DRY HYDRANT MANUAL

City of Steamboat Springs
Steamboat Springs Rural Fire Protection District








Structural and Wildland Fire Suppression

"Dry Hydrant Manual"

Suction Supply Water Source Design, Installation, and Reference Manual

City of Steamboat Springs
Steamboat Springs Rural Fire Protection District

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I. Definitions

AHJ – Authority Having Jurisdiction. The fire department representative, having authority to enforce the fire code and/or fire department rules and regulations in a particular area.

Buried Tank – A fully enclosed tank capable of handling water storage that is buried below the ground surface to a level to prevent freezing and prohibit water loss due to evaporation.

Dry Barrel Hydrant – A municipal type hydrant that allows for access to a piped water system under pressure but allows for the riser barrel to remain dry with the operation of a valve below the frost line.

Dry Hydrant – A pipe with a threaded connection that allows fire apparatus to access a suction water supply source, which is remote from the water location. The term "dry" refers to the fact that the level of the water in the pipe is located in the ground at a level below the frost line and the remainder of the pipe to the threaded connection is empty (dry) of water until a suction source is provided by the fire apparatus.

Exposure – Any item near a fire but not directly involved in the fire that is at risk for heat damage and ignition due to the close proximity of a fire.

Fire Code – The currently adopted version of a set of rules, regulations, and standards used in the protection of life and property from fire. Contact the AHJ for information about the current code adopted.

Fire Flow Availability - The amount of water available at a structural fire scene that can be used for fire suppression operations as delivered through a fire apparatus with pumping capabilities.

Fire Flow Demand – The amount of water needed to safely and effectively extinguish a structural fire in a structure of a given size and construction type and containing average contents for that occupancy as well as protect exposures (may be guided by ISO, NFPA, IFC, etc.).

Hose, Attack – Fire fighting hose supplying water from the fire apparatus with pumping capability to the point of attack of the fire where the firefighter is located.

Hose, Suction – Rigid hose connecting the suction supply water source connection to the pumping capable fire apparatus. Usually comes in 10-foot sections with each engine carrying 2 to 3 sections maximum.

Hose, Supply – Hose used to pump from the fire apparatus at the suction supply water source to the fire apparatus at the fire scene. Also used to fill portable water fire apparatus (water tender) at the suction supply water source for transferring to a different location.

IFC – International Fire Code.

ISO – Insurance Services Office. A private firm that is contracted by insurance companies to evaluate the fire protection capabilities of a community including, but not limited to, the fire department and community water supplies.

NFPA – National Fire Protection Association. A group that publishes fire protection standards that are recognized and utilized worldwide.

Open Water Source – A water source such as a pond, lake or river that is open to the atmosphere and is subject to freezing and water loss due to evaporation.

PVC - Poly-Vinyl Chloride. A composite plastic used to make pipe that is capable of containing fluids along its length.

Turnouts- Turnouts shall be an all-weather driving surface, at least 10 feet wide and 40 feet long. Turnouts shall be located as required by the Code Official.

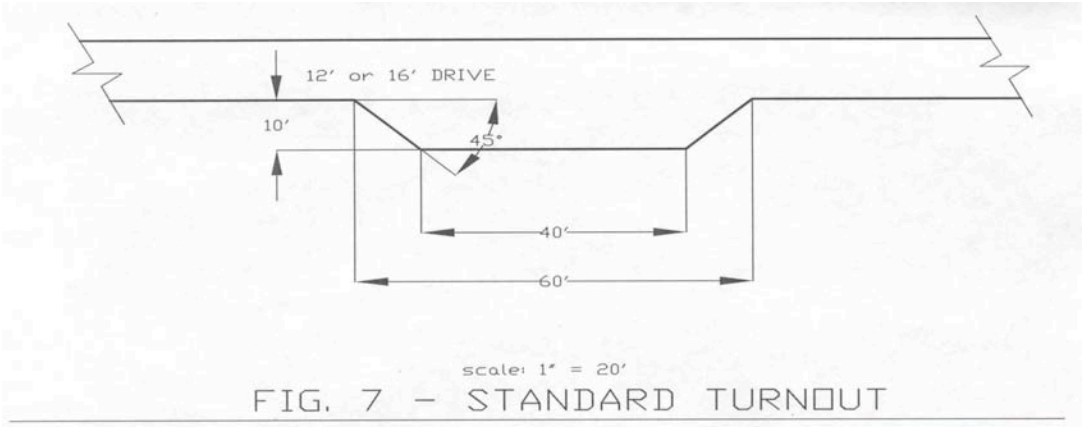

FIG. 7 – STANDARD TURNOUT

Staging Area – An area at the suction supply water source connection that allows for a pumping capable fire apparatus to connect to the water supply and still allow other fire apparatus to pass by the location unimpeded. A staging area is also an area at the fire scene that allows for the deployment of the pumping apparatus, hose and related equipment as well as a portable water tank if a water tender shuttle operation is used.

Suction Supply Water Source – A non-pressurized or low-pressure water system that provides water for fire suppression operations which must be drawn by vacuum (suction) from the water source to the pump.

Turnaround – An area large enough for large fire apparatus to turnaround, or to change direction of travel on a drivable surface.

Water Tender – A piece of fire apparatus which has a purpose of carrying water from water sources to a fire location without a water source. This procedure is commonly called a water tender shuttle operation. The water tender then supplies water to pumping apparatus for use on the fire.

II. Introduction

As with any rural area, providing a water supply for firefighting can be a difficult, expensive, manpower intensive and time consuming adventure. Pressurized municipal type water supplies with hydrants and large volumes of water storage are usually not realistic in rural areas due to the separation of the structures and the number of structures served. A solution can be found in

suction supply water sources, which are commonly known as dry hydrants. Well-planned and placed suction supply water sources along with water tender shuttles can provide a basic level of water supply for both structural and wildland firefighting. Be advised though, that this basic level of supply is only meant for small residential structures or small wildland fires. Larger residential structures as well as commercial structures and areas where structures have high hazard exposures should provide other fire suppression control measures to mitigate the lack of water supplies that are indicated by the fire flow demand tables shown in the fire code.

Water supply in a fire suppression operation is necessary not only for property protection but also most importantly for safety of the occupants of the structure and the safety of the firefighters. It is the individual and group responsibility as a rural property owner to assist the fire department with the protection of his/her life and property by providing access to local water supplies.

