

NATURAL RESOURCES CONSERVATION SERVICE

VIRGINIA CONSERVATION PRACTICE STANDARD

DRY HYDRANT

(Each)

Code 432

DEFINITION

A non-pressurized permanent pipe assembly system installed into water source that permits the withdrawal of water by suction.

PURPOSE

To provide all weather access to an available water source for fire suppression.

CONDITIONS WHERE PRACTICE APPLIES

Where a dependable source of water is available, where transport vehicles can access the site, and where a source of water is needed for fire suppression.

CRITERIA

SITE CONDITIONS

Site conditions shall be such that an all weather vehicle access is available to the dry hydrant or can be developed. The dry hydrant shall be reasonably close to the water source to minimize the length of suction line. This should be determined in conjunction with local fire officials. Special care and maintenance will be required when debris and fine soil particles are part of the streambed. If streams are used, those with sand, gravel, or rock bottoms provide the best operating conditions.

WATER REQUIREMENT

The quantity to be considered available to a dry hydrant is the minimum available (at not over 15 feet total static lift) during a drought having an average 50-year (2.0 percent chance) recurrence interval. A dependable water supply is considered to be:

1. A minimum of 30,000 gallons (1.1 acre-inches) of pumpable impoundment water;
2. A minimum pump flow rate of 250 gpm without interruption for 2 hours;
3. The volume designated by the fire department or other jurisdictional authority to meet their water supply plans; or
4. Computed in accordance with National Fire Protection Association (NFPA) Standard 1231, "Water Supplies for Suburban and Rural Fire Fighting" for private water points.

LOCATION

A location map showing the exact site of the hydrant and vehicle access shall be furnished local fire department with a copy to the landowner. A letter of approval to use the site shall be obtained from the landowner prior to construction. Access, topography, and location should be reviewed by fire department personnel prior to installation.

The fire truck connection shall be within 10 feet of the edge of an all weather access road. The all weather access road and fire truck pumper connection shall be higher than the auxiliary

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spillway elevation if installed in a constructed impoundment.

WATER SUPPLY

The adequacy of the water supply from impoundments shall be determined and documented in accordance to appropriate local criteria. The RESOP or similar computer program can be used to determine the water supply contained by earthen construction or water impounding embankments unless the following minimum criteria are met:

1. The impoundment has a surface area greater than or equal to 1.0 acre.
2. The pool depth is greater than or equal to 6 feet.
3. The drainage area to surface area ratio is greater than or equal to 8:1.

The adequacy of stream flow source can be determined from regional analysis of stream gage data. Adequacy of pit-type ponds shall be documented based on water budgets, long-term water table depths, soil survey data, and experience.

PIPE

The pipe material may be iron, steel or plastic. The pipe shall have watertight joints. Plastic pipe shall be schedule 40, SDR-26 or stronger. No more than two 90-degree elbows shall be used in the entire pipe system. Pipe shall be 6 inches nominal diameter or larger. The pipe shall be fitted with intake screen or strainer and standard fire truck hose adapters for quick connect/release operations acceptable to the local fire department.

The depth at which the pipe is installed shall be below the frost-free depth for the area.

PIPE INTAKE

The pipe intake shall be placed 2.0 feet below the 50-year drought elevation to account for the minimum water supply requirements and to avoid a vortex or whirlpool during pumping.

The intake screen should have a minimum opening of 4 times the pipe cross sectional area. Where the intake is more than 3 feet off the bottom, a trash rack may be used in lieu of a screen.

A dry hydrant installation shall provide for a positive slope toward the water source. In pits or impoundments, the intake screen or strainer shall be supported and secured at least two feet above the pool bottom. The intake shall be at least 4 feet beyond the earth slope.

PUMP LIFT

The top of the fire truck pumping connection or centerline of pump (whichever is higher) shall be no more than 15 feet in elevation above the bottom of the fire protection pool or stream surface during drought conditions.

The fire truck connection shall be approximately 24 inches above the ground surface, but never higher than the intake of the fire truck.

The total lift (pumping head) shall not exceed 20 feet when all losses are totaled. Each head loss (in terms of equivalent length of pipe) shall be figured using the below tables and in accordance with the following formula:

Total Head Loss = head loss x (line length + Equivalent length of pipe) + elevation change.

