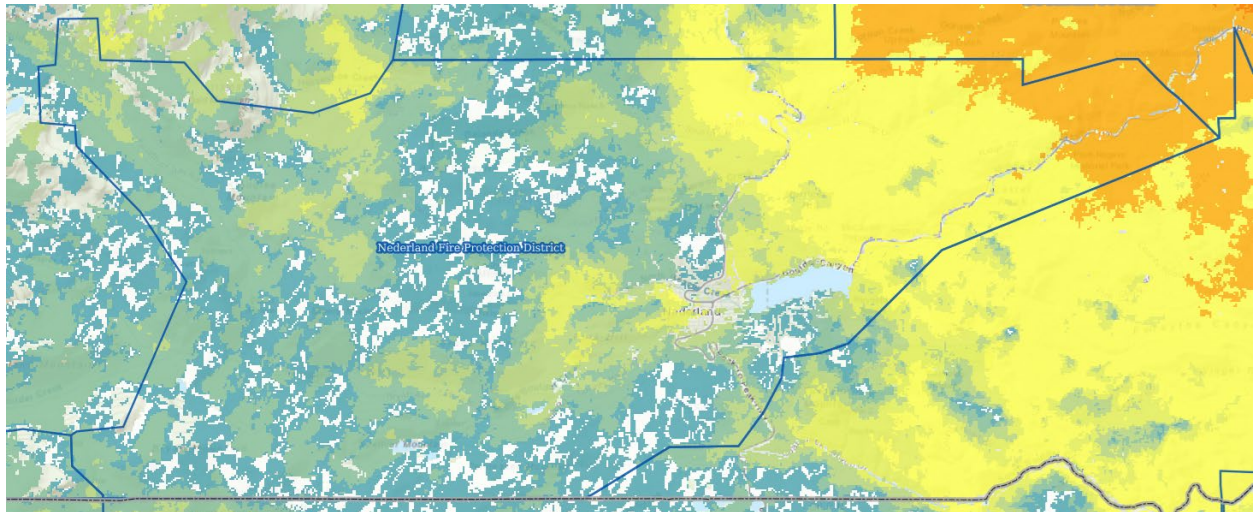


NEDERLAND FIRE PROTECTION DISTRICT - 2023

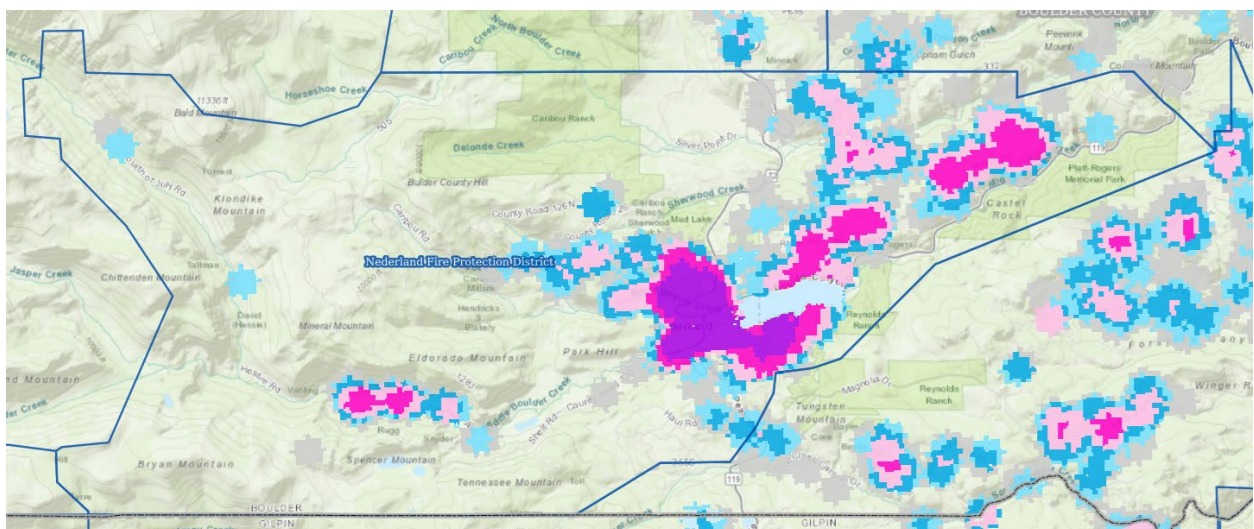




“NFPD Wildfire Risk” source: CSFS Forest Atlas



“NFPD Burn Probability” source: CSFS Forest Atlas



“NFPD WUI Density” source: CSFS Forest Atlas

## NFPA 1142 References

**5.2.5.2** Occupancies having conditions similar to the following shall be assigned occupancy hazard classification number 7:

- (1) Apartments
- (2) Colleges and universities
- (3) Clubs
- (4) Dormitories
- **(5) Dwellings**
- (6) Fire stations
- (7) Fraternity or sorority houses
- (8) Hospitals
- (9) Hotels and motels
- (10) Libraries (except large stockroom areas)
- (11) Museums
- (12) Nursing and convalescent homes
- (13) Offices (including data processing)
- (14) Police stations
- (15) Prisons
- (16) Schools
- (17) Theaters without stages

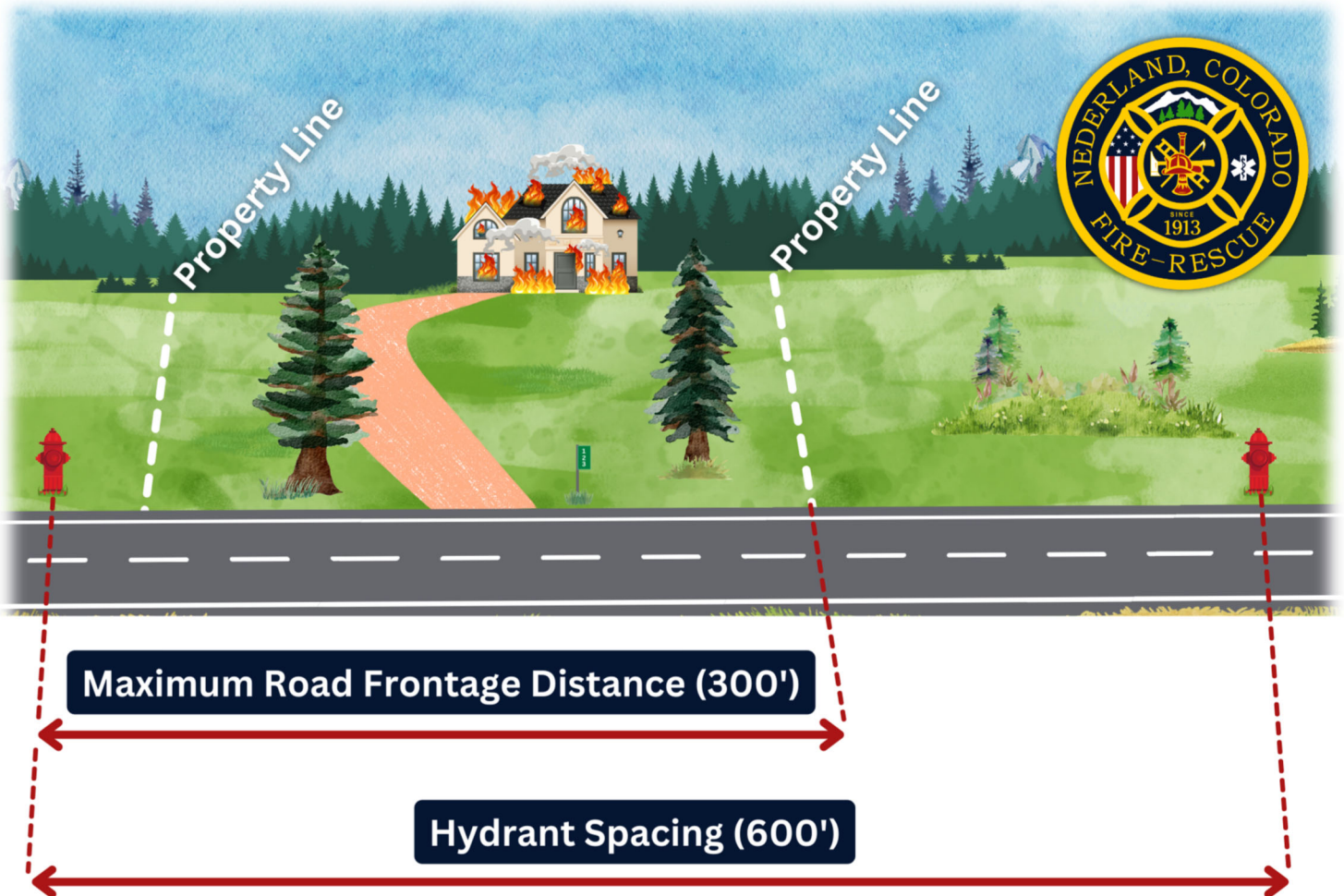
Table 6.2.1 Construction Classification Number

