

Pipe with 10cm inside diameter

Equivalent Length in Meters

a. Elbow (standard) 4.0

b. Pipe length 10.0

Total Equivalent Pipe Length 14.0

Fittings

Study the variety of tees and elbows: note carefully the direction of flow through

the tee. To determine the equivalent length of a fitting, (a) pick proper dot on "fitting" line, (b) connect with inside diameter of pipe, then using a straight edge

read equivalent length of straight pipe in meters, and (c) add the fitting equivalent length to the actual length of pipe being used.

Source:

Crane Company Technical Paper #409, pages 20-21.

Bamboo Piping

Where bamboo is readily available, it seems to be a good substitute for metal pipe. Bamboo pipe is easy to make with unskilled labor and local materials. The important features of the design and construction of a bamboo piping system are

given here.

Bamboo pipe is extensively used in Indonesia to transport water to villages. In many rural areas of Taiwan, bamboo is commonly used in place of galvanized iron for deep wells up to a maximum depth of 150 meters (492'). Bamboos of 50mm (2") diameter are straightened by means of heat, and the inside nodes knocked out. The screen is made by punching holes in the bamboo and wrapping that section with a fibrous mat-like material from a palm tree, *Chamaerops humilis*. In fact, such fibrous screens are also used in many galvanized iron tube wells.

Bamboo piping can hold pressure up to two atmospheres (about 2.1kg per square centimeter or 30 pounds per square inch). It cannot, therefore, be used as pressure piping. It is most suitable in areas where the source of supply is higher than the area to be served and the flow is under gravity.

