

A GUIDE
TO PLANNING AND INSTALLING

DRY FIRE HYDRANTS



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PREFACE

This booklet is intended to assist fire service personnel, municipal agencies, and private companies or individuals in the planning and installation of 'Dry Fire Hydrants'. Since each installation will be unique in itself, we will try to present an orderly method to plan for and install a Dry Fire Hydrant system. Personnel involved in installing a dry fire hydrant system are encouraged to read this booklet thoroughly before beginning fieldwork on the project. Installation tips were obtained from numerous fire departments throughout Wisconsin, along with the experiences of several fire departments from Rusk County, Wisconsin.

The installation procedures described in this booklet apply to the use of 6" Schedule 40 PVC pipe for the hydrant. Some alterations in the installation methods will be necessary for other types of materials that may be used for hydrant installation.

The dry fire hydrant system described is designed to be used with fire department engines and/or high volume pumps, not small portable pumps.

Products mentioned in this booklet are examples of materials that are available for use in a dry fire hydrant project. The Wisconsin Department of Natural Resources does not endorse any specific product or manufacturer.

Other recommended materials to help in the planning and installation processes are:

- 1.) A video production that goes with this booklet entitled *Planning for and Installing Dry Fire Hydrants* is available from the Wisconsin Department of Natural Resources, Tomahawk, WI 54487. Cost is \$7.00, ppd.
- 2.) A booklet and video entitled *Operation Water* produced by the NFPA and available from the National Interagency Fire Center, Boise, ID 83705. Cost is \$2.75, ppd.
- 3.) NFPA 1231, *Standard for Water Supplies for Suburban and Rural Fire Fighting*, 1993 edition, available from NFPA, P.O. Box 9101, Quincy, MA 02269.

We hope that the enclosed information will assist you in the planning and installation of your dry fire hydrant system. Comments and pictures of your installation would be appreciated.

If you should have questions that are not covered in this booklet or tips and ideas on dry fire hydrants that you would like to share with other fire service personnel, you may contact the authors at: Wisconsin Department of Natural Resources, N4103 WSH 27, Ladysmith, WI 54848-9309 USA Telephone (715) 532-3911 John Pohlman, Forester-Ranger or Robert White, Forestry Technician Advanced, Revised January 1997

PLANNING YOUR HYDRANT LOCATIONS

A. If this is a countywide or multiple jurisdiction project, set up a meeting between all of the area fire departments and/or municipal agencies involved. If you are located within a DNR organized fire control area, consider inviting the DNR Fire Officer. These people should know the waters of their particular fire jurisdictions very well. The local DNR Fire Officer can assist with maps, permits, fill-site information, and RCFP Title IV Grant applications. In this way you can plan the location of the dry fire hydrants to avoid two departments placing hydrants right next to each other. In some cases, one fire department might have to cross over into another fire jurisdiction for a good water source, thus creating the situation that two fire departments are sharing a single dry fire hydrant. When this occurs, it generally balances out between the involved departments and helps to reduce the cost to all departments involved in the project.

B. On a county or jurisdictional map, locate the areas in which you would like to install a dry fire hydrant. You may wish to consider population trends, property valuation, loss potential, and fire history to help prioritize your selections. Mark each location, along with its priority, on the map. Consider installing high priority hydrants first, and others in future years as a long-range plan. Once you have found the general areas, locate the closest water sources; (i.e., lakes, streams, flowages, farm ponds, etc.) that may serve as a hydrant location. Three miles or less between hydrants is a good average distance to keep turn around time to a reasonable minimum.

FIELD CHECKING LOCATIONS & DESIGN CONSIDERATIONS

After the locations have been mapped, it is time to check them out in the field. Some of the things to look for during field checking are:

- A. Determine the riparian land owner at the site location. You need their permission to do the work on their property. **BE SURE TO GET THE PERMISSION IN WRITING !!** Also, if the hydrant is on a road ROW, you will need town, county or state DOT approval(s). If a railroad owns the property, you will need their permission and may be required to pay a land use fee. If the town or county owns the property you will be digging on, you will need their permission. Obtaining written permission may take some time and, in the case of town or county ownership, may require the town board or county board to pass a resolution permitting your activity. (See Permits and Land Use Agreements on page 5).
- B. Depth of water at the site during the lowest water levels of the year. This is the most critical consideration. You need a minimum of 4' to 5' of water over the suction screen and pipe during low water. This will prevent freeze-out of the screen, obstructions to navigation, and reduce the chance of water swirl (cavitation) while drafting. The depth of water can be checked by boat with a depth line or stick. You may also use Scuba divers if they are available from local clubs. Take into consideration the 25, 50, and 100 year water levels if this information is available. This will give you an idea of what kind of low and high water levels you can expect during drought or flood years.
- C. What is the composition of the bottom of the lake, stream or pond? You need a sand, sand/gravel, gravel, or gravel/rock type of bottom for the hydrant to work well. Otherwise, muck and/or vegetative matter may clog up the suction screen. You may be able to purchase some type of mat to lay down under your suction screen to retard vegetative matter from growing up into your screen, or if you have enough water depth, you can raise the screen up off the bottom.
- D. Check the ease of digging. Can a large backhoe get close enough to the water or out into the water to reach out and get down at least 5 feet below the surface of the water to start the trench?
- E. Consider how you are going to protect the hydrant connection from damage or burial by snow. Do you need to put in posts, etc. to serve as a crash barrier? How will you mark the hydrant to avoid it being hit by a snow plow? Who will be responsible for keeping the hydrant locations open in the winter? What type of suction hose support do you need?
- F. After you have found the required water depth and if the area is suitable for a hydrant location, measure to the shore to figure out the amount of pipe that will be needed in the water. Commercially made screens are generally 5 feet in length and should be included in this measurement. Then measure from the shoreline to the location for the hydrant connection. Add the vertical riser height to these figures to give you the approximate total feet of pipe for the installation. Remember, if you have a gently-sloping shoreline you will have to insulate or mound over your pipe and around your vertical riser to prevent freeze-up of the water standing in the pipe and vertical riser. Ideally, you should have 5 to 6 feet of soil over the lateral pipe run and around the riser above the highest water level in your riser. Be generous in your estimate of pipe needs as it is better to have too much pipe than to be short of pipe for your project. (Remember-- the fewer joints the better, and the less chance for air leaks in your hydrant).
- G. Before leaving the proposed hydrant location, check for any utilities (gas lines, telephone, CATV, electric service, etc.) that may be affected. **IT IS YOUR RESPONSIBILITY TO HAVE ALL UTILITY OWNERS NOTIFIED AT LEAST 3 WORKING DAYS BEFORE YOU START EXCAVATING** (per s.182.0175(2)(a)(3), Wis. Stats.). The charts on pages 15 and 16 are for PVC pipe and will assist you in determining how long a lateral lay and how much vertical lift you can have and still flow the rated capacity of the pump or engine used at the hydrant location. Chart C on page 17 is for hard rubber suction hose used for connecting the pump to the hydrant. There are other charts available for pipes made of different materials. They can be obtained from any local engineering firm or possibly your local library. Use the Design Worksheet on page 19 to assist you in laying out your hydrant. Also, see Example 1 on page 20.

HOW TO USE THE CHARTS

1. Add the total length of straight pipe you will use at the site (screen +lateral run + riser + wide sweep pipe = STRAIGHT PIPE). Write this down on the worksheet at step 1.
2. Using Chart A, page 15, add up the number of feet of straight pipe equivalent for all fittings used to make up the hydrant (elbows + hydrant adapter + any reducers = STRAIGHT PIPE EQUIV. FOR FITTINGS). Write this down on the worksheet at step 2.
3. Add the numbers from step #1 and step #2 together to obtain the TOTAL STRAIGHT PIPE EQUIVALENT of the hydrant. Write this figure down on the Design Worksheet at step 3.
4. Determine the maximum GPM you want the hydrant to flow. Usually this would be the pumping capacity of the pump or engine you would use at this hydrant. Write this figure down on the Design Worksheet at step 4.
5. Using Chart B, page 16, determine your head loss due to friction per 100' of pipe (number from step #3) based on the GPM from step #4. If you have over or under 100' of pipe equivalent (from step #3), you must adjust your head loss from the chart. Example: Your TOTAL STRAIGHT PIPE EQUIVALENT is 110' and you want 1000 GPM -- head loss from the chart is 5.8'/100' of pipe. For this run, you would have a head loss of 6.4' ($5.8' \times 110' / 100' = 6.4'$). Write your figure down as HEAD LOSS FOR PIPE AND FITTINGS on the Design Worksheet at step 5.
6. From Chart C, page 17, figure your head loss due to friction in the suction hose you will be using on the hydrant. Write this down on the Design Worksheet as SUCTION HOSE HEAD LOSS at step 6.
7. Next you must determine your static lift. This is the vertical distance from the water's surface in the hydrant pipe (use the lowest water level as it will represent the maximum lift needed) to the pump intake. Write this figure down on the Design Worksheet as STATIC LIFT at step 7. You should try not to exceed 8-10' if possible. Remember -- this is a vertical measurement!!
8. Add the answers from steps 5, 6, and 7 together on the Design Worksheet at step 8. This will give you your TOTAL SUCTION LIFT). You do not want to exceed 20-25' of Suction Lift at the pump intake. If you do, all the pump capacity will be used for suction (or lift) and the pump may not flow its rated capacity.
9. Basically what this is saying is the higher the flow you want to obtain from the hydrant, the smaller the number needs to be under Total Suction Lift. You can do three things to affect the total lift. You can: 1) shorten your lateral run, 2) move the pump intake closer to the water level in the riser thus lessening the static lift, or 3) use larger pipe for the lateral run and riser, then reduce down to 6" at the hydrant connection. This will reduce your friction in the pipe thus lowering your head loss in step 5.

