Rural Fire Command

by

Larry Davis

Issue #35 — November 2005

A Dry Hydrant Success Story

How one county maximizes its dry hydrant output

RFI
RURAL FIREFIGHTING INSTITUTE

Training America's Rural Fire & Emergency Responders

A Message the Author, Larry Davis

In October 2002, I started writing the monthly "Rural Fire Command" column for *FireRescue Magazine*. Since that time, the RFC column has been carried in just about every subsequent issue of the magazine.

As time has passed, several readers have contacted me about obtaining back issues of the column. Some expressed an interest in acquiring the articles in Powerpoint format for use in training programs.

This led to, my adaptation of the RFC columns to the PowerPoint format. These PowerPoint programs are being made available through the combined efforts of *FireRescue Magazine* and the Rural Firefighting Institute.

Dry Hydrants: A Success Story

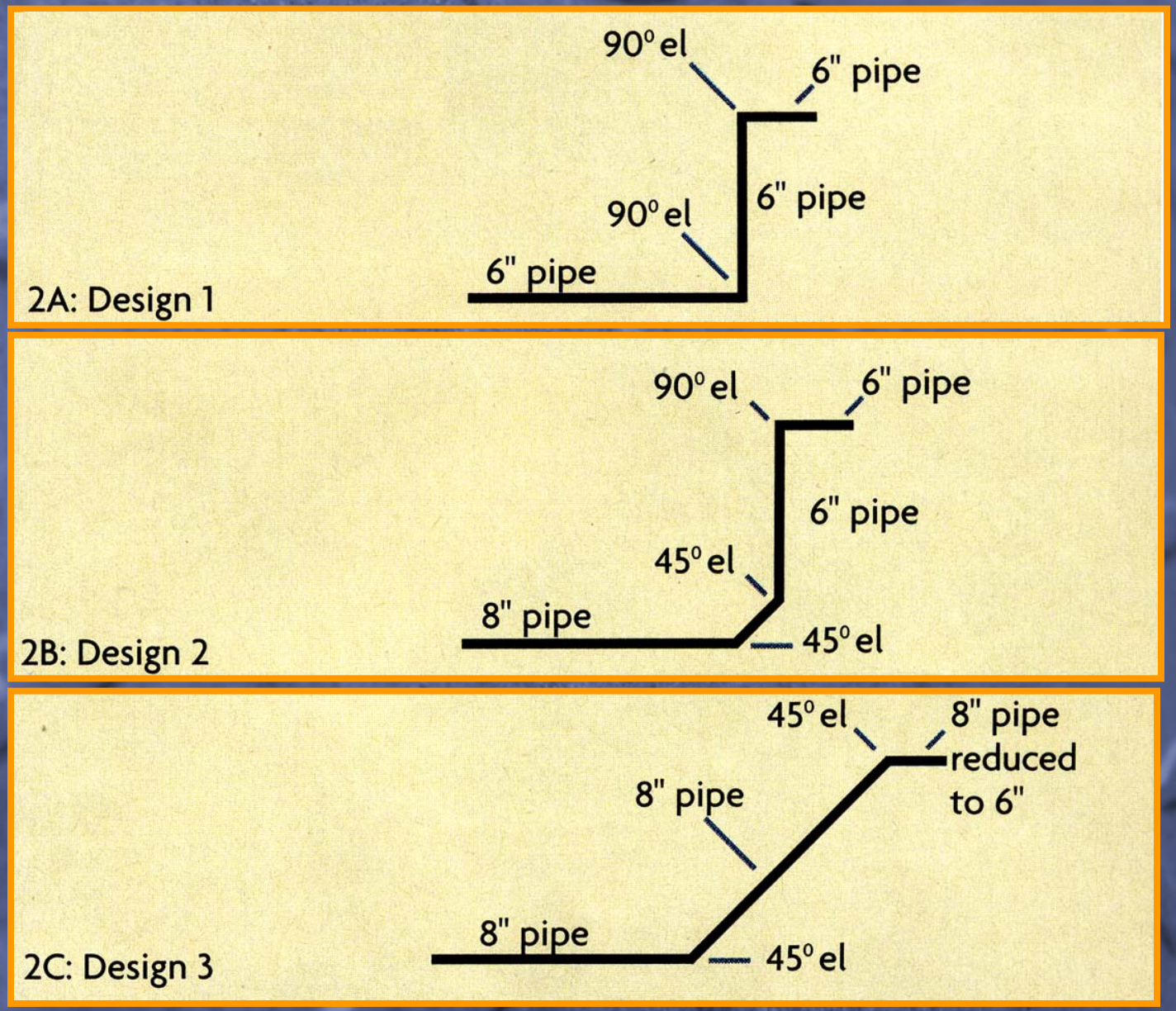
How one county maximizes its dry hydrant output

The greatest compliment to those of us at *FireRescue* Magazine is the feedback we receive from readers who want to share success stories that relate to or are a direct result of a subject we covered in one of our columns. This month's Rural Command column has come about because of a recent discussion on how to maximize flow from dry hydrants.