Table 1. Equivalent length of pipe for 250 gpm and 500 gpm pumping rates.

| <u>Pipe Feature</u> | <u>Pumping Rate</u> <u>250 gpm</u> | | | <u>Pumping Rate</u> <u>500 gpm</u> | | |
|-------------------------------|---------------------------------------|--------------|---------------|---------------------------------------|--------------|---------------|
| | <u>Pipe Diameter</u> | | | <u>Pipe Diameter</u> | | |
| | <u>6 in.</u> | <u>8 in.</u> | <u>10 in.</u> | <u>6 in.</u> | <u>8 in.</u> | <u>10 in.</u> |
| Intake Screen | 2.0 ft. | 2.0 ft. | 2.0 ft. | 8.0 ft. | 8.0 ft. | 8.0 ft. |
| 90° elbow (standard) | 16.0 | 22.0 | 27.0 | 16.0 | 22.0 | 27.0 |
| 90° elbow (long sweep) | 11.0 | 14.0 | 18.0 | 11.0 | 14.0 | 18.0 |
| 45° elbow | 7.5 | 10.0 | 13.0 | 7.5 | 10.0 | 13.0 |
| Hydrant Connection (6" x 4W") | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |

Table 2. Head loss (per 100 ft. of pipe).

| <u>Pumping Rate</u> | <u>Pipe Diameter</u> | | |
|---------------------|----------------------|--------------|---------------|
| | <u>6 in.</u> | <u>8 in.</u> | <u>10 in.</u> |
| 250 gpm | 0.586 | 0.126 | 0.039 |
| 500 gpm | 2.343 | 0.503 | 0.153 |
| 750 gpm | 5.267 | 1.131 | 0.344 |

DRY HYDRANT

Dry barrel (conventional) hydrants may not be used due to excess suction loss and the necessity that they be absolutely airtight.

A recessed hydrant (below ground-level connection) may be specified for use in areas with special needs, such as in a high vandalism area or for low profile and aesthetic needs. It is also referred to as a flush mount hydrant and does not require the 24-inch riser. It may be used with the 45° or straight dry hydrant head assembly.

DRY HYDRANT HEAD

The hydrant sleeve shall be made of bronze, brass, aluminum alloy or other durable, non-corrosive metal. Sleeve must be permanently affixed inside a PVC head using epoxy adhesive and stainless steel bolts.

The hydrant head shall be able to accept a 6-inch NHT (American National Fire Hose Thread) connection to provide maximum supply. Hydrant (6 inch) head shall conform to ASTM 2466.

All hydrants shall contain a removable head strainer and stainless steel snap ring that can be removed without special tools. The strainer shall be conical in shape to maximize straining area. All hydrants shall use a rubber "O" ring between the threaded sleeve and PVC head.

DRY HYDRANT CAP

The cap shall be of snap-on/snap-off design and removable without special tools. It shall be joined with a steel cable or chain and be permanently attached to the dry hydrant head. The cap shall be hard plastic or of the same metal as NHT connection for maximum corrosion resistance.

STRAINER

The strainer shall be fabricated from PVC material compatible with the pipe. Individual inlet holes shall not exceed 3/8-inch diameter. All components, including pins, shall be non-corrosive. Manufactured well screens shall be corrosion resistant. Screens and strainers shall have a minimum open area of 4 times the pipe cross sectional area.

A strainer may be formed by drilling ¼ inch to 3/8 inch diameter holes with a minimum of one hole diameter between the holes in PVC pipe. Drill holes shall be deburred and the pipe cleaned before putting the strainer into service. The screens or strainers shall be capped with a removable end cap.

END CAP

The end cap must be easily removed without special tools. Perforations are recommended in the end cap, also, to improve flow conditions into the strainer and for jetting action for silt cleanout.

SITE PREPARATION

The dry hydrant access area and pipe location shall be cleared to the extent needed for pipe installation and access by fire fighting personnel and equipment. Clearing and brush removal for safe line-of-sight to the road shall be included. Clearing debris, logs, stumps, and other trash shall be burned, buried, removed from the site, or otherwise disposed of in accordance with state and local laws in a manner that does not interfere with hydrant installation or vehicle access. All burning operations shall be in conformance with existing state and local regulations.

Any fence encountered within the construction area shall be carefully dismantled and relocated as necessary to avoid a fence gate across the access road.