An individual can invest in a water supply for the protection of their individual property but the costs can sometimes be prohibitive for that individual homeowner depending on the amount of water storage required (see following section). A more cost effective method is for a group of homeowners or a subdivision to pool their resources to provide a shared water source for fire protection. The negatives to a group water supply are that most insurance companies will only recognize the water source if it is within 1000 feet by road of the structure in question. Clustered developments may be able to capitalize on this but a subdivision that is more spread out will find it difficult to space the water sources to obtain the 1000 feet limit.

The general rule of thumb, as shown in the reviewed literature, for the number of water supplies in a community based upon potential structures served and the turnaround time for water tender shuttles, is one water source for every three square miles of coverage area. Again the question becomes how much water should this water supply provide which will be addressed in the following section.

The intention of this manual is to provide clear and concise design and installation criteria for suction supply water sources in order to provide a level of quality and consistency for all systems installed. The following manual is a compilation of local knowledge as well as information from the reference material listed at the end.

III. Volume of Water Determination

How much water is needed for fire suppression operations depends on many factors. Wildland fires will need greatly varying amounts depending on their size, the weather conditions and what fuel the fire is burning in. Therefore, it is not realistic to set a water supply amount based upon wildland fire needs alone. A fire in a structure will have a fire flow demand that is determined by the size of the structure, the type of construction, and the occupancy (determines the average contents). This information is used with the table in the fire code to determine the fire flow demand. For example, a 2000 sq.ft. home of Type V-N construction and is an R-3 occupancy would require 1500 gpm for two hours. There is an exception in the code that allows for that to be reduced to 1000 gpm for R-3 occupancies below 3600 sq.ft. So best case, to effectively and safely fight a fire in a 2000 sq.ft. residence would require a water storage volume of 120,000 gallons. This would be possible for a subdivision based pressurized water system or a large open water suction supply water source. Buried underground tank suction water supplies would not be cost effective in this situation. Understanding that this volume of water storage is not realistic

in rural areas, the code allows for a reduction in the fire flow based upon the requirements of the AHJ. In order to make a determination on rural water supply requirements, the AHJ has decided to base its recommendations on nationally recognized standards of ISO, NFPA and the requirements of the individuals insurance company. This allowed reduction in fire flow demand is due to a lesser extent of exposure hazards to other structures in rural areas and not a need for less water. The amount of water needed to effectively and safely fight a structure fire is still dictated based upon the fire code tables. The understanding is that there may not be enough water to fight the fire at the structure but that the limited exposures in a rural setting can be protected. Therefore, it is again the individual's responsibility to provide other mitigation measures to allow for the reduction in fire flow availability such as residential fire sprinkler systems and wildland fire mitigation (also an exposure). The following are guidelines for choosing an amount of water storage needed for an individual structure.

Insurance

In our experience it has been found that each individual insurance company has different recommendations. If the water supply is being installed in order to obtain insurance coverage, then it is recommended that the minimum water storage volume amount be determined by the individual insurance company requirement. It would also be recommended that the design incorporate expansion capabilities in order to meet future and changing insurance company requirements. Verification should be obtained from the insurance company if the fire supply amount is required to be guaranteed above and beyond the desired domestic supply. If so, the storage volume should be adjusted accordingly.

ISO

The minimum required to be recognized by ISO is 250 gpm for 2 hours, which results in a total storage requirement of 30,000 gallons. Also ISO requires an additional 10% to compensate for water in storage that is not available to the pump for a total of 33,000 gallons +. This has the potential (not guaranteed) to provide a better property protection rating only if the structure is within 5 miles of a fire station and the water supply connection is within 1000 feet of the structure. Additionally, the following is a summary of the ISO suction water supply requirements.

- Dry hydrant location shall be within 5 road miles of a fire station.
- Water supply capacity shall be 250 gpm for two hours. If water supply is in a tank or cistern the capacity will need to be increased by 10%. (30,000 gal. + 10% = 33,000 gal.)
- Dry hydrant shall be within 1000 ft of any building wishing to receive credit for water supply.
- Dry hydrant shall be properly designed, installed, tested and annually maintained.
- **All dry hydrant design, installation, testing and maintenance schedules shall be submitted to ISO along with a GPS location of the water supply. If ISO reviews the information and approves the water supply then it will be plotted on their map and listed in their publication to insurance companies.**

Be advised that the ISO requirement for water supply is that there is a guaranteed volume available. This means that if there is a combined domestic and fire supply storage tank, then the total storage volume must include desired domestic demand. This can usually be accomplished by installing a larger tank and putting the domestic tap higher in the tank so that there is always the guaranteed fire supply amount. Total tank volume should therefore be the total of the desired domestic demand and the required fire supply. For example, if the desired domestic storage is

10,000 gallons and the required fire supply is 33,000 gallons then the total tank size should be a minimum of 43,000 gallons.

NFPA

NFPA 1142 gives a suggested fire flow demand amount for a structure based upon structure size (interior volume), occupancy hazard and construction classification. This number also accounts for average contents for the occupancy and would need to be modified for unusual combustible loading for the occupancy hazard. Chapters 4 through 7 of NFPA 1142 address calculation of the water volume amount. Annex H gives calculation examples for different scenarios. NFPA 1142 should be consulted for all details associated with calculation of water volume for this method. Roughly the water volume amount range for a 2000 sq.ft. 2-story home (8 feet per story) with attic to a 10,000 sq.ft. 2-story (10 feet per story) home with vaulted ceilings and both with an exposure hazard (i.e. detached garage or barn within 50 feet) would be approximately 4300 gallons to 26,800 gallons.

Fire Department Recommendation

It is the recommendation that nothing less than 10,000 gallons be installed for fire suppression needs. Lesser amounts have been determined to be ineffective with the related set-up and tear–down times to move between smaller water sources.

IV. Permits

In order to provide the consistency and quality assurance of a water supply installation, a permit and inspection process has been adopted. This helps assure less risk of damage to the pumping fire apparatus and increased safety for the users of the water source. This also provides a better chance for the client who is wishing to have their water source possibly recognized and rated by ISO. **The conditions of the permit will be strictly enforced. It is the contractor's responsibility to follow all requirements of the permit.** Failure to follow the requirements will result in the water source not being recognized by the fire department. The contractor will be solely responsible for the costs associated to remedy any problems. The following page shows a copy of the accepted permit.

From the point of publication of this document forward, **all suction supply water sources will be required to be designed by a Colorado registered professional engineer. The only exception will be a complete pre-engineered system from a reputable manufacturer.** All plans will still need to be submitted as indicated on the permit but the engineer from the manufacturer can be registered in another state. A letter from the manufacturer's engineer will be required to indicate compliance with all issues in the permit and this manual. A local engineer may need to draw up the site plan, if necessary.