<b>Construction Type</b>	<b>Classification Number</b>
Type I (442 or 332)	0.5
Type II (222, 111, or 000)	0.75
Type III (211 or 200)	1.0
Type IV (2HH)	0.75
Type V (111 or 000)	1.5

**6.2.2** For dwellings, the maximum construction classification number shall be 1.0



# FIRE CODE - HYDRANT SPACING



*Beginning January 1, 2022, The Nederland Fire Protection District has adopted IFC 2018 with Appendix B, C, and D.*

**TABLE C102.1** states the maximum distance from any point on street or road frontage to a hydrant to be 250 feet. Footnote "g" extends this 25% by providing an NFPA13D fire sprinkler system to 312.5 feet. That is reduced to 300 feet by Town Municipal Code - Chapter 13 Article IV, Sec. 13-112. (i) (1) and per Section 102.8 of the IFC.

**TABLE C102.1** states the maximum distance between hydrants to be 500 feet. Footnote "g" extends this 25% by providing an NFPA13D fire sprinkler system to 625 feet, which is reduced to 600 feet by Nederland Fire to accommodate apparatus placement and hose deployment, and to meet Town Municipal Code - Chapter 13 Article IV, Sec. 13-112. (i) (1).

Meyers Services  
303-582-3046  
PO Box 291  
Rollinsville, CO 80474

Prepared For                      Estimate Date                      Estimate Number  
Andrew Joslin                      05/08/2023                      00012499  
Nederland Fire Department

Description	Rate	Qty	Line Total
Pick-Up & Delivery Pick up and delivery of machines	\$350.00	2	\$700.00
Mid Size Excavator	\$1,850.00	1	\$1,850.00
Compactor	\$1,000.00	1	\$1,000.00
labor	\$850.00	1	\$850.00
Squeegee	\$950.00	1	\$950.00
1800 Gallon Cistern	\$3,795.00	1	\$3,795.00
		Subtotal	9,145.00
		Tax	0.00
		Estimate Total (USD)	\$9,145.00

Notes

This estimate is created for:  
Nederland Fire Department  
c/o Andrew Joslin

1800 Gallon Cistern

Meyers Services will:

- call for all public locates prior to digging
- deliver all machines and materials necessary to complete the project
- excavate for new cistern in proposed area
- bed bottom of excavation with 12" of squeegee
- install new 1800 gallon cistern
- back fill and compact cistern to grade
- rake and clean to finish



\* This estimate is subject to change depending on location of tank

### Terms

1. 50% down payment on total estimated cost to get the project scheduled. Payment in full due at the end of the job.

-other payment agreements made with homeowners/ contractors must be approved and under contract with Meyers Services.

2. Any items, materials or services not specifically called out in the SCOPE OF WORK will be billed at our standard task rate. 165\$ for machine time, \$175 for large machine time and \$50 for labor per hour. Overtime and weekend rates are as follows: \$75/ hour each laborer and \$250/ hour machine time. Materials are purchased at market pricing at that time.

3. Any and all permitting required by the county is the responsibility of the client previous to the beginning of work, if a license is required for permitting that Meyers Services carries we will charge the permitting fee and need to be notified previous to the start of work.

\* Meyers Services will call for inspection as necessary

4. Homeowner/ contractor are responsible for surveying, grade staking, and marking the project

5. If rock is a factor and blasting is necessary that will be discussed with client and will be additional cost of blasting subcontracting.

