Ohio Division of Forestry

DRY FIRE HYDRANT GRANT PROGRAM APPLICATION

SUBMIT TO:

Ohio Division of Forestry
Dry Fire Hydrant Program
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DRY FIRE HYDRANT GRANT PROGRAM

INTRODUCTION

The Ohio Dry Fire Hydrant Grant Program is funded under the United States Forest Service's (USFS) 2015 USFS Wildfire Risk Reduction Grant (Federal Award Number: 15-DG-11420004-123)-with the intent of improving wildfire protection and fire department preparedness. The program is administered by the Ohio Division of Forestry.

ELIGIBLE GRANTEES

Fire departments within the Ohio Division of Forestry wildfire protection area that have a cooperative agreement in place with the Ohio Division of Forestry are eligible to apply for Dry Fire Hydrant Grants. Applicants must have an active DUNS number and be registered with SAM.gov. Applicants that do not meet these criteria will not be considered. Fire departments may submit one application for one dry hydrant this grant cycle.

FUNDING OVERVIEW

- This opportunity is a reimbursement grant. Recipients are required to make all purchases associated with the project and will be reimbursed upon successful completion of the project and submittal of all required documentation.
- Maximum reimbursement per project is $2,250. Reimbursement will only be provided for permissible expenses that are documented appropriately and that occur after the signing of a grant agreement.
- This opportunity is a matching grant. The recipient fire department must provide a matching project investment equal to the reimbursement request. Matching investment may be provided with cash contribution or through in-kind service. In-kind service must be documented pursuant to Division of Forestry direction.

INELIGIBLE PROPOSALS

The program is for dry fire hydrants not currently being funded, and is not intended as a substitute for existing funded projects. The focus of the program is to support new initiatives, which would not otherwise occur.

DRY FIRE HYDRANT REFERENCES

National Fire Protection Association Standard 1142 (Standard on Water Supplies for Suburban and Rural Fire Fighting) and Dry Fire Hydrant Manual, USDA Forest Service may be referenced for technical information.

PERMITS & PERMISSIONS

It is the responsibility of the fire department making application for a Dry Fire Hydrant Grant to research and obtain any applicable federal, state, and/or local permits and permissions which may affect installation, maintenance, and use of the proposed dry fire hydrant. Applicable permits may cover property issues such as easements and right-of-ways, as well as streambank disturbance or other environmental/conservation issues. In addition to permits there may also be applicable proffers that need to be considered by the recipient fire department.

GRANT AWARDS

Grants will be awarded to applicants submitting well-prepared applications that clearly illustrate maximum benefit, value, and need. Consideration will be given to water source availability within the fire response area, reported wildfire occurrence, and description of the value this program would add to the local fire department.

DRY FIRE HYDRANT GRANT APPLICATION / INFORMATION

Date: _____ **FDID #** _____

DUNS #: _____ **Tax ID #** _____

Name of Fire Department: _____

Address: _____

City/State/Zip: _____

Applicant / Project Manager: _____

E-Mail: _____

Phone Numbers: Primary phone: _____ Secondary phone: _____

DRY HYDRANT SITE INFORMATION

County: _____ Township: _____

Location of Proposed Dry Fire Hydrant:

Land Owner: _____

Street Address: _____ Site latitude: _____

Cross Street: _____ Site longitude: _____

Type of Water Source: ☐ **Pond** ☐ **Lake** ☐ **River** ☐ **Stream/Creek**

Distance from Dry Fire Hydrant to Public Road: _____

Distance (miles) from Fire Station to Dry Fire Hydrant site: _____

Distance (miles) from Dry Fire Hydrant site to closest hydrant/water sources: _____

Number of hydrants/water sources in FD response area: _____ Square miles in FD response area _____

Road map indicating location of proposed hydrant site **[must be included with application]**

Sketch of proposed layout at hydrant site (include measurements) [**must be included with application]**

Printed/electronic photo of proposed hydrant site(s) [**must be included with application]**

ADDITIONAL APPLICATION REQUIREMENTS:

1. **Briefly describe, on a separate sheet of paper, the benefits and value provided by the installation of the proposed dry fire hydrant. This description needs to focus on the reduction of fire losses, savings in fuel cost, sharing of resources, and the maximizing of your firefighting resources.**
2. **Applicants must complete and submit NFPA 1142 Annex I Dry Hydrant Design Worksheet and NFPA 1142 Annex I Dry Hydrant Hardware Layout Worksheet with other application materials. Applications will not be accepted without these forms because they indicate the viability of the proposed project. Consider contacting your local SWCD or NRCS office for advice and assistance in planning your dry hydrant project.**
3. **Dry hydrants must be designed and engineered to provide a minimum flow of 1,000 gpm.**

Budget (please itemize for direct grant expenses and cost share match)

	Direct Grant Expenses	Local Cash Match	Local In-kind Match
Personnel			
Supplies			
Equipment			
Contractual (including rental, hired services)			
Other:			
TOTAL			

DRY FIRE HYDRANT GRANT REQUIREMENTS

The above named fire department hereby makes application for a Dry Fire Hydrant Grant, administered by the Ohio Division of Forestry. The fire department agrees to comply with all following requirements of the Grant program. Failure to do so may result in zero reimbursement to the grant recipient.

1. Maximum reimbursement for the dry fire hydrant grant is $2,250 to be provided in one payment upon invoice from the grant recipient.
2. Reimbursable expenses include materials used to construct, build, and install the dry fire hydrant such as fittings, adapters, strainers, caps, plugs, elbows, PVC pipe, hardware, pipe cement, gravel, fill material, cement, and lumber. Purchase of tangible items not affixed to the dry hydrant or site are not reimbursable. Equipment rental is a reimbursable expense.
3. Fire department will only be reimbursed for expenditures documented with paid invoices, cancelled checks, or official receipts. Documents shall be submitted to the Ohio Division of Forestry thirty days after the expiration date of the sub-award agreement. Please submit these forms, along with the Request for Reimbursement Form provide by the Ohio Division of Forestry.
4. The recipient fire department must provide a matching project investment equal to the reimbursement request. Matching investment may be provided with cash contribution or through in-kind service.

5. In kind service person-hours are valued at the current Ohio median hourly wage as defined at http://www.bls.gov/oes/current/oes_oh.htm for occupation code 47-0000. In-kind equipment use value should be calculated at fair market value.

6. All in-kind service must be tracked and documented appropriately using the In-Kind Contribution Form provided by Ohio Division of Forestry.

7. Fire department must contact the Ohio Division of Forestry for any modifications to the sub-award agreement and approved project scope of work and budget.

8. The dry fire hydrant must be installed within 8 months of notice that project has been accepted and funded.

9. The dry fire hydrant must be installed commensurate with specifications as detailed in National Fire Protection Association Standard 1142 (Standard on Water Supplies for Suburban and Rural Fire Fighting) 2012 edition or later (ref. Chapter 8 and Annex I.) and must be constructed and installed as indicated in the NFPA 1142 Annex I Dry Hydrant Design worksheet and Dry Hydrant Hardware Layout worksheet submitted with application.

10. Periodic maintenance of the site and hydrant should be performed regularly. At a minimum the dry fire hydrant should be back flushed once each six months. It is the responsibility of the fire department to maintain the hydrant.