The discussion stemmed from "Fluid Motion, Part 3: Dry hydrants are really pump suction extensions" (December 2004, p. 86), in which I touted the use of 8" pipe and 45° elbows instead of the traditional 6" pipe and 90° elbows for dry hydrants. The article prompted a letter to the editor (June 2005, p. 30) and several e-mails; as a result, I replied to the letter and asked readers for their thoughts. One person in particular, Chief Patrick M. Schoeffel of the Powhatan County (Va.) Fire Department (PCFD), wanted to share his department's experience with *FireRescue* readers. He not only responded in writing, but he's also been kind enough to share the accompanying photos and data developed by his department. I greatly appreciate the work the PCFD has done and the time and effort Chief Schoeffel took to share this information.

Figure 1. During a water-on-wheels operation, PCFD Engine 4 fills tankers at 1700 gpm from an 8” dry hydrant (a 20-ft horizontal distance and an 8-ft lift).

Figure 2. Powhatan Co. Dry-Hydrant Designs



If you use 6" PVC pipe, you can take a 1500-gpm pumper capable of flowing over 2000 gpm & reduce its flow by 50%.

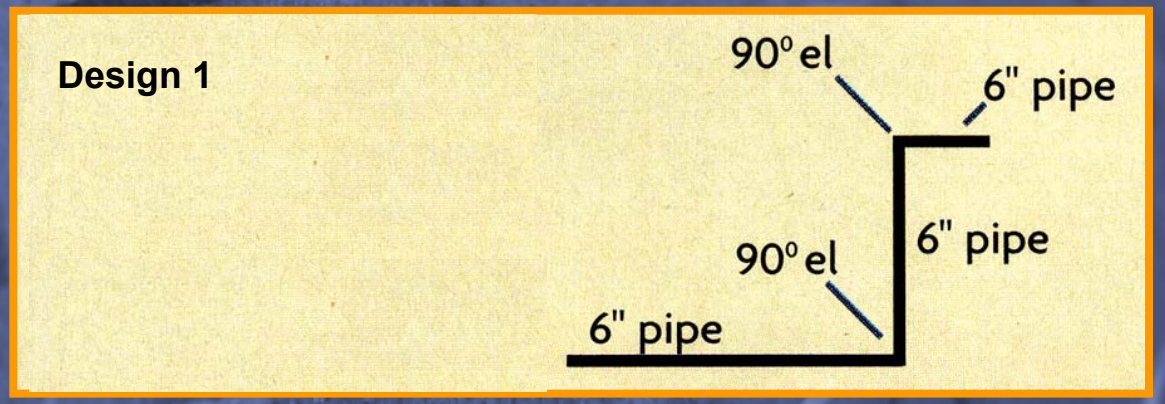


Figure 3. One of the original (Design 1) dry hydrants: It has a 25-ft horizontal run of 6” pipe and a 12-ft lift. It can supply only 900 gpm.

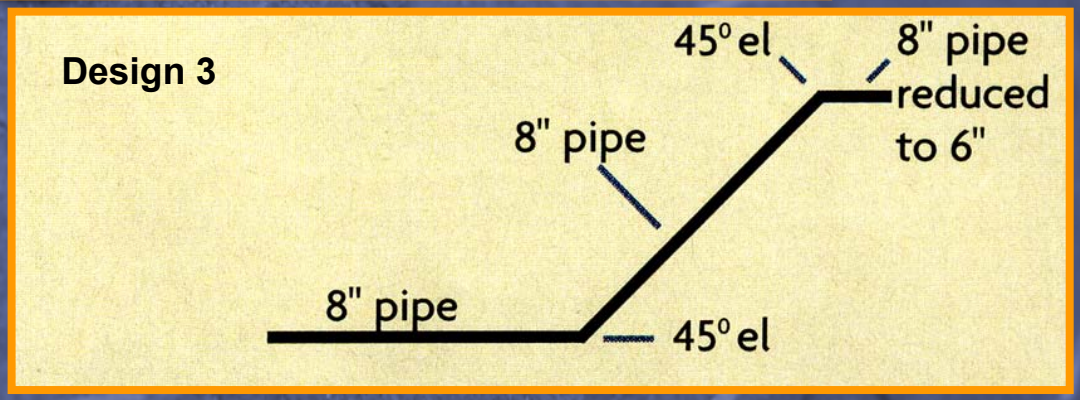


Figure 5. This 8” dry hydrant (Design 3) can supply 1800 gpm. The horizontal run is 20 ft (8” pipe) and the lift is 8 ft.

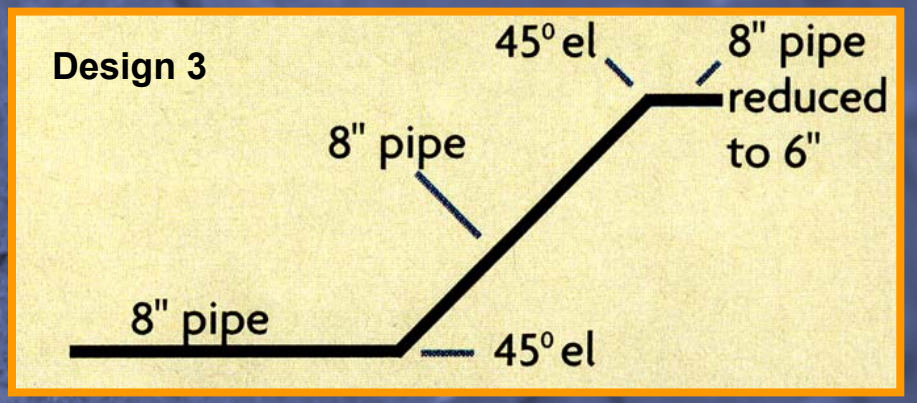


Figure 6. This 8” dry hydrant (Design 3) runs 260 ft (8” pipe) and has a 12-ft lift.