Full plans as indicated by the permit will need to be submitted with every project. Inspections, site visits and flow tests will be discussed later in this manual.

City of
Steamboat Springs
Fire Prevention Services

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Proudly serving the City of Steamboat Springs and the Steamboat Springs Rural Fire Protection District

Suction Water Supply Permit (Dry Hydrant)

Application Date:_____ **Permit # _____**

Project Name:_____ Project Location:_____
Contractor Name:_____ Contractor Phone:_____
Contractor Address (mailing):_____

Open Water Source_____ Buried (Tank) Water Source_____

Plans (All items in this section must be completed in order to receive permit number and/or scheduling of any inspections)

_____Site plan showing layout, emergency apparatus access, hydrant protection, and signage
_____Engineering calculations verifying pipe flow of 500 gpm minimum at fire department connection to hydrant
_____Specifications of water intake (anti-vortex baffle or strainer)
_____Specifications for tank burial (i.e. anchoring, bed material)
_____Tank specifications (type, size)
_____Used tank (if tank is used, provide documentation of adequate cleaning process)
_____Fire department connection specifications

Inspections Required (Permit fee includes 1 Rough and 1 Final Inspection only. Any additional or partial inspections may be subject to an hourly charge of $50.00 per hour/minimum 1 hour.)

Initial site visit
_____Verify location and access

Rough Inspection
_____Verify no debris in pipes (contractor responsible for providing access to all sections of pipe)
_____Verify water intake in place (anti-vortex baffle or strainer)
_____Inspect interior of tank (contractor responsible for providing materials necessary to access tank)
_____Tank secured
_____Piping secured

Final Inspection (If rough inspection has not been performed by Fire Prevention, tank will not be recognized as a viable water source)
_____Proper protection
_____Proper signage
_____Proper color
_____Exposed pipe secured
_____Proper connection

Flow Test
_____Minimum of 500 gpm

Signature of this permit indicates understanding of all of the above requirements and responsibility for completing all tasks. All inspections must be scheduled a minimum of 24 hours in advance and are on a first come, first serve basis as time permits.

Contractor:_____ Date:_____

Figure 1 – Sample Permit

V. Common Design Criteria

With all suction supply water sources (both open and buried tank), there are some common design criteria that must be followed to allow proper fire apparatus use of the water.

Flow Rate

The minimum design flow shall be no less than 500 gpm at the outlet of the truck pump. Total frictional loss leading up to the pump shall include all piping and fittings including the strainer (if applicable) and the suction hose. The c-factor for the suction hose can be assumed to be the same as PVC pipe and the length either 10 feet or 20 feet and 6 inches in diameter depending on the distance from the truck to the connection point.

Pump information from Waterous Company is found in Appendix 1 of this document. Their engineer has stated that a Waterous CS pump with a 71799 impeller should be able to provide a 500 gpm design flow as long as the suction lift does not exceed 15.5 feet of suction lift at 7000 feet altitude. Should the total pipe length from strainer to the pump inlet exceed 30 feet in length, additional head loss calculations should be performed. Also, assume a water temperature of 36^{o}F for vapor pressure calculations. Elevation needs to be the elevation of the water source connection.

Site Layout

For direct connection to the on-scene pumping apparatus, the connection to the water source should be no closer than 75 feet to the structure to allow for a safe operating distance from structure and no further than 100 feet to allow for pre-connected hoses off of the engine to reach around the residence. Connection must be located in a staging area to allow for fire scene operations. See figure 2 below for a diagram.

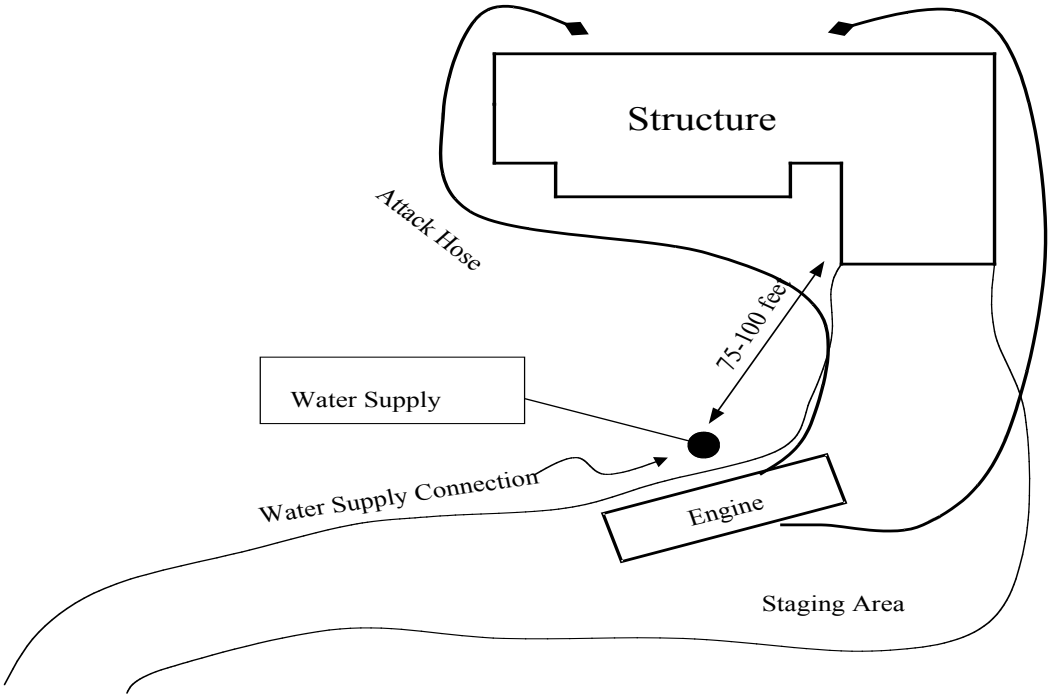

Figure 1 - On-site water supply layout

If a relay-pumping situation is to be used where the connection is located remotely from the structure (within 1000 feet by drivable road distance) then a staging area must be provided both at the water source and at the structure. The access road from the water source connection to the scene must be wide enough to allow for passage of other fire apparatus while there is supply hose laying on the drivable surface. See figure 3 below for a diagram.