11. Due to the varied nature of water sources found throughout Ohio it may be necessary, in some applications, to utilize dry fire hydrant components that cause project costs to rise in order to insure a dependable drafting source year around. The fire department is responsible for paying all expenses in excess of permissible reimbursement amount. These expenses may be counted toward match.

12. The fire department is responsible for ensuring that proposed dry fire hydrant sites have dependable all weather access.

13. The fire department is responsible for addressing all applicable federal, state, and/or local permitting and processes and maintaining supporting documentation thereof on file at the recipient fire department.

Fire Department Authorized Signature: _____

Name (print)**:** _____

Title: _____

Date: _____

planks not less than 4 in. (100 mm) in width, set close together on edge, spiked at intervals of 18 in. (460 mm), and covered with 1 in. (25 mm) tongue-and-groove flooring, laid crosswise or diagonally to the plank, or with ½ in. (12.5 mm) wood structural panel.

6.3.6.10 Roof Decks. Roof decks shall be constructed of spline or tongue-and-groove plank not less than 2 in. (50 mm) in thickness; or of laminated planks not less than 3 in. (75 mm) in width, set close together on edge, and laid as required for floors; or of 1⅛ in. (28.5 mm) thick interior wood structural panel (exterior glue); or of approved noncombustible or limited-combustible materials of equivalent fire durability.

6.3.7 Type V (111 or 000) Construction. Type V (111 or 000) construction shall be that type in which exterior walls, bearing walls, columns, beams, girders, trusses, arches, floors, and roofs are entirely or partially of wood or other approved combustible material smaller than material required for Type IV construction. In addition, structural members shall have fire resistance ratings not less than those specified in Table 6.3.1.

Chapter 7 Water Supply

7.1 Approved Water Supply.

7.1.1* Any water supply source used to meet the requirements of this standard shall be of a quality approved by the AHJ.

7.1.2 The water supply source shall be maintained and accessible on a year-round basis.

7.1.3 In locations where adequate municipal-type water systems are not provided and additional fire protection is needed, minimum water supplies shall be established in, or transportable to, the designated area.

7.1.4 Unless otherwise permitted by the AHJ, all approved nonpressurized water supply sources shall be accessible using dry hydrants that meet the requirements of this standard.

7.1.5* To be acceptable, water supply sources shall maintain the minimum capacity and delivery requirements on a year-round basis, based on the 50-year drought for the water source.

7.2* Water Use Agreements. The AHJ shall enter into a water use agreement when a private water supply source is to be used to meet the requirements of this standard.

7.3 Identifying Water Sources. A water source indicator approved by the AHJ shall be erected at each water point identifying the site for fire department emergency use.

7.4 Fire Department Connections. Any fitting provided at a water source to permit a fire apparatus to connect to the water source shall be approved by the AHJ and shall conform to NFPA 1963, *Standard for Fire Hose Connections.*

7.5* Access to Water Sources. Roads providing a means of access to any required water supply shall be constructed and maintained in accordance with the following:

(1) Roadways shall have a minimum clear width of 12 ft (3.7 m) for each lane of travel.
(2) Turns shall be constructed with a minimum radius of 100 ft (30.5 m) to the centerline.
(3) The maximum sustained grade shall not exceed 8 percent.
(4) All cut-and-fill slopes shall be stable for the soil involved.
(5) Bridges, culverts, or grade dips shall be provided at all drainageway crossings; roadside ditches shall be deep enough to provide drainage with special drainage facilities (tile, etc.) at all seep areas and high water-table areas.
(6) The surface shall be treated as required for year-round travel.
(7) Erosion control measures shall be used as needed to protect road ditches, cross drains, and cut-and-fill slopes.
(8)*Where turnarounds are utilized during fire-fighting operations, they shall be designed with a diameter of 120 ft (36.5 m) or larger, as required, to accommodate the equipment of the responding fire department.
(9) Load-carrying capacity shall be adequate to carry the maximum vehicle load expected.
(10) The road shall be suitable for all-weather use.
(11) When a bridge is required to be used as part of a fire department access road, it shall be constructed and maintained in accordance with nationally recognized standards. [1:18.2.3.4.5.1]
(12) The bridge shall be designed for a live load sufficient to carry the imposed loads of fire apparatus. [1:18.2.3.4.5.2]
(13) Vehicle load limits shall be posted at both entrances to bridges where required by the AHJ. [1:18.2.3.4.5.3]

7.6 Mobile Water Supply Training. To promote operational safety and effectiveness, the AHJ shall determine what training is required. *(See C.10.)*

7.7 Records.

7.7.1 A record of each water supply shall be prepared and periodically updated.

7.7.2 The records shall be retained in accordance with the record retention policy of the jurisdiction or state.

7.7.3 Records developed to meet the requirements of this standard shall be retained for a minimum of 3 years after the agreement, facility, or equipment is no longer used for its original purpose.

Chapter 8 Dry Hydrants

8.1* General. The AHJ shall ensure that generally accepted design practices are employed during the following:

(1) Dry hydrant location planning
(2) The permit process
(3) Design criteria
(4) Construction

8.2 Planning and Permits. The planning, permitting, and design processes shall be completed before the actual construction begins.

8.2.1 Planning shall be coordinated among public and private entities that could be impacted by the installation of a dry hydrant.

8.2.2* Required permits to install a dry hydrant shall be obtained prior to installation.

8.3* Dry Hydrant Design and Location.

8.3.1* The AHJ shall approve all aspects of the dry hydrant design and construction, including the type of materials, pipe size, and system fittings to be used.

DRY HYDRANT HARDWARE LAYOUT WORKSHEET

A Description and Size	B Straight line equivalent feet of pipe[1]	C Conversion for pipe coefficient[2]	D Loss (psi)[3]
Strainer[4]	5		0.156
25 ft of 6 in. PVC horizontal	25		0.78
6 in. long sweep elbow	13.57		0.42
10 ft of 6 in. PVC vertical	10		0.312
6 in. long sweep elbow	13.57		0.42
1 ft of 6 in. pipe	1		0.0312
Pressure loss in piping system			2.12 psi

[1] See Table I.1(c).

[2] See Table I.1(d) if applicable for C less than 150.

[3] See Table I.1(e).

[4] The area of all holes must be at least four times the cross-sectional area of the pipe. A figure of 5 equivalent ft is used regardless of the strainer pipe diameter.

For SI units: 1 gal = 3.785 L; 1 ft = 0.305 m; 1 in. = 2.54 mm; 1 psi = 6.895 kPa.

 NFPA 1142

FIGURE I.1(d) Example Using Dry Hydrant Hardware Layout Worksheet.

8.3.2* As a minimum, Schedule 40 pipe and component fittings shall be used.

8.3.3* All dry hydrant systems shall be designed and constructed to provide a minimum flow of 1000 gpm (3800 L/min) at draft.

8.3.4* The water supply source for the dry hydrant shall provide, on a year-round basis, the required quantity of water, as determined in Chapter 4, and the minimum flow as required in 8.3.3.

8.3.5* Dry hydrant systems shall be designed and constructed so that slope and piping configurations do not impede drafting capability.

8.3.6* All exposed surfaces and all underground metal surfaces shall be protected to prevent deterioration.

8.3.7* A minimum number of elbows shall be used in the piping system.