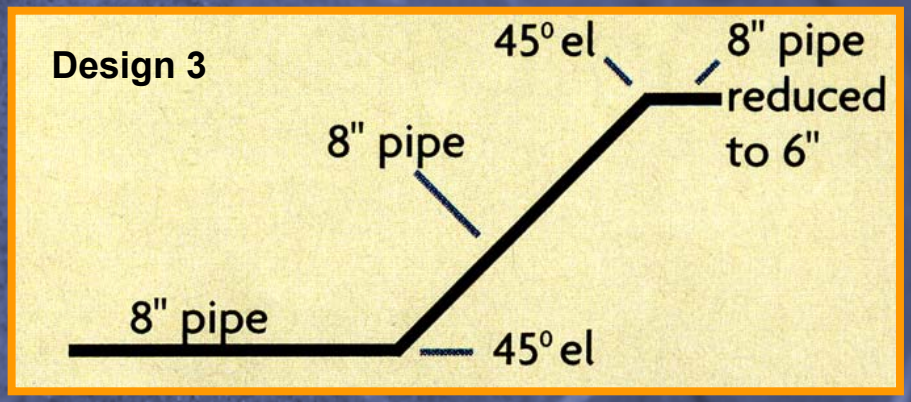


Figure 7. PCFD E-4 delivers almost 1900 gpm during a 2003 pump class. The pumper drafts through a dry hydrant (Design 3) with a 40-ft run of pipe and a 7-ft lift.

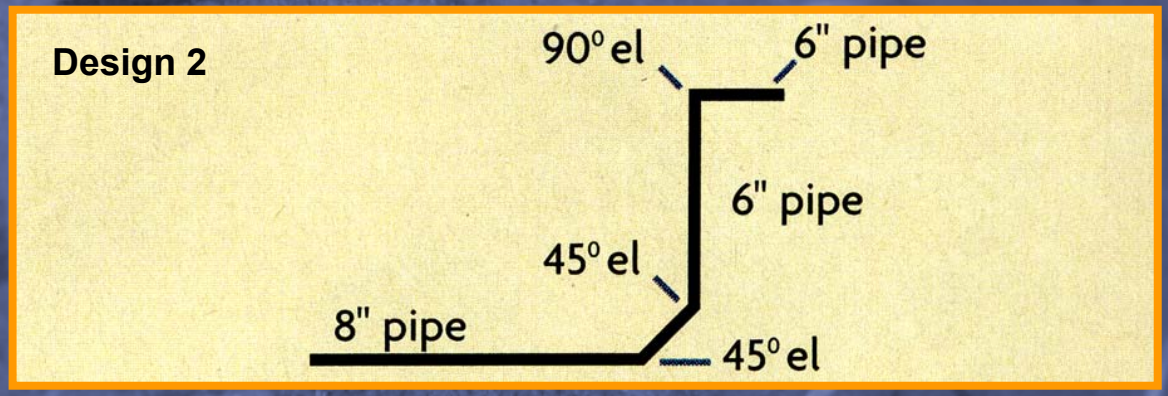


Figure 10. Engine 1 delivers 1700 gpm from a dry hydrant (Design 2). This design uses 8” PVC pipe for the horizontal run, two 45° els, and a 6” PVC riser to a 90° el.

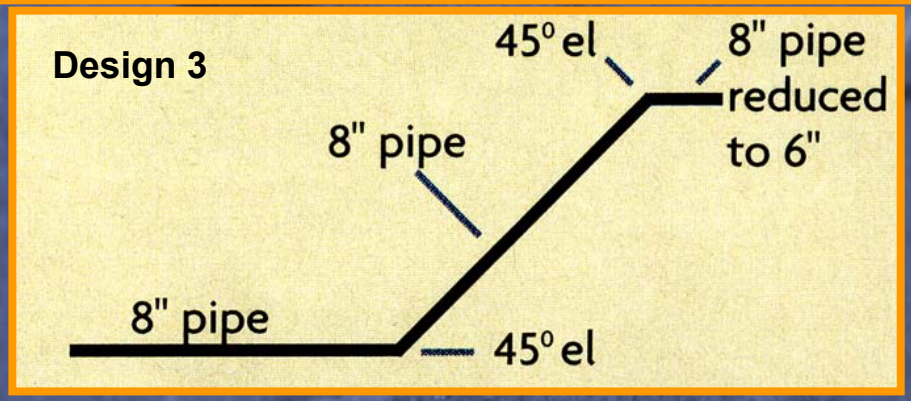


Figure 11. Engine 1 delivers 2040 gpm from a dry hydrant (Design 3). The design uses 8” pipe for the horizontal run, one 45° el, and an 8” PVC riser to a 45° el.

The Powhatan Experience

Powhatan County is located about 30 miles from Richmond, and is currently experiencing suburban sprawl similar to many other rural communities. The PCFD is made up of five volunteer fire departments that protect the county's 273 square miles and its 23,000+ population.