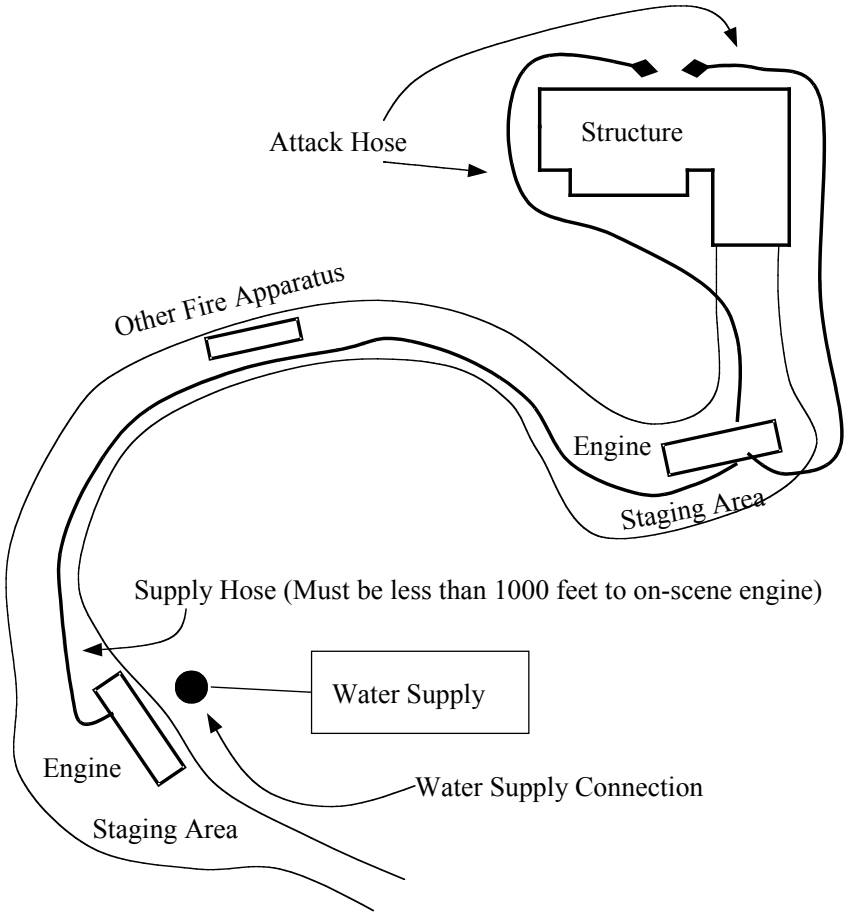

Figure 2 - Remote water supply layout

If a water supply connection is to be used for water tender shuttle operations, then the connection must be located with appropriate staging areas to allow for the placement of a pumping fire apparatus and water tender such that other vehicle traffic can pass unimpeded past the fill site. A turnaround shall be located within 150 feet of the fill site or be incorporated into the fill site staging area.

The suction hose carried on the apparatus are 10 foot lengths of rigid hose and each apparatus carries two sections. The face of the threaded part of the water supply connection must be located 8 feet from the edge of the drivable surface to allow for proper and timely connection to the fire apparatus. If topography does not allow for this distance then 18 feet should be used.

The staging area for an on-site water supply at the structure should be a minimum of 60 feet long to allow for foot travel around the front and back of the apparatus. The width should be a

minimum of 25 feet to allow for the placement of one or two portable tanks and to allow for foot travel around the sides of the apparatus. The grades should be a maximum of 4% to allow for proper pump operation and safe foot travel at the fire scene.

The staging area at a remote or relay water supply within 1000 feet of the structure should be big enough to allow for the pumping fire apparatus to park and connect to the water supply connection. The grade should be no more than 4% and the size should be a minimum of 60 feet by 10 feet and should allow for the easy passage of other fire apparatus past the water source to the structure location. The staging area should be located so that the pumping apparatus can connect to the water supply source and be located fully in the staging area. The staging area may be constructed in a turnout style.

The staging area at a shuttle water supply used for water tender shuttles should be minimum of 10 feet by 60 feet and a maximum grade of 4%. The staging area should be located so that the pumping apparatus can connect to the water supply source and be located fully in the staging area. The staging area may be constructed in a turnout style.

Access
Access to the water supply connection is to follow the road and driveway standards for the AHJ. The Steamboat Springs Rural Fire Protection District utilizes the *Steamboat Springs Fire Prevention Services Administrative Policy and Procedure Manual 4.1.1D* with the subject of Fire Apparatus Access Road Standards for the Steamboat Springs Rural Fire Protection District. Contact the AHJ for the most recent copy. As noted above, the width of the access road/driveway may need to be modified if relay pumping is to be used to allow for the supply hose to occupy some of the drivable surface.

Materials
All piping shall be a minimum of 6" SCH 40 PVC or better and appropriate for pressurized water applications (i.e. not sewer pipe). Metal piping can be used as long as leak-free fittings can be provided and piping is coated to limit corrosion. Larger diameter piping may be necessary depending on the calculated friction loss of the piping material and the related distance from the water source to the connection.

Thrust Blocks
Thrust blocks should be provided at each elbow to minimize pipe movement. Thrust blocks should be sized and installed per the design engineer's specifications.

Connections and Fittings
The connection that the fire apparatus attaches to is to be 6" NHT/NST (sometimes called fire hose thread) and shall be a male connection with a threaded female cap. Fittings shall be aluminum, brass or equivalent material to allow for exposure to the elements with no noticeable degradation in quality. The number of elbows should be minimized to help reduce the friction loss. Since the water supplies are suction based all fittings must provide a leak-free fit with no vacuum loss. The water supply connection should have a strainer if provided by the connection manufacturer. All provided gaskets at the supply connection should be in place.

Vehicle Protection
To protect the water supply connection, vehicle impact protection must be provided. The vehicle protection will be spaced between the drivable surface and the connection at approximately 2

feet from the plane of the face of the connection to the vehicle protection and spaced 3 feet clear space either side of the centerline of the connection.

The vehicle protection should be a minimum of 4 inch steel pipe buried three feet below the surface with 3 feet exposed above the surface. A 1 foot diameter base should be poured in concrete at the bottom most portion of the pole extending for the first 2 feet of the pole. The interior of the pipe should also be filled with concrete to the top most edge.

Alternative materials such as boulders can be utilized to provide a more aesthetic look. Spacing should be as addressed above and should be at least 3 feet in height. Approval on an individual basis can be requested in writing to the AHJ.

Exposed Piping Support
If PVC piping is used, no more than 3 total feet of pipe may be exposed out of the ground without providing additional support. No more than 2 vertical feet may extend out of the ground without providing additional support by means of a reinforcement collar or additional mounding of dirt. No more than 1 foot horizontal of pipe may be exposed without providing a support structure.

