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Author(s): Lloyd E. Myers and Gary W. Frasier
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Asphalt-Fiberglass for Precipitation Catchments

LLOYD E. MYERS AND GARY W. FRASIER

Highlight: *Field experience gained in the construction of nine water harvesting catchments since 1962 has shown that field-fabricated asphalt-fiberglass coverings are a dependable means of providing water for livestock on many rangeland areas. Initial construction costs, including site preparation and labor, were less than $1.25 per square yard. The asphalt-fiberglass coverings are easy to install, require no sophisticated equipment or skills, and are highly resistant to mechanical damage to wind or animals.*

Efficient management of many large rangeland areas requires adequate and dependable livestock water supplies. Sufficient numbers of reliable streams and wells are frequently not available. Ponds built by damming intermittent streams often go dry just when they are needed the most. As a result, ranchers in some areas haul water for their livestock at costs estimated as high as $38 per 1,000 gallons (Pearson et al., 1969). Collection of precipitation by artificial catchments could provide water at less cost than hauling. Economic analyses have shown that installation of water harvesting catchments can be a sound investment for the stockman (Workman et al., 1968). Such catchments have been and are being built by governmental agencies to obtain water for livestock.

Many materials and methods have been investigated in attempts to lower the cost of artificial catchments (Myers, 1967). Some of these are promising but need further development. One relatively new material, field-fabricated asphalt-fiberglass, appears worthy of immediate consideration by rangeland managers. Field experience since 1962 has shown that this material is strong, durable, relatively easy to install, and costs less than sheet steel or butyl rubber.

The authors are research hydraulic engineers, Agricultural Research Service, U.S. Water Conservation Laboratory, Phoenix, Arizona. At present, the senior author is associate deputy administrator, Western Region, Agricultural Research Service, U.S. Department of Agriculture, Berkeley, California.

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Performance of Asphalt-Fiberglass Catchments

Nine asphalt-fiberglass catchments, fabricated on site by saturating glass matting with low viscosity asphalt emulsion and then sealing with roofing grade asphalt emulsion, have been constructed since 1967. Five of these were installed in areas of such rugged terrain that use of 4-wheel drive vehicles was necessary to gain access. Two installations were on sites where buried rocks up to 3 feet in diameter could not be removed and no other type of ground cover, including reinforced butyl sheeting, could have been used.

Performance of eight of these catchments has been excellent. Seal coat application was not made on the ninth catchment until 16 months after base coat application, and the seal coat asphalt did not bond satisfactorily to the oxidized base coat. No significant deterioration or mechanical damage by wind or animals has been observed on any of the other catchments. As further evidence of durability, asphalt-fiberglass linings installed in two small reservoirs during 1962 and 1964 are still in reasonably good condition despite an almost total lack of maintenance. Deer have climbed in and out of one of these reservoirs, on 45° side slopes, with no damage to the lining. Plant growth problems have been limited to two catchments in Hawaii. On one of these catchments, windblown seeds sprouted in three 2-ft^2 patches of soil on the surface. These were removed in less than 5 min by hand pulling. On the other catchment, some grass grew through the membrane near the edge because of inadequate soil sterilization before catchment installation.

Since 1967, runoff from a 2,500-ft^2 asphalt-fiberglass catchment at the Granite Reef Test Site near Mesa, Arizona, has averaged 95% of the rainfall measured by a standard weighing raingage. This is in an 8-inch average annual rainfall area where, on the average, 50% of the total rainfall occurs in storms of less than 0.4 inch. Eighty percent of the total rainfall occurs in storms with rainfall intensities of less than 0.2 inch/hour. Preliminary rainfall-runoff measurements for the catchment on Maui, Hawaii, in a 100-inch average annual rainfall area, indicated good rainfall collection efficiency.

