TESTIMONY REGARDING OCD CASE 12969, CONCERNING THE ADOPTION OF A PIT RULE AND RESCINDING CERTAIN ORDERS.

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INTRODUCTION

The proposed rule is directed toward protection of ground water and surface water. However, the NMEMRD is pledged to protect the environment, not only water. This testimony will focus on the need to protect not only recoverable water, but also the vadose zone, from contaminants, including salts, that may be accumulated or concentrated in pits. I will first present a little background on unsaturated hydrology, and then comment on details of the proposed rule.

BACKGROUND: UNSATURATED HYDROLOGY

Usually, we think of environmental water as either ground water or surface water. However, almost all non-aquatic life, including soil bacteria and plants, depends directly or indirectly on water in the pores of the vadose (unsaturated) zone. I will therefore begin with a short review of water motion and contaminant transport in the unsaturated zone. **Fig. 1** presents an example of the moisture content as measured in dry porous rock. Borehole 1009 was drilled beneath asphalt pavement, which covered and extended beyond a closed evaporation pit. Some 10 or 15 years after an evaporation pit was closed and the surrounding area covered by asphalt, the influence of either the pit or the asphalt can be seen to a depth of 100 ft. This illustrates that a surface disturbance can cause deep, long-lasting hydrologic effects.

<u>Suction</u>. Water in unsaturated ground is held in suction by capillary forces, like water in a sponge, as illustrated in **Fig. 2**. Suction means one must expend energy to force the water out of the porosity of the soil. Technically, *suction* is the energy per unit volume required to extract the water. Suction is expressed in units of pressure, or equivalently, as the negative height (head) of a hypothetical column of water that would generate a pressure of that magnitude.

<u>Potential</u>. Water below the surface of the ground has a *negative* potential energy--that is, one must expend energy to lift the water to ground surface. The total *potential* at any depth in the ground is the energy required to extract a unit volume of water from the pores of the soil, and to lift it to ground surface. Potential is expressed as a negative pressure or negative head, like suction. Water moves toward lower (more negative) potential. In other terms, water in the vadose zone moves according to the combined forces of suction and gravity. In **Fig. 3,** above a depth of 60 feet, water is moving downward toward lower potential. However, in most of the region between 60 and 90 ft of depth, water is moving *upward* toward lower potential. In this region, suction is pulling upward more than gravity is pulling downward.

<u>Impact</u>. As illustrated by **Fig. 3**, moisture flow and the accompanying contaminant transport in the vadose zone is not always predictable unless you make local measurements. In arid regions, most of the precipitation that soaks into the ground is returned to the surface by unsaturated flow and by plants, where it evaporates or

transpires to the atmosphere. Unsaturated flow can bring soluble contaminants to the root zone and to the surface. **Fig. 4** shows the accumulation of white salts on the surface of a porous rock in an undisturbed canyon. The lower photo shows similar salts on the surface of porous tuff along a road cut. In these places, the natural white deposits were about 1 mm thick, and would wash away in summer rains, only to form again the following spring if the winter had sufficient snow. Similarly, soluble wastes buried in shallow pits can migrate to the surface and to surrounding soil. The transport rate is just a matter of time and weather.

DISCUSSION OF THE PROPOSED RULE

1. **Sections B3(b)** and **C2(g)(iii)** provide specific exemptions for existing pits. In general, exemptions should be few--all pits should be brought into compliance. If environmental protection requires that pits have liners, it should make no difference whether the pit is old or new.

2. **Section C2(a)** allows pits to be located adjacent to a watercourse so long as some unspecified level of the pit is "safely above the ordinary high-water mark." This is unclear language, very subject to interpretation, particularly if the water "mark" disappears through weathering. This language is in potential conflict with the OCD pit construction guideline, which says "high water level," without the vague term, "*ordinary*." In New Mexico, arroyos and broader valleys are watercourses, but are ordinarily dry. Thus, it can be logically argued that the "*ordinary*" high water mark is the bottom of the watercourse! Pit bottoms should be located above the expected 100-year flood level, especially if wastes are buried in the pits at closure.