Suction Hose Support
A draft hose support structure may be provided to minimize the strain on the exposed pipe during cold weather and to help facilitate connection of the suction hose with minimal manpower. The draft hose support structure should be located 3 feet from the riser connection and the top of the support should be the same height as the bottom of the connection to allow for the draft hose to be in a horizontal position.

Freeze Protection
If the water in the riser is less than 4 feet below the ground surface then additional freeze protection for the riser should be provided. If the water in the riser is more than 4 feet below the ground surface then additional freeze protection is still highly recommended. The additional freeze protection also provides additional support for the exposed pipe above the ground surface. The freeze protection should extend the entire length of the riser section and shall consist at a minimum of a 2 inch thick Styrofoam collar surrounding the riser, which in turn is surrounded by a PVC pipe of diameter 4 inches bigger than the riser pipe. A cap at the top of the freeze protection assembly must be installed and sealed to protect the insulation material. Refer to NFPA 1142 for further design specifications and figures.

Height of Connection
The top of the threaded connection will be no more than 30 inches from the ground surface and no less than 24 inches from the ground surface. The area around the connection must be designed to allow for easy attachment of the hose and to allow for 360 degrees of turn for spanner wrenches (18 inches in length). The fire apparatus staging area must be constructed so that in no instance is the inlet of the pump on the truck lower than the connection. If the pump inlet is lower than the water source connection, there is a risk of air lock in the piping, which would not allow the water source to be used. Each jurisdiction may have different height requirements. Check with local AHJ for information.

Wet versus Dry Barrel
For most applications a wet barrel system will be used where there are no valves between the water source and the connection. This is the standard dry hydrant set-up and is applicable when the water source is below the level of the connection such that the level of the water in the riser is below the freeze level. If the water source is located above the level of the connection such that there would be water coming out of the connection by gravity flow, then a municipal type dry barrel hydrant will need to be used. Be advised that these municipal type dry barrel hydrants are not designed for suction supply and are more difficult to provide a leak free suction source. Therefore, the connection and staging area for the truck must be placed at a level in relation to the water source to provide a gravity flow of water from the hydrant connection for the entire water supply volume.

Signage
A sign shall be provided stating "Suction Supply Water Source", listing an identification number to be assigned by the fire department, and water volume available for the water source. Sign shall have RED background with WHITE letters no less than 1 inch in size and shall be placed on a post so as not to impede use of the water supply connection. The sign may also be attached to the hydrant with a chain.

EXAMPLE:

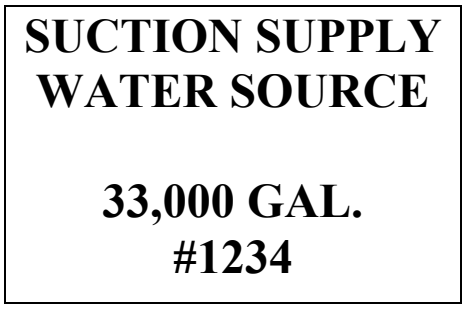

Figure 4 – Suction Water Supply Sign

Color
The following color schemes shall be used for exposed piping and caps. If a water supply accesses non-potable water, then the piping shall be painted green with the caps remaining red. If the water supply comes from a shared domestic potable supply, then the piping shall be painted blue with caps remaining red. The green color shall be a darker green and the blue shall be a darker blue. Red should be left as it comes from the manufacturer.

VI. Open Water Source Design and Installation Criteria

Pond/Lake
Open water source suction water supplies are probably the most common water source for rural firefighting throughout the United States. Most of the reference material listed later in this document deals with these types of water sources. What we have found to be the limiting factor with open water sources is the lack of routine maintenance of the system resulting in a silted in water inlet strainer which also results in potential fire apparatus pump damage. Regular maintenance is key to these water sources being effective. Maintenance recommendations are listed later in this manual under **Section XII. Maintenance**. The strong benefit to these water sources is that for an existing pond/lake, it is a small cost for the amount of water storage

available compared to a buried tank water supply. For example a 1-acre pond with an average depth of 10 feet at low water level contains approximately 2.5 million gallons of total storage with a usable storage volume of approximately 1 million gallons assuming the strainer is 2 feet off of the bottom and an ice depth of 3 feet. The costs are then the strainer, PVC pipe and fittings, the draft connection, any freeze protection, support protection, vehicle protection, signage and any grading to provide a staging area and applicable access. The following design criteria must be met for open water sources.

- The low water level should be calculated based upon a 20-year drought cycle. Drought data must be provided with the plans submittal.
- An ice depth of 3 feet should be used.
- Strainer design/location
    - The bottom of the strainer needs to be located a minimum of 2 feet off of the bottom of the water source to provide adequate room for silting prior to maintenance.
    - The start of the strainer needs to be a minimum of 6 feet horizontal distance from where the pipe exits the soil.
    - The top of the strainer must have a minimum of 2 feet of water above it at all times to avoid the formation of a whirlpool during suction. Less water will allow the whirlpool to let air into the strainer, which will break the draft suction.
    - The strainer shall be placed with the holes pointing downwards to prevent sediment deposition in the intake piping.
    - The strainer can be commercially purchased or can be constructed with the following conditions.
        - The total area of holes in the strainer must be a minimum of 4 times the cross-sectional area of the pipe it is connected to.
        - The holes can be ¼ to ½ inches in diameter and shall be spaced with one diameter spacing apart from the next nearest hole.
        - All holes shall be deburred.
        - The holes shall be placed on no more than 2/3 of the circumference of the pipe.
        - A 1 inch rib shall be left at the bottom of the strainer.
        - The end of the strainer shall have a spring-loaded flap to allow for backflushing of the piping as part of the routine maintenance. All metal components of the strainer need to be of a non-corrosive material.
- A 4 foot X 4 foot X 4 inch concrete pad shall be provided under the suction strainer. See Figure 5.
- A minimum of one support structure must be used between the end of the strainer and where the pipe enters the soil. The design can vary but must be submitted with the plan review documentation.

Stream

It is not recommended in this area that a stream/river be used as a water source. Due to the seasonal variations in the water level and the freeze depth normally associated with the winter months, maintaining the separation distances from the ice and the bottom of the stream/river at low water levels would be difficult.