6. All terms and conditions will be applied by Meyers Services; any extra cost will be discussed with home owner and contractor for the following reasons:

- the amount of disposal of stumps, debris or material

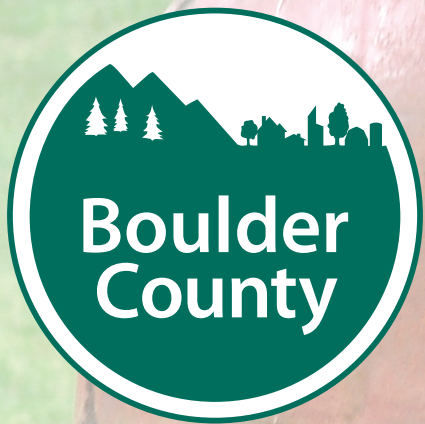
- any extra material needed for the project will be extra cost at standard market pricing

- If a hammer attachment is needed to remove rock this will be discussed with homeowner/ contractor before additional fees are added

7. All estimates are given with the assumption that all provided engineered plans are correct and required.

8. If rental machines remain on rent due to conditions outside of Meyers Services control (weather, other subcontractors, inspection etc.) it additional rental fees are the responsibility of the contractor or homeowner

This estimates pricing is good for 60 before expiration and is subject to change.



**Boulder  
County**

**Boulder County  
Community Planning &  
Permitting Publications**

# Emergency Water Supply for Firefighting

**Community Planning &  
Permitting Department**  
Courthouse Annex Building  
2045 13th Street  
PO Box 471  
Boulder, CO 80302

**Wildfire Mitigation:**

Phone: 720-564-2625 or  
720-564-2641

Email: [wildfiremitigation@bouldercounty.org](mailto:wildfiremitigation@bouldercounty.org)  
[www.bouldercounty.org](http://www.bouldercounty.org)

## Emergency Water Supply for Firefighting

Water is a critical resource in firefighting, both for suppressing structural fires and for defending structures from wildland fires. When firefighters arrive at a home, they need a dependable and ready supply of water. But in most rural and mountainous areas of Boulder County, unlike urban areas, there are no high-pressure water mains and fire hydrants to deliver the water. Instead, fire districts must rely on equipment and personnel to move water from local water sources to the fire.

This can be a slow and time-consuming process that requires coordination of many resources. Water sources are all too often a long distance from the fire, and it can take a great deal of time and effort to transport the water to where it is needed. Additionally, transporting water requires equipment and personnel that could otherwise be utilized for fighting fire. The lack of readily available water can seriously impair the ability of firefighters to do their job in a safe and effective manner.

If firefighters are unable to maintain an uninterrupted supply of water on the fire, the result can be a relatively unchecked spread of the fire, leading to the complete loss of structures or an extension of the fire beyond the capabilities of the emergency personnel involved. To help mitigate this situation, Boulder County is requiring the installation of individual and community emergency water storage and delivery systems in rural and mountainous areas.

### Individual Fire Cisterns

One of the most basic and reliable means for storing large amounts of water for firefighting is an individual fire cistern. This is essentially a large, watertight concrete, fiberglass, or reinforced polyethylene plastic tank installed in the ground near a residence, with some plumbing attached to facilitate drafting the water. Individual cisterns must meet the following criteria:

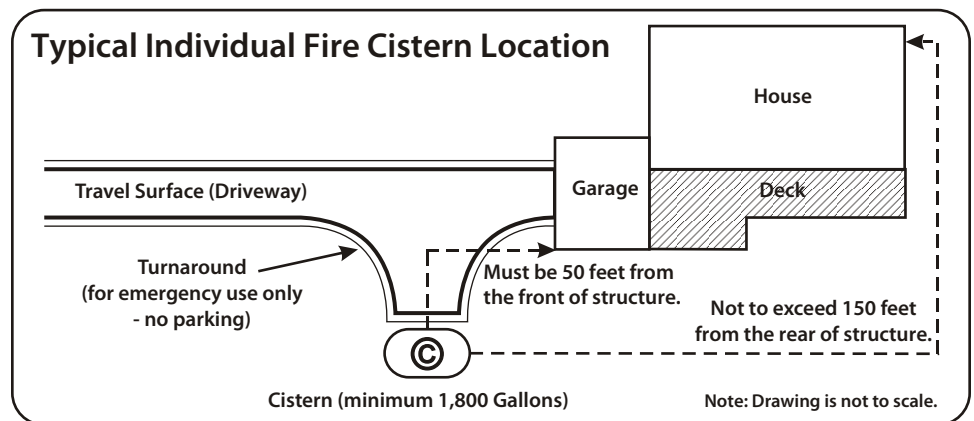


Figure 1: Typical Individual Fire Cistern Location.

