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Mixing Bentonite



ENGINEERING RESEARCH
APR 19'74
FOOTHILLS READING ROOM

For Sealing Purposes

M-720

Colorado State University • Extension Service

Fort Collins

Circular 204-A

The material in this booklet represents the efforts of many who have contributed to bentonite sealing work. Closely associated with the development of the major mixing devices and procedures are R. D. Dirmeyer, Jr., project leader of sediment-sealing investigations, Colorado State University, and M. A. McNamee, Agricultural Engineer, Wyoming Agricultural Extension Service.

R. A. Asmus, Hydraulics Laboratory Shop Supervisor, Colorado State University, contributed much to the design of equipment.

The field of low-cost canal sealing with clay sediments has been under investigation at Colorado State University since 1953. This research is sponsored by the Colorado State University Research Foundation and the Colorado Agricultural Experiment Station in cooperation with other organizations, including the U. S. Agricultural Research Service and many irrigation districts and private companies.

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Written and illustrated by R. T. Shen, Assistant Research Engineer, Civil Engineering Department, Colorado State University, Fort Collins.

When you use bentonite for sediment-sealing of ditches, ponds, etc., the mixed bentonite slurry must get into the bed material, plug the leaks and stay there! To accomplish this you must understand the type of bed material you have and the type of bentonite mixture that can seal it.

The mixture must be "right" for your bed conditions!

In Sandy Material

use the dispersion method

When the holes in your bed material are small, you need high-swell bentonite in powder form. The bentonite must be well dispersed in the water. You need a very smooth suspension of about one-percent concentration by weight.

- Feed bentonite with an air-slide hopper (p. 3)
- Mix bentonite and water with a jet-disperser (p. 4, 5)
- Make a thick slurry then dilute it (p. 6)
- Use bubbling air to help break the unmixed lumps (p. 6)

In Rocky Material

use the multiple-dam method

When the holes in your bed material range from small to large, you need high-swell bentonite blended with coarse clay or other bridging agents. Try to find some material available near your site that can serve to fill the larger cracks. You need a thick, lumpy slurry.

- Build dams with the blended mixture (p. 7)
- Break the dams with power equipment (p. 7)
- Supplement your slurry with spot treatment (p. 8)