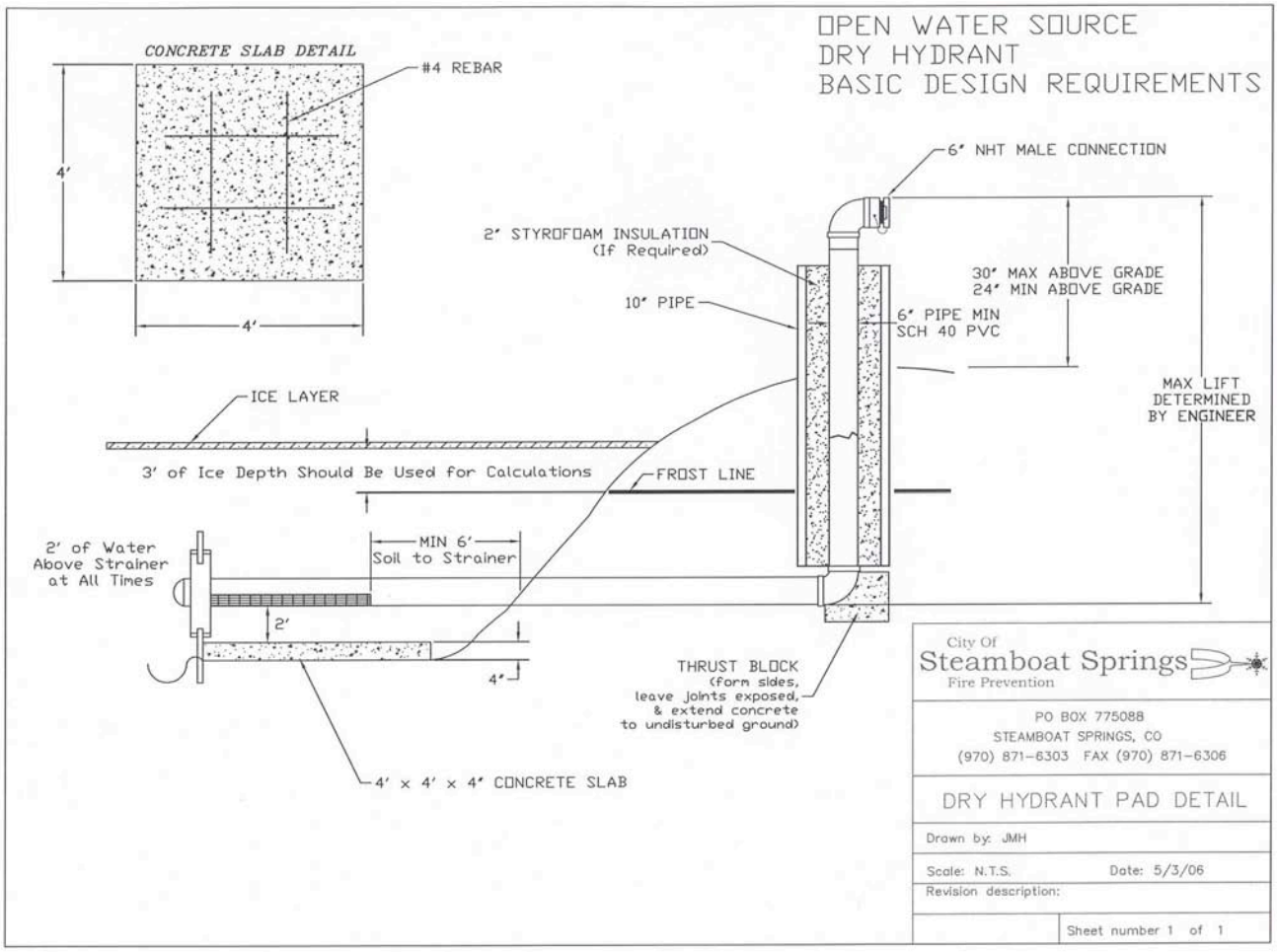

Figure 5 – Dry Hydrant Pad Detail

VII. Buried Tank Water Source Design and Installation Criteria

Probably the lowest maintenance water source is a buried tank water source. The total volume of storage can be located in one tank or in multiple tanks manifolded together. A lot of times for a single residence application, the domestic use storage and fire storage tanks are incorporated together. If this is done, then the desired domestic storage volume must be included above and beyond the fire storage requirements. The domestic tap should be placed at a level in the tank so that there will always be the required volume of fire suppression water available. A shared fire storage with suction supply access and domestic supply must have approval from the local environmental health official and may require design changes to protect the water quality for potable use.

Tank materials

Acceptable tank material shall include fiberglass or equivalent, concrete, and steel. The tank must include or have the capabilities of adding the man way access, suction pipe, vent pipe(s) and any fill and water level meter pipes. If the tank to be installed is used, then documentation must be provided with the plan submittal stating what the tank was previously used for and how it was cleaned and prepared for fire suppression water storage. The applicant should consult with the AHJ, prior to purchasing such a tank to ensure that it will be acceptable. All materials

that may potentially affect the pumping apparatus pump must be removed prior to installation of the tank.

Excavation requirements
Open trench safety shall be the sole responsibility of the installation and excavation contractor. All excavation including backfill, compaction and cover materials and depth shall follow the engineers design specifications as well as the tank manufacturers standards.

Bedding Requirements
The bedding requirements shall be specified by the engineer and the tank manufacturer and shall be the more stringent of the two. Specifications of the bedding requirements must be provided in the plans submittal.

Anchoring
Anchoring should be provided per the design engineer and tank manufacturer specifications. Anchoring is used to prevent the tank if empty from lifting out of the ground if the water table level is above the water level inside of the tank. Anchoring shall be provided in addition to foundation drainage.

Freeze Protection
Freeze protection should be incorporated for the tank and shall follow the design engineers specifications.

Venting
Venting for the tank should provide a cross sectional area equal or greater to the cross sectional area of the suction pipe. The vent pipe should extend above the ground to a level that snow will not obstruct the inlet. The inlet should be screened so as not to allow animals or debris to access the tank and shall be a minimum of 4 feet above grade at the vent for snow. Screen shall be ¼" corrosion resistant hardware cloth or 24 mesh screen if tank is for potable use also.

Fill/Recirculation Connections and Requirements
A minimum of one 2-½ inch inlets must be provided to the tank to allow for refill and recirculation. The inlets can be incorporated into the vent pipe. The connections must be a 2-½ inch threaded female (NHT) with swivel and a male plug.

Water Uptake Structure
A vortex breaker, baffle or equivalent must be installed on the suction pipe inside of the tank to eliminate the possibility of cavitation or any air production that may cause a loss of the draft suction. Ask your tank supplier about anti-vortex systems that can be built into the outlet of your tank by the manufacturer.