Figure 1 is a sketch of a bamboo pipe water supply system for a number of  
  
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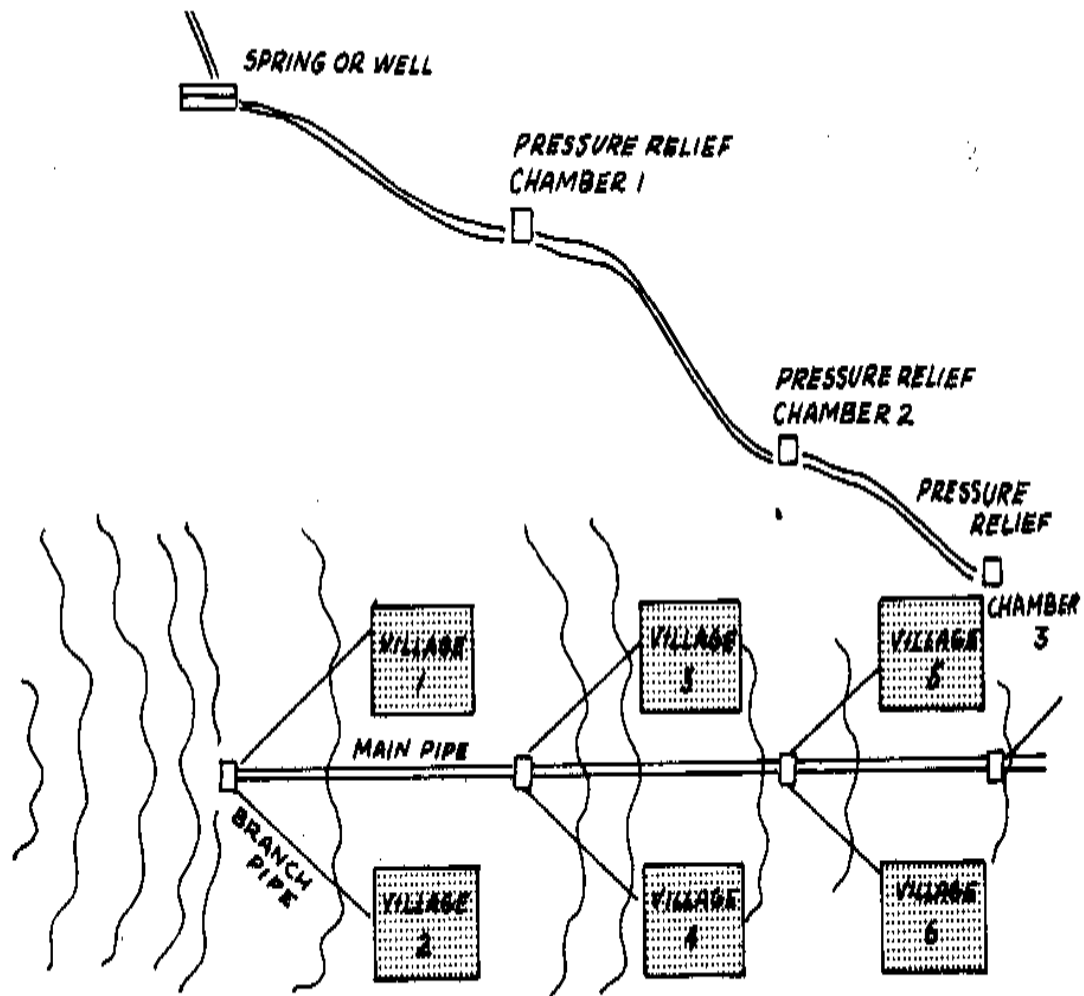
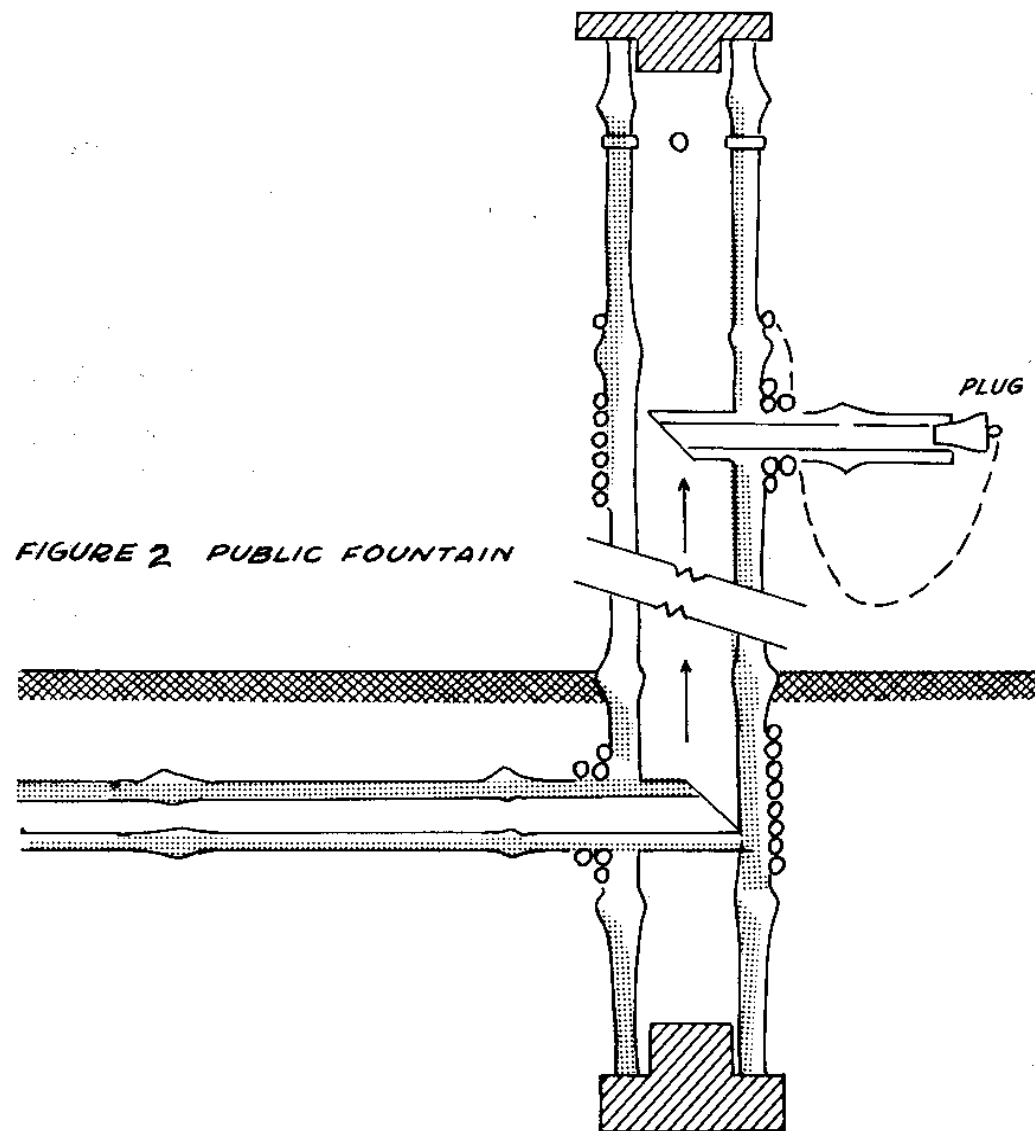


FIGURE 1

villages. Figure 2 shows a public water fountain.