The Dispersion Method

CLEAR WATER

Bypass

Bubbling air

TEMPORARY DAM

MIXING POOL

Disperser

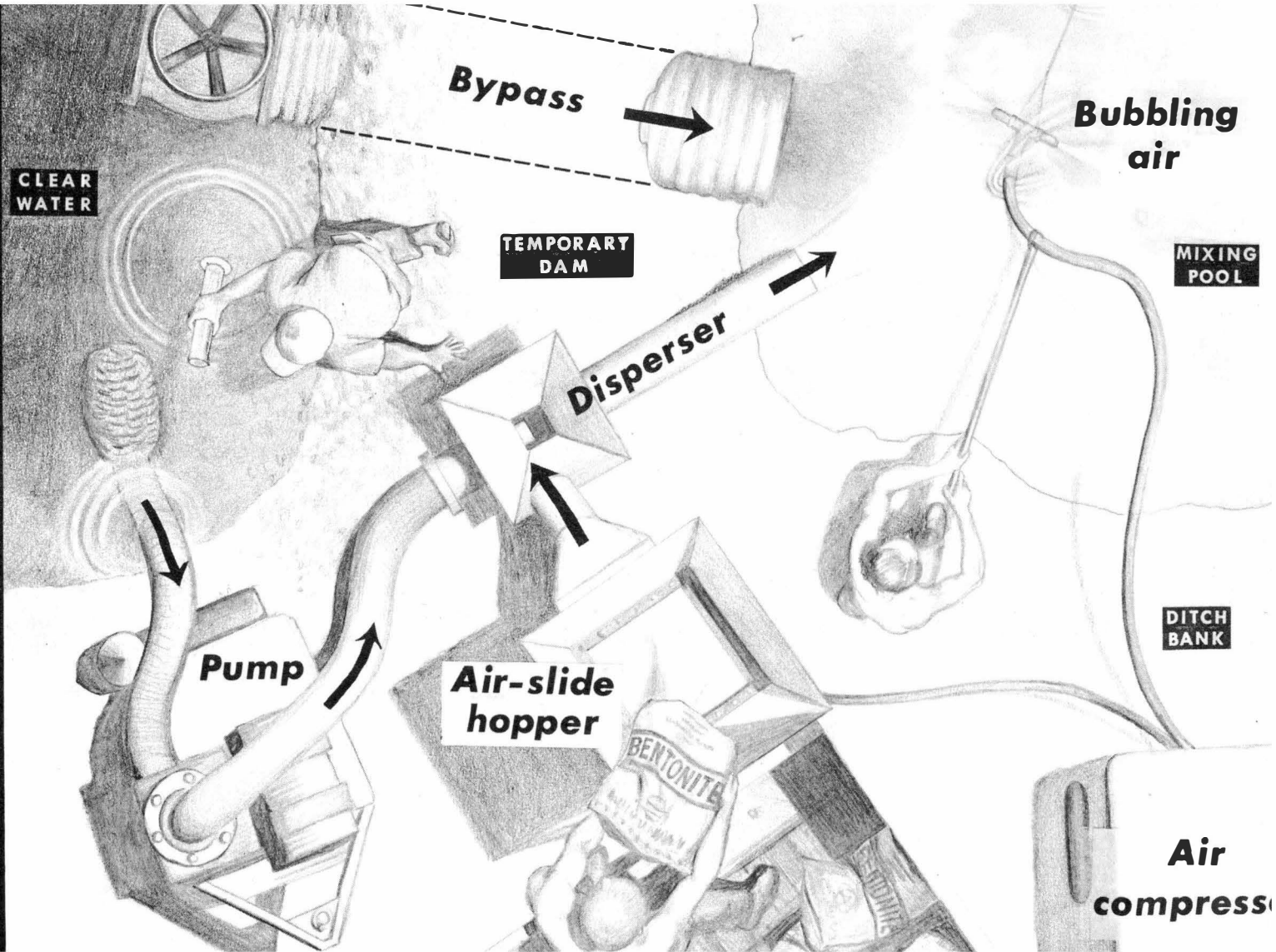
DITCH BANK

Pump

Air-slide hopper

BENTONITE

Air compressor





The Air-Slide Hopper

Use:

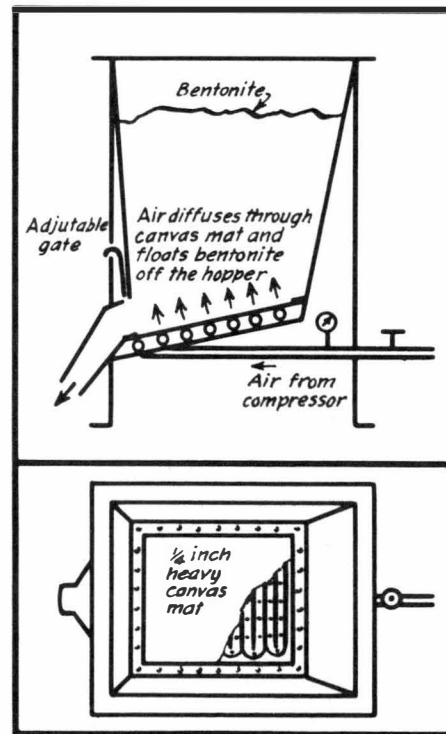
This feeding system is designed for powdered bentonite, not for coarse or granulated bentonite. It regulates the supply of bentonite at a smooth, uniform rate. It can make dry bentonite flow in a steady stream into the disperser.

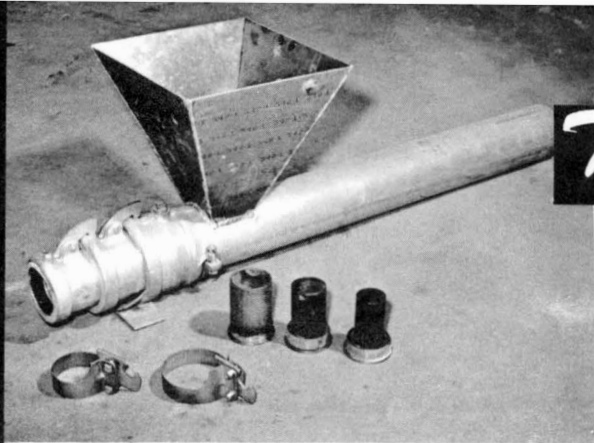
Design:

You can build this hopper to your own dimensions. Be sure to make the gate easy to close so that in case of pump shut-down you can prevent the bentonite from clogging the jet disperser.

Operation:

- Connect an air compressor to this hopper. The air diffuses upward through the canvas mat and "liquefies" the bentonite so that it "flows" away.
- Adjust the air supply to control the feeding rate. Keep the bentonite in the hopper at least one foot deep throughout the operation.
- The canvas must be kept dry at all times, whether during operation or in storage.