Example only

Figure 6 – Vortex Breaker

VIII. Plans Submittal Requirements

The following information will be required to be submitted at the time the permit is pulled.

- An engineer designed site plan showing the layout of the water source, piping, connection, emergency apparatus access and staging areas, hydrant protection locations, support structures locations and signage locations.
- Detail sheet showing
    - Hydrant protection design
    - Support structures design
    - Connection specifications
    - Freeze protection details
- Section view of water source, piping, connection, thrust blocks, strainer, any support structures and staging area with all necessary elevations.
- Water source details in section view should include any bedding, fill and anchoring details.
- Detail of water intake (i.e. strainer or anti-vortex baffle).
- Engineering calculations verifying pipe flow of 500-gpm minimum at pump outlet.
- Details specific to particular water source mentioned in the previous two sections.

Plans will be reviewed by the AHJ and returned to the installation contractor upon completion of any necessary changes. Applicant should meet with AHJ in the initial design phases to avoid costly design changes later in the process.

IX. Fire Department Inspections

Initial Site Visit

An initial site visit will need to be performed by the AHJ as part of the design process to field verify access and site conditions as well as to work with the design engineer to locate the water source and connection locations. This step will most likely occur prior to permit application and plans submittal.

Rough Inspection

The rough inspection is necessary to verify construction prior to any backfill. The installation contractor is responsible for providing all materials necessary for inspection of the water supply

components including ladders, lights, pumps, etc. A stamped copy of the approved plans will need to be onsite for the AHJ to reference. The rough inspection will include but not be limited to the following.

- Verify no debris in pipes. Visual access must be provided to all sections of pipe. This may require that not all fittings are in place or may require the use of a sewer pipe inspection type of camera. Other means such as a pig may be utilized, but must be approved by the AHJ.
- Verify that the water intake structure (screen, anti-vortex baffle) is in place and of the approved design.
- Verify pipe is of designed size.
- Verify thrust blocks are available and installed.
- Check pipe bedding material and depth.
- Check pipe layout pitch
- Verify freeze protection is to be installed appropriately
- Verify riser support structures are to be installed appropriately
- If a buried tank water supply
    - Inspect interior of tank for debris (contractor responsible for having tank adequately ventilated to allow for access without confined space entry equipment).
    - Tank secured and strapped according to design
    - Bedding material approved type and depth

Final Inspection

The final inspection is necessary to verify final installation and its compliance with the approved design. The installation contractor is responsible for providing all materials necessary for inspection of the water supply components including ladders, lights, pumps, etc. A stamped copy of the approved plans will need to be onsite for the AHJ to reference. The final inspection will include but not be limited to the following.

- Access and staging areas are finalized and per approved design.
- Connection is in the approved location in reference to the staging area and of approved type. All connection fittings are in place.
- Riser, connection, and caps are painted accordingly.
- Signage is in place and as approved.
- Any riser support is in place.
- Draft hose support is in place if called for.
- Vehicle protection is in place and of approved design.

X. Flow Testing

Procedures

The last step for final acceptance of the water supply by the fire department is to perform a flow test. The applicant can choose to hire an independent contractor to perform the flow test or can contract with the fire department to perform the flow test. The flow test needs to demonstrate the capability of the suction water supply to provide a minimum of 500 gpm at the pump outlet. The current charge rate for the use of fire department apparatus can be obtained from the AHJ of the jurisdiction. Acceptable measurement techniques are

- Flow through a known size orifice with a pitot gauge reading.
- Pump to a tank of a known volume (i.e. water tender). Measure the time and back calculate the amount of volume filled in one minute.

- Pump through calibrated flow meter.

The AHJ does not need to be present at the flow test if an independent contractor is used as long as the AHJ has previously approved the particular contractor for this type of testing. If the AHJ is not present at the time of the test then the contractor will need to provide a detailed report of the flow test procedures and results.

XI. Supply Contacts

Contact your local AHJ for a list of suppliers, designers and contractors that have performed work in their jurisdiction. Call 871-8216 for more information or a copy of the list.

XII. Maintenance

Maintenance needs for tank, river, and lake/pond water sources

The following items will need to be inspected on an annual basis. If the owner contracts with an outside source to perform the inspections then a detailed report of the maintenance performed and the findings will need to be given to the AHJ.

GENERAL:

- Keep site clear of obstructions and regularly maintain the access area to keep the dry hydrant available for emergency use. Provisions shall be made to have snow removed after each storm.
- Repair and replace vegetation around the dry hydrant and access as needed and remove any unwanted vegetation.
- All exposed piping should be inspected for cracks and degradation of material. Photographic documentation of the condition should be provided annually for all exposed pipe. Paint condition should also be inspected and the piping should be repainted (latex base only) if necessary.
- All fittings should be inspected for damaged threads and that the proper caps are in place. All caps should be removed and put back on to check for proper operation. A light amount of white grease should be installed on all threaded areas to facilitate future removal. All gaskets should be replaced annually. A dry barrel hydrant (municipal type) should be operated from full close to full open to ensure proper operation.
- Check that all signage is still in place and legible. Replace if necessary
- Check that the vehicle protection is in place and not damaged. Replace if necessary.
- Inspect all access and staging areas and repair as necessary. Provide photographic documentation.
- Every dry hydrant shall be tested at the maximum design flow rate every 2 years.

OPEN WATER SOURCES:

LAKES/PONDS/ RIVER:

- Check and document water level at time of inspection.
- Inspection should be performed at low water level with no ice to allow for the maximum chance at safe examination of the strainer.
- The suction strainer and inlet pipe must be inspected annually either by lowering the water level in the water source or by other means. Ensure strainer flap operates properly. Inspect the strainer for damage or obstruction.

- A minimum of 2 feet of clearance must be present from the strainer to any dirt surface. Anything less than that and the deposited sediment must be mechanically removed back to the original design specifications.
- Back flush water supply piping with a minimum of 1000 gallons of water by gravity feed or no greater than 50 psi to remove any debris present in the piping.

BURIED TANKS:

- Check and document water level at time of inspection. Fill tank to maximum level if low.
- Inspect all exposed venting pipe and check for obstructions. Check for damage to pipe and replace any necessary components.
- Inspect fill connections for damage. Unthread caps and put back on. Put a light level of white grease on the threads to facilitate future removal. Replacing gaskets annually is suggested.
- Inspect the water level gauge and insure that it is operating properly and properly reflects the water level in the tank.
- Make sure man way entrance is clear and can be accessed.