A total of 67 dry hydrants have been installed throughout the county, which come in the three different designs shown in Figure 2. Eight of the hydrants consist of 6" PVC pipe and two 90° elbows (Design 1 as shown in Figure 2a); seven consist of an 8" horizontal PVC pipe, two 45° elbows (to make a 90° bend), a 6" vertical PVC pipe and a 6" x 90° elbow (Design 2 as shown in Figure 2b); the remaining 52 consist of 8" PVC pipe with two 45° elbows (Design 3 as shown in Figure 2c).

The first dry hydrants in Powhatan County were installed about 30 years ago, when the PCFD had 750-gpm pumpers. The standard dry hydrant at that time consisted of the traditional design using 6" PVC pipe and two 90° elbows, as shown in Figure 2a, because all the literature on dry hydrants stated that all piping should be at least 6 inches in diameter. The 6" PVC dry hydrants were able to provide the 750-gpm pumpers with decent flows, and life was good.

The department then started improving its water-supply operations by specing larger pumps, purchasing 5" hose and researching dry-hydrant designs. About 15 years ago, the department acquired a copy of my book, *Rural Firefighting Operations, Book 2: The Encyclopedia of Water Supplies and Water Delivery Techniques*. In it, I point out the need for designing dry hydrants to deliver the flows required, and that 8" pipe and 45° elbows should be used to boost delivery rates. As a result, the PCFD established a minimum delivery-rate requirement of 1500 gpm for all new dry hydrants, which in turn led to the development of Design 2 and then Design 3.

The Powhatan Flow Tests

Figure 4 shows the results of flow tests the PCFD conducted using its three dry-hydrant designs. The same 1500-gpm pumper was used for each test, and all dry hydrants consisted of almost identical runs of pipe and lengths; the only variables were pipe diameters and the types of elbows used. As you can see from Figure 4, Design 2 allowed the 1500-gpm pumper to increase its delivery rate by 67% over Design 1. Further, Design 3 increased pumper delivery rates 100% over Design 1 and 20% over Design 2.

"Here is one way to look at it," Chief Schoeffel points out. *If you use 6" PVC pipe, you can take a 1500-gpm pumper capable of flowing over 2000 gpm and reduce its flow by 50%."*

Figure 4: Powhatan Dry Hydrant Flow Tests using a 1500-gpm Pumper.

Test	Design	Flow
1	1) 6" pipe & two 90° els	1,020 gpm
2	2) 8" pipe, & two 45° els, 6" pipe & 90° els	1,700 gpm
3	3) 8" pipe & two 45° els	2,040 gpm

“Here is one way to look at it,” Chief Schoeffel points out. *If you use 6" PVC pipe, you can take a 1500-gpm pumper capable of flowing over 2000 gpm and reduce its flow by 50%.”*