COSTS

- A. When planning for your dry hydrants, you can figure an approximate cost of \$550 to \$750 per hydrant, including contractor labor and machine costs. This is an average figure when using 6" Schedule 40 PVC pipe, a commercially-made screen, and hydrant connector. You may be able to get a contractor to donate the labor and thus reduce the cost per hydrant. If using other pipe material, adjust the cost accordingly. Shop around for pipe prices and hydrant materials. There is a large range of pricing for these items.
- B. If you wish to save some money and have the time, manpower, and patience, you can make your own round suction screens. You will need: 1) a 5'-6' piece of 6" schedule 40 PVC pipe, 2) a 6" coupler, and 3) a 6" end cap. Drill 1000 holes $5/16"$ around $\frac{3}{4}$ of the pipe leaving a strip on the side with no holes. Glue the coupler on one end and attach the cap to the other end by drilling through the cap from the side after it has been placed over the end of the 6" pipe. Pin the cap to the pipe so it can be removed if there is a need to clean out the interior of the suction screen. A commercial screen costs about \$100--\$125. You can make one for about \$25--\$30. Check with local school shop classes. They may be willing to make the screens for you.
- C. Determine the number of dry hydrant sites you wish to install and apply for any available grants (i.e.,RCFP Title IV, etc.) that may help to cover some of the costs.
- D. If this is a county-wide or multiple jurisdiction project and you are applying for RCFP Title IV grants through WDNR, submit all grant applications together, along with a cover letter to the DNR explaining the project.

PERMITS AND LAND USE AGREEMENTS

(As it pertains to the State of Wisconsin)

- A. Pick up, fill out and submit the required forms for the sites you have selected. Check with the DNR Water Management Specialist for what they want you to file. Generally, these items are needed:
1. Application/Permit for Dry Fire Hydrant Projects (Form 3500-96, see Appendix A, page 21). The riparian landowner and sponsor (e.g. fire department, or municipality) must be listed and sign as co-applicants.
 2. Dry fire hydrant project plan, including materials to be used and sectional views (see Appendix B, page 23).
 3. A completed, signed, and dated Fee Form (Form 3500-53A) along with the required fee (Note: Governmental or municipally funded projects are fee exempt).
 4. Plat map of township showing the exact location of dry fire hydrant. (see Appendix C, page 24)
 5. You will need to submit clear photographs of the project site. Include at least 1 front view and 1 side view. You may also be required to submit clear photos after the completion of the project.
 6. Land use agreement(s) between the riparian landowners involved and the fire department or agency installing the hydrant on private, town, and county lands, (see Appendix D, page 25), or a copy of the permit issued by state D.O.T., railroad company or power company for state highway, RR, or power company lands.
 7. For any dry fire hydrants going in on town or county property, the town or county attorney may recommend a resolution by the governing body to allow the installation of the hydrant. (see Appendix E, page 27)
- B. Check with the county zoning administrator to see if they require any permits to satisfy their zoning ordinance.
- C. If you use private farm ponds for your site, you may not need any permits under certain conditions. Check with your DNR Water Management Specialist and County Zoning Administrator.
- D. The Army Corps of Engineers will issue their own permit for your project, if necessary. The DNR Water Management Specialist will submit a copy of the permit application to the Corps of Engineers.
- E. The riparian landowner and fire department or municipality may wish to register the Land Use Agreement with the County Register of Deeds. This would show on the abstract of subsequent landowners that an agreement does exist for the hydrant.

INSTALLATION OF HYDRANTS

- A. Locate a contractor with a large backhoe (generally, the larger the better, as you may need the long reach). **REMEMBER -- NOTIFY ALL UTILITIES AT LEAST 3 WORKING DAYS IN ADVANCE OF STARTING TO EXCAVATE !! CALL -- BEFORE YOU DIG !!**
- B. Try to start your installations when the water is warm and at its lowest level. Avoid installing the hydrants immediately after a heavy rain as this may affect the water levels. It is important that the suction screen be 4 to 5 feet below the lowest water level that can occur at the hydrant site. This will avoid freeze up during low water conditions and minimize obstructions to navigation.
- C. You will need a certain amount of clean fill hauled to the site. Also, you will need some top dressing material that can be seeded and mulched. Choose material that will not wash-out easily. It is a good idea to mound-up the dirt over the pipe to help prevent frost penetration and maintain your grade when the loose soil settles.
- D. Mark the backhoe bucket or arm to make sure you are deep enough when you start the trench. Remember this is a vertical distance and in order to work properly, the bucket and arm of the backhoe must be able to work through the vertical position while digging.
- E. Dig in the hydrant trench. Keep the bottom of the trench level and at the same depth all the way into the hydrant connection location. Do not allow anyone to go into the trench!! It is not necessary and is an extreme safety hazard!!
- F. It is less complicated to maintain a level trench cut all the way to where the riser will start up to the hydrant connection, rather than to try to slope the pipe up from the shore. (See Figures 1 and 2, pages 28 & 29). A sloped trench may be more advantageous when dealing with extreme elevation difference and distances between the top of the bank and the shore. A sloped trench can effectively reduce the TOTAL SUCTION LIFT by having a shorter total run of pipe,

and using fewer angled elbows. Digging the trench to match the 45° angles can make this type of installation more complicated.

G. Glue the screen section, pipe, elbows, and riser pipe together and let the glue set-up. It is better to use two (2) 45° elbows and a short piece of PVC pipe for the riser elbow rather than one 90° elbow. The wide sweep would allow you to insert a 2 1/2" suction hose into the pipe if your hydrant connection was broken off. We taped the joints with an adhesive-backed, rubberized, wide tape for extra sealing to help prevent air leaks. (See Photos 1 & 2).



Photo 1: Gluing pipe fittings together and taping joints.



Photo 2: Gluing riser section on the assembled horizontal run section. Note the wide sweep elbow.

H. When the trench is finished and the glue has set up, launch a boat and run out the screen and pipe. You can set the screen end on the edge of the boat. The pipe will float until you sink the screen. It helps to have one or two people with chest waders to work in the water. They can help line up the pipe with the trench. **BE CAREFUL THAT THEY DO NOT FALL INTO THE TRENCH WHEN DOING THIS. ALL PERSONNEL IN OR ON THE WATER SHOULD BE WEARING A PERSONAL FLOATATION DEVICE!!** Make sure the pipe and screen are directly over the trench before you release the screen and sink the pipe. It is possible to pull the whole hydrant assembly back out of the water to

redo a mistake after it has been sunk if the connections hold. Proper placement is a must for successful operation in the future. (See Photos 3, 4, & 5).



Photo 3: Assembled hydrant system ready for placement in the water.



Photo 4: Aligning pipe assembly with the trench.



Photo 5: Sinking hydrant assembly into the trench after proper alignment.

I. If you have access to a scuba diving team, have them check your screen position when the sediment in the water settles. Ideally, they should do this before you start to back-fill the trench. They can tell you first hand if you have a problem with your suction screen or not. If the water is too murky for them to see at this point, have them check the screen a couple of days later, after the water has had a better chance to clear. Some of the things that should be checked

for are: large rocks on the pipe or suction screen, pipe extending too far out into the water (if installation was made in moving water this could cause movement of the screen and pipe with the current), back-fill covering the screen (or any part of the screen), or the screen is in the trench or a hole (water movement could cause the screen to be covered with sand, etc.). The divers can also place your mat material under the screen if you should need a mat. If you have a long run of uncovered PVC pipe laying on the bottom of the lake or stream, be sure to weight it down to prevent it from floating up during back-flushing or moving with the current. If the screen extends out over a dropoff or is in a fast current, it must be tethered to the bottom to prevent movement or floating.

J. Back-fill the trench both in the water and out, bringing the shoreline back to natural grade, slightly higher over the pipe. A Bobcat can work well for this. Cover the opening in the riser pipe to prevent rock and fill from falling into the pipe while back-filling. (See Photo 6).