3. **Sections C2(b) and (c)** provide for double liners and leak detection in disposal pits, which is an excellent requirement. However, the proposed rule does not specify liner materials and construction, and the pit construction guidelines specify materials in vague terms such as "good resistance to tears and punctures." Liner materials should be specified by performance, such as hydraulic conductivity, tensile strength, puncture strength, and environmental stress cracking. These properties are usually quantifiable by ASTM tests, and are routinely quoted in sales literature of the pond industry. It is better to specify performance properties than to specify exact materials, thereby leaving the selection of particular materials and thicknesses to the operators. For example, the rule could specify permeability by requiring any liner, synthetic or constructed, to have a demonstrated transmission less than the equivalent of a layer one foot thick, with hydraulic conductivity less than 10^{-8} cm/second.

4. **Construction**. The proposed rule ignores pit construction and operating requirements such as freeboard, while the construction guidelines say only that "wave action shall be taken into account." The rule merely specifies construction so as to "prevent contamination" and "protect the environment." Such terms are subject to such wide interpretation as to be unenforceable. Vague terms are unfair to responsible industry, by allowing irresponsible industry to operate at lower cost. A clear, definite rule and quantitative guidelines are needed.

5. **Section C2(e)** specifies that "spray-borne solids" must remain within the pond's lined perimeter. This is ambiguous language, in potential conflict with the guideline that says "spray-borne salt." The rule should require that spray-borne *solids and dissolved solids* are confined to the lined perimeter of the pond or pit.

6. **Section C2(g)** provides a blanket exemption for approximately 300 square miles of the southeast, and for the "oil and gas producing areas of the San Juan Basin" that are more than 100 ft above a named river or 50 ft above any other channel. I have two objections to this language.

First, the language is insufficiently precise for regulatory purposes.

It is not clear whether the Chama River is excluded by virtue of being a "creek" that drains into the Rio Grande. If so, pits near it are apparently subject to the 50-foot requirement, not the 100-foot requirement of the named rivers.

The meaning of "oil and gas producing areas" is not clear, and probably not legally defensible. If an oil company were to drill in a previously untapped area, the area might arguably be called "oil producing" and no liner would be required. However, if a geothermal company were to drill, then presumably a pit liner would be required because the drilling would not be "within the oil and gas producing areas."

Second, the blanket exemptions do not protect the environment.

Contaminants, particularly salts, will be distributed to the environment by unlined pits in the San Juan basin. The moisture and potential profiles shown in Figs. 1 and 3 indicate that soluble contaminants can move under unsaturated conditions. When saturated flow occurs in fractures and preferential subsurface channels, contaminants can be carried much faster, and can move hundreds of feet in a few years. This was noted during environmental restoration studies at Los Alamos, where components of explosives were found in the aquifer hundreds of feet below a discharge on the surface of normally dry ground. Soluble contaminants, once discharged into the ground, can move back to the root zone or to the surface.

In an arid region, the shores adjacent to a lake can not usually be classified as a wetland, as will be defined by 19.15.1.7 NMAC. Such lake shores are not rivers or drainage channels. It therefore would be permissible to place unlined pits close to such lakes in the San Juan basin unless "protectable" ground water were present.

It has been argued that the Division has authority to protect only water, and cannot require pit liners in the absence of ground water. This is an unfounded argument, because the second EMNR Department Goal is to "protect the environment ... ." Furthermore, protection of the environment is cited 11 times in the proposed rule itself. In the San Juan basin, the rule provides limited protection for streams and groundwater, but little protection for the living environment, which is dependent on the soils and pore water of the vadose zone. In particular, the discharge of salts into the soil destroys the biological productivity of the soil.

7. **Section C2(g)** allows discharge to an unlined pit in any area where the discharge quality meets WQCC standards. Allowing unlimited discharges so long as the concentration in the discharge meets WQCC standards is an invitation to pollution. An evaporation pit concentrates the contaminants so that, although the initial discharge may meet standards, the water infiltrating the soil does not meet standards. Furthermore, the standards were meant to be the limit above which remediation would be required--not meant to be the extent to which all water can permissibly be polluted. When large discharges occur, as with coalbed methane production, the total quantity of contaminant released is more important than the concentration in the release itself.

Allowing unlimited discharges to the soil also invites intentional misapplication of the rule. In a marginal case, if the discharged water did not meet WQCC standards, the operator could dilute it with fresh water, thereby releasing all of the contaminants but in an increasingly mobile form! Such dilution is being done to justify the discharge of polluted mine water in southern New Mexico. Furthermore, the OCD has received at least one proposal from a major producer to dilute contaminated soils until the mixture meets the standard beyond which remediation is not required. Whether diluted or not, the important number is the total quantity of salt or other contaminants that will be discharged onto the landscape, not the concentration at the outlet pipe.