Maintenance Contract

In order to track and help the water supply owner remember to perform the routine maintenance, a maintenance contract will be required for all suction supply water sources. Failure of the owner to perform the regularly scheduled maintenance will mean that the water supply will be removed from the fire department accepted water supplies list until the maintenance is performed. Proof of the maintenance shall be provided to the AHJ, each time maintenance is performed. These documents will be included in the file for the water source. A copy of the maintenance contract is available from the AHJ for the jurisdiction.

XIII. Water Use Agreement

In order to provide the best possible emergency response for everyone served it is sometimes necessary to draw upon approved water sources for use outside of the area the water source was constructed to serve. In order to allow the fire department to legally use the water outside of the design area and to cover the cost to the water system owner, a water use contract should be in place. A copy of the water use agreement can be obtained from the AHJ. The applicant for the water source has the option of not signing the agreement if they do not wish to participate.

CONTRACT FOR WATER USE FOR EMERGENCY SITUATIONS
BETWEEN
THE STEAMBOAT SPRINGS RURAL FIRE PROTECTION DISTRICT
AND
PROVIDER

THIS CONTRACT FOR WATER USE FOR EMERGENCY SITUATIONS ("Agreement") is made by and between the STEAMBOAT SPRINGS RURAL FIRE PROTECTION DISTRICT, a Colorado special district (the "District") and _____
_____ (the "Provider").

WHEREAS, the District is a Colorado special district empowered to provide fire protection and emergency medical services within and without its boundaries; and

WHEREAS, the Provider is an entity which owns and/or operates a domestic rural water system in Routt County, Colorado (the "System"); and

WHEREAS, in the event of a fire emergency near Provider's System, such System may be the closest water source available for use by the District in a fire emergency situation; and

WHEREAS, the Provider desires to make available its System and water provided through its System to the District in emergency situations when the District is providing fire protection services near the System, for which the District will compensate Provider as herein described.

NOW, THEREFORE, IN CONSIDERATION of the mutual undertakings, promises and agreements herein contained, the District and Provider hereby agree, promise and covenant as follows:

1. The Provider hereby permits the District to tap into any fire hydrant or other water source in the Provider's System in order to obtain water to be used to suppress any fire in an emergency situation in the vicinity of the System. For purposes of this Agreement, an emergency situation shall be defined as any situation which the District, in its sole discretion, determines it to be necessary or appropriate to use the Provider's water via fire hydrants and/or any other water source in Provider's System.

2. Whenever the District takes water from Provider's System, the District shall measure the approximate quantity of water taken based on the capacity of the emergency apparatus used, and shall report such amount of water taken, after the emergency situation is over. The District shall make reasonable attempts to contact the operator of the Provider's System prior to or during the use of such System.

3. The District agrees to compensate the Provider for water taken by the District from the System by paying to the Provider a price per gallon at the then existing City of Steamboat Springs base or first level per gallon commercial rate for each gallon taken by the District from the System in such emergency situation.

4. This Agreement shall commence on execution hereof by both parties, and shall continue from year to year until either the District or the Provider shall give written notice to the other at least one (1) month before the end of any calendar year of the election of such party to terminate this Agreement, in which event this Agreement shall terminate at the end of such calendar year.

5. If in using the System to obtain water the District physically damages any part of the System, the District will promptly at its cost and expense repair such System.

6. This Agreement constitutes the entire Agreement between the District and the Provider with respect to the subject matter hereof, and may be amended only by an instrument in writing signed by both parties.

7. Notice to the District required or permitted hereunder shall be in writing and shall be deemed given if sent by ordinary mail, postage prepaid, or by FAX transmission, to the Board of Directors, Steamboat Rural Fire Protection District, P.O. Box 773763, Steamboat Springs, Colorado 80477-3763, FAX 970-879-8808. Notice to the Provider required or permitted hereunder shall be in writing and shall be deemed given if sent by ordinary mail, postage prepaid, or by FAX transmission, to the following address and FAX:
_____
_____.

Either party may change its mailing or FAX address by notice given in the manner set forth in the preceding sentence.

8. The failure to enforce or the waiver of any specific requirements of this Agreement by either party shall not be construed as a general waiver of the Agreement or any provisions herein, nor shall such action stop either party from subsequently enforcing this Agreement according to the terms hereof.

9. If any part of this Agreement is determined to be invalid by a court of competent jurisdiction, the remaining portions of this Agreement shall remain in full force and effect, and the parties shall attempt to amend this Agreement to carry out the intent of the invalid provision as closely as possible and in accordance with applicable law.

10. In the event any dispute arises concerning this Agreement, and the matter is turned over to an attorney, the substantially prevailing party in such dispute shall be entitled, in addition to other damages and costs, to receive reasonable attorney's fees from the other party.

11. The approval of this Agreement and the authority of the officials of the District to execute this Agreement is evidenced by a resolution passed by the Board of Directors of the District at a regular meeting of said Board of Directors duly held on the _____ day of _____, 200__.

12. The ratification and approval of this Agreement and the authority of the officials of the Provider to execute this Agreement is evidenced by a resolution passed by the Board of Directors of the Provider at a regular meeting of said Board of Directors duly held on the _____ day of _____, 200___.

IN WITNESS WHEREOF the parties hereto have caused this Agreement to be executed and their respective corporate seals to be affixed and attested to by their duly authorized representative on the respective dates set forth below, and this Agreement shall be fully effective from and after the date of execution by the last party to sign.

_____

Date: _____ By: _____
_____, President

ATTEST:

Date: _____ By: _____
_____, Secretary

STEAMBOAT SPRINGS RURAL FIRE PROTECTION DISTRICT

Date: _____ By: _____
President

ATTEST:

Date: _____ By: _____
Secretary

XIV. References

Larimer County, Colorado. *The Dry Hydrant Concept.* http://www.co.larimer.co.us/wildfire/dry_hydrant_concept.htm

National Fire Protection Association. *NFPA 1142, Standard on Water Supplies for Suburban and Rural Firefighting.* 2001 Edition.

USDA-NRCS. *Conservation Practice Standard, Dry Hydrant, Code 432.* NRCS, Alabama. August 1999.

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USDA-SCS. *Dry Hydrant Manual, A Guide for Developing Alternative Water Sources for Rural Fire Protection.* Resource Conservation and Development Council Office, Gainsville, GA.

Wisconsin Department of Natural Resources. *A Guide to Planning and Installing Dry Fire Hydrants.* PUB-FR-044 2003.