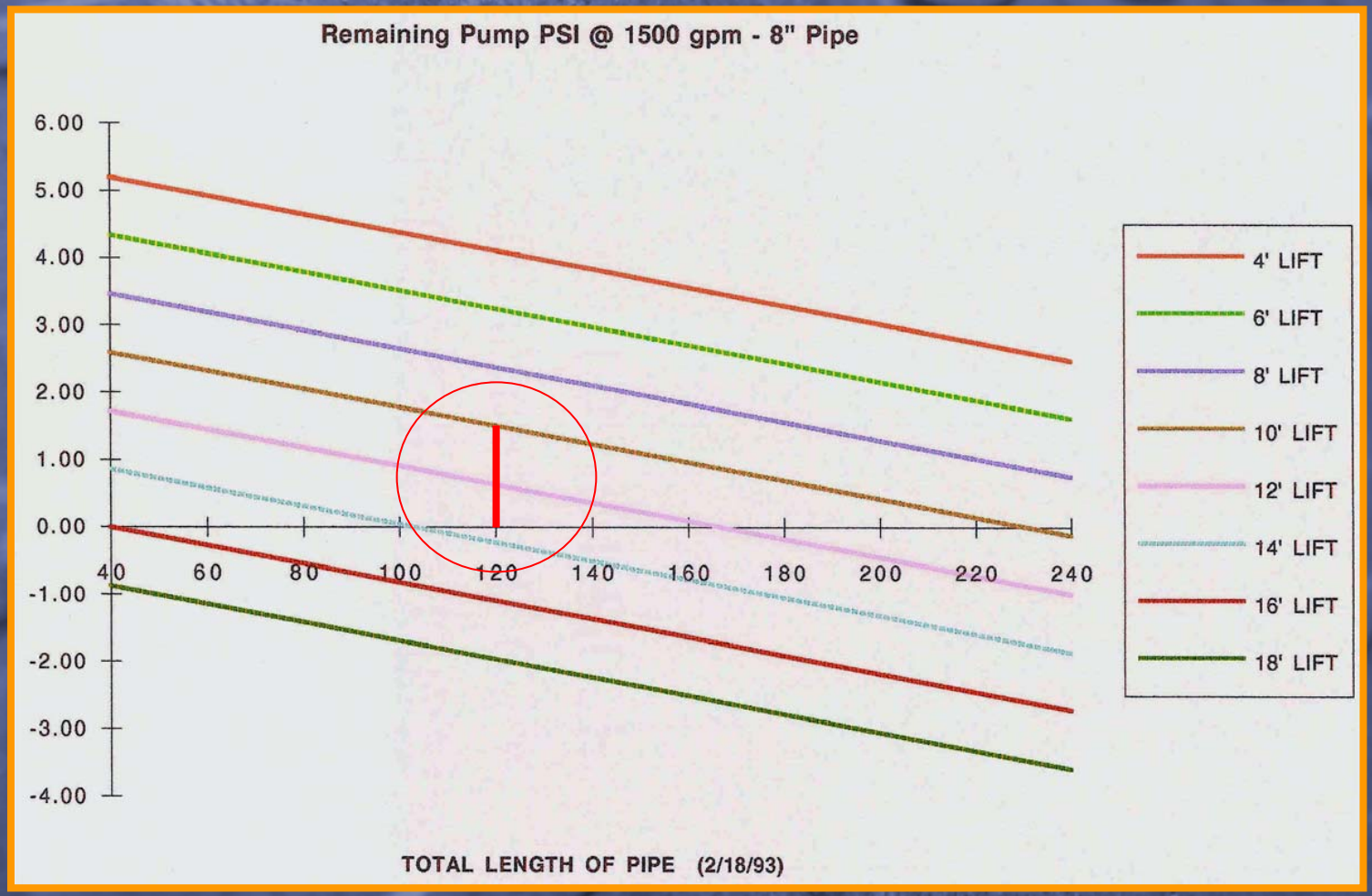
The PCFD Dry-Hydrant Piping Graph

To help simplify dry-hydrant design, Brian Marburger, a friend of Chief Schoeffel and a computer guru, took the dry-hydrant design information from my text and created the graph shown in Figure 8, which can be used to determine whether a given 8” dry-hydrant piping plan will provide the required 1500 gpm. Follow the instructions below to properly use the graph.

1. Go to the potential dry-hydrant site, and determine the total length of 8" pipe (including equivalent lengths for the 45° els) needed for the dry hydrant.
2. Determine the lift in feet.
3. Start at the left end of the horizontal axis on the graph and move to the right to find the total length of 8" pipe required.
4. Draw a vertical line upward or downward to the diagonal line for the required lift.
5. If the vertical line and the diagonal line intersect above the horizontal axis, the hydrant can deliver 1500 gpm. If they intersect below the horizontal axis, it can’t deliver 1500 gpm.

An 8” Dry Hydrant Example

For example, let’s say a dry hydrant requires a total of 120 ft of 8" pipe with a 10-ft lift. Move along the horizontal axis of the graph until you reach 120 feet. Then move vertically to the 10-ft lift line. Since this point lies above the horizontal axis, the proposed dry hydrant will be able to supply 1500 gpm.



What about a 16-ft lift?

Will this same length of pipe work with a 16-ft lift? To answer this question, move to the 120' point on the graph, then move vertically to the 16-ft lift. Since this point lies below the horizontal line, the hydrant can't deliver 1500 gpm.