8.3.8 Suction hose connection(s) shall be compatible with the fire department's hard suction hose size and shall conform to NFPA 1963, *Standard for Fire Hose Connections*. The connection(s) shall include a protective cap. The cap and adapter shall be of materials that minimize rust and galvanic corrosion.

8.3.9 Dry hydrant system piping shall be supported and/or stabilized using approved engineering design practices.

8.3.10 Stabilization or equivalent protection shall be employed at elbows and other system stress points.

8.3.11 In addition to strength of materials and structural support criteria, design shall specify appropriate aggregates and soil materials to be used to backfill/cover piping during installation.

8.3.12 All connections shall be clean, and the appropriate sealing materials shall be used according to manufacturer's specifications so as to ensure that all joints are airtight.

8.3.13* System strainers shall be constructed to permit required fire flow.

8.4* Dry Hydrant Locations.

8.4.1 A minimum of 3 ft (0.9144 m) shall be provided around the dry hydrant.

8.4.2* Dry hydrants shall be located so that they are accessible under all weather conditions.

8.4.3 The dry hydrant system and access to the site shall be developed in a manner that allows the fire department pump to connect to the hydrant using not more than 20 ft (6 m) of hard suction hose.

8.4.4 Dry hydrants shall be located a minimum of 100 ft (30 m) from any structure.

8.4.5 No parking or other obstacles shall be allowed within 20 ft (6 m) of the access side of the hydrant.

8.4.6* Dry hydrants shall be protected from damage by vehicular and other perils, including freezing and damage from ice and other objects.

8.4.7* Dry hydrant locations shall be made visible from the main roadway during emergencies by reflective marking and signage approved by the AHJ.

8.4.8 All identification signs shall be approved by the highway authority prior to installation if they are to be located on the right-of-way or are subject to state laws.

8.5* Depth of Water Sources.

8.5.1 There shall be not less than 2 ft (0.6 m) of water above the strainer and not less than 1 ft (0.3 m) below the strainer.

8.5.2 Depth of the water shall be based on the 50-year drought level for the water source.

8.6* Installation Procedure for Dry Hydrant System. The AHJ shall ensure that the installation meets all design criteria.

8.7 Inspection and Maintenance of Dry Hydrants.

8.7.1* Dry hydrants shall be inspected at least quarterly and maintained as necessary to keep them in good operating condition.

8.7.2 Thorough surveys shall be conducted, to reveal any deterioration in the water supply situation in ponds, streams, or cisterns.

8.7.3 Grass, brush, and other vegetation shall be kept trimmed and neat. Vegetation shall be cleared for a minimum 3 ft (0.9 m) radius from around hydrants.

8.7.4 The hydrants shall be marked, as needed, with reflective material to enhance their visibility during emergencies, in accordance with 8.4.7.

8.7.5 Hydrant risers shall be protected from ultraviolet (UV) degradation by painting or other measures.

8.7.6* The hydrants shall be flow tested at least annually with a fire department pump to ensure that the minimum design flow is maintained.

8.8* Records for Dry Hydrants. The AHJ shall maintain, in a safe location, maps and records of each dry hydrant installation and the subsequent tests, inspections, maintenance, and repairs to the dry hydrant.

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.2 In some areas, water supply systems have been installed for domestic water purposes only. These systems could be equipped with hydrants that might not have the volume, pressure, and duration of flow needed for adequate fire-fighting purposes. Where such conditions exist, this standard and annex should be applied in water supply matters.

A.1.3.2 Locations such as these require individual evaluations to determine the minimum water supply to protect the hazards present.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is

The minimum water supply equals 3086 gal.

For SI units: 1 ft = 0.305 m; 1 ft^2 = 0.092 m^2; 1 ft^3 = 0.028 m^3; 1 gal = 3.785 L.

H.3.2 Multiple-Structure Calculations. The following are examples of minimum water supply calculations where there are multiple structures.

Example 1. A row of five dwellings is identical to the dwelling in H.2.1, except that one dwelling has a brick barn (Type III construction) measuring 80 ft × 40 ft that is located 35 ft from the dwelling. The barn is larger than 100 ft^2 in area and is less than 50 ft from the dwelling. Therefore, the minimum water supply for this dwelling, 3429 gal, should be multiplied by 1.5 for the exposure:

$$3429 \text{ gal} \times 1.5 = 5144 \text{ gal}$$

If the dwellings and barn are to be protected by the same water supply, as is likely, the water supply should be calculated based on the structure that requires the largest minimum water supply. If the barn has no hay storage and is 25 ft in height to the pitched ridgepole, and the ridgepole is 10 ft above the eaves, the calculations would be as follows:

Ground floor area = 80 ft × 40 ft = 3200 ft^2

Height = 15 ft + 5 ft = 20 ft (For pitched roofs, use half the distance from attic floor to ridgepole.)

Total volume = 3200 ft^2 × 20 ft = 64,000 ft^3

The occupancy hazard classification number is 4 for the barn with no hay storage *(see 5.2.2)*, and the construction classification number is 1.0 *(see Table 6.2.1)*, resulting in the following calculations:

$$\frac{64{,}000}{4} \times 1.0 = 16{,}000 \text{ gal}$$

16,000 × 1.5 for exposure hazard = 24,000 gal

The minimum water supply equals 24,000 gal. Since this is larger than the 5144 gal required for the dwelling, 24,000 gal would be the minimum water supply for the barn and dwelling.

For SI units: 1 ft = 0.305 m; 1 ft^2 = 0.092 m^2; 1 ft^3 = 0.028 m^3; 1 gal = 3.785 L.

Example 2. A farm equipment shed is identical to commercial occupancy in H.2.2, except that it has a one-story, pitched-roof frame dwelling (Type V Construction) measuring 50 ft × 25 ft that is located 45 ft from the equipment shed. The dwelling is an exposure because it is larger than 100 ft^2 in area and is less than 50 ft from the equipment shed. Therefore, the minimum water supply for the equipment shed is 26,250 gal × 1.5, or 39,375 gal.

The minimum water supply for the farm equipment shed equals 39,375 gal.

The total water supply for the dwelling is calculated as follows:

Ground floor area = 50 ft × 25 ft = 1250 ft^2

Height = 8 ft + 4 ft = 12 ft

Total volume = 1250 ft^2 × 12 ft = 15,000 ft^3

The occupancy hazard classification number is 7 *(see 5.2.5)*, and the construction classification number is 1.0 *(see 6.2.2)*, resulting in the following calculation:

$$\frac{15{,}000}{7} \times 1.0 = 2143 \text{ gal}$$

The dwelling has an exposure from the farm equipment shed; therefore, multiply by the exposure factor of 1.5 as follows:

$$2143 \text{ gal} \times 1.5 = 3215 \text{ gal}$$

The farm equipment shed requires the larger minimum water supply. Therefore, if these two buildings were to be protected by the same water supply, the minimum water supply would be 39,375 gal.

For SI units: 1 ft = 0.305 m; 1 ft^2 = 0.092 m^2; 1 ft^3 = 0.028 m^3; 1 gal = 3.785 L.

Example 3. If the church and office building described in H.2.3 are less than 50 ft from each other, they would be exposures to each other. Therefore, the required water supply for the church would be 26,000 gal × 1.5 for the exposure factor, or 39,000 gal. Likewise, the water supply for the office building would be 25,000 gal × 1.5 for the exposure factor, or 37,500 gal. The larger amount would dictate the minimum water supply requirement for the site, which in this case would be 39,000 gal.