Water running off an asphalt surface can be discolored by oxidized asphalt, particularly in arid regions. The discoloration is directly proportional to the time between rains and inversely proportional to the volume of runoff (Frasier et al., 1970). Discoloration is minimal in high rainfall areas. The discolored water is odorless and tasteless and is readily consumed by cattle.

Construction of Catchments

Catchments should be installed on a natural slope of 5 to 20%. All vegetation must be cleared to bare soil, and rocks larger than 1-inch diameter should be removed by hand raking. Larger rocks that are partially buried in the soil may be left in place if there are no sharp projections and the rock surface merges smoothly with the soil surface as shown in Figure 1. A low berm or dike is constructed around the perimeter of the catchment, as shown in cross section in Figures 2 and 3. When water is conveyed from the catchment to the storage structure through a pipe, the berms on the lower side can be made higher to provide short-term water storage on the catchment during high intensity rainfall, thereby reducing the required pipe size. The catchment surface and berms should be compacted with a roller or rubber-tired vehicle to obtain a reasonably smooth surface. To prevent regrowth of vegetation, a suitable soil sterilant should be applied. A trench, at least 5 inches wide and 4 inches deep, is dug on top of the berms around the plot for anchoring the edges of the asphalt-fiberglass cover.

The fiberglass used is fabricated from multiple-length, chopped glass strands bonded into a continuous mat 36 to 72 inches wide with a polyester resin sizing which softens when treated with asphalt. Starting on the lower berm of the catchment, the fiberglass is unrolled in a strip transverse to the slope with the lower edge extending into the bottom of the anchor trench. The ends of this fiberglass strip and subsequently laid strips must also extend into the side trenches. Care should be taken to avoid wrinkles. The fiberglass is then coated with 1/2 to 3/4 gal of asphalt emulsion per square yard to saturate the mat and bond it to the underlying soil as shown in Figure 4. Both cationic and anionic emulsions with 60% solids have proved satisfactory for this base coat. The asphalt can be applied with standard gear pump asphalt spray equipment, or it can be poured on the fiberglass from buckets and spread with soft-bristled industrial floor brooms. After the first fiberglass strip is coated, the next strip is unrolled, overlapping the first strip about 4 inches, and coated with asphalt. This procedure is continued up the slope until the entire catchment is covered. The asphalt emulsion softens the sizing in the matting, allowing it to conform to minor irregularities in the catchment surface within a few hours. Immediately after this base coat is applied, the trenches around the catchment are partially backfilled to prevent wind from damaging the covering before the asphalt sets and hardens.

The seal coat is applied after the base coat has cured and is no longer tacky. During warm, sunny weather, the base coat will cure in 1 or 2 weeks. Light rainfall during the curing will not ordinarily damage the base coat, but installations should be made during clear weather if possible. During this time, any "fishmouth" wrinkles in lap joints should be repaired to prevent wind or water entry. This is easily done by cutting the wrinkle lengthwise along the center of the wrinkle, pressing the cut edges flat, placing a fiberglass patch over the wrinkle, and saturating the patch with asphalt emulsion.

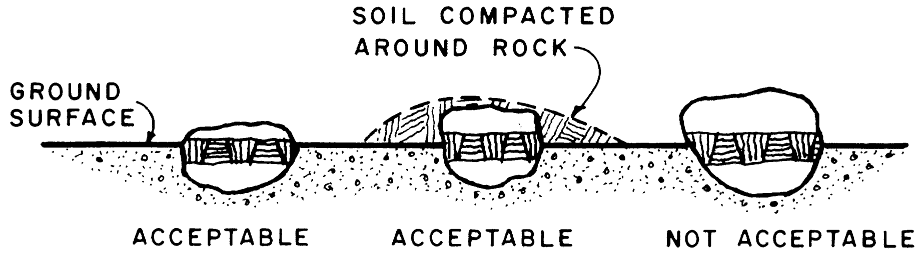

Fig. 1. *Illustration of acceptable and nonacceptable buried rocks.*

The seal coat used is a roofing type asphalt-clay emulsion, with a minimum solids content of 48%, guaranteed for 10 years when applied to a roof at a rate of 1/3 gal per yd^2. The seal coat is applied to the fiberglass by spraying or spreading with brooms at a rate of 1/3 to 1/2 gal per yd^2. Good coverage of lap joints is easier with brooms than with spraying, because the material can be brushed against the laps to fill any small voids. A single, carefully applied seal coat should be adequate for catchment surfaces. Seal coats usually require 2 days of clear, warm weather for curing. Rain can seriously damage uncured seal coats. After the seal coat application, the anchor trenches are completely backfilled.