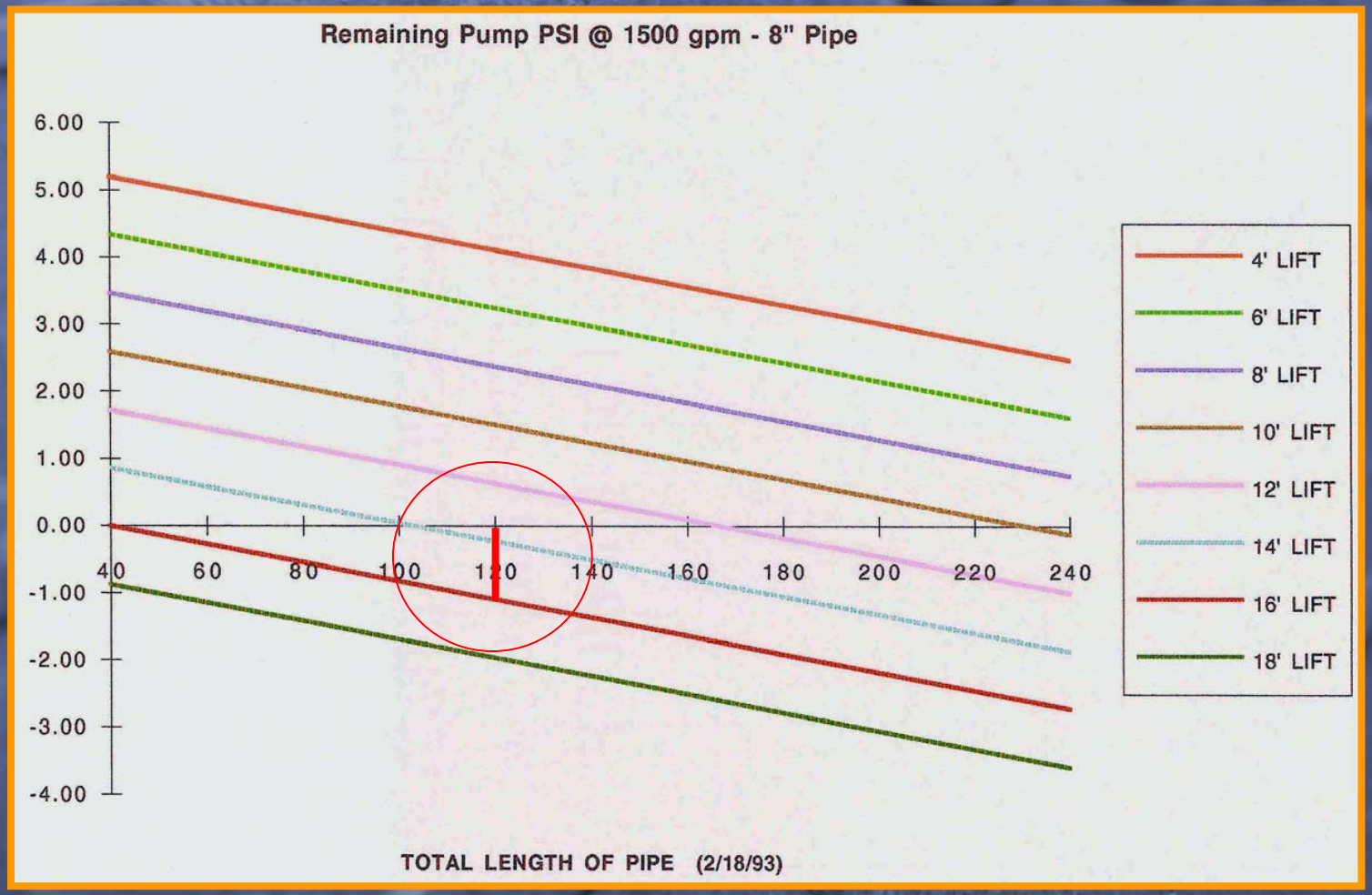
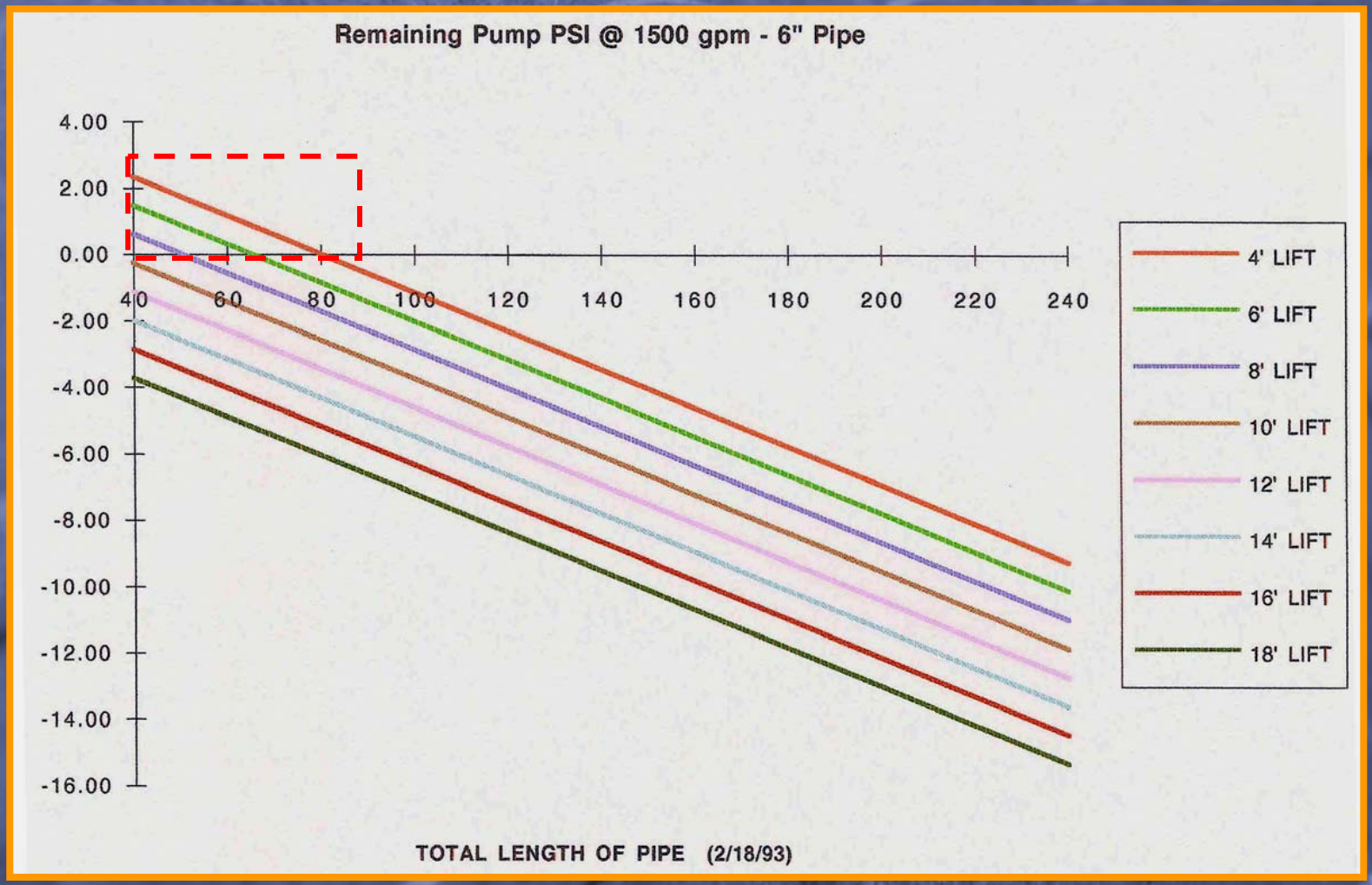
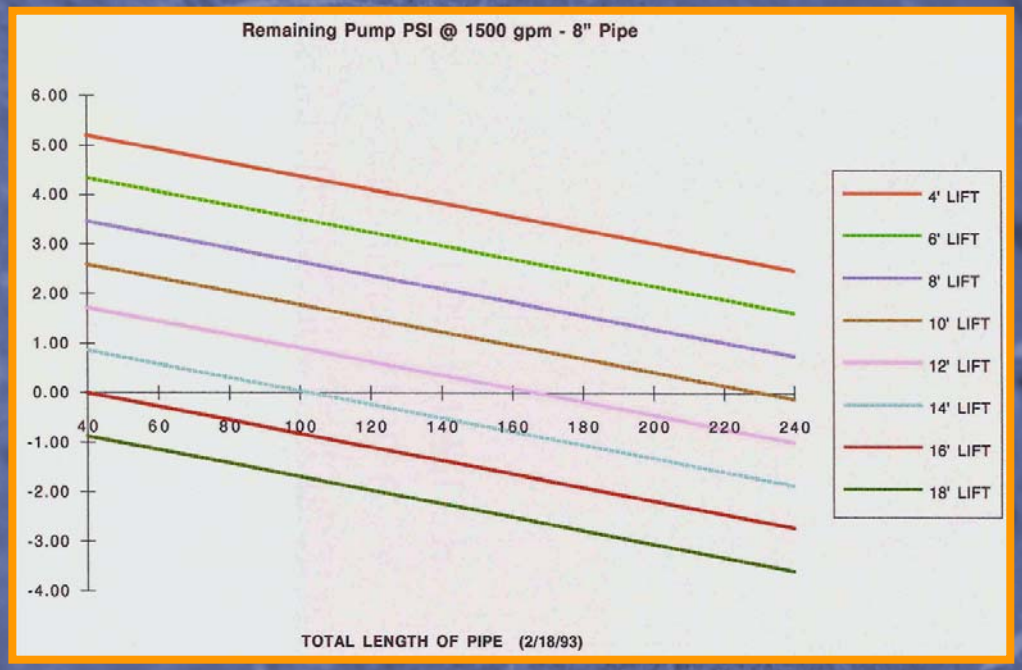