8. **Section E** of the proposed rule specifies that drilling fluids and cuttings in a pit may be disposed in a manner "approved by the division." This invites burial of chlorides and other soluble wastes in closed pits. The drying of wastes prior to burial is somewhat of an artifice. The dried, buried wastes will later be transported by runoff, infiltration, and unsaturated flow. The extent to which they are dried prior to burial simply delays the migration, but does not prevent it. Unfortunately, the proposed rule does not even require that liners be maintained intact upon closure. However, even an intact buried liner will eventually fail, allowing the wastes to migrate. The migration may be especially abrupt if the buried liner acts as a subsurface basin that collects infiltrated rain, or if the closed pit is located in a watercourse that is scoured by a flash flood above the "normal" high water mark.

8. **Section F** requires closure of pits within six months. The STRONGER guideline for workover pits is 120 days. Rapid closure is important particularly because Section C2(a) of the proposed rule would allow workover pits in the bottom of a watercourse.

9. **Burial of wastes** in closed pits is in general unacceptable. The proposed rule implicitly allows such burial, without even the minimal requirement of an intact liner. In the exempt areas, burial may occur without any liner! Anything soluble left in a pit will migrate. While the migration of wastes from one pit might seem inconsequential, it is the combined migration from thousands of pits that will affect surface ecology, which in turn can affect surface water far from the site. It is reasonable to allow burial of insoluble harmless minerals, but on-site burial of soluble wastes in unlined pits across thousands of square miles should not be allowed. In another state, the petroleum industry has argued that it cannot maintain liner integrity during pit closure. I accept that judgment, and conclude that soluble wastes must be removed from pits for injection or other safe disposal. **Fig. 5** illustrates the kind of environment left by pits, several years after closure.

SUMMARY
OCD is to be commended for its effort to develop a pit rule requiring liners, which prevent the immediate percolation of wastes into the ground. However, the proposed rule is seriously faulty for exempting large areas of the state from the liner requirement. Other industries are not allowed to dump their wastes across the landscape. Oil and gas activities affect large areas, which can become wastelands. This industry can, and should, be held to the same degree of environmental responsibility as other industries. Until the industry and the regulations by which it abides demonstrate such responsibility, the industry does not deserve to move into new, unspoiled areas.

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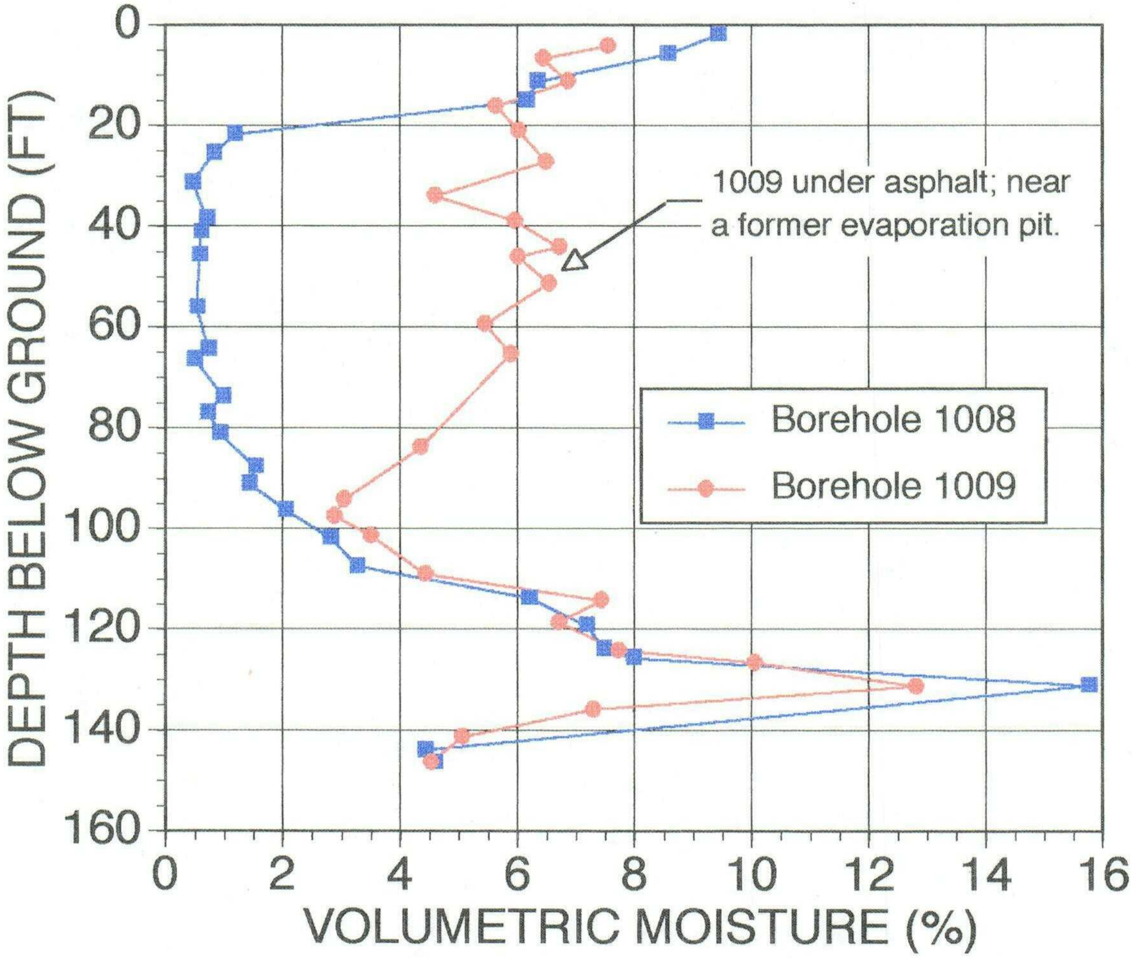