For SI units: 1 ft = 0.305 m; 1 ft^2 = 0.092 m^2; 1 ft^3 = 0.028 m^3; 1 gal = 3.785 L.

Annex I Dry Hydrant Design

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

I.1 The dry hydrant design worksheet shown in Figure I.1(a) and the dry hydrant hardware layout worksheet shown in Figure I.1(b) in conjunction with Table I.1(a) through Table I.1(h) can be used to assist in the design or evaluation of a dry hydrant installation. The tables allow for flow calculations and conversions between various pipe materials to assist in determining the size of pipe and fittings that will be needed to match the dry hydrant system design and the capability of the pumps expected to be used at the dry hydrant site.

Start with the dry hydrant design worksheet *[see Figure I.1(a)]*.

The process of designing a dry hydrant system discussed in this Annex and the values shown in Table I.1(a) through Table I.1(h) are based on calculations in U.S. units. Values in metric units must be converted to U.S. units prior to being used with worksheets shown in Figure I.1(a) and Figure I.1(b).

Lines 1–3: Enter the name of the fire department and the location and identification of the dry hydrant. Include the latitude and longitude of the site in decimal degrees format and the map datum being used. Examples of map datum include the North American Datum (NAD) 83, the World Geodetic System (WGS) 84, or the Universal Transverse Mercator (UTM). Use the map datum that is compatible with your GIS platform.

Line 4: Determine and record the flow rate that the completed system is expected to flow. NFPA 1142 requires a minimum flow rate of 1000 gpm.

Line 5: Determine the elevation above sea level of the site where the dry hydrant is to be installed and record that elevation.

Line 6: From Table I.1(a), determine and record the normal atmospheric pressure at that elevation. This is the theoretical pressure loss that could occur in the system if a pump

connected to the dry hydrant could create a perfect vacuum. Because the pumps on fire apparatus are not 100 percent efficient, all of the available atmospheric pressure cannot be used to offset the pressure loss in the dry hydrant system and to move water within the system.

Line 7: Determine the lift from the surface of the water to the center of the pump intake that will be connected to the dry hydrant. Account for times of drought in determining the height of the surface of the water. Be sure the measurement is to the center of the pump intake, not just to the center of the outlet on the dry hydrant system. The outlet on the dry hydrant system should never be higher than the inlet on the pump intake. Record this measurement in feet and multiply it by 0.434 to get the credited pressure loss.

Line 8: Vapor pressure, a part of the total site pressure loss, is based on the temperature of the water. Determine the maximum temperature the water is expected to reach during the hottest part of the year. Then using Table I.1(b), find and record the vapor pressure.

Line 9: A pressure loss constant of 5 psi is used as the loss from the water passing through the entrance to the pump and the pump's intake system, including the loss due to internal turbulence in the intake system.

Line 10: Subtract the sum of the lift (line 7), the vapor pressure (line 8), and the pressure loss in the pump's intake system (line 9) from the atmospheric pressure (line 6) and record the result. This result is the available site pressure or the pressure that is available to overcome the pressure loss in the designed dry hydrant system and in the suction hose for the chosen water flow rate.

Line 11: Using the dry hydrant hardware layout worksheet *[see Figure I.1(b)]*, record the size and description in column A of each component in the dry hydrant system, except fittings that produce a sudden reduction in diameter, which will be calculated later on the dry hydrant design worksheet line 12. Six-inch or larger pipe is recommended due to the reduction in friction loss and to the increase in water supply, for very little incremental cost.

Start at the strainer and work to the pump intake connection. A value of 5 ft of pipe is shown on the dry hydrant hardware layout worksheet *[see Figure I.1(b)]* for the strainer with the assumption that the sum of the area of all holes in the strainer is equal to at least four times the cross-sectional area of the pipe. For each fitting that does not reduce the pipe size, use Table I.1(c) to determine the equivalent feet of straight pipe represented by the fitting and record that value in column B. If the pipe or fitting has a C value other than 150, use Table I.1(d) to determine the conversion to C = 150 for the material involved. For example, if the pipe is cement-lined cast iron with a "C" value of 140, the conversion value is 1.14 to equate it to a C value of 150. Multiply the length of the pipe or the noted equivalent lengths by the conversion factor and record that value in column C.

Next, using Table I.1(e), determine the friction loss per foot of pipe for the size of the pipe. Multiply the friction loss by the feet of pipe or equivalent to get the loss in psi in that component of the piping system. Record that value in column D.

A value of 1 ft is shown for the connection between the adapter where the suction hose connects to the dry hydrant system and the elbow at the vertical end of the dry hydrant system. Add the values in column D to get the loss in the piping system. Now return to the dry hydrant design worksheet *[see Figure I.1(a)]* and enter the same on line 11 as just recorded on Figure I.1(b).

Line 12: Record each fitting that reduces the pipe size; for example, a 6 in. × 5 in. reducer. Using Table I.1(f), determine the pressure loss for each reduction where two different diameter pipe sizes are used or where a reducer is used for the suction hose connection adapter at the dry hydrant head.

Line 13: Record the pressure loss due to velocity head that is created when water begins to move from being at rest. In the case of a dry hydrant, this flow is from a static pressure of 0 psi. Table I.1(g) provides the velocity head in psi for different pipe sizes and flow rates. If two sizes of pipe are used in the dry hydrant system, the value for the smaller pipe should be used.

Line 14: Begin by recording the size and length of suction hose that will be used to connect the fire department pump to the dry hydrant. Using Table I.1(h), determine the pressure loss in the suction hose used to connect the pumper to the dry hydrant. Note that the loss is per 10 ft section of suction hose, so it is necessary to adjust the loss if more than 10 ft of suction hose will need to be used. Record the loss.

Line 15: Add the loss in the pipe and fittings (line 11), the loss from sudden reductions (line 12), the velocity head (line 13), and the head loss in the suction hose (line 14). This result is the pressure needed to overcome the piping and water movement loss. Record that value on line 15.

Line 16: Subtract the total loss (line 15) from the available site pressure (line 10) and record that value on line 16. If the result is a positive number, the user can repeat the process using a greater flow to get an idea of the potential capability of the dry hydrant. If the result on line 16 is a negative number, the capability of the dry hydrant is not equal to the desired flow rate shown on line 4 of the dry hydrant design worksheet, and adjustments might need to be made. If the system is already installed or limited to the piping arrangement used in the calculation, this will mean revising the design flow rate downward and repeating the calculations. If the design can be changed and the result in line 16 is negative by 3.00 or greater, it will probably be advantageous to use a larger diameter pipe.

Line 17: Record any comments about the system that are important to document as well as any special situations pertinent to the system.

Once the system is installed, backflush the system to ensure that there is no blockage or foreign matter in the system. The system should be backflushed at no more than 20 psi. Then the system should be flow tested to determine that the calculated flow can be obtained. If there is a significant difference between the calculated flow and the actual flow, and the actual flow is lower, there could be a design error, a leak in the system, a pump equipment problem, or a restriction in the system.