Figure 9. 6” Dry-Hydrant Piping Graph

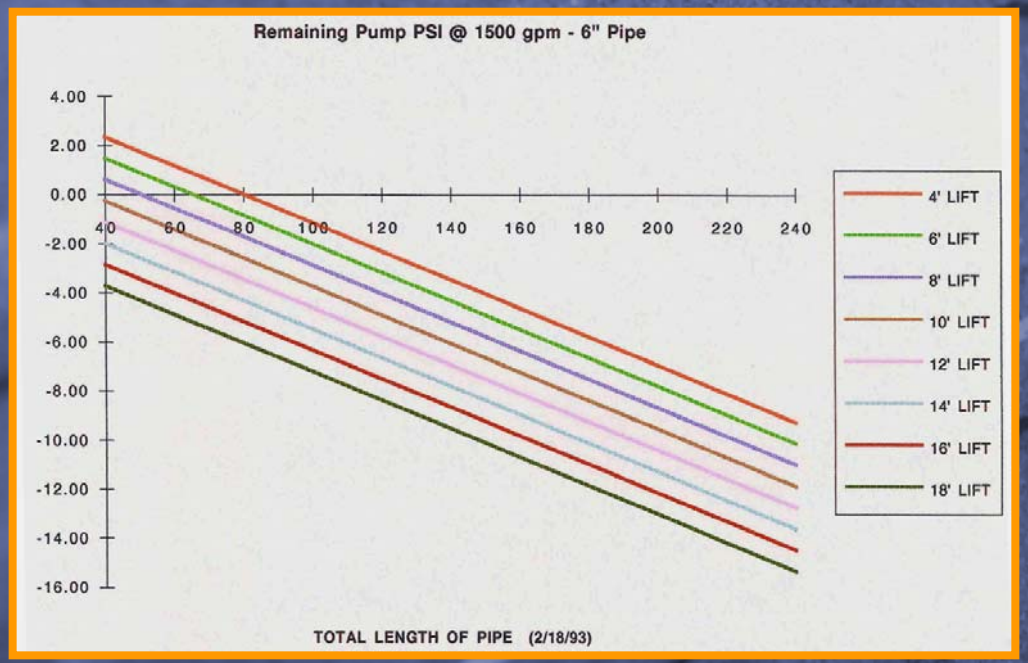
To compare 8” piping to 6” piping, Marburger also created a similar graph for 6" pipe. As you can see by the rectangle, 6" pipe severely limits the potential to flow 1500 gpm from a dry hydrant when compared to 8” pipe.