Neeper & Gilkeson, 1996

Fig. 1. Volumetric moisture as a function of depth in dry porous tuff. Porosity is approximately 50%.

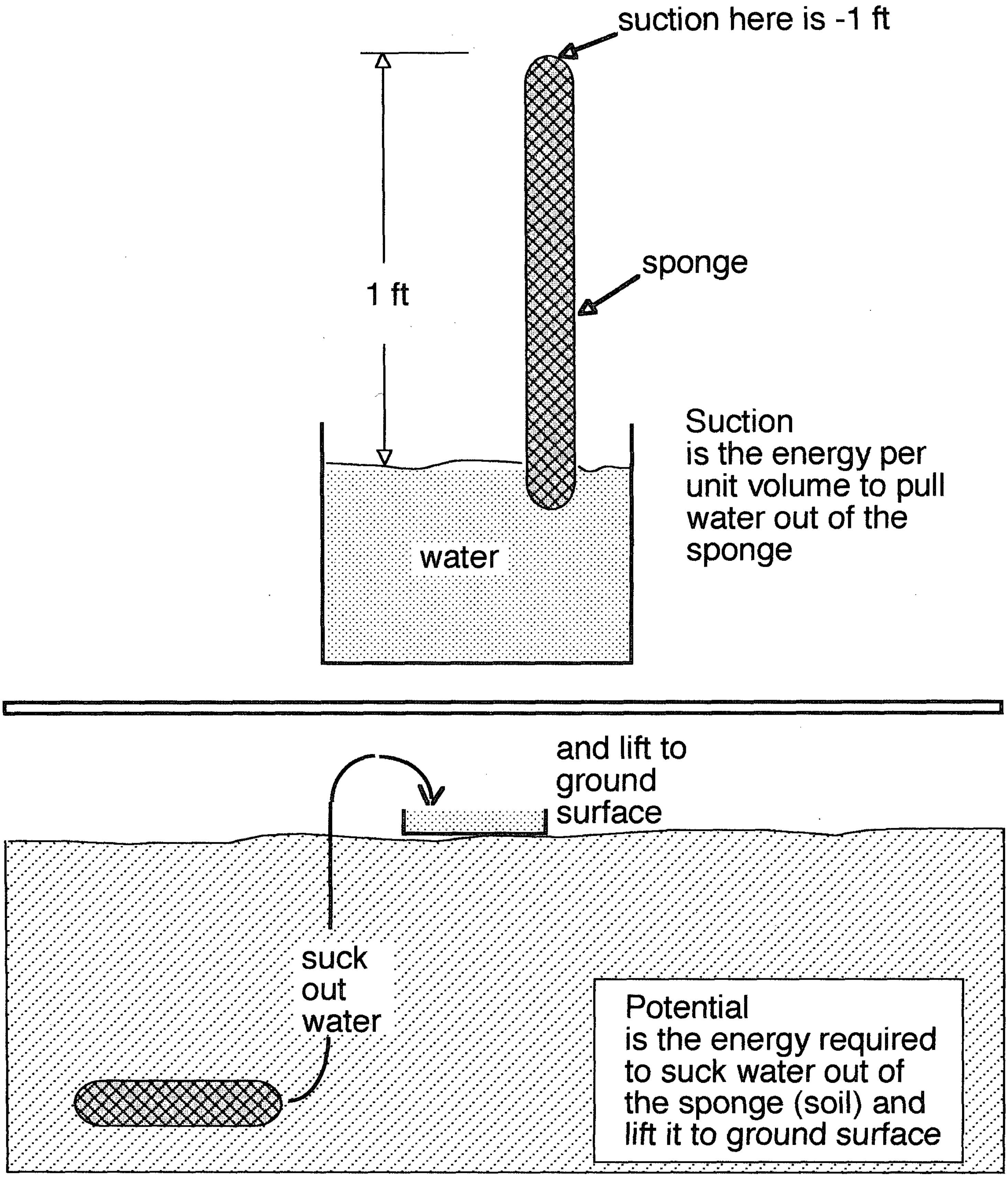

Fig. 2. Schematic diagrams of suction and potential.