Photo 6: Top of riser pipe temporarily covered with hydrant connection to prevent fill material from entering pipe.

Again, remember that during high water, the water level in the pipe and riser will move towards the frost line. You must prevent the frost from reaching this water or your hydrant could freeze up! To do this, you can mound up dirt around the riser and over the pipe, or lay down a styrofoam barrier around the riser and along the pipe 2' to 3' under the top of the ground. Commercially made styrofoam sleeves are available to fit most sizes of pipe.

K. You will now have a long length of riser pipe sticking out of the ground. (See Photo 7). Measure the distance from the bottom of the suction intake on the pump that will be used with your hydrant to the ground at the hydrant location, with the pump positioned as it would be when you would be pumping. Cut off the riser so that when you attach the hydrant connection to the riser, the top of the opening of the hydrant connection is lower than the bottom of the pump intake. This will prevent any airlocks in your suction line. It is very important that the pump intake be above the hydrant connection!! (See Figure 3, and Photo 8)



Photo 7: Riser pipe extending above ground before being cut to proper height.



Photo 8: Hydrant connection installed on pipe so that it is below the pump intake.

L. Set up your guards and any suction hose support you feel necessary. Remember there is a lot of weight on the hydrant connection when you have suction hose attached and are drafting. Finish level, seeding, and mulching the area to prevent erosion. (See Photo 9).



Photo 9: Completed hydrant installation with guards and suction hose support installed. Area has been seeded and mulched to prevent erosion.

M. Test pump the hydrant.

N. Paint the hydrant in the color of your choice. Unless the PVC pipe that you are using is sunscreen protected, the pipe exposed to daylight must be painted to prevent ultraviolet light from breaking down the chemical composition of the pipe!

O. Remember to back-flush the hydrants as often as necessary to remove any debris that may accumulate on the screen (leaves, soil, sticks, etc.).

P. There is some debate as to the correct position of the screen. A commercial-built screen comes with holes drilled on about 2/3 of its surface and a strip with no holes drilled. Some prefer the holes facing down towards the bottom to help prevent water swirl during low water levels. Others prefer the holes facing up so as not to draw foreign matter into the screen. The individual installation and pump flow probably best determines which way to face the screen. A baffle can be installed above the screen to reduce water swirl if you decide to have the holes facing upwards. There are several styles of commercially made screens available to fit different installation situations.

Q. If your only water source would be a shallow pond, lake, or stream, you may have to consider a seasonal-type hydrant -- one that is only good during certain times of the year, i.e., spring, summer and fall.

R. Many good locations for water points may have been overlooked because of installation problems. For example, the installation of a hydrant on a bridge, or where the hydrant pipe would not be able to be buried below the frost line. Obviously, these hydrants would freeze in cold weather, making them in-operable for several months of the year.

The Wascott VFD has developed a method for making these "seasonal hydrants" useable all year. The principle is to inject low pressure air into the hydrant to evacuate the water, and make the hydrant freeze resistant. The method is simple, inexpensive, and reliable, and may expand the number of sites that can be adapted for hydrant use. This method would only work if the screen remains below the bottom of the ice during winter freeze-up and enough water remains unfrozen to provide the required volumes. The lateral run of pipe should be at a slight downward angle towards the screen to allow for near total evacuation of the water back down to the screen. Remember to check the air pressure gauge periodically to make sure you are maintaining your pressure in the hydrant. See page 31 for instructions on this adaptation.

FOLLOW-UP

- A. Notify the DNR Water Management Specialist or designee when your installation is complete so that they can close out the surveillance forms for the project.
- B. Compile all records, bills, canceled checks, and submit them to the DNR at Madison for payment of RCFP Title IV moneys if you received a grant.
- C. Contact property owners, township and county officials, and let them know of the hydrant location(s). Get a commitment from them to keep the hydrant sites plowed and shoveled out during the winter. You may need to contract for this service if it will not be provided by local units of government.
- D. Give maps of hydrant locations to mutual aid fire departments and local fire dispatch so they can quickly locate them. You might want to assign a fire plate or rural address number to the hydrant site to assist in locating the hydrant.
- E. Advise all property owners in the area of the hydrant(s) to contact their insurance agents and explain that they now have an all-weather, year around water source near them for fire suppression. This may decrease their property insurance rates.
- F. The fire department may wish to contact ISO to advise them of their dry fire hydrant system to see if this may affect the rating of all, or portions, of their fire district. In order to possibly affect the ISO rating, accurate records must be kept on the flow capacity, testing, maintenance, and use of the hydrants for fire suppression.

Chart A

STRAIGHT PIPE EQUIVALENT FOR FITTINGS (IN FEET)*

PVC PIPE DIAMETER	2.5"	3.0"	4.0"	5.0"	6.0"	8.0"	10.0"
90° Elbow, Standard	6.5	8.5	11.0	14.0	16.0	22.0	27.0
90° Elbow, Medium Sweep	5.5	7.0	9.5	12.0	14.0	18.0	22.0
90° Elbow, Long Sweep	4.5	5.5	7.0	9.0	11.0	14.0	18.0
45° Elbow	3.0	4.5	5.0	6.5	7.5	10.0	13.0
Hydrant Connection(6"x4.5")					2.5		
Reducer (8" x 6")						3.5	

*Source: *Handbook of PVC Pipe*

Chart B
HEAD LOSS PER 100 FEET OF PVC PIPE

Size	3"	4"	5"	6"	7"	8"	10"
GPM							
100	2.4	.6	.2	.1			
200	8.6	2.1	.7	.3	.1	.1	
250	13.0	3.2	1.1	.5	.1	.1	
300	18.2	4.5	1.5	.6	.2	.2	.1
350	24.2	6.0	2.0	.8	.3	.2	.1
400	30.9	7.6	2.6	1.1	.4	.3	.1
500	46.8	11.5	3.9	1.6	.8	.4	.1
600	65.6	16.2	5.5	2.2	1.1	.6	.2
700	87.2	21.5	7.3	3.0	1.4	.7	.2
750	99.1	24.4	8.3	3.4	1.6	.8	.3
800	111.7	27.5	9.3	3.8	1.8	.9	.3
900	138.9	34.3	11.6	4.8	2.3	1.2	.4
1000	168.8	41.6	14.1	5.8	2.7	1.4	.5
1100	201.4	49.7	16.8	6.9	3.3	1.7	.6
1200	236.7	58.4	19.7	8.1	3.8	2.0	.7
1300	274.5	67.7	22.9	9.4	4.4	2.3	.8
1400	314.9	77.7	26.2	10.8	5.1	2.7	.9
1500	357.7	88.5	29.8	12.3	5.8	3.0	1.0
1600	403.2	99.5	33.6	13.8	6.5	3.4	1.2
1700	451.1	111.3	37.6	15.5	7.3	3.8	1.3
1800	501.5	123.7	41.8	17.2	8.1	4.2	1.4
1900	554.3	136.7	46.1	19.0	9.0	4.7	1.6
2000	609.5	150.4	50.8	20.9	9.9	5.2	1.7
2100	667.2	164.6	55.6	22.9	10.8	5.6	1.9
2200	727.2	179.4	60.6	24.9	11.8	6.2	2.1
2300	789.6	194.8	65.8	27.1	12.8	6.7	2.3
2400	854.4	210.7	71.2	29.3	13.8	7.2	2.4
2500	921.4	227.3	76.7	31.6	14.9	7.8	2.6
2600	990.9	244.4	82.5	34.0	16.1	8.4	2.8
2700	1062.6	262.1	88.5	36.5	17.2	9.0	3.0
2800	1136.6	280.4	94.7	39.0	18.4	9.6	3.2
2900	1213.0	299.2	101.0	41.6	19.7	10.3	3.5
3000	1291.6	318.6	107.6	44.3	21.0	10.9	3.7