8” Piping Graph

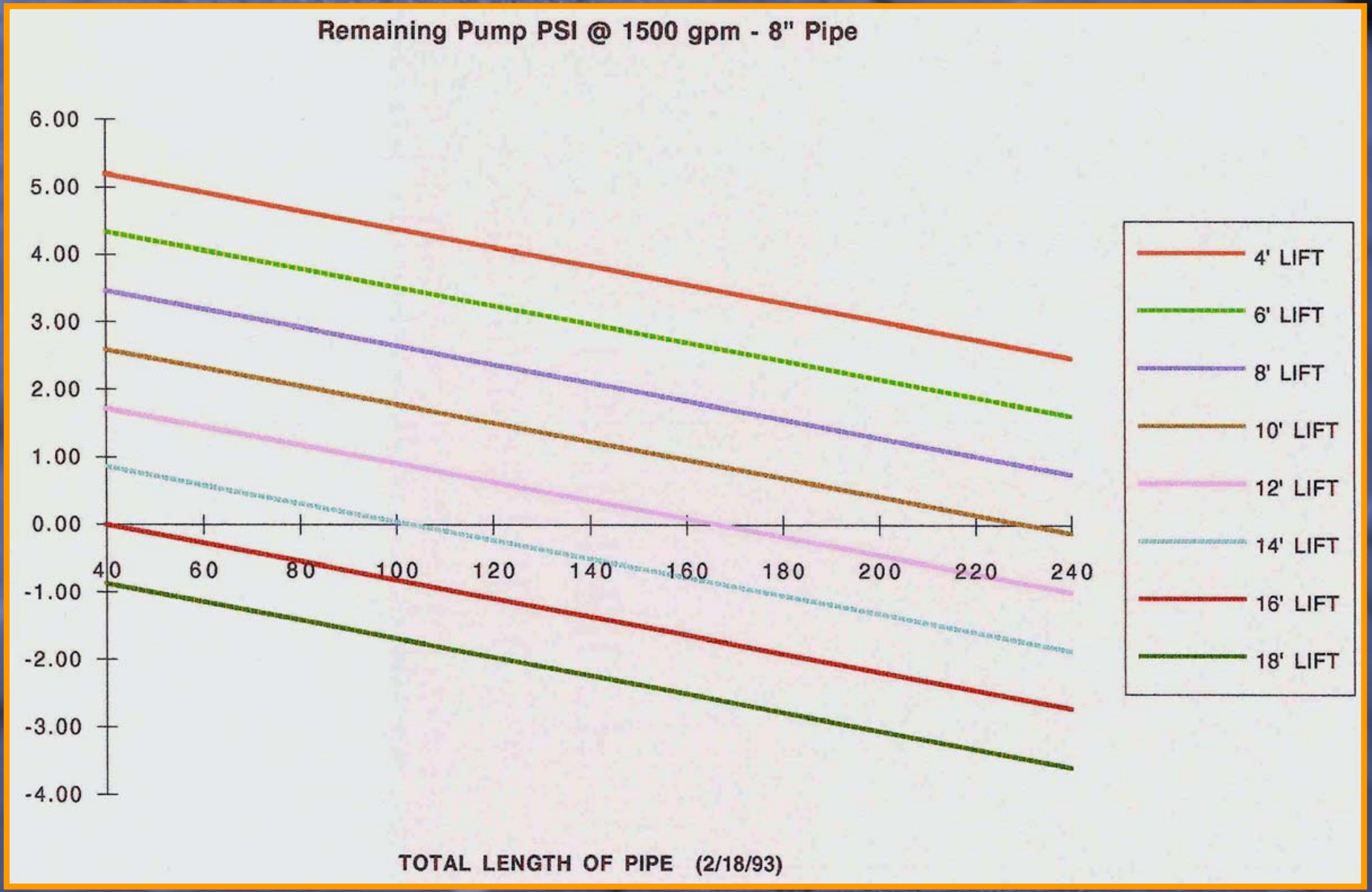
Can deliver 1500 gpm with 220 ft of 8” pipe and a 10-ft lift.



6” Piping Graph

Can deliver 1500 gpm with 80-ft of 6” pipe and a 4-ft lift.

Figure 8. 8” Dry-Hydrant Piping Graph



ISO and Dry Hydrants

The PCFD has used this information to its advantage. All new dry hydrants in Powhatan County are now installed using 8" pipe, and as funds become available, the old-style (Designs 1 and 2) dry hydrants are being replaced. Dry hydrants range in length from 20 ft to 380 ft, and all of them can deliver 1500 gpm.

The work done by the PCFD has also improved its ISO® Public Protection Classification, which has been reduced from a 9/10 split to a 7/10 split.

Until next month, stay safe.

For Questions or comments on this or any of the Rural Fire Command articles, contact the author at ldavis@RFI411.org

About the Author

Larry Davis is a full member of the Society of Fire Protection Engineers, a Certified Fire Protection Specialist, and a Certified Fire Service Instructor II with more than 30 years experience as a fire service instructor. He is Vice President of GBW Associates, and Chairman of the Rural Firefighting Institute.

Davis has conducted more than 400 Rural Firefighting Tactics and Rural Water Supply Operations seminars throughout the United States and Canada. In addition, he has written numerous fire service texts, including *Rural Firefighting Operations*, books I, II, and III. Most recently, Davis co-wrote the *Rural Firefighting Handbook* and *Foam Firefighting Operations*, book I with Dominic Colletti.

RFI
RURAL FIREFIGHTING INSTITUTE

Training America's Rural Fire & Emergency Responders

To obtain any or all of the other issues of the Rural Fire Command column, contact RFI at:

Info@RFI411.org
or
RFI
13017 Wisteria Drive, #309
Germantown, MD 20874-2607
Phone: 800.251.4188

Visit the RFI website at www.rfi411.org to learn of the other training resources and services available from RFI.