EXCAVATION

Excavation for placement of the dry hydrant pipe and riser shall be done by trenching or other approved methods. Excavation should begin in the water source and proceed toward the

hydrant location. Trenches having cuts greater than 5 feet shall be sloped on a 2:1 slope above the 5-foot height to avoid sidewall caving and to improve backfill compaction. Care must be taken during underwater excavation to avoid ridges and valleys in the bottom grade. The bottom grade shall be sloped toward the water source. The grade should be at least 0.25 ft./100 ft. but not be more than 0.5 ft./100 ft.

Excavation and shaping of the site shall facilitate and enhance easy on/off road access to the dry hydrant.

INSTALLATION

Dry hydrant installation shall provide for a minimum 0.25 ft./100 ft. of slope toward the water source. In impoundments, the intake screen or strainer shall be supported and secured at least 2 feet above the pool bottom. The screen should be at least 8 ft. beyond fill slope – pipe contact point. For streams, the intake screen or strainer shall be anchored in a 2-4 foot deep by 4-foot wide bed of crushed stone or gravel located below the streambed. The inlet end of the screen or strainer shall be capped to prevent entry of silt and debris.

FILL PLACEMENT

If suitable, material excavated from the pipe trench, access area shaping, or other source may be used for pipe backfill and other site filling and shaping activities. The fill material used in the trench must be free from all sod, roots, stones over two inches in diameter, frozen soil, and other objectionable material. Soil placed against plastic pipe shall be free of any isolated stones. A minimum of 2 feet of cover perpendicular to the slope is required. The soil surface shall be mounded over the pipe for settlement and to divert surface water.

The pipe riser shall be anchored in place prior to fill placement. Backfill should start at the access road and proceed toward the water source.

Fill material shall be placed in thin layers not exceeding 9 inches thick and compacted. Compaction around the pipe above water level shall be by hand tamping or by manually directed power tampers. The sides of the trench shall be scarified so that they will bond with the fill

material and minimize settlement. Compaction around the pipe below water level shall proceed from the embankment end and shall be done by soil weight and compaction on material above the water level. Loose, sandy material or pea size gravel should be used as backfill below water level to promote drainage and anchoring. Trench confinement and compaction will force excess water from the fill material. Care must be taken so that loose soil in the water will not be pushed out over the intake screen.

MATERIALS

All materials shall meet or exceed the minimum requirements for materials described in the various sections of this standard.

CONSTRUCTION MATERIALS AND METHODS

Pipe materials shall be of the specified type, size, and length as shown on the drawings. Pipe connections shall be properly cleaned and cemented so that all connections are airtight.

The pipe shall be placed in the trench to design elevations and anchored in position ready for backfill. The purpose of anchoring is to hold the pipe riser in proper position, location, and elevation until all backfill operations are completed. Anchoring may be accomplished by tying pipe to stakes, concreting in place, or by tying and placing rounded pea-size or larger gravel around lower pipe elbow.

All pipe connections shall be tested prior to placement in the trench. Testing may be done by placing water in the pipe under atmospheric pressure only or under pump pressure and a check made for leaks. All leaks found shall be repaired and pipe retested.

Pipe joint connections shall be cleaned and the appropriate cleaning and sealing material used according to manufacturer's recommendations. The pipe shall be drained, placed in the trench to design elevations and anchored in position ready for backfill. A support shall be provided for the intake screen to assure that the intake has 2 foot of clearance from the pond bottom or is below the stream bottom in a 2 ft. x 4 ft. gravel bed or similar wet well.

In ponds, the end of the pipe shall be supported by cement blocks, 1-inch diameter galvanized pipe-post and strap, or other permanent supports under the pipe. The pipe shall be adequately secured to the support with corrosion resistant material. Screens or strainers may also be covered with 12 inches of crushed rock or gravel.

For streams with bedload, the intake screen or strainer shall be anchored in a 2 to 4 foot deep by 4-foot wide bed of crushed stone or gravel located below the streambed. The inlet end of the screen or strainer shall be capped to prevent entry of silt and debris. The strainer must be buried deep enough to prevent scouring action of the stream from exposing the strainer and tearing it loose from the supply pipe.

Connectors acceptable to and approved by the local fire department shall be used. The fire department will run a pump test at the design capacity after the pipe has been backfilled to confirm operation of the installation.