Maintenance of Catchments

All water harvesting structures should be visited at least every 6 months to make sure float valves, drinking troughs, water storage systems, and catchment surfaces are maintained in good operating condition. A new seal coat will have to be applied to an asphalt-fiberglass catchment surface every 5 to 10 years, depending on the quality of the material used and the care with which it was applied. Exposure of the white fiberglass will indicate the need for a new seal coat. The catchment should be given a light tack coat of cutback asphalt to ensure bonding of the seal coat to the oxidized surface.

Although properly constructed asphalt-fiberglass catchments are highly resistant to mechanical damage, such damage can occur. Holes in the cover are easily repaired with a patch of fiberglass matting saturated with asphalt emulsion. Large patches should also be given a seal coat. Windblown seeds can germinate and grow in any soil accumulating on the lining surface. The plants and soil should be removed. Penetrating-type plants such as yucca (*Yucca* sp.) or nut sedge (*Carex* sp.) not removed or killed during plot preparation can grow up through the

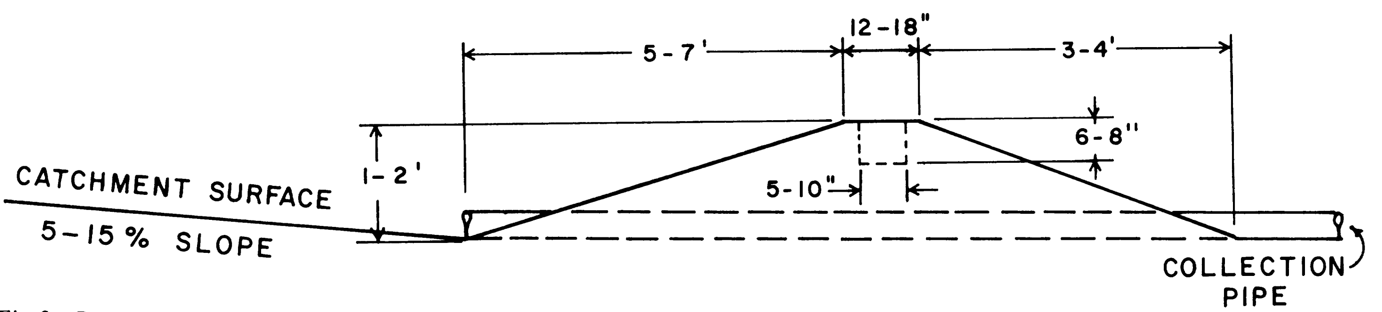

Fig. 2. *Desired shape of berm at lower edge of catchment area.*

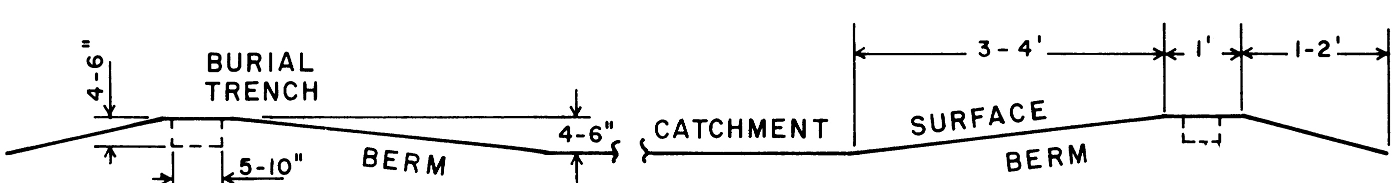

Fig. 3. *Berm shape for sides of catchment area.*

Fig. 4. *Laying the fiberglass mat and spraying with asphalt emulsion.*

Table 1. Construction costs for 1,100-yd² asphalt-fiberglass catchment.