Chart C
HEAD LOSS PER 100 FEET OF HARD RUBBER SUCTION HOSE

SIZE	1½"	2½"	4"	4½"	5"	6"
GPM						
100	84.1	7.0	.7	.4	.2	.1
200	303.6	25.3	2.6	1.4	.9	.4
250	459.0	38.2	3.9	2.2	1.3	.5
300	643.3	53.6	5.4	3.1	1.8	.8
350	855.9	71.3	7.2	4.1	2.4	1.0
400	1096.0	91.3	9.3	5.2	3.1	1.3
500	1656.9	138.0	14.0	7.9	4.7	1.9
600	2322.4	193.4	19.7	11.1	6.6	2.7
700	3089.7	257.3	26.1	14.7	8.8	3.6
800	3956.6	329.5	33.5	18.9	11.3	4.7
900	4921.0	409.9	41.6	23.5	14.1	5.8
1000	5981.4	498.2	50.6	28.5	17.1	7.0
1100	7136.1	594.4	60.4	34.0	20.4	8.4
1200	8383.8	698.3	71.0	40.0	24.0	9.9
1300	9723.5	809.9	82.3	46.4	27.8	11.4
1400	11153.9	929.0	94.4	53.2	31.9	13.1
1500	12674.2	1055.6	107.2	60.5	36.2	14.9
1600	14283.3	1189.6	120.9	68.1	40.9	16.8
1700	15980.5	1331.0	135.2	76.2	45.7	18.8
1800	17765.0	1479.6	150.3	84.7	50.8	20.9
1900	19635.9	1635.5	166.2	93.7	56.1	23.1
2000	21592.7	1798.5	182.7	103.0	61.7	25.4
2100	23634.7	1968.5	200.0	112.8	67.5	27.8
2200	25761.2	2145.7	218.0	122.9	73.6	30.3
2300	27971.7	2329.8	236.7	133.4	80.0	32.9
2400	30265.7	2520.8	256.1	144.4	86.5	35.6
2500	32642.5	2718.8	276.2	155.7	93.3	38.4
2600	35101.9	2923.7	297.0	167.5	100.3	41.3
2700	37643.1	3135.3	318.5	179.6	107.6	44.3
2800	40265.8	3353.8	340.7	192.1	115.0	47.4
2900	42969.6	3579.0	363.6	205.0	122.8	50.6
3000	45753.9	3810.9	387.1	218.3	130.7	53.8

Dry Fire Hydrant Water Delivery System Components



- A. Head Assembly-Snap-on cap
- B. Head Assembly-Rocker lug cap
- C. Strainer Assembly
- D. Horizontal Strainer Assembly
- E. Barrel Strainer
- F. Stream Strainer
- G. Low Level Strainer

- H. Suction Hose Adapters
- I. Suction Hose Adapters
- J. Reflective Hydrant Sign
- K. Strainer Support Clamp
- L. Suction Hose
- M. Riser Insulation Sleeve
- N. Reflective Hydrant Decal

DESIGN WORKSHEET

Fire Department

Dry Fire Hydrant Location

Step 1

- Screen Length
- Lateral Run Length
- Riser Height
- Wide Sweep Pipe Length

Straight Pipe =

Step 2

Use **Chart A** To Fill In The Following Values:

Hydrant Adapter _____ Reducer

Elbow Elbow _____

Elbow Elbow _____

Straight Pipe Equivalent For Fittings = _____

Step 3

Straight Pipe + Straight Pipe Equivalent For Fittings = Total
 + = Straight Pipe
 Equivalent

Step 4

Desired Gpm Flow = _____ (Rated Pump Capacity)

Step 5

Using Answers From Steps 3 & 4 Use Chart B To Determine Head Loss For Pipe And Fittings.

Head Loss For Pipe And Fittings =

Step 6

Using Chart C, Determine Suction Hose Head Loss For Length Of Suction Hose Used To Connect The Pump To The Hydrant.

Suction Hose Head Loss =

Step 7

Static Lift =

Step 8

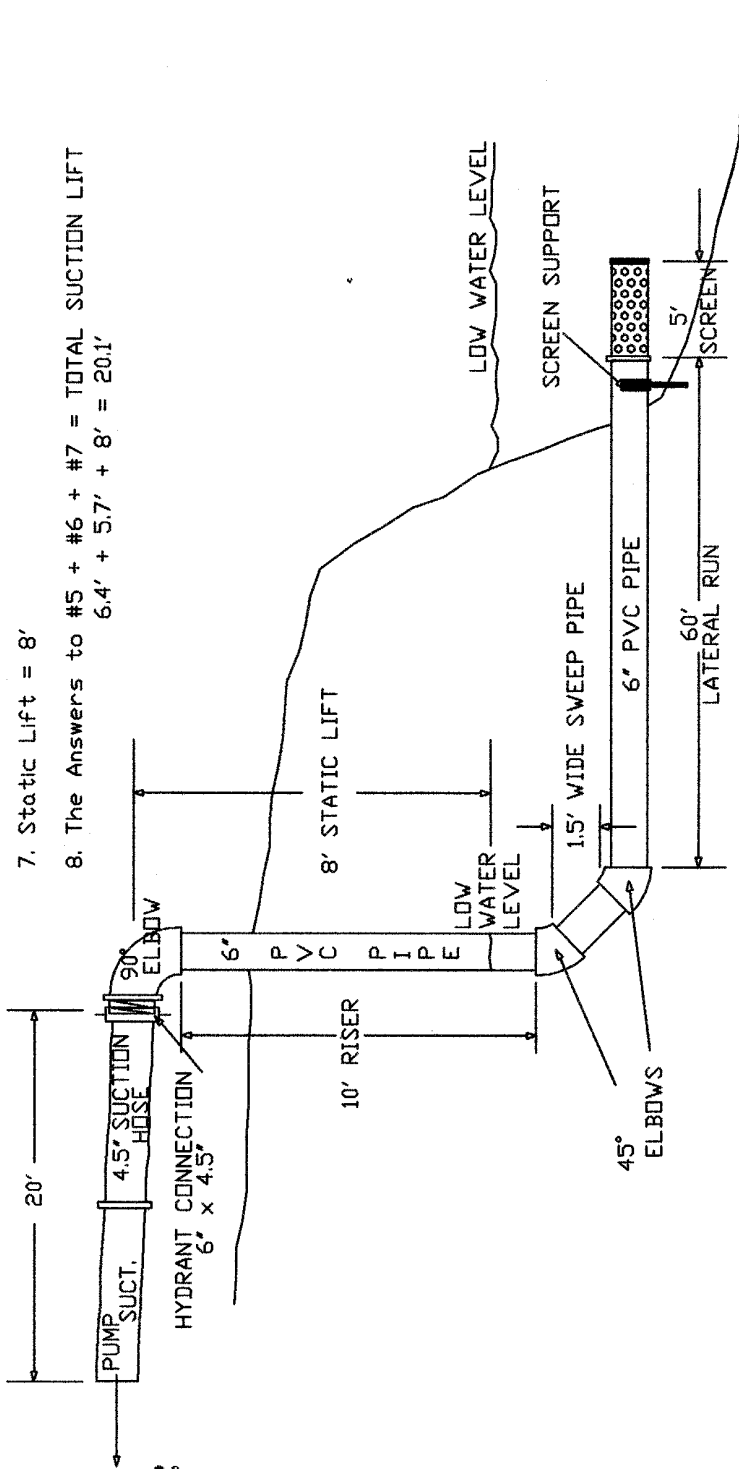
Add The Answers From Steps 5, 6, & 7 Together To Get Total Suction Lift.

#5 + #6 _____ + #7 _____ = Total Suction Lift

If Total Suction Lift Is Greater Than 20-25 Feet, The Pump May Not Be Able To Flow Its Rated Gpm!

Example 1

1. Lateral + Screen + Riser + Wide Sweep Pipe = STRAIGHT PIPE
 $60' + 5' + 10' + 1.5' = 76.5'$
2. 2-45 Elbows + 1-90 Elbow + Hydrant Connection (Chart A) = STRAIGHT PIPE EQUIV.
 $15' + 16' + 2.5' = 33.5'$
3. STRAIGHT PIPE + STRAIGHT PIPE EQUIV. = TOTAL STRAIGHT PIPE EQUIV.
 $76.5' + 33.5' = 110'$
4. Desired GPM Flow - 1000 GPM
5. Head Loss for Pipe & Fittings (Chart B) = 6.4'
 $5.8' \times 110' / 100' = 6.4'$
6. Head Loss in Hard Rubber Suction Hose (Chart C) = 5.7'
 $28.5' \times 20' / 100' = 5.7'$
7. Static Lift = 8'
8. The Answers to #5 + #6 + #7 = TOTAL SUCTION LIFT
 $6.4' + 5.7' + 8' = 20.1'$



This form is required under Section 30.12(3), Wis.Stats. Refusal to provide this information may result in the dismissal of your application. Personally identifiable information on this form will be used for no other purpose.

Landowner's Name		Project Address		Project Location _____ 1/4, _____ 1/4,	
Street or Route				Section _____, T _____ N, R _____ (E) (W)	
City, State, Zip Code		() City () Town () Village of			
Home Telephone No. ()	Work Telephone No. ()	Fire Number	Tax Parcel No.	County	Name of Waterway

I hereby certify that the information contained herein is true and accurate. I am the owner of the riparian property or am the duly authorized representative and may sign this application on behalf of the owner(s) of said property. I have read and understand all of the conditions of this permit and attached pages and will construct the above-mentioned project in compliance with all such conditions. I understand that failure to comply with any or all of the provisions of the permit renders the authorization contained herein null and void and may result in a fine and/or imprisonment under the provisions of s. 30.12(5), Wis.Stats. or forfeiture under s. 30.15, Wis.Stats.