The Single-Jet Disperser

Use:

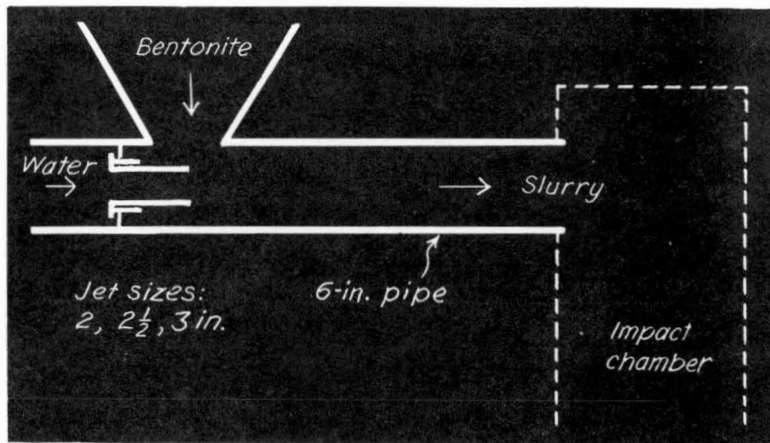
This disperser can be used with the portable type of sprinkler irrigation pump. It can produce a smooth bentonite slurry rapidly. Because of the large size of the single jet passage, this disperser is not easily clogged by the trash in the ditch water.

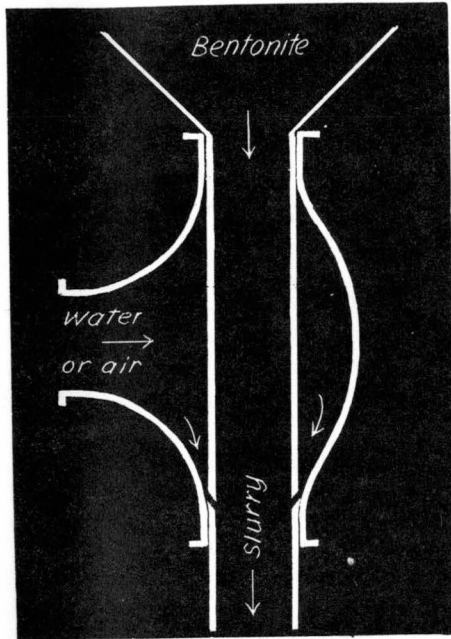
Design:

You can build this disperser to your own dimensions. The exchangeable jet sizes make it possible to adjust to the available pump size on each job. You may add an impact chamber to prevent the jet from eroding the banks.

Operation:

- Keep the intake pressure above 30 pounds per square inch; the higher the pressure the better the efficiency.
- You can mix about 200 pounds of bentonite per minute with a 2-inch jet and a 4-inch pump, and 600 pounds per minute with a 3-inch jet and a 6-inch pump.
- Be sure to empty your slurry into a mixing pool separate from the clear water intake.



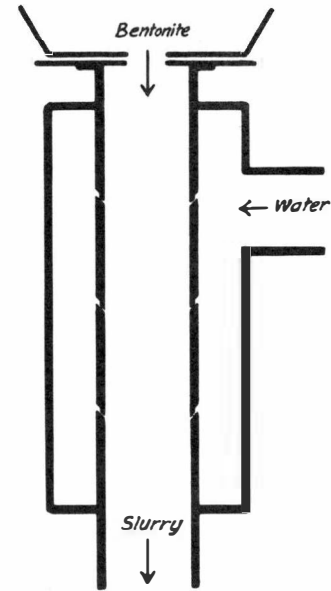


The Cone-Jet Dispenser

This device works like the single-jet dispenser but it is more expensive to construct because of the more exacting machine work needed.

The "Cronese" Dispenser

This device operates on the multiple-jet principle. It is used by Cronese Products, Inc., Glendale, California.



The Multiple-Jet Dispenser

This device has been used successfully by the Central Nebraska Public Power and Irrigation District, Holdrege, Nebraska.

The Dispersion Method

Dilution and Supplementary Mixing



Dilute the thick slurry (usually 6 to 8%) with the clear water from the by-pass. Add your slurry into the most turbulent part of the clear water entrance.

You can break up any unmixed lumps with bubbling air from your compressor. Use a pipe-T or some other design for nozzle and maneuver it manually across the bottom of the mixing pool.