Minimum size pipe and fittings shall be 6-inch nominal inside diameter. All PVC components are to be Schedule 40, SDR 26, or stronger. Pipe shall conform to ASTM D 1785 or D 2241. Fittings shall conform to ASTM D 2466 or D 2467. Solvent cement shall conform to ASTM D 2564 – Tetrahydrofurnace (THF) primer and between 800-1000 centipoise viscosity cement. (Never use all-purpose cements to join PVC pipe and fittings).

All PVC pipe and fittings exposed to sunlight shall be primed and painted with a high-grade epoxy paint. The underwater support shall be concrete or non-corrosive metal. It shall be of sufficient design to support and stabilize the strainer inlet and to provide ease of adjustment.

TESTING

Pipe joint sealants should be given a chance to cure before testing the piping system. A 24-hour time is recommended for PVC pipe. The local fire department shall perform an initial pump test at the design capacity after installation to confirm satisfactory operation. After the initial test, tests should be performed semi-annually. Careful attention should be given to silt, debris, or other interference that may limit the full operation of the hydrant.

MARKINGS

The dry hydrant shall be clearly marked in a manner acceptable to the fire department. Use of reflective paint on signs and connection cap will help improve visibility during emergencies. Letters and/or numbers should be 3 inches high with ½-inch stroke and be reflective. Physical barriers may be needed to protect the above ground pipe system.

ACCESS

Vehicle access to and from the dry hydrant shall be provided for the truck and pumper units. Access shall have an all-weather surface, be well drained and be at least 12 feet wide for ease of movement by personnel and equipment during an emergency. The access road shall be an all-weather surface in conformance with Virginia Conservation Practice Standard *Access Road (Code 560)*. The road surface and the surface at the dry hydrant shall provide adequate support for heavy vehicles at all times of the year. A minimum turnaround diameter of 90 feet for the mobile water supply apparatus should be provided where feasible. The access road must be acceptable to the local fire department.

When local road traffic may be involved, an all-weather road surface adjacent to the dry hydrant and completely off the public road is recommended for safety of the emergency personnel and the public. Visibility and sight distances should be considered when locating access roads and pull off areas.

PROTECTION

After the dry hydrant installation, the site shall be graded for surface drainage and vegetated or otherwise protected from erosion. Vegetation shall be in accordance with the Virginia Conservation Practice Standard *Critical Area Planting (Code 342)*.

CONSIDERATIONS

The dry hydrant will have a minimal effect on the water quality at the site and downstream due to its anticipated infrequent use and low volumes of water pumped when used.

The quality of the water may be impacted due to erosion during construction but should be minimal due to the short construction time. The quality of water could be impacted due to spilled fuels and lubricants by fire trucks using the dry hydrant but should be minimal due to the anticipated infrequent use.

This practice has the potential to negatively affect National Register listed or eligible (significant) cultural resources (archaeological, historical or traditional cultural properties); it also has the potential to protect listed or eligible historic structures. Consider these factors during planning and also follow the NRCS State policy during construction and maintenance.

PLANS AND SPECIFICATIONS

Plans and specifications for installing dry hydrants shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. Required permits shall be obtained prior to initiating any work.

OPERATION AND MAINTENANCE

Keeping the site clear of obstruction and regular mowing of the dry hydrant access area will be required to keep the area readily available for emergency use.

Pumper testing of the dry hydrant shall be done at least semi-annually to verify site usability. This test shall include back flushing, followed by a pumper test at the maximum designed flow rate. Careful attention should be given to silt, debris, aquatic growth, or other interference that may limit the full operation of the dry hydrant.

Checks of the intake screen should be made once every five years to identify any sediment build-up and to provide information for a clean-out operation or for aquatic growth control needs. The hydrant should be back-flushed each spring and fall to remove any silt or debris that may have accumulated on the screen.

REFERENCES

1. National Fire Protection Association (NFPA) Standard 1231, "Water Supplies for Suburban and Rural Fire Fighting".
2. Reservoir Operations (RESOP) Computer Program.
3. ASTM 2466 Hydrant Head.
4. NRCS, VA, Field Office Technical Guide (FOTG), Section IV.

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DRY HYDRANT

Approved Practice Narrative

(Each)

CODE 432

432 D1 Dry Hydrant: A dry hydrant will be installed as shown by the attached designs and specifications.

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