- It must be a **minimum 1,800 gallons** capacity (note that some fire districts require a **minimum of 2,400 gallons**, and the amount may be greater depending upon the total square footage of the structures).
- It must be located at least **50 feet from the front** of the structure, and not to exceed **150 feet from the rear** of the structure. It should be located next to an emergency turn-around, or where the driveway meets the road, whichever is closer (see Figure 1).
- Fire cisterns do not necessarily need to be located next to an operational well, and in fact should be a separate and independent water supply. Note that a well at the home **will not provide water quickly enough and in sufficient quantity** for fire control; some kind of additional water storage is necessary.
- The fire cistern **may not be the same** as that used for your domestic water supply or your sprinkler system (if applicable). Aside from the more obvious problems of cross-contamination, these fire cisterns often need to be in very different locations. While the domestic water or a sprinkler system storage tank is generally next to or underneath the house, the fire cistern needs to be some distance away.

# Individual On-site Cistern for Fire Protection

## Single Family Residence - Precast Concrete Cistern

All concrete fire cisterns include the tank, a lid, a 2' Riser & Cistern Filler Lid, a suction vent and a draft connection (dry fire hydrant)

### Installation Instructions:

- Cisterns must be buried to prevent the water in the tank from freezing; this requires excavation and may require blasting to achieve. Excavations for the tank should be at least **12" larger than the outside dimensions** of the tank.
- The base of the excavation must be level with no protruding rock. It must be covered with a minimum of 6" of compacted sand, gravel or crushed stone  $\frac{3}{4}$ " in diameter or less. Bed must be leveled and compacted before setting the tank.
- Backfill material must be 2" in diameter or less in order to avoid damage to the tank. Granular backfill should be rolled in from the side in equal lifts around the tank and compacted. Avoid dumping directly on the lid of the tank.
- Excavator should provide a safe and clear offloading site within 15' from the rear of the truck to the center of the tank. After installation, **DO NOT** drive on the tank.

The installer must check with the local Fire Protection District (FPD) and the Community Planning & Permitting Department for requirements on tank placement, dry hydrant connection, and filling requirements. Some FPDs will fill the tank at the time of testing and inspection. Others require the tank be filled before testing.

**Note:** A separate building permit may be necessary for cistern installation if it is not associated with another specific construction project.

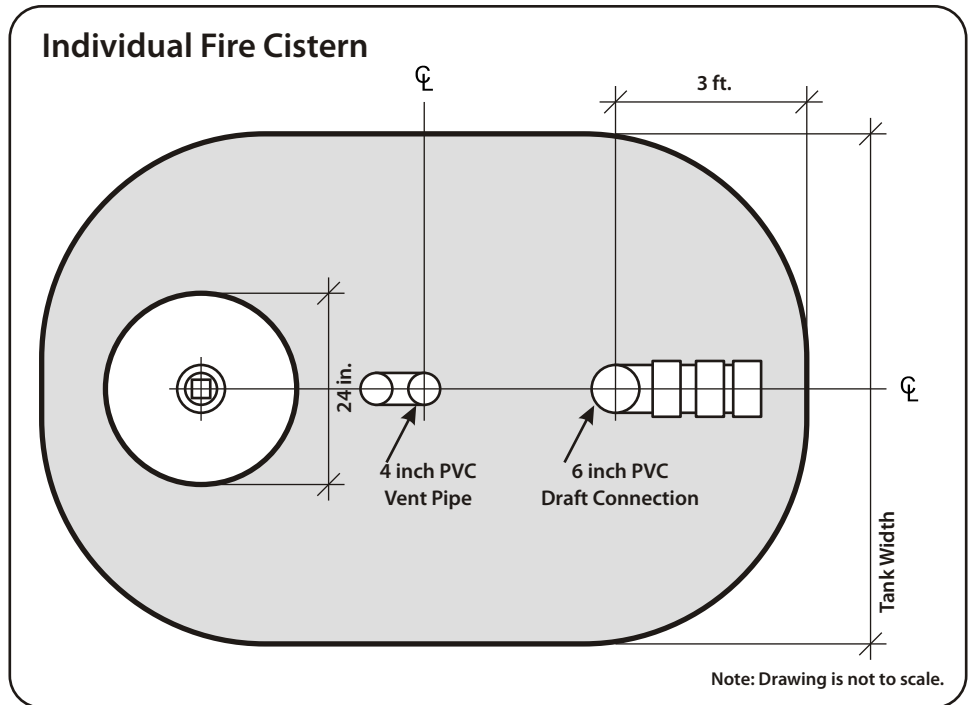


Figure 2: Individual Fire Cistern Plan View.