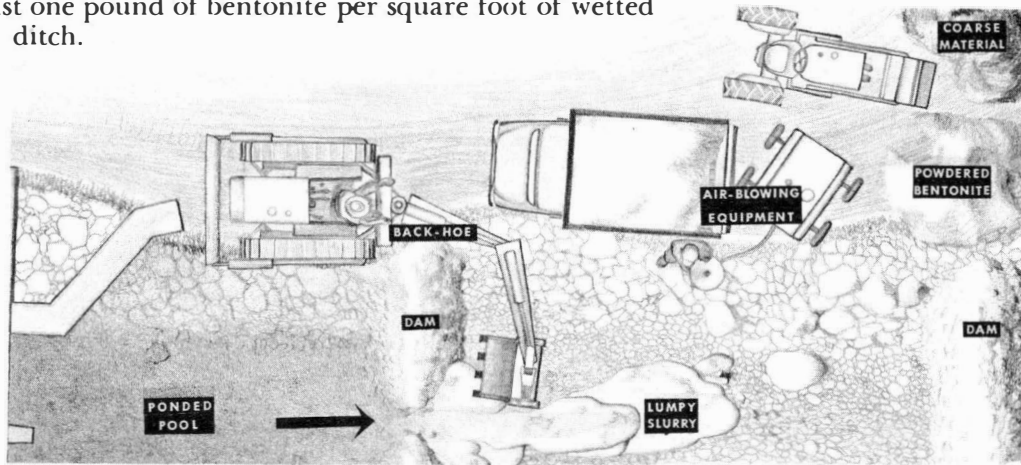
Concentration Control

Sample your slurry below the mixing pool. Determine its concentration with a Bouyoucos hydrometer in a standard testing jar. This reading can be corrected for temperature and water quality. To find the correction factor, you simply take a hydrometer reading on a clear water sample from the upstream end. Adjust the control gate of the clear water by-pass to vary the bentonite concentration in the mixing pool. Try to keep it to 12 grams per liter (1.2%).



To Build Dams

Load a dump truck with alternate scoops of bentonite and bridging material so that they blend together. Dump the mixture into the ditch at planned locations. Don't forget that you need extra dams near the high-loss areas. The dams should be high enough to pond the water above the highwater line. There should be enough dams to give an average of at least one pound of bentonite per square foot of wetted area in the ditch.



To Break Dams

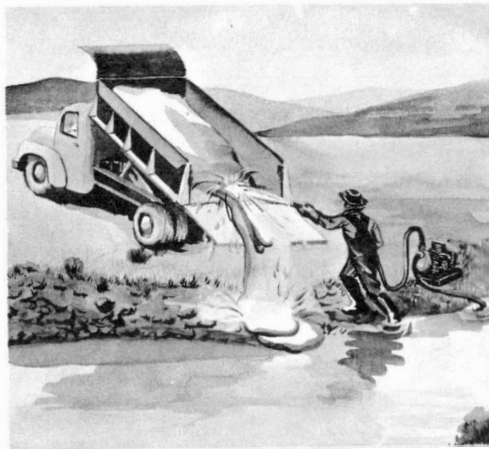
As you let a small flow of water into the first pond, get your power equipment ready (back-hoe, shovel, clam-shell, or dragline). When the ponded water begins to overtop the dam, you can make a breach in the dam. Water will gush through the break into the next pond. You should pick up sealing material from the down stream side and dump it into the water where it is very turbulent. In this way you break up the dam and make a thick slurry. You must work fast so that you will have time to move downstream to repeat the operation on the next dam.

Air-Blowing

a spot treatment

This procedure is used to blow dry bentonite into ponded water over the leaky zones to supplement the slurry, or as a local treatment. All of the jet-type dispersers can be used for this purpose. You simply supply air (from a compressor) instead of water at the intake.

- If you want to spread a blanket of lumpy bentonite through water over a leaky bottom, you should use granulated bentonite.
- If you want to make a dispersed slurry to seal small holes in the upper banks, you should use powdered bentonite.



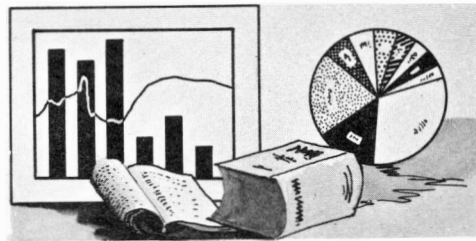
Jet-Sluicing

a spot treatment

This procedure is used to treat limited gravelly or rocky bank areas. Load a dump truck with dry bentonite and park it on the bank immediately above the area to be treated. Tip your load slightly and aim a jet of water at the lower end. The bentonite will be washed down in a thick lumpy slurry.

Other publications on the use of bentonite for sealing purposes are:

- Sealing Sandy Ditches With the Bentonite Dispersion Method—Circular 202-A
- Sealing Rocky Ditches With the Bentonite Multiple-Dam Method—Circular 203-A
- Testing Bentonite for Sealing Purposes—Circular 205-A
- Sealing Farm Ponds and Reservoirs With Bentonite—Circular 206-A



For additional information, get in touch with your county agricultural agent or write to:

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or

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More Information