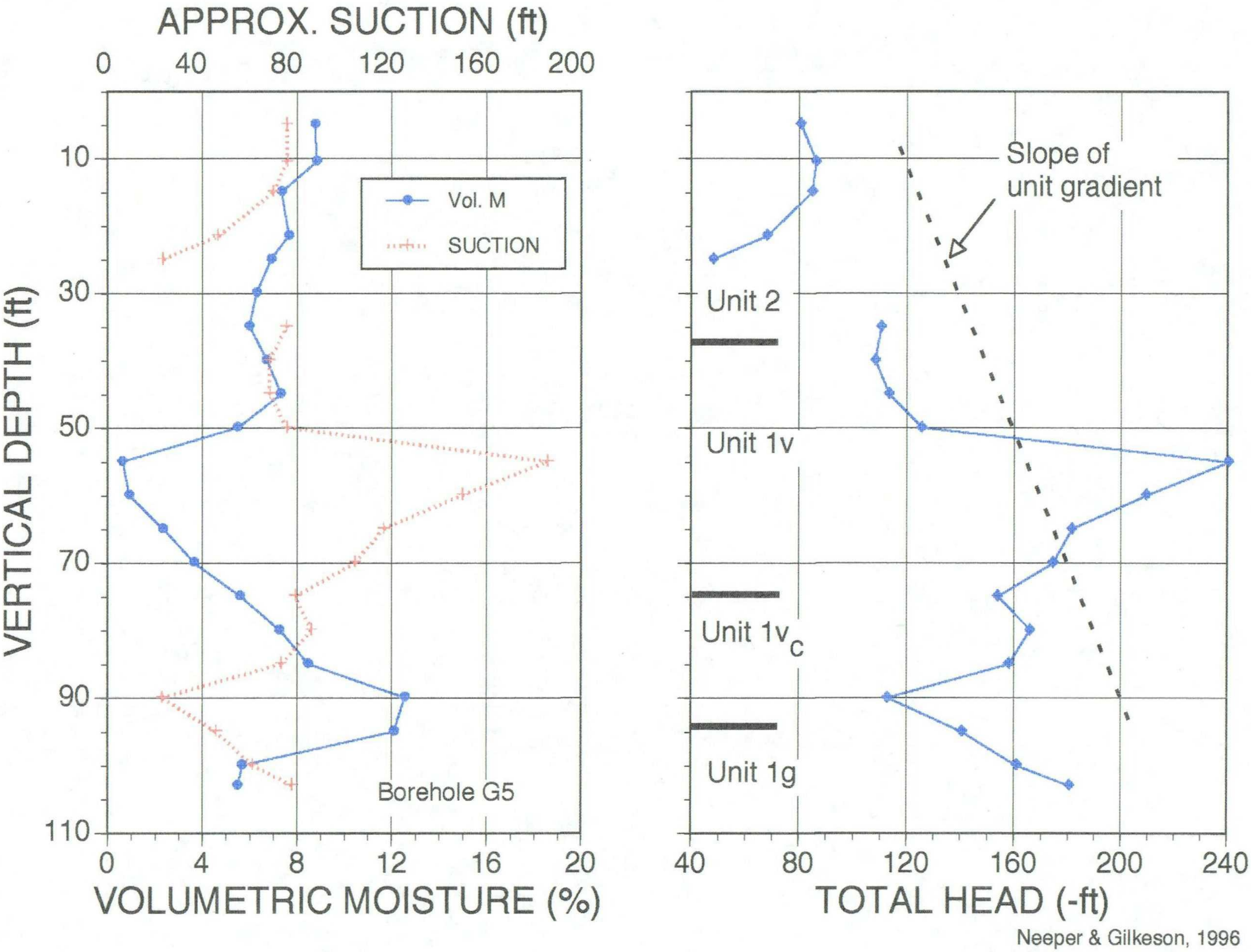

Fig. 3. Measured moisture, suction, and potential in a borehole.