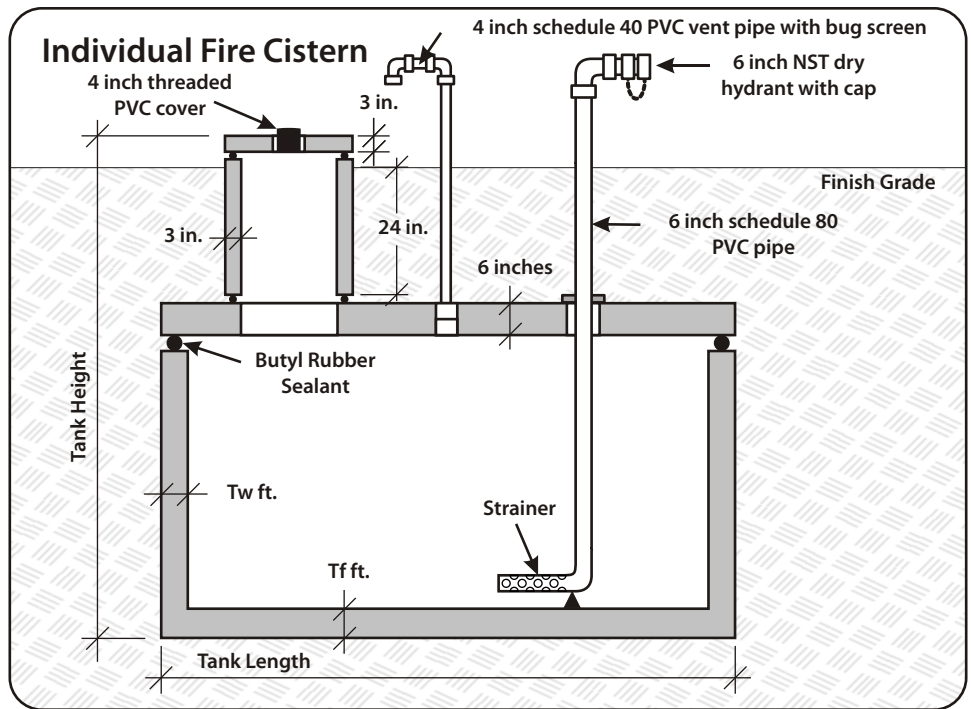


Figure 3: Individual Fire Cistern Elevation Drawing.

### Water Cistern Size Table

	Width	Length	Height	Tw	Tf	Weight
1800 Gallon	6'-8"	10'-2"	8'-1"	4"	4"	14,489
2400 Gallon	6'-8"	12'-8"	8'-1"	4"	4"	16,549

## Community Fire Cisterns

Many fire protection districts prefer that individual homeowners make a monetary contribution to a community cistern fund in lieu of the placement of an individual fire cistern on site. This provides the fire district with a more reliable water source, since they have ownership and general control over the use of the community cistern. If a community cistern program is available in your area, you are encouraged to make a contribution for its use and maintenance.

- Community fire cisterns differ from individual cisterns in that they are much larger, often 10,000 gallons or more. They are centrally located, usually near a fire station or fire barn, or in some other easily accessible area within a community. These kinds of fire cisterns are generally installed and maintained by a fire protection district. Typically, the excavation and grading associated with the installation of a community cistern is handled thru a Limited Impact waiver process initiated by the Fire Protection District.
- Community fire cisterns are most appropriate in subdivisions where the majority of the lots are around one (1) acre in size and residential driveways are generally less than 150 feet in length. If your parcel is 5 acres or more and/or your driveway is over 400 feet or more in length, it is very likely you will need an individual fire cistern on your site. Contact your local fire authority for more specific information about contributing to a community fire cistern fund.

## Other Water Sources

Static bodies of water, such as ponds, lakes, rivers and other non-pressurized sources such as perennial streams, can also be used as water supplies for firefighting. These sources are not considered as reliable as cisterns, however, because they can be seasonally unavailable (they may dry up in the summer, and be frozen over during the winter) and may be difficult to access (due to sloping and/or soft ground, and/or vegetation along the shoreline). Additionally, the water in them is often privately owned and therefore may not be as readily available during an emergency as that in a cistern.

## Dry Fire Hydrants

Regardless of the type of water source, firefighters need to have an effective way of getting water from the source into the engine and onto the fire. For this, they utilize a non-pressurized pipe system permanently installed in a water source. These are known as "draft" or "dry" fire hydrants.