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## Health Aspects

If bamboo piping is to carry water for drinking purposes, the only preservative treatment recommended is boric acid: borax in a 1:1 ratio by weight. The

**recommended**

treatment is to immerse green bamboo completely in a solution of 95 percent water and 5 percent boric acid.

After a bamboo pipe is put into operation it gives an undesirable odor to the water. This, however, disappears after about three weeks. If chlorination is done before discharge to the pipe, a reservoir giving sufficient contact time for effective disinfection is required since bamboo pipe removes chlorine compounds and no residual chlorine will be maintained in the pipe. To avoid possible contamination by ground water, an ever present danger, it is desirable to maintain the pressure within the pipe at a higher level than any water pressure outside the pipe. Any leakage will then be from the pipe, and contaminated water will not enter the pipe.

**Design and Construction****Tools and Materials**

Chisels (see text and Figure 3)

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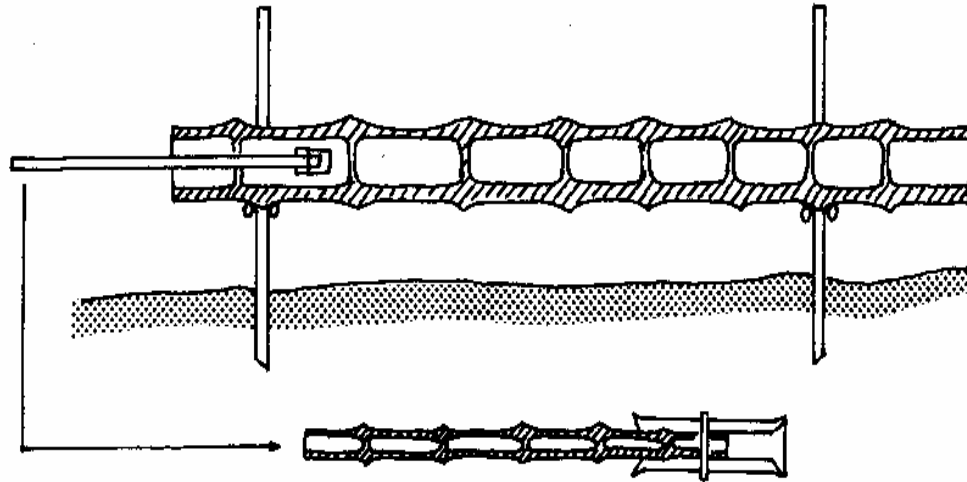


FIGURE 3

Nail, cotter pin, or linchpin

Caulking materials

Tar

Rope

Bamboo pipe is made of lengths of bamboo of the desired diameter by boring out the dividing membrane at the joints. A circular chisel for this purpose is shown in Figure 3. One end of a short length of steel pipe is belled out to increase the

diameter and the edge sharpened. A length of bamboo pipe of sufficiently small diameter to slide into the pipe is used as a boring bar and secured to the pipe by

drilling a small hole through the assembly and driving a nail through the hole.