Printed or Typed Full Name of Applicant		Signature of Applicant		Date signed	
Printed or Typed Full Name of Contractor		Address		Phone Number	

ATTENTION! YOU MUST COMPLY WITH THE ATTACHED PERMIT CONDITIONS

FINDINGS OF FACT

1. The Department and the applicant have completed all procedural requirements and the project as permitted will comply with all applicable requirements of Wisconsin Administrative Code and Wisconsin Statutes.
2. The proposed project will not impact wetlands, materially obstruct navigation, is not detrimental to the public interest, and will not adversely affect water quality if the project is constructed in accordance with this permit.
3. The Department has determined that the granting of this permit would not be a major state action significantly affecting the quality of the human environment.

CONCLUSIONS OF LAW

1. The Department has authority under s. 30.12(3), Wis.Stats., and applicable Wisconsin Administrative Codes.
2. The Department has complied with s. 1.11, Wis.Stats.

NOTICE OF APPEAL RIGHTS

If you believe that you have a right to challenge this decision, you should know that the Wisconsin statutes and administrative rules establish time periods within which requests to review Department decisions must be filed. To request a contested case hearing pursuant to s. 227.42, Wis.Stats., you have 30 days after the decision is mailed, or otherwise served by the Department, to serve a petition for hearing on the Secretary of the Department of Natural Resources. All requests for contested case hearings must be made in accordance with section NR 2.05 (5), Wis. Adm. Code. This section of the code requires that the grounds for the petition for hearing be identified and that the desired changes be described. Pursuant to section NR 2.05 (5) Wis. Adm. Code, and section 227.42, Wis.Stats., you are required to include specific information demonstrating all four of the following:

1. The substantial interest of the petitioner which is injured in fact or threatened with injury by the Department's action or inaction;
2. That there is no evidence of legislative intent that this interest is not to be protected;
3. That the injury to the petitioner is different in kind or degree from the injury to the general public caused by the Department's action or inaction ; and
4. That there is a dispute of material fact (you must specify the disputed facts).

This notice is provided pursuant to s. 227.48(2), Wis.Stats.

LEAVE BLANK - DEPARTMENT OF NATURAL RESOURCE USE ONLY	
STATE OF WISCONSIN - DEPARTMENT OF NATURAL RESOURCES For the Secretary	
Issued By _____	Date Signed _____
Title _____	Fee Received \$ _____

Dry Hydrant Permit Conditions

1. Your accepting this permit and beginning to construct the project means that you have read, understand and agree to follow all conditions of this permit.
2. You must submit a photograph of the completed project to the Department within 10 days of project completion.
3. This permit is not valid unless you have obtained all required approvals from other LOCAL, STATE and FEDERAL jurisdictions.
4. The dry hydrant:
 - a. May not be placed in a wetland or in a manner that adversely impedes surface or subsurface flow into or out of any wetland.
 - b. Must have a perforated inlet screen with cap on the inlet end.
 - c. Must be installed with the riserlandward of the ordinary high-water mark (OHWM).
 - d. Must be installed so that the inlet pipe is covered by at least 3 feet of water during normal low water levels.
 - e. Must be installed within the permittee's riparian zone.
5. The dry hydrant project:
 - a. May not result in the permanent or temporary deposition of fill in any surface water, floodplain or wetland.
 - b. May not result in the waterward extension of the upland.
6. The banks:
 - a. Shall have any grading or excavation confined to the minimum area necessary for construction.
 - b. Proper erosion control measures, including the use of staked hay bales and silt fencing, must be used and maintained during and after the construction of this project. All erodible areas must be immediately seeded and mulched with a fast growing grass mixture. This grass seed mixture must become established and stabilize all erodible areas. These erosion control measures must adequately protect the waterway and wetlands from erosion and run-off.
7. **This permit expires on November 1 of the calendar year following the date of issuance.** No construction may take place after that date unless you obtain a written extension of this permit from the Department before the date the permit expires.
8. You must keep a copy of this permit at the project site at all times until the project is completed.
9. You must allow Department employees access to the project site to make inspections at any time to determine whether the work is in compliance with this permit and any other legal requirements.
10. If necessary the Department may amend this permit by changing or adding conditions to ensure that the project is in compliance with all applicable legal requirements and revoke this permit to protect the public interest.
11. Other conditions: _____

**Copies of this
permit sent to:**

**Conservation Warden
County Zoning Administrator
U.S. Army Corps of Engineers
Local DNR Forester
Water Management Specialist**

DRAWINGS OF PROPOSED ACTIVITY SHOULD BE PREPARED IN ACCORDANCE WITH SAMPLE DRAWING

Location Sketch (Indicate scale.) Show route to project site: include nearest main road and crossroad.