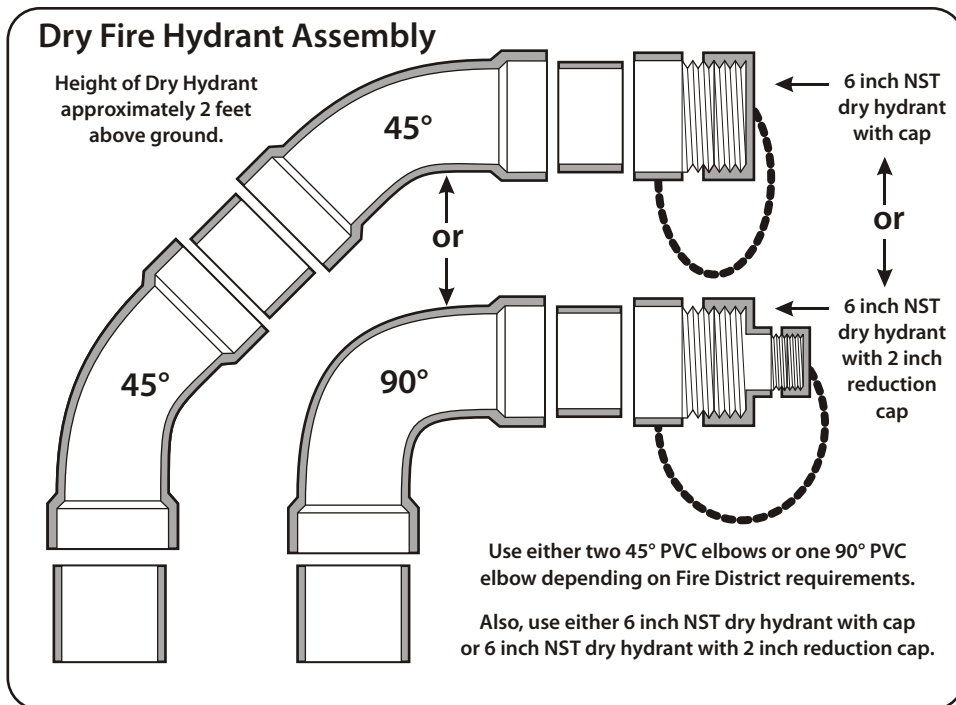


Figure 4: Dry Fire Hydrant Assembly.

## Pressurized Water Supply Systems

There are only a few fire areas in the mountainous parts of Boulder County that have pressurized water supply systems, with adequate pressure and flow from the fire hydrants, which meet minimum fire flow requirements of the Fire Code. Among these are the Pine Brook Hills and Spring Valley subdivisions, some of the lower sections of Lefthand Canyon and Olde Stage Road, and some of the various mountain towns and cities. Most fire districts follow the provisions of Appendix III-A of the Fire Code on fire flow from hydrants; and the National Fire Protection Association (NFPA) "Standard on Water Supplies for Suburban and Rural Fire Fighting", NFPA 1231-1993, on water supplies without fire hydrants. Some districts services may exceed these requirements and will be determined through the review of the individual application. Consult your local fire authority for more information about whether or not your property is serviced by such a system.

## Fire Sprinkler Systems

Residential fire sprinkler systems have been shown to minimize damage from fires in structures. They are a way of buying time and getting to the fire while it's still small enough to extinguish or control until on-site or other water sources can be made available.

Fire sprinklers do not take the place of hydrants and cisterns, or vice versa, and should not be confused with fire cisterns and other emergency water supply requirements.

Even if you have a sprinkler system installed in the house, it will do little to help in case of a wildfire unless your house is already on fire.

Additionally, sprinkler systems are usually pressurized by an electric pump, which may or may not be operational during a wildfire because often power is lost during such events. It is best to have available a back-up generator as auxiliary power in the event of an electrical outage. Gravity-fed systems may also be considered.

Requirements for residential fire sprinkler systems are addressed under the Boulder County Building Code and locally adopted Fire Codes.



## Dry Fire Hydrants (Continued)

Dry hydrants provide a simple, cost-effective and efficient means of accessing and drafting water from a water source. They help to reduce the amount of time it takes to fill-up fire engines by providing a quick connection point to an uninterrupted, clean water supply. The arrangement also allows access to water from a roadway, instead of having to work on potentially soft ground immediately adjacent to a pond or stream. Dry fire hydrants also help facilitate the complex process of shuttling water long distances from a source to fire.