Figure I.1(c) and Figure I.1(d) show an example of a completed dry hydrant design worksheet and dry hydrant hardware layout worksheet. The Sampletown Fire Department is planning to install a dry hydrant at 123 Country Lane at latitude 37.345 and longitude 118.575 on the NAD 83 datum. This will be dry hydrant SFD 06. The elevation at the area is 2500 ft, and the design is for a 1000 gpm flow. In laying out the system, there is a need for 25 ft of horizontal 6 in. pipe and 10 ft of vertical pipe with two 90-degree long-sweep elbows. PVC pipe and fittings will be used for this installation. A 6 in. × 5 in. reducer will be used where the suction hose will connect to the dry hydrant. A 10 ft length of 5 in. suction hose will be used to connect the pumper to the dry hydrant. The distance from the surface of the water to the centerline of the pump is 6 ft.

DRY HYDRANT DESIGN WORKSHEET

1. Fire Department _____
2. Dry hydrant location _____
   Latitude/Longitude _____ / _____ Datum _____
3. Dry hydrant ID number _____

4. Design flow rate	_____	gpm
5. Elevation of site above sea level	_____	ft
6. Normal atmospheric pressure [from Table I.1(a)]	_____	psi
7. Lift _____ ft × 0.434	_____	psi
8. Water temperature _____ °F vapor pressure [from Table I.1(b)]	_____	psi
9. Pressure loss at pump intake	5.0	psi
Available site pressure		
10. Line 6 minus (line 7 + line 8 + line 9)	_____	psi
11. Pressure loss in pipe and fittings (from Dry Hydrant Hardware Layout Worksheet)	_____	psi
12. Pressure loss from sudden reduction [from Table I.1(f)]		
_____ × _____	_____	psi
_____ × _____	_____	psi
_____ × _____	_____	psi
13. Velocity head [from Table I.1(g)]	_____	psi
14. Pressure loss in suction hose [from Table I.1(h)] Size _____ in. No. of 10 ft length(s) _____ × _____ tabular value =	_____	psi
15. Pressure needed to overcome piping and water movement loss Add (line 11 + line 12 + line 13 + line 14)	_____	psi
16. Resulting calculation of available site pressure Enter line 10 minus line 15	_____	psi

17. Comments _____

For SI units: 1 gal = 3.785 L; 1 ft = 0.305 m; 1 in. = 2.54 mm; 1 psi = 6.895 kPa.

FIGURE I.1(a) Dry Hydrant Design Worksheet.

DRY HYDRANT HARDWARE LAYOUT WORKSHEET

A Description and Size	B Straight line equivalent feet of pipe[1]	C Conversion for pipe coefficient[2]	D Loss (psi)[3]
Strainer[4]	5		
1 ft of 6 in. pipe	1		

Pressure loss in piping system _____ psi

[1] See Table I.1(c).

[2] See Table I.1(d) if applicable for C less than 150.

[3] See Table I.1(e).

[4] The area of all holes must be at least four times the cross-sectional area of the pipe. A figure of 5 equivalent ft is used regardless of the strainer pipe diameter.

For SI units: 1 gal = 3.785 L; 1 ft = 0.305 m; 1 in. = 2.54 mm; 1 psi = 6.895 kPa.

FIGURE I.1(b) Dry Hydrant Hardware Layout Worksheet.

Table I.1(a) Normal Atmospheric Pressure at Different Elevations

Elevation (ft)	Normal Atmospheric Pressure, Absolute (psi)
0	14.70
1,000	14.20
2,000	13.70
3,000	13.20
4,000	12.70
5,000	12.20
6,000	11.80
7,000	11.30
8,000	10.90
9,000	10.50
10,000	10.05
11,000	9.70
12,000	9.35

For SI units, 1 ft = 0.305 m; 1 psi = 6.895 kPa.

Table I.1(b) Vapor Pressure for Water

Water Temperature		Vapor Pressure (psi)
°F	°C	
32	0.0	0.089
50	10.0	0.180
60	15.6	0.260
65	18.3	0.310
70	21.1	0.360
75	23.9	0.430
80	26.7	0.520

For SI units, 1 psi = 6.895 kPa.

Table I.1(c) Straight Pipe Equivalents for Fittings (ft)

	Pipe Diameter (in.)			
Fitting	6	8	10	12
45-degree elbow	10.49	12.08	15.05	18.01
90-degree elbow standard	18.92	26.90	33.06	40.58
90-degree elbow long sweep	13.57	19.61	24.05	27.13
Tee (cross) flow turned 90 degrees	30.10	52.67	75.24	90.29
Gate valve	4.56	6.04	7.52	9.01
Butterfly valve	15.10	18.10	28.61	31.58
Swing check valve	48.11	66.58	82.77	97.18

For SI units, 1 in. = 25.4 mm; 1 ft = 0.305 m.
Note: Coefficient (C) = 150.

Table I.1(d) Coefficient (C) Values for New Pipe

Pipe Material	C	Conversion Factor to C = 150
Cast iron, unlined	120	1.5
Cast iron, cement-lined	140	1.14
Cast iron, bitumastic enamel-lined	140	1.14
Average steel, new	140	1.14
Reinforced concrete	140	1.14
Plastic (PVC)	150	1.0

Table I.1(e) Friction Loss Per Foot of Pipe (psi)

	Pipe Diameter (in.)			
gpm	6	8	10	12
500	0.0086	0.0021	—	—
600	0.0122	0.0029	—	—
650	0.0141	0.0033	—	—
700	0.0162	0.0038	—	—
750	0.0184	0.0043	—	—
800	0.0207	0.0049	0.0017	—
850	0.0231	0.0055	0.0018	—
900	0.0258	0.0060	0.0020	—
950	0.0283	0.0066	0.0023	—
1000	0.0312	0.0073	0.0025	—
1050	0.0342	0.0080	0.0027	—
1100	0.0373	0.0088	0.0032	—
1200	0.0438	0.0102	0.0035	—
1250	0.0472	0.0111	0.0038	—
1300	0.0508	0.0119	0.0041	0.0017
1400	0.0583	0.0137	0.0047	0.0019
1500	0.0662	0.0157	0.0054	0.0022
1600	0.0757	0.0174	0.0060	0.0025
1700	0.0834	0.0195	0.0069	0.0027
1750	0.0880	0.0212	0.0071	0.0030
1800	0.0928	0.0218	0.0074	0.0031
1900	0.1015	0.0241	0.0082	0.0034
2000	0.1094	0.0265	0.0091	0.0038

For SI units, 1 in. = 25.4 mm; 1 ft = 0.305 m; 1 gpm = 3.785 L/min; 1 psi = 6.895 kPa.
Note: Coefficient (C) = 150.

Table I.1(f) Pressure Loss Due to Sudden Reduction (psi)

	Flow (gpm)*						
Reduction	**500**	**750**	**1000**	**1250**	**1500**	**1750**	**2000**
6 in. × 5 in.	0.03	0.08	0.15	0.25	0.40	0.55	0.76
6 in. × 4½ in.	0.09	0.20	0.37	0.63	0.90	1.30	1.70
6 in. × 4 in.	0.25	0.44	1.0	1.53	2.2	2.39	—
Bell Reducers†							
8 in. × 6 in.	0.03	0.06	0.12	0.18	0.26	0.36	0.50
10 in. × 6 in.	0.07	0.14	0.26	0.40	0.57	0.76	0.99
12 in. × 6 in.	0.08	0.18	0.31	0.47	0.67	0.89	1.15

For SI units, 1 in. = 25.4 mm; 1 gpm = 3.785 L/min; 1 psi = 6.895 kPa.
*Interpolate for other gpm flows.
†Used when dry hydrant system has two different diameter pipe sizes.
Note: Coefficient (C) = 150.