(A

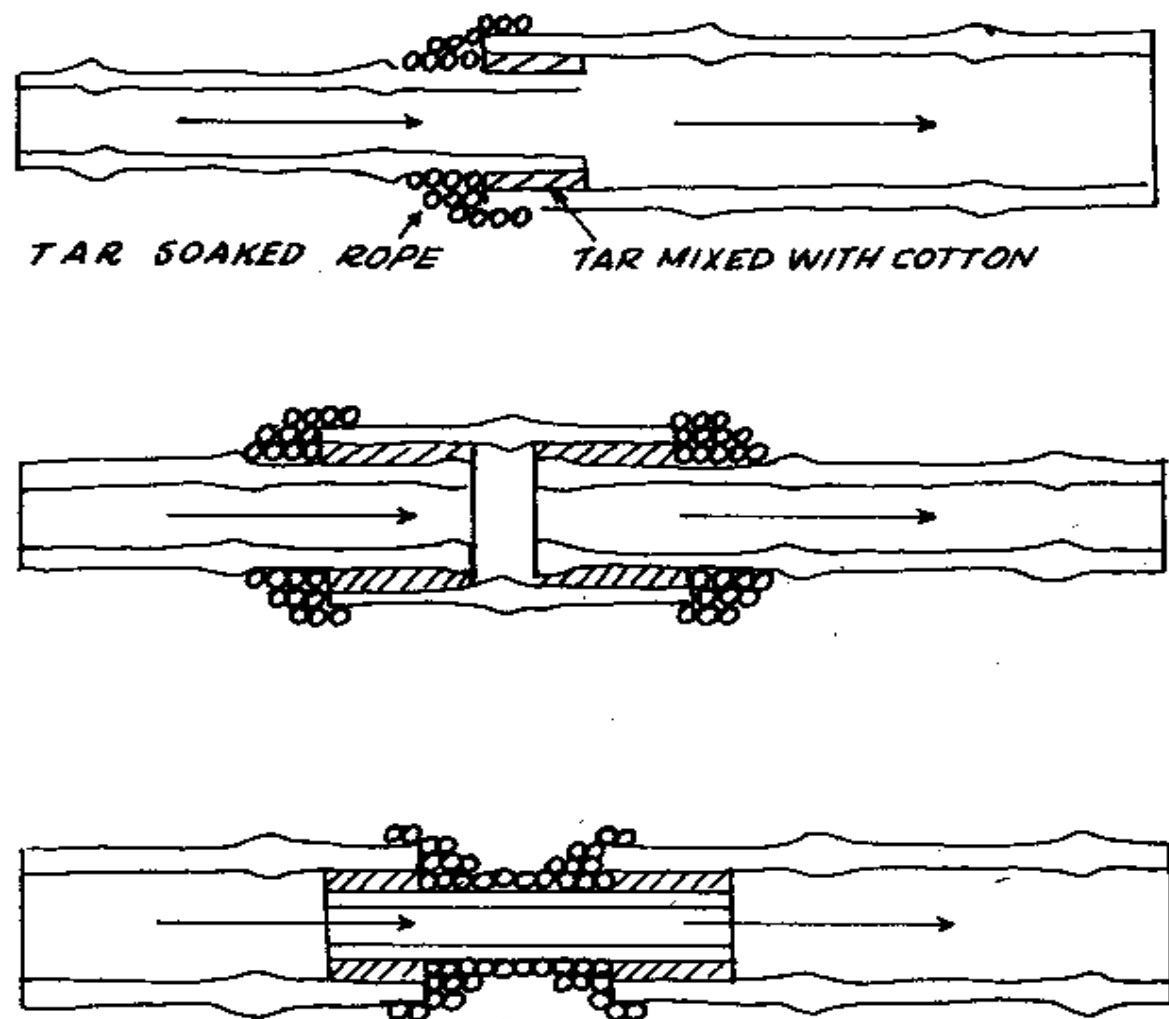
cotter pin or linchpin could be used instead of the nail.) Three or more chisels ranging from smallest to the maximum desired diameter are required. At each joint the membrane is removed by first boring a hole with the smallest diameter

chisel, then progressively enlarging the hole with the larger diameter chisels.

Bamboo pipe lengths are joined in a number of ways, as shown in Figure 4. Joints

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FIGURE 4



are made watertight by caulking with cotton wool mixed with tar, then tightly binding with rope soaked in hot tar.



Bamboo pipe is preserved by laying the pipe below ground level and ensuring a continuous flow in the pipe. Where the pipe is laid above ground level, it is protected by wrapping it with layers of palm fiber with soil between the layers. This treatment will give a life expectancy of about 3 to 4 years to the pipe; some

bamboo will last up to 5-6 years. Deterioration and failure usually occur at the natural joints, which are the weakest parts.