Item	Cost	
Plot preparation		
Bulldozer, 6 hr at $20	$120	
Labor, 14 hr at $3.50	49	
Supervision, 10 hr at $6	60	$229
Soil sterilant		
Monoborchlorate, 150 lb at 14 cents	$ 21	
Labor, 2 hr at $3.50	7	
Supervision, 1 hr at $6	6	$ 34
Asphalt-fiberglass		
Fiberglass 1½ oz, 1,200 yd² at 40 cents	$480	
SS-2 emulsion, 550 gal at 30 cents	165	
Brooms, 3 at $5	15	
Labor, 20 hr at $3.50	70	
Supervision, 10 hr at $6	60	$790
Seal coat		
Roofing emulsion, 370 gal at 60 cents	$222	
Brooms, 3 at $5	15	
Labor, 8 hr at $3.50	28	
Supervision, 4 hr at $6	24	$289
Total		$1,342

lining. Small plants can be killed by injecting soil sterilant under the lining. Large plants can be removed by cutting the lining, digging them out, and patching the cut area.

Catchment Construction Costs

Detailed on-site costs for constructing an asphalt-fiberglass catchment on a rough, rocky, brush-covered site near Safford, Arizona, are presented in Table 1. Three men spent 7 hours raking cobbles and debris from the 1,100-yd^2 site after brush clearing, rough smoothing, and berm construction by a bulldozer. Asphalt emulsion was purchased in 55-gallon drums, and the price includes the cost of the drums. Total on-site cost was $1,342. A second catchment, installed on a relatively rock-free, naturally smooth site near Tombstone, Arizona, cost less. The site was prepared by a road grader in 1 hour, with no hand raking, and the asphalt was purchased at a bulk lot price in the user's drums. On-site cost of this 1,100-yd^2 catchment was $1,050. Experience in constructing nine asphalt-fiberglass catchments indicates that, by making necessary adjustments in costs of materials, equipment, and wages, the information in Table 1 gives a reasonable estimate of probable construction costs. The total cost of the collected water is also dependent upon water storage costs, land costs, and the precipitation (Cooley et al., 1972; Dedrick et al., 1969).

The above costs do not include site selection, surveying, or travel to and from the job. These costs will be required for any type of catchment construction. Similarly, fencing costs are not included. The Tombstone catchment, installed in July 1971, was not fenced because the asphalt-fiberglass is resistant to damage by animal traffic. Observations a year later showed no damage from cattle walking on the catchment surface.

Advantages

Field experience gained in the construction of nine water harvesting catchments since 1962 has shown that field-fabricated asphalt-fiberglass coverings are a dependable means of providing water for livestock on many rangeland areas. Catchments can be constructed with this material at an initial cost, including site preparation and labor, of less than $1.25/yd^2.

The asphalt-fiberglass coverings are easy to install, requiring no sophisticated equipment or skills. The material has been successfully installed on surfaces too rough for more conventional-type catchment materials. Maintenance on the covering is simple and should require less than 3 man-hours per year between seal

Fig. 5. *Completed asphalt-fiberglass lined catchment and reservoir on Fort Apache Indian Reservation.*

coat applications.

The asphalt-fiberglass is flexible during installation, permitting the lining to conform to surface irregularities. After complete curing, the lining becomes semirigid and is highly resistant to damage by wind or animals walking on the surface.