Table I.1(g) Velocity Head in Suction Pipe (psi)

	Pipe Diameter (in.)			
gpm	**6**	**8**	**10**	**12**
500	0.22	0.07	0.03	0.014
600	0.31	0.10	0.04	0.020
700	0.43	0.14	0.06	0.027
750	0.49	0.15	0.06	0.031
800	0.56	0.18	0.07	0.035
900	0.70	0.22	0.09	0.044
1000	0.87	0.28	0.11	0.054
1250	1.36	0.43	0.18	0.085
1500	1.95	0.62	0.25	0.122
1750	2.66	0.84	0.34	0.166
2000	3.47	1.10	0.45	0.217

For SI units, 1 in. = 25.4 mm; 1 gpm = 3.785 L/min; 1 psi = 6.895 kPa.

Table I.1(h) Pressure Loss in Suction Hose (psi/10 ft of Hose)

	Hose Size (in.)					
gpm	**2½**	**3**	**4**	**4½**	**5**	**6**
500	4.23	2.08	0.49	0.27	0.16	0.065
600	6.08	2.99	0.71	0.39	0.23	0.094
700	8.28	4.07	0.97	0.53	0.31	0.127
750	9.51	4.67	1.11	0.61	0.36	0.146
800	10.82	5.31	1.26	0.70	0.41	0.166
900	—	6.72	1.60	0.88	0.52	0.211
1000	—	8.30	1.97	1.09	0.64	0.260
1250	—	12.97	3.08	1.70	1.00	0.406
1500	—	—	4.43	2.45	1.44	0.585
1750	—	—	6.03	3.34	1.96	0.796
2000	—	—	7.88	4.36	2.56	1.04

For SI units, 1 in. = 25.4 mm; 1 ft = 0.305 m; 1 gpm = 3.785 L/min.

DRY HYDRANT DESIGN WORKSHEET

1. Fire Department Sampletown Fire Department
2. Dry hydrant location 123 Country Lane
   Latitude/Longitude 37.345 / 118.575 Datum NAD 83
3. Dry hydrant ID number SFD 06

4. Design flow rate	1000	gpm
5. Elevation of site above sea level	2500	ft
6. Normal atmospheric pressure [from Table I.1(a)]	13.45	psi
7. Lift 6 ft × 0.434	2.6	psi
8. Water temperature 70 °F vapor pressure [from Table I.1(b)]	0.36	psi
9. Pressure loss at pump intake	**5.0**	psi
Available site pressure		
10. Line 6 minus (line 7 + line 8 + line 9)	5.49	psi
11. Pressure loss in pipe and fittings (from Dry Hydrant Hardware Layout Worksheet)	2.12	psi
12. Pressure loss from sudden reduction [from Table I.1(f)]		
6 × 5	0.15	psi
_____ × _____	_____	psi
_____ × _____	_____	psi
13. Velocity head [from Table I.1(g)]	0.87	psi
14. Pressure loss in suction hose [from Table I.1(h)] Size 5 in. No. of 10 ft length(s) 1 × 0.64 tabular value =	0.64	psi
15. Pressure needed to overcome piping and water movement loss Add (line 11 + line 12 + line 13 + line 14)	3.78	psi
16. Resulting calculation of available site pressure Enter line 10 minus line 15	1.71	psi

17. Comments _____

For SI units: 1 gal = 3.785 L; 1 ft = 0.305 m; 1 in. = 2.54 mm; 1 psi = 6.895 kPa.

FIGURE I.1(c) Example Using Dry Hydrant Design Worksheet.

Description: DRY HYDRANT- VERTICAL STANDPIPE

BILL OF MATERIALS

	ITEM	NO.	UNIT
1	HYDRANT HEAD ASSEMBLY 90°	1	EACH
2	____" _____ PIPE –STANDPIPE		L.F.
3	____" _____ 90° ELBOW		EACH
4	____" _____ PIPELINE		L.F.
5	____" _____ COUPLINGS		EACH
6	____" PVC INTAKE STRAINER	1	EACH
7	NO. ____ STONE		C.Y.
8	"QUICK SETTING" PVC GLUE		
9	PRIMER CLEANER		
10	6"X 6"X 8' TREATED POST	2	EACH
11	4"X 4" TREATED TIMBER	1	EACH

ALL PIPE MATERIAL SHALL BE _____ MEETING ASTM _____

PIPELINE, STANDPIPE, & STRAINER MUST BE OF THE SAME MATERIAL

NOTE TO EXCAVATOR

EXCAVATOR MUST NOTIFY ALL UTILITIES AT LEAST 48 HOURS AND NOT MORE THAN 10 DAYS PRIOR TO THE PLANNED COMMENCEMENT OF EXCAVATION.

1. MEMBER UTILITIES WILL BE CONTACTED BY CALLING OUPS (1-800-362-2764) AND OHIO OIL AND GAS ASSOCIATION (614-587-0444).
2. EACH LIMITED BASIS PARTICIPANT WILL BE CONTACTED BY THE EXCAVATOR USING THE TELEPHONE NUMBERS PROVIDED.

UNDERGROUND UTILITIES AT EXCAVATION SITE

UTILITY			MEMBER OUPS	LIMITED BASIS PARTICIPANTS
NAME	ADDRESS	PHONE No.		

THIS INSTALLATION DESIGNED FOR _____ GPM.

BENCHMARK DESCRIPTION:

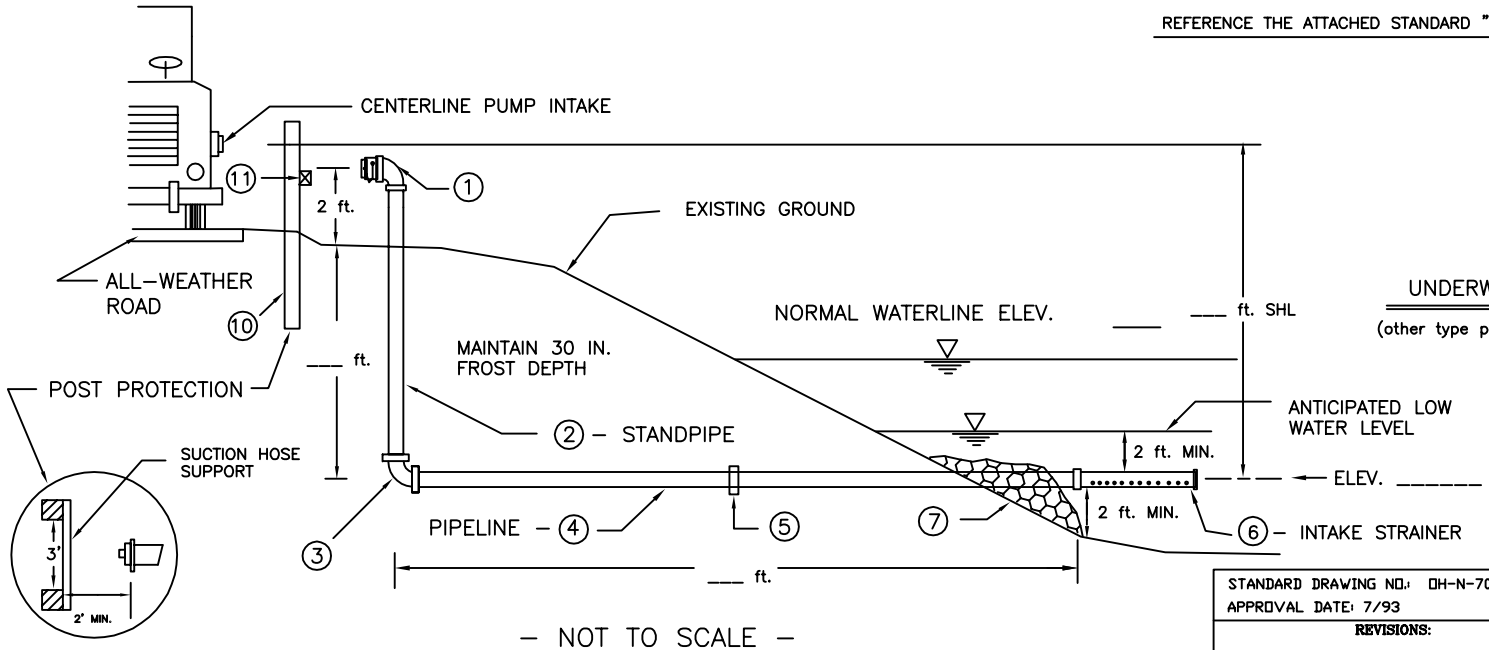
ADDRESS:

DETAILED HYDRANT LOCATION

NO PERSON SHALL ENTER THE TRENCH UNLESS ALL PROVISIONS OF OSHA 1926 ARE MET!

ALL EXPOSED PVC SURFACES SHALL BE PAINTED WITH REFLECTIVE MATERIAL.

REFERENCE THE ATTACHED STANDARD "DRY HYDRANT"



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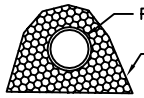


UNDERWATER SUPPORT AND ANCHOR

(other type pipe support and anchor may be approved)

STANDARD DRAWING NO.: OH-N-701-CAD

APPROVAL DATE: 7/93

REVISIONS:

DRY HYDRANT

for

SEC. ___ _____TWP. _____ CO. OHIO

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	DATE		DATE
DESIGNED		APPROVED BY	
DRAWN	B. JORDAN 7/93	TITLE	
TRACED		CONST. APPROVAL	
CHECKED		TITLE	
		SHEET No.	
		OF	

Filename: OH070193.DWG

Description: DRY HYDRANT- SLOPING STANDPIPE

Filename: OH070293.DWG

BILL OF MATERIALS

	ITEM	NO.	UNIT
1	HYDRANT HEAD ASSEMBLY 45°	1	EACH
2	____" _____ PIPE –STANDPIPE		L.F.
3	____" _____ 45° ELBOW		EACH
4	____" _____ PIPELINE		L.F.
5	____" _____ COUPLINGS		EACH
6	____" PVC INTAKE STRAINER	1	EACH
7	NO. ____ STONE		C.Y.
8	"QUICK SETTING" PVC GLUE		
9	PRIMER CLEANER		
10	6"X 6"X 8' TREATED POST	2	EACH
11	4"X 4" TREATED TIMBER	1	EACH

ALL PIPE MATERIAL SHALL BE _____ MEETING ASTM _____

PIPELINE, STANDPIPE, & STRAINER MUST BE OF THE SAME MATERIAL

NOTE TO EXCAVATOR

EXCAVATOR MUST NOTIFY ALL UTILITIES AT LEAST 48 HOURS AND NOT MORE THAN 10 DAYS PRIOR TO THE PLANNED COMMENCEMENT OF EXCAVATION.

1. MEMBER UTILITIES WILL BE CONTACTED BY CALLING OUPS (1-800-362-2764) AND OHIO OIL AND GAS ASSOCIATION (614-587-0444).
2. EACH LIMITED BASIS PARTICIPANT WILL BE CONTACTED BY THE EXCAVATOR USING THE TELEPHONE NUMBERS PROVIDED.

UNDERGROUND UTILITIES AT EXCAVATION SITE

UTILITY			MEMBER OUPS	LIMITED BASIS PARTICIPANTS
NAME	ADDRESS	PHONE No.		

THIS INSTALLATION DESIGNED FOR _____ GPM.

BENCHMARK DESCRIPTION:

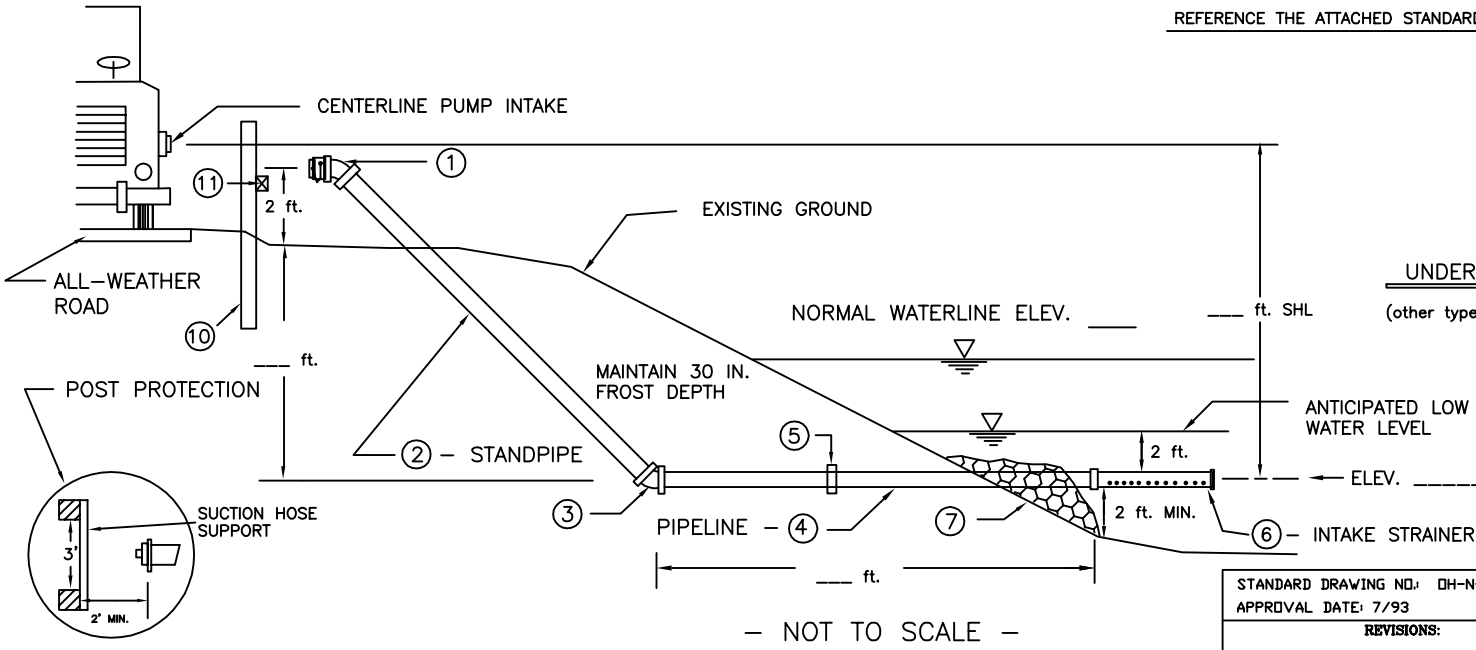
ADDRESS:

DETAILED HYDRANT LOCATION

NO PERSON SHALL ENTER THE TRENCH UNLESS ALL PROVISIONS OF OSHA 1926 ARE MET!