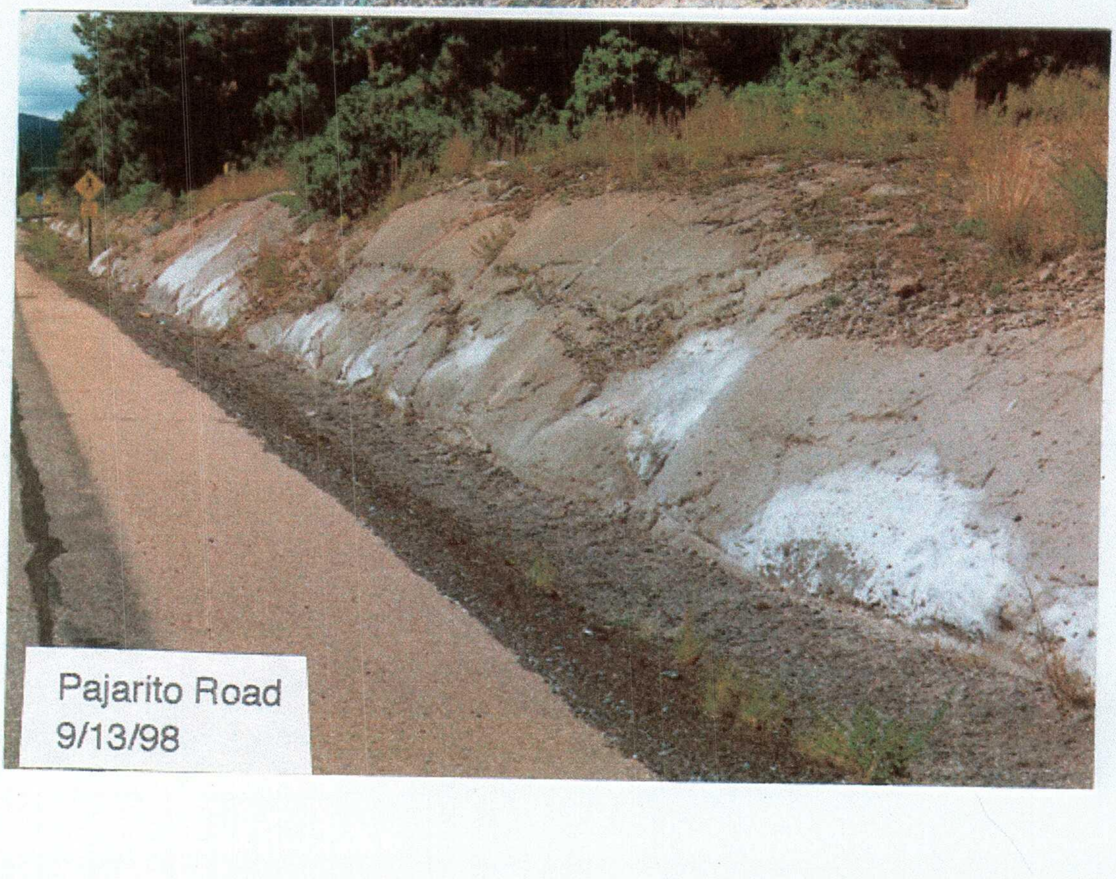

Fig. 4. Salts left on rock surfaces by unsaturated transport.

Fig. 5. Pit, several years after closure.