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Spring Food Habits of White-tailed Deer in the South Texas Plains

JAMES H. EVERITT AND D. LYNN DRAWE

Highlight: *During the spring seasons of 1970 and 1971, rumen analyses were used to determine food preferences of white-tailed deer on the H. B. Zachry Randado Ranch in South Texas. A total of 83 plant taxa were found to be eaten by this deer herd. Forbs comprised an average of 37.1% by volume of the diet, browse 33.1%, and cacti 17.5%, while grass comprised only 2.5% volume of the diet. Pricklypear cactus was heavily consumed and comprised an average of 15.4% of the total diet. Forbs were most heavily utilized in early spring. Perennial species were more prevalent than annuals in the diet. Important differences occurred in the diet between years, between early and late spring, and between the three major range sites on the study area.*

Increased emphasis on hunting for recreation has focused attention on improved management of wildlife in general, and of deer in particular. Ramsey (1965) emphasized that potential economic returns from deer were greater than from livestock under average prices and adequate deer harvest. Since the white-tailed deer provides a significant amount of recreation to the public and is a source of economic returns to the landowner, a knowledge of the food habits of the white-tailed deer is essential if deer herd management is to improve.

Deer food habits studies have been conducted in many parts of the United States. Atwood (1941) lists more than 600 plants utilized by white-tails in the United States. Because of the variability of plant species from area to area, no general list of deer food preferences can be made.

Numerous studies have been conducted on the food habits of white-tailed deer in Texas. Hahn (1945), McMahan (1964), and Kelley (1970) found deer in the Edwards Plateau of Central Texas to be primarily browsers, but grasses and forbs were important during spring. Davis (1951) and Davis and Winkler (1968) also found browse to be the major food of white-tailed deer in South Texas; however, forbs were important in spring. Grasses were utilized little and were important only in winter and early spring. Chamrad and Box (1968) conducted a winter and spring food habits study on the Welder Wildlife Refuge in South Texas and found deer to be grazers, with forbs and grasses comprising 90% of the diet. Drawe (1968) investigated midsummer food habits of deer on the Welder Refuge and found forbs to constitute over 60% of the diet. Browse accounted for 33% of the diet, while grass was not significant.

This paper reports the results of a study of the white-tailed deer's spring food habits on the H. B. Zachry Randado Ranch in the western portion of the South Texas Plains. Because of limited time, only spring food habits were studied; diet for the other seasons is being determined by another researcher. The objectives of this study were (1) to determine spring food preference of white-tailed deer on the ranch; (2) to compare food preferences in Spring, 1970, with those of Spring, 1971; (3) to compare early spring with late spring diet; and (4) to determine food preferences on various range sites of the ranch.

Authors are graduate research assistant and assistant professor of range science, Texas A&I University, Kingsville.

At present the senior author is agricultural research technician, Earth Resources Satellite Program, Agricultural Research Service, Weslaco, Texas.

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Study Area

The H. B. Zachry Randado Ranch is located approximately 28 miles southwest of Hebbronville and 26 miles northeast of Zapata on the Jim Hogg-Zapata County line. The ranch consists of 7,500 acres of native rangeland enclosed by an 8-foot high, deer-proof fence. This area is included in the South Texas Plains vegetational region (Gould, 1969).

The climate of this area is mild with short winters and relatively warm temperatures throughout the year. Average annual rainfall for Jim Hogg County is 20.78 inches. Heaviest rains occur in May and September, with monthly averages of 2.66 and 3.65 inches, respectively, (Texas Almanac, 1970).

Temperatures are high with a yearly average of 71.3°F.[1] January is the coldest month with an average minimum temperature of 47°F, while July is warmest with an average maximum of 99°F.[2]

The topography of the ranch can be described as flat, but broken by caliche and gravel ridges.

Four major range sites have been named on the ranch in a concurrent research study (Higginbotham, 1972) (Table 1). The first of these is the shallow ridge site associated with Zapata fine

[1] Soil Conservation Service Records, Hebbronville, Texas; unpublished data.

[2] Don Meyer, Climatologist, Hebbronville, Texas; personal communication.