ALL EXPOSED PVC SURFACES SHALL BE PRIMED AND PAINTED WITH REFLECTIVE MATERIAL.

REFERENCE THE ATTACHED STANDARD "DRY HYDRANT"



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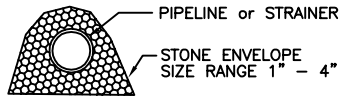


UNDERWATER SUPPORT AND ANCHOR

(other type pipe support and anchor may be approved)

STANDARD DRAWING NO.: OH-N-702-CAD

APPROVAL DATE: 7/93

REVISIONS:

DRY HYDRANT

for

SEC. ___ _____TWP. _____ CO. OHIO

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	DATE		DATE
DESIGNED		APPROVED BY	
DRAWN	B. JORDAN '93	TITLE	
TRACED		CONST. APPROVAL	
CHECKED		TITLE	
		SHEET No.	
		OF	

Description: DRY HYDRANT– VERTICAL & SLOPING STANDPIPE

BILL OF MATERIALS

	ITEM	NO.	UNIT
1	HYDRANT HEAD ASSEMBLY 90°	1	EACH
2	___" _____ PIPE –STANDPIPE		L.F.
3	___" _____ 45° ELBOW		EACH
4	___" _____ PIPELINE		L.F.
5	___" _____ COUPLINGS		EACH
6	___" PVC INTAKE STRAINER	1	EACH
7	NO. ___ STONE		C.Y.
8	"QUICK SETTING" PVC GLUE		
9	PRIMER CLEANER		
10	6"X 6"X 8' TREATED POST	2	EACH
11	4"X 4" TREATED TIMBER	1	EACH

ALL PIPE MATERIAL SHALL BE _____ MEETING ASTM _____

PIPELINE, STANDPIPE, & STRAINER MUST BE OF THE SAME MATERIAL

NOTE TO EXCAVATOR

EXCAVATOR MUST NOTIFY ALL UTILITIES AT LEAST 48 HOURS AND NOT MORE THAN 10 DAYS PRIOR TO THE PLANNED COMMENCEMENT OF EXCAVATION.

1. MEMBER UTILITIES WILL BE CONTACTED BY CALLING OUPS (1-800-362-2764) AND OHIO OIL AND GAS ASSOCIATION (614-587-0444).
2. EACH LIMITED BASIS PARTICIPANT WILL BE CONTACTED BY THE EXCAVATOR USING THE TELEPHONE NUMBERS PROVIDED.

UNDERGROUND UTILITIES AT EXCAVATION SITE

UTILITY			MEMBER OUPS	LIMITED BASIS PARTICIPANTS
NAME	ADDRESS	PHONE No.		

THIS INSTALLATION DESIGNED FOR _____ GPM.

BENCHMARK DESCRIPTION:

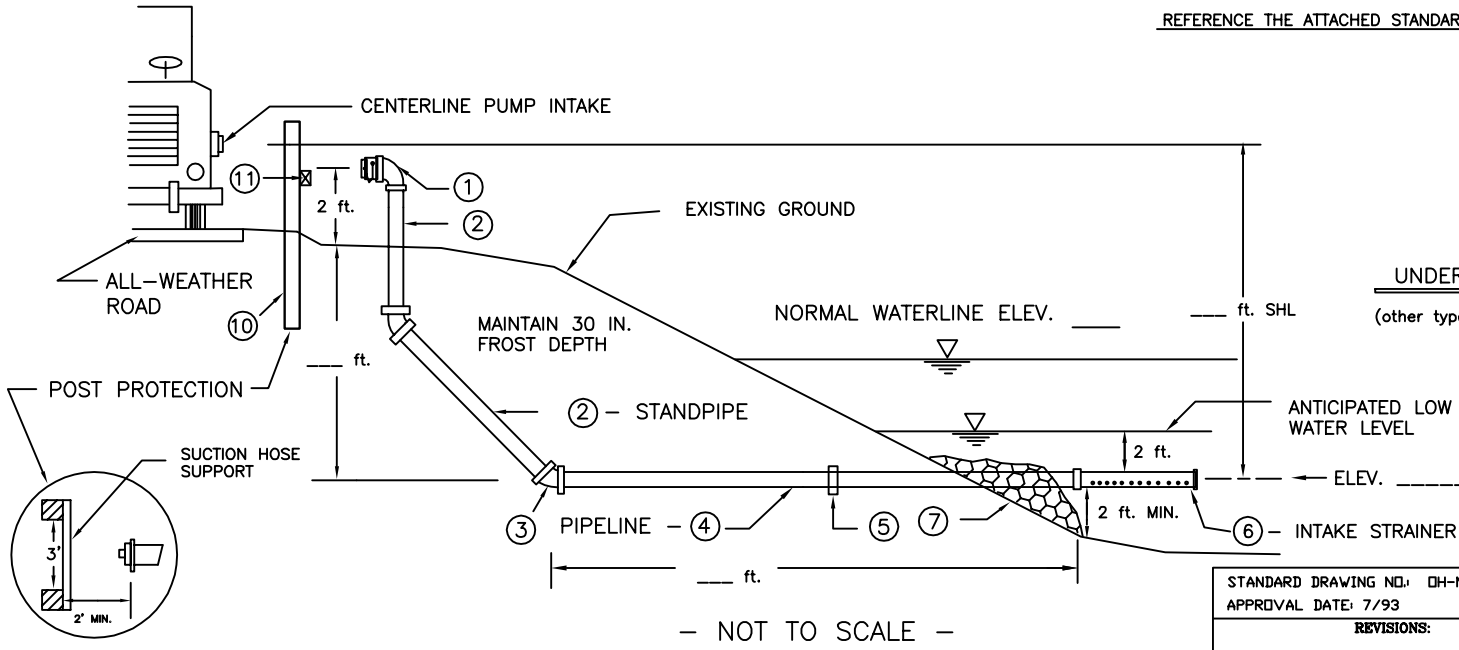
ADDRESS:

DETAILED HYDRANT LOCATION

NO PERSON SHALL ENTER THE TRENCH UNLESS ALL PROVISIONS OF OSHA 1926 ARE MET!

ALL EXPOSED PVC SURFACES SHALL BE PRIMED AND PAINTED WITH REFLECTIVE MATERIAL.

REFERENCE THE ATTACHED STANDARD "DRY HYDRANT"



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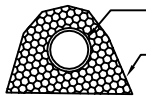

UNDERWATER SUPPORT AND ANCHOR

(other type pipe support and anchor may be approved)

STANDARD DRAWING NO.: OH-N-703-CAD

APPROVAL DATE: 7/93

REVISIONS:

DRY HYDRANT

for

SEC. ___ _____TWP. _____ CO. OHIO

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	DATE		DATE
DESIGNED		APPROVED BY	
DRAWN	B. JORDAN '93	TITLE	
TRACED		CONST. APPROVAL	
CHECKED		TITLE	
		SHEET No.	
		OF	

Filename: OH070393.DWG