

# SPECIFICATIONS FOR COLORADO CLAYS FOR SEALING CANALS AND PONDS

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REPORT

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This is one of three progress reports relating to the investigations of Colorado clays for sealing of canals and ponds. The other two progress reports are:

1. Sampling and Testing of Colorado Clays for Sealing Purposes.
2. Methods of Using Colorado Clays for Sealing Canals and Ponds.

This 3-year study will be terminated July 1, 1963, except for limited follow-up evaluation of field trial installations.



The specifications were developed in cooperation with the Soil Conservation Service and the Agricultural Stabilization and Conservation Service in Colorado. It will be recognized that they may require modification for extreme conditions — such as for sealing open rocky materials where extra amounts of grit or sand-size particles may be required for satisfactory sealing results.

Various meanings have been attached to the words, clay and bentonite. Clay is used both as a rock term, such as blue clay, and as a particle size term. In the latter usage, it commonly means very fine-grained. In like manner, bentonite may mean any material formed by the in-place alteration of volcanic ash to clay. It also may refer to any clay material containing 85% or more of the clay mineral, montmorillonite. After evaluating many of the clay materials that have been used in canal and pond sealing work in Colorado, it is believed that the favorable clays can be defined satisfactorily with three general types as shown in the table below:

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Test	Type I Clay <sup>1</sup> High-Swell Bentonite	Type II Clay <sup>1</sup> Low-Swell Bentonite	Type III Clay <sup>2</sup> Wash-in Clay
Layer Permeability	0.005 ft./day	0.005 ft./day	0.005 ft./day
Filter Permeability	10.0 ml.(or cc.)/min.	10.0 ml.(or cc.)/min.	10.0 ml./min.
Free Swell	600% or more	50 to 600%	---
Mix Index	---	---	40% or more
100% passing	3/8-inch screen	3/4-inch screen	1-inch screen
Moisture Content	15% or less	20% or less	20% or less
Colloidal Yield	50% or more	40% or more	30% or more
Grit Content	10% or less	20% or less	30% or less

<sup>1</sup>Used mainly for layer applications.

<sup>2</sup>Used mainly for wash-in applications.

In considering the clays used in past clay sealing work in Colorado, several general statements seem appropriate:

1. A Wyoming bentonite of drilling mud quality (90 bbl. yield or more) will usually exceed the minimum specifications for Type I clay.

2. Most Colorado clays are of Type II and III. Few, if any, of the Colorado deposits will yield (consistently) Type I clay.

3. The Type I clay is usually applied at a rate of 1 to 3 lbs/sq. ft. and as a dry layer (1/8 to 3/8-inch thick).

4. The Type II clay is also pointed at layer applications but generally because of less processing and larger lumps, it is commonly applied in thicker layers than the Type I clay - usually at a rate of 2 to 8 lbs/sq. ft. or 1/4 to 1-inch thick layer.

5. The Type III clay is best for applications in which the clay is carried into place with flowing water, but it is also used for layer applications.

6. The Type I and II clays can also be used for wash-in applications, but they are much more difficult to mix into water than the Type III clays.

One major development problem has been the control of clay quality during mining. One reason for this is that specifications have been lacking. The information in the table on the preceding page is pointed at the specifications problem.

Of the various deposits sampled, 14 are now being developed to varying extents on a commercial basis. A summary of available (spring 1963) clays and services are listed below:

For additional information relating to specifications and development of clay deposits refer to:

1. Dirmeyer, R.D.; Skinner, M.M.; Lutz, G.A.; and White, L.G.; Evaluation of Colorado Clays for Sealing Purposes, Civil Engineering Section, Colorado State University, Fort Collins, Colorado (in preparation - Spring, 1963).

2. Soil Conservation Service and Extension Service offices in Colorado.



River Basin	Producer or Owner	Deposit No.	Location Reference	Mining Procedure	Clay Quality	Installation and Delivery
North Platte	Colter	(S89)	Walden	Not developed	Type II <sup>1</sup>	None
South Platte	Munroe Conda	(S33) (S37)	Fort Collins S. of Boulder	Partly developed Satisfactory	Type II <sup>1</sup> Type III <sup>2</sup>	None Delivery only
Arkansas	Lamberg Kessler Dilley Stough Butterfield	(S49) (S34) (S28) (S44) (S44)	Salida Canon City Canon City Las Animas Las Animas	Satisfactory Partly developed Satisfactory Partly developed Satisfactory	Type III <sup>2</sup> Type III <sup>1</sup> Type III <sup>2</sup> Type II <sup>1</sup> Type II <sup>2</sup>	Both ? Both ? Both
Rio Grande	Cowan	(S40)	Mosca	Satisfactory	Type III <sup>2</sup>	Both
San Juan	Flora	(S101)	Durango	?	Type II <sup>?</sup>	?
Colorado	Rump Redlands Kelley Wells	(S42) (S42) (S42) (S42)	Grand Junction Grand Junction Grand Junction Fruita	Satisfactory Satisfactory Satisfactory Satisfactory	Type II <sup>2</sup> Type II <sup>1</sup> Type II <sup>1</sup> Type II <sup>1</sup>	None ? None None ? None ?

<sup>1</sup>Deposit only partially developed (spring 1963). Clay probably could comply if processed adequately (such as by screening, drying, etc.).

<sup>2</sup>May not meet specification in every respect but producer is working toward compliance - the most common deficiencies at the present time are: Moisture content too high or lump size too large.