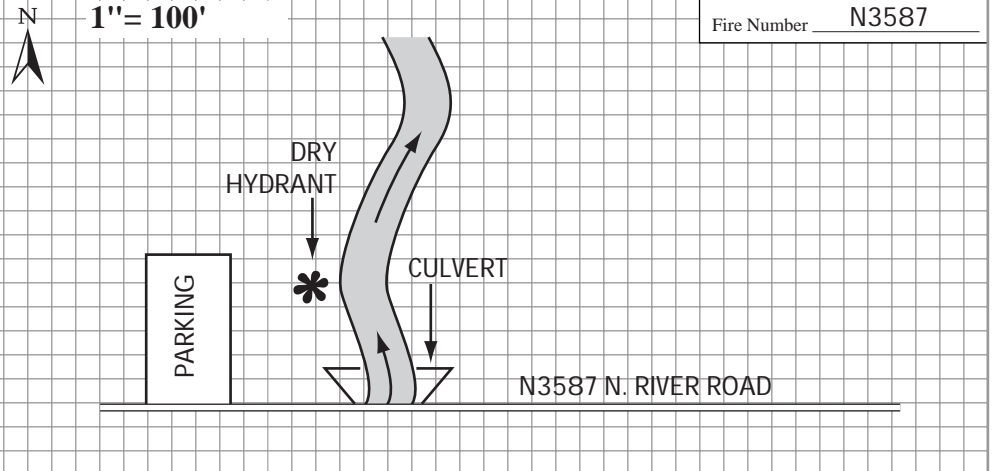
DRY HYDRANT SAMPLE DRAWING

Proposed Materials

18" diameter PVC pipe with perforated inlet screen

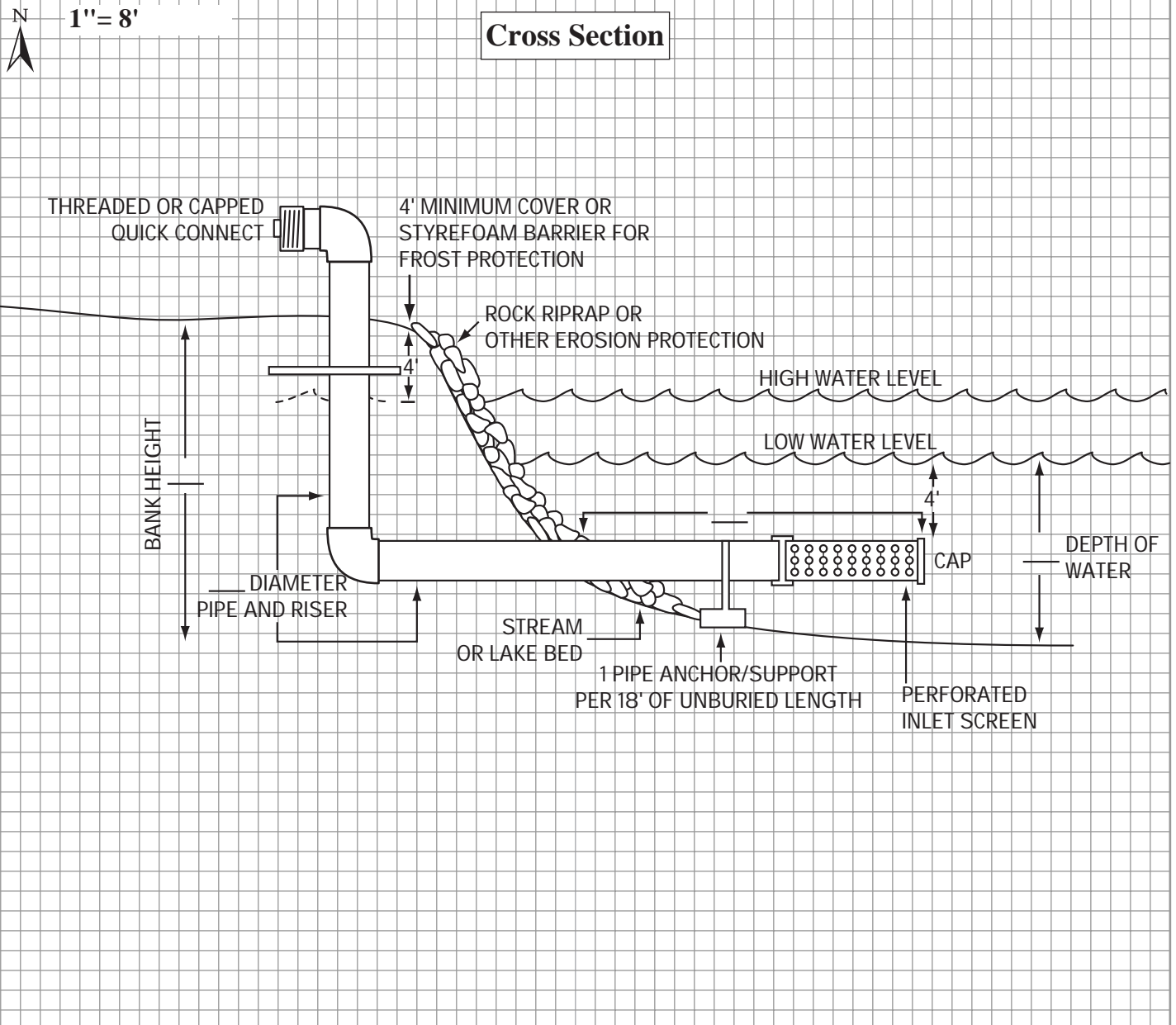
6-12" diameter rock riprap

Additional erosion controls:



Fire Number N3587

Project Plans. (Include top view and typical cross sections. Clearly identify features and dimensions or indicate scale.) Use additional sheets if necessary.



DRAWINGS OF PROPOSED
ACTIVITY SHOULD BE
PREPARED IN ACCORDANCE
WITH SAMPLE DRAWING

Location Sketch (Indicate scale.) Show route
to project site: include nearest main road and crossroad.

Proposed Materials



1" = _____ ft.

Fire Number _____

Project Plans. (Include top view and typical cross sections. Clearly identify features and dimensions or indicate scale.)
Use additional sheets if necessary.

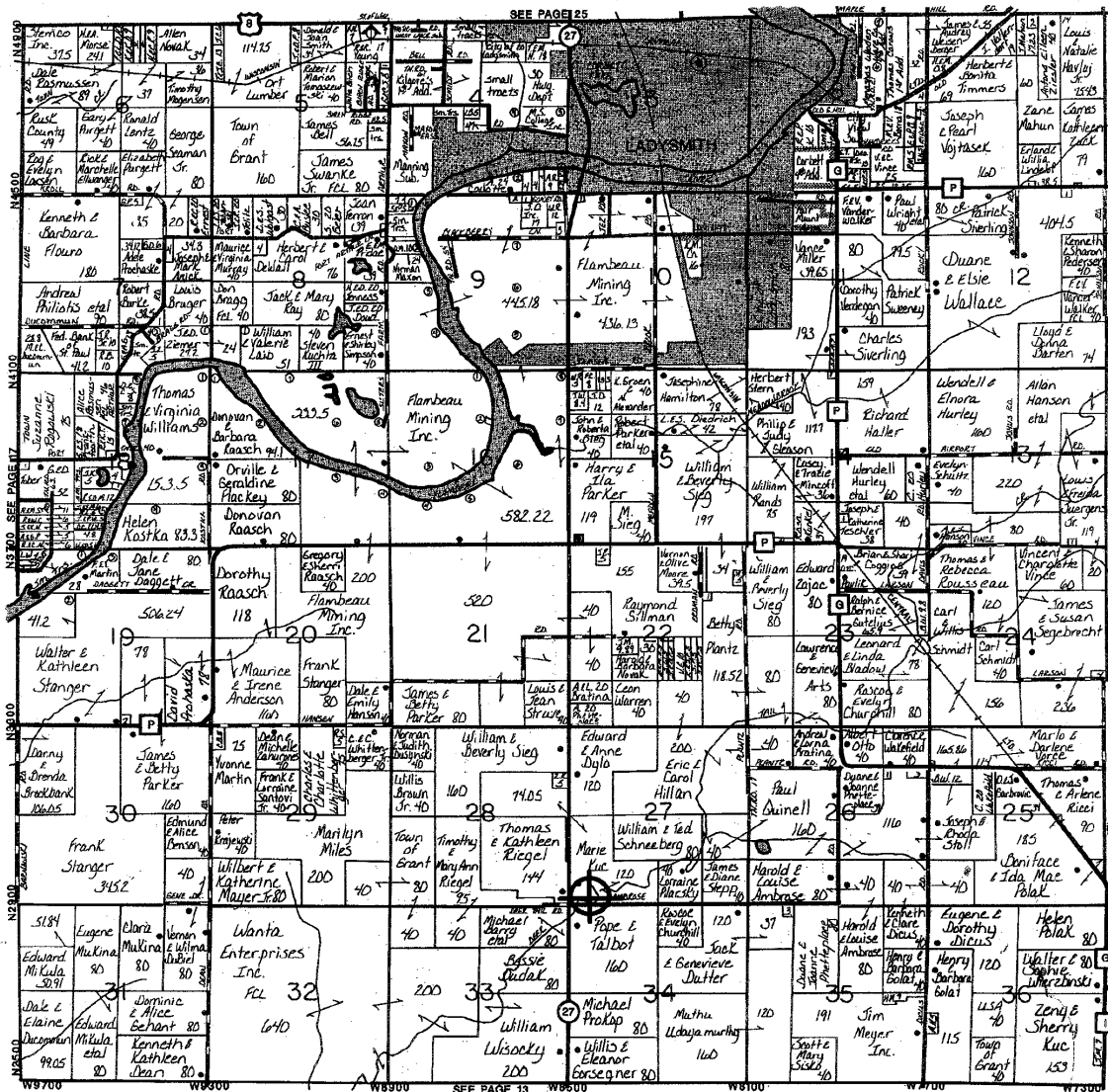


1" = _____ ft.

Cross Section

GRANT

T.34N. - R.6W.



Appendix D
LAND USE AGREEMENT

TO WHOM IT MAY CONCERN:

This agreement, made the 1st day of June, 1985, by and between Chester Heiny (Owner) of Ladysmith, Wisconsin, and Ladysmith Fire Department of Ladysmith, Wisconsin, (Permittee), to enter upon and use the following described area located on CTH P, West of WSH 27, in Rusk County, Wisconsin.
(Legal description of property)
E 1/2 of SWSE Section 24, T34N, R7W

for the purpose of installation of a dry fire hydrant for drafting water. In order to accomplish this purpose the Permittee intends to place or construct the following items on the above-described land:
6" PVC pipe and guards, with pipe terminating in a fire department connection.

This agreement shall be in effect commencing the 1st day of June, 1985.

It is understood by the Owner and the Permittee that this agreement is subject to the following conditions:

1. The Owner may terminate this agreement by written notice if the continued use of this land by the Permittee will interfere with present or future management objectives of the Owner for the above-described area, or the Permittee breaches any terms or condition contained in this agreement.
2. Neither this agreement nor any right or duty in whole or in part by the Permittee under this agreement may be assigned, delegated or subcontracted without the written consent of the Owner.
3. All items placed on the property of the Owner by the Permittee shall remain the property of the Permittee. If this agreement is terminated, the Owner shall permit the Permittee adequate time to remove said property and return the land to its natural state.
4. All stumps, slash, waste materials and other debris shall be disposed of by the Permittee as directed by the Owner.
5. The Permittee shall be responsible for obtaining any and all permits required for constructing items placed on the lands of the Owner.
6. No cutting or trimming of trees shall be done unless approved by the Owner.
7. All signs, postings and other markers shall conform to all codes and local ordinances and shall be provided by the Permittee. The Permittee retains ownership of all signs or postings.
8. The Permittee shall maintain the area under this agreement in a safe condition at all times.

(Land Use Agreement, Page 2)

9. The Permittee agrees to save, keep harmless, defend and indemnify the Owner and all its officers, employees and agents, against any and all liability claims, costs of whatever kind and nature, for injury to or death of any person or persons, and for loss or damage to any property occurring in connection with or in any way incidental to or arising out of the occupancy, use, service, operation or performance of work in connection with this agreement or omissions of Permittee's employees, agents or representatives.

10. This agreement does not give the Permittee, its members or agents, any rights to hunting, fishing, or trapping. The Owner grants the right to the Permittee to enter the lands under this agreement only for the express purpose as stated by the Permittee.

11. Additional conditions specifically pertaining to this agreed land use will be valid if enumerated in the space provided between this condition and closing signature. Every such addition will be initialed by the Permittee and the Owner.

12.