Where the depth of the pipe below the water source is such that the maximum pressure will be exceeded, pressure relief chambers must be installed. A typical chamber is shown in Figure 5. These chambers are also installed as reservoirs for

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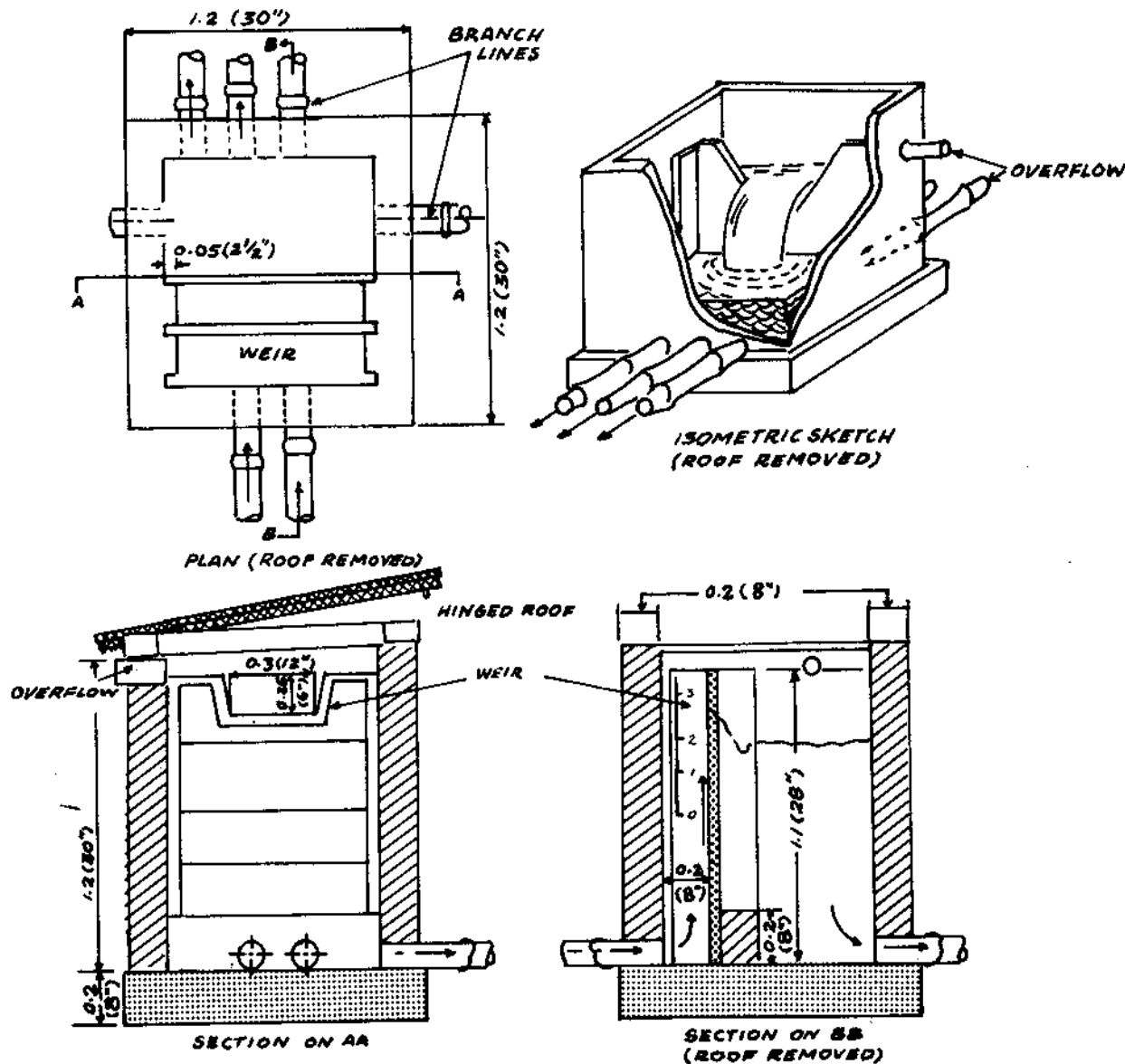