### Dry Fire Hydrant Assembly:

- Typically constructed from rigid pipe (such as Schedule 80 PVC). *Note that exposed portions of PVC pipe must be painted for UV protection.* Red paint is best to make the dry hydrant easier to locate under low light or smoky conditions.
- Must have a standard fire fitting (6-inch NH threaded connection with a cap and screen) on the outlet side, and a coarse filtration strainer on the intake side. *Note that before installing a dry fire hydrant you should consult your local fire authority for the exact type of connections needed to be compatible with the districts' and/or other agencies' equipment.*
- Must be clearly marked by placing reflective signs and/or reflectors on 3-foot metal posts nearby. Placing large rocks 12" in front of the pipe is also recommended to help avoid accidental collisions.

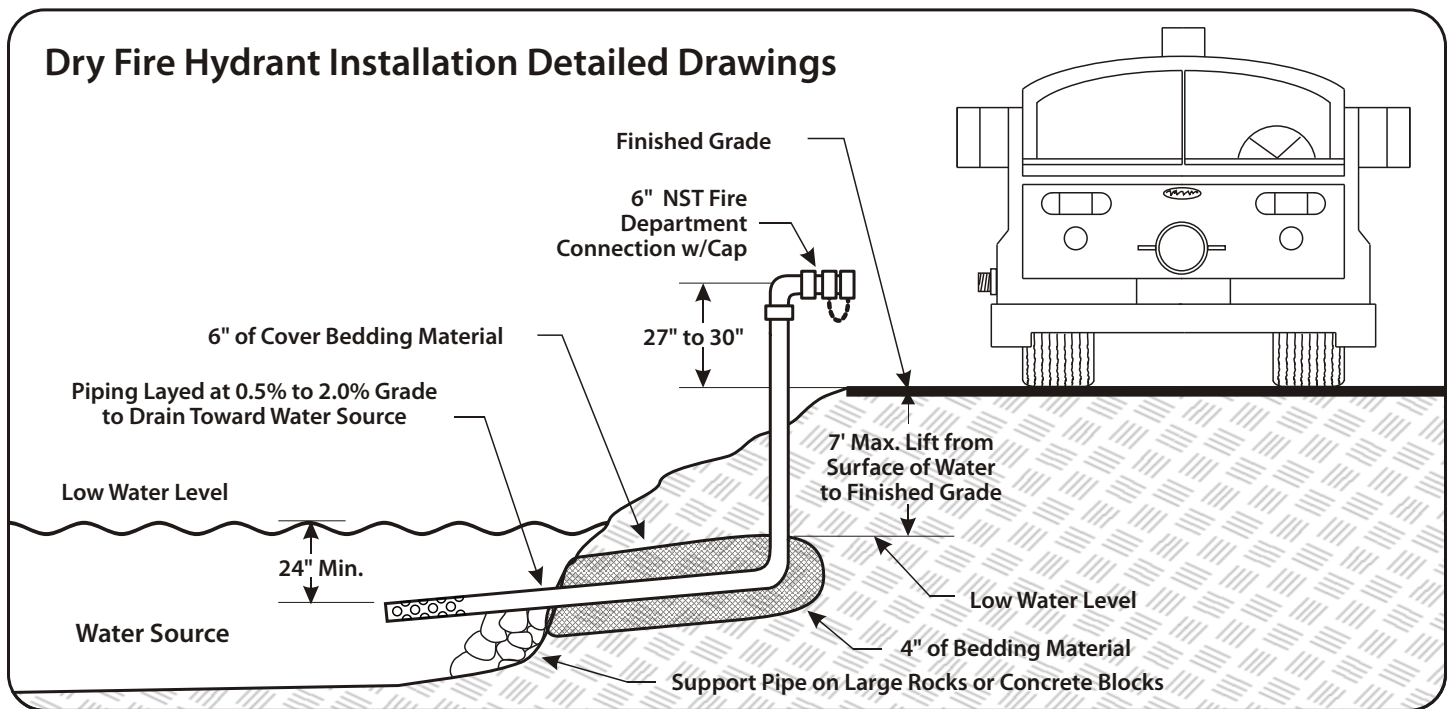


Figure 5: Dry Fire Hydrant Installation.