Ladysmith Fire Department
Permittee
by /s/ Brad Scheurer, Chief

Chester Heiny
Owner
by/s/ Chester Heiny

Rusk Co. Highway Dept.
Owner--Highway Right-of Way

/s/ Ken Zimmer
Highway Commissioner
June 1, 1985

June 1, 1985

Appendix E

85-57

RESOLUTION
--TO ENTER INTO LAND USE AGREEMENTS
FOR FIRE DEPARTMENT INSTALLATION OF
FIRE FIGHTING EQUIPMENT ON COUNTY LANDS--

WHEREAS, in the interest of fire protection, Rusk County has been asked to grant certain fire departments the right to install fire fighting equipment on lands owned by the County; and

WHEREAS, the Land and Forestry Committee has reviewed the proposals and believes that they are in the interest of the citizens of the County; and

WHEREAS, land use agreements have been drafted, outlining the understanding of the parties.

NOW, THEREFORE, BE IT RESOLVED by the Rusk County Board of Supervisors that it approves of the Land Use Agreements, attached hereto and incorporated by reference, for use of described County land for installation of fire fighting equipment.

BE IT FURTHER RESOLVED that the Board Chairman and County Clerk are authorized to execute the same.

/s/ Marvin Hanson, Chr. Rusk Co. Board

/s/ Richard Sargent, Rusk Co. Clerk

PASSED BY COUNTY BOARD AT THEIR
SEPT. 1985 MEETING

RECOMMENDED WAY TO INSTALL HYDRANT

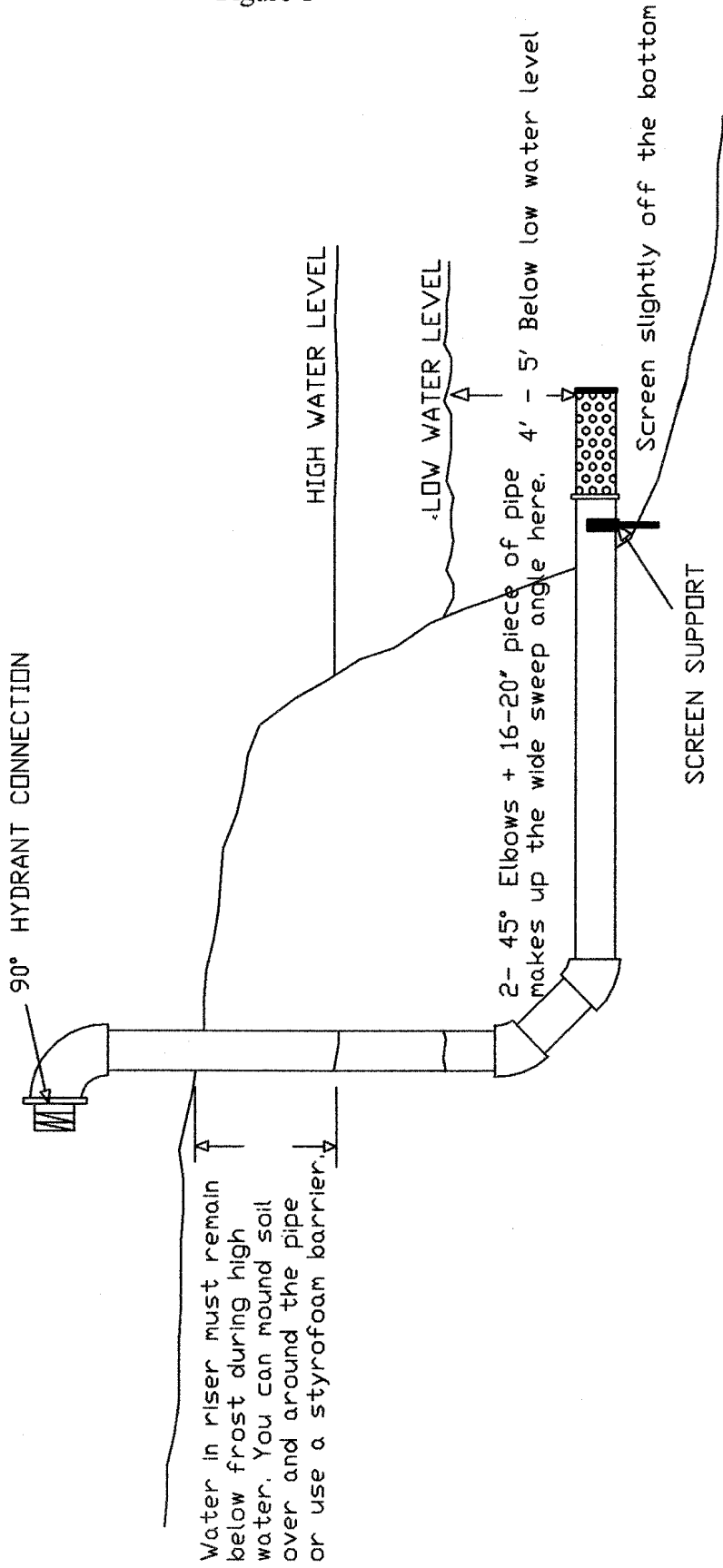


Figure 1

OPTIONAL INSTALLATION METHOD

Use this option only if you have a steep bank such that the backhoe cannot reach deep enough to maintain a level trench cut to the riser or if you have a long uphill run. The idea here is to minimize your use of pipe and to have less angled elbows for your joints. This will help reduce the total suction lift. Remember to maintain adequate soil cover over buried portions of pipe to prevent frost penetration.