FIGURE 5

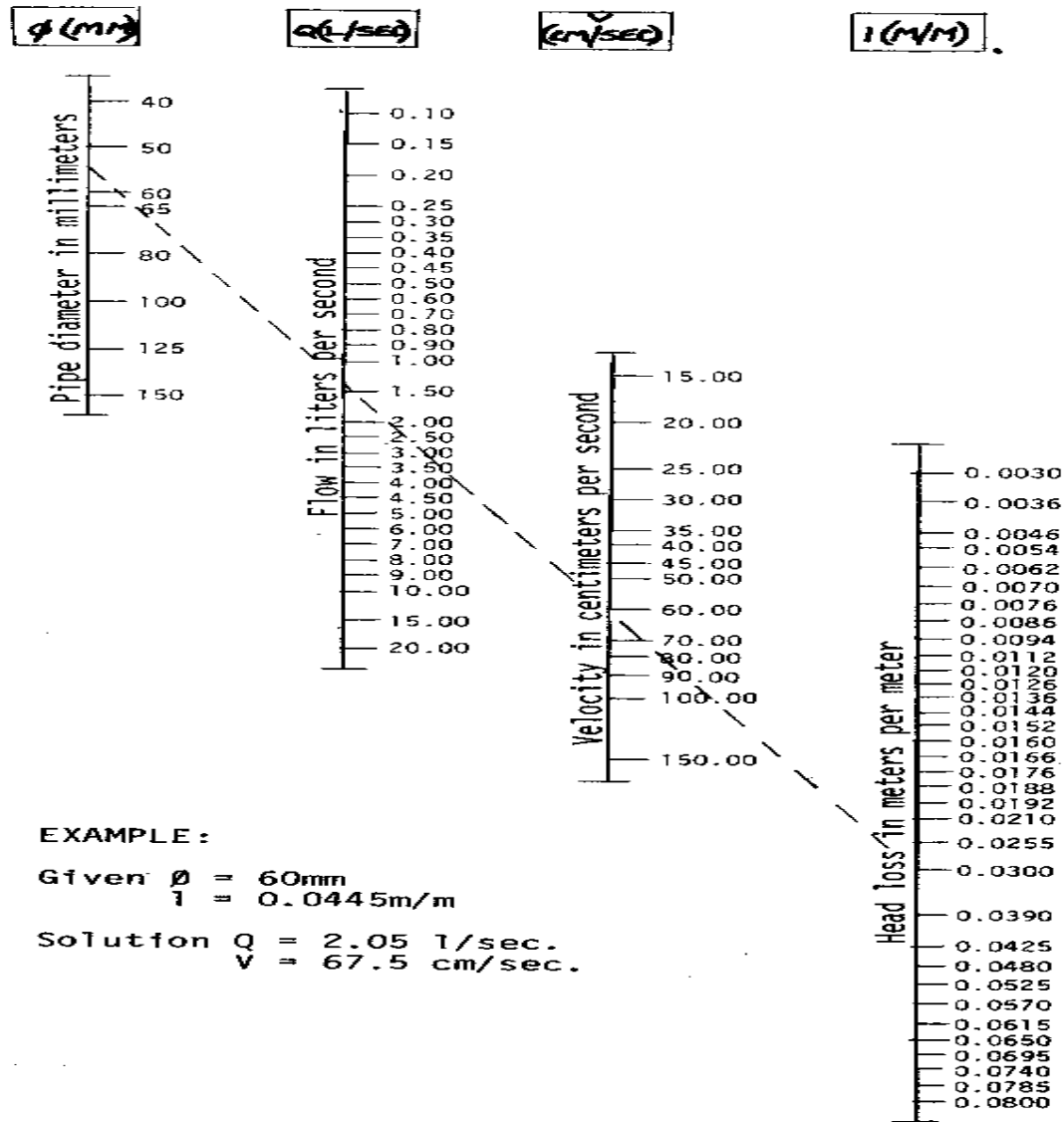
branch supply lines to villages en route.

Size requirements for bamboo pipe may be determined by using the pipe capacity

**alignment chart in Figure 6.**

**fig6x87.gif (600x600)**

**FIGURE 6**  
**NOMOGRAPH FOR FLOW IN BAMBOO PIPE**



Source :

Water Supply Using Bamboo Pipe. AID-UNC/IPSED Series Item No. 3, International Program in Sanitary Engineering Design, University of North Carolina, 1966.

## WATER LIFTING

Pump Specifications: Choosing or Evaluating a Pump

The form given in Figure 1, the "Pump Application Fact Sheet," is a check list

fig1x89.gif (600x600)