PROBLEMS

1. It is hard to dig the trench to match the angle.
2. Takes more time to install.

ADVANTAGES

1. Less pipe used.
2. Less friction loss due to fittings.

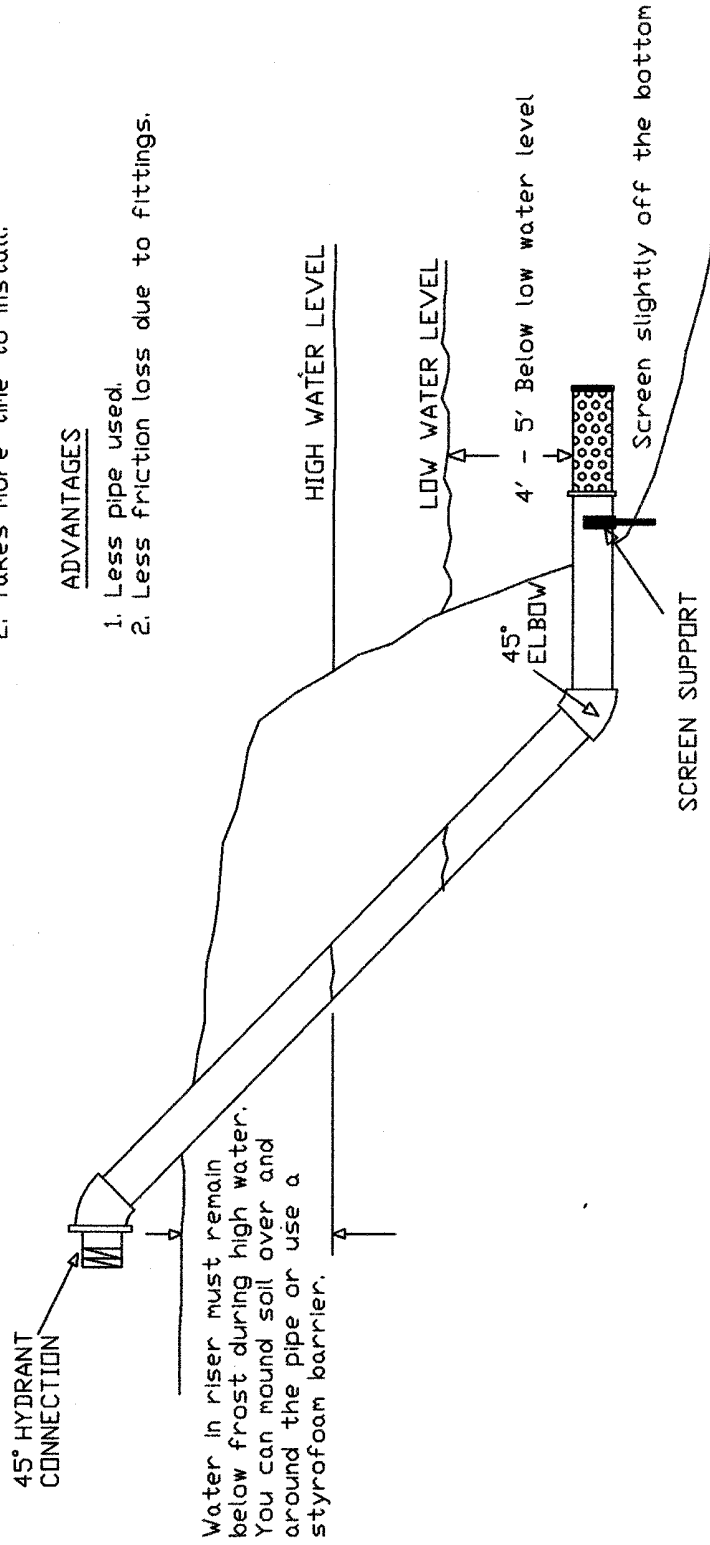
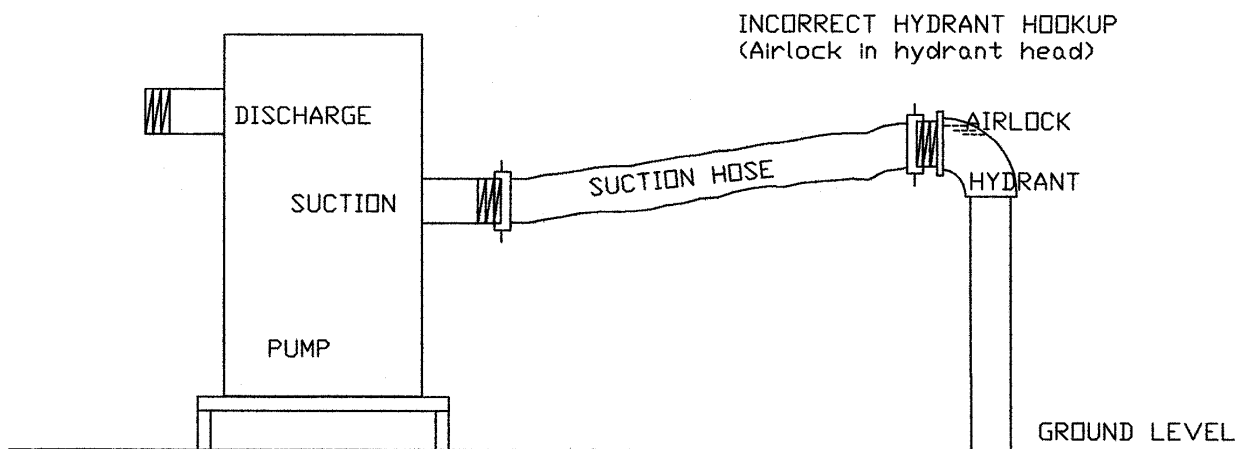
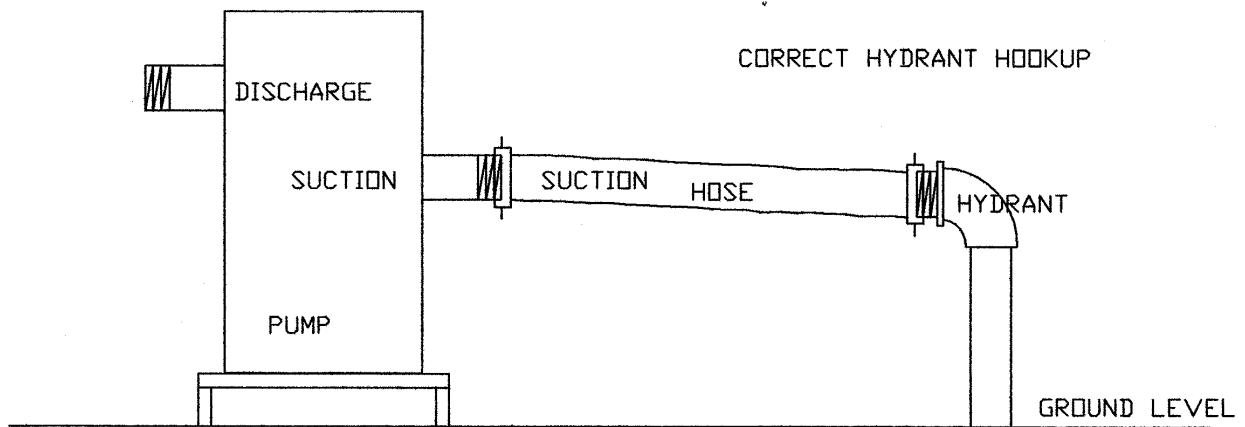
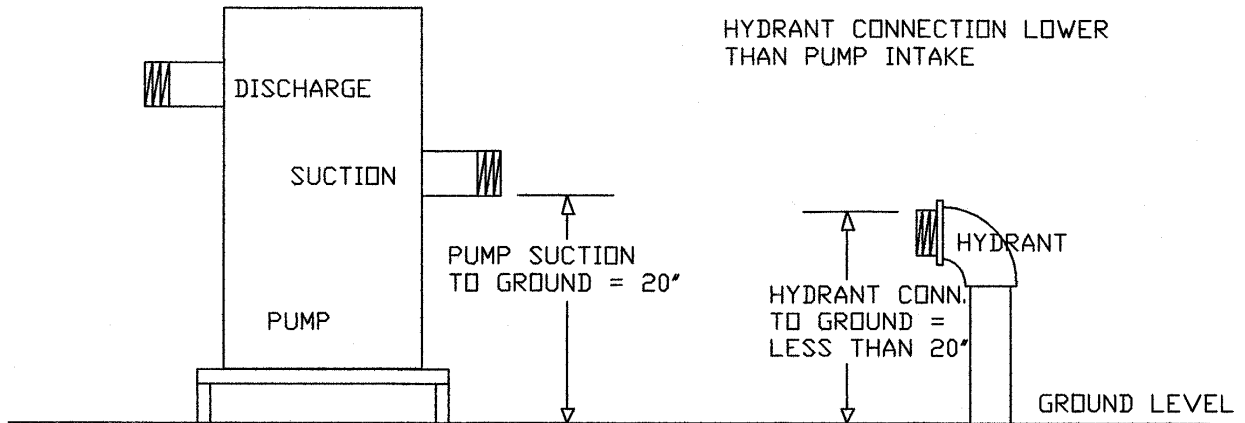
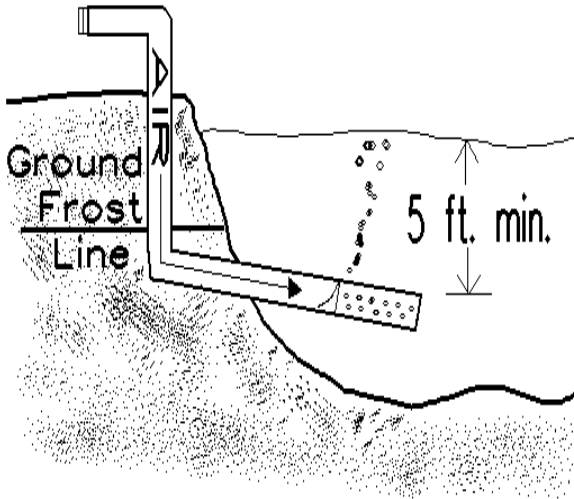


Figure 2

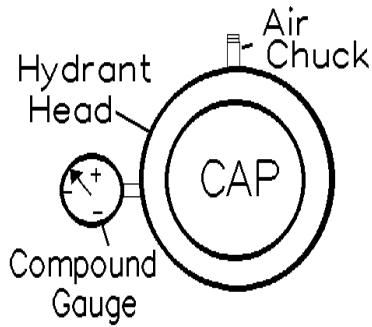
Figure 3



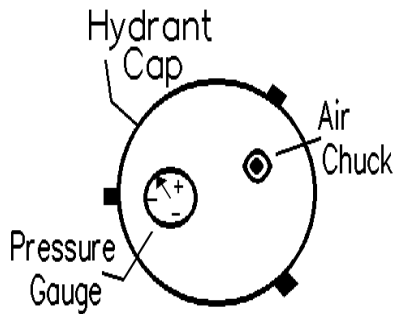


Seasonal Hydrant Adaptation

"Seasonal hydrants" may be installed in areas where frost would freeze any water in the hydrant pipe. The Wascott VFD developed a system to prevent freezing by injecting air into the hydrant thereby displacing the water below the frost line. With the water displaced below the frost line, the hydrant should be useable year around for drafting purposes. Air is injected into the hydrant until it bubbles out of the screen or the pressure gauge ceases to rise. This low pressure air should not cause a safety problem, but all personnel should be advised to remove the hydrant cap slowly to prevent any possible injury. The air gauge should be checked periodically to be sure the water remains displaced.



METHOD 1: Drill and tap a compound gauge and air chuck into the hydrant head. Be sure to seal all threads. This method has the advantage that when drafting, there is an indication of the amount of suction your pump is producing. If you cannot draw a vacuum, you have an air leak. The disadvantage of this method is that damage to either the gauge or air chuck could result in making the hydrant unusable by creating an air leak.



METHOD 2: Install an air pressure gauge and air chuck in the cap of the hydrant by drilling and tapping into the metal. The chain for the hydrant cap will have to be removed. Use Teflon tape on the threads of the gauge and chuck. This method has the advantage that if the chuck or gauge is damaged, it will not effect the air tight integrity of the hydrant while drafting because the cap is removed.

FIELD NOTES



