

April 25, 1963

INSTITUTE OF
WATER UTILIZATION

RESEARCH PROGRESS REPORT FOR 1963

1. INVESTIGATION OF SITES, METHODS, AQUIFER DETERIORATION CONTROL, AND EFFECTS OF ARTIFICIAL GROUND WATER RECHARGE OF ALLUVIAL BASINS TYPICAL OF THE ARID SOUTHWESTERN UNITED STATES.

Project Number: 505. Funds: State. Personnel: L. G. Wilson (Leader), Sol Resnick, and one half-time Research Assistant.

Artificial recharge experiments were conducted on a test pit at Beardsley, Arizona in cooperation with the Maricopa County Water Conservation, District Number One. Three constant head and three falling head infiltration tests were conducted on the pit. The average intake rate under constant head conditions decreased from 3.88 acre feet/day at a head of 9.68 ft., for the first test, which lasted 9 days, to 0.82 acre feet/day at the head of 14.56 feet/day, for the third test, which also lasted 9 days. Similarly for the falling head tests the maximum intake rate was 72.0 feet/day at a head of 10.80 feet, for the first test, and 4.32 feet/day at a head of 10.56 feet, for the third test. The decrease in intake rates was attributed to deposition of sediment and microbial build-up on the surface of the pit. Seepage meter tests, conducted by the U.S. Water Conservation Laboratory, Tempe, Arizona, showed that water below the surface restricting zone existed in the unsaturated state. In order to obtain a relative idea of the reduction in intake rate with sediment deposition and soil moisture tension in the Beardsley sediments, a column experiment was conducted. A 4" I.D. lucite tube, 2 feet long, was filled to within 0.5 feet of the top with Beardsley pit material. A tensiometer was installed and a constant head of water was applied. It was found that when 1.5 inches of montmorillonitic clay was deposited in the surface of the material, the intake rate was reduced to 1/10 the value when flow was unobstructed. The soil moisture tension for the reduced rate was 40.0 cm. of water. The presence of water in the unsaturated state below the recharge pit would explain why no water was observed in observation wells adjacent to the pit.

Additional experiments were conducted to determine the effectiveness of grass filters in reducing the sediment load of flood water, destined for recharge purposes. Coastal Bermuda was the most efficient grass of six grass varieties and one alfalfa variety tested. In addition, the filtration efficiency was sustained to a higher degree during prolonged submergence by Coastal Bermuda.

than the other grasses.

An investigation was conducted on the process of sediment removal by pea-gravel filters. Experimental results indicated that the removal of sediment from turbid waters by means of "aged" pea-size gravel filters occurred as a result of adsorption of the suspended sediment to an organic film (schmutzdecke) coating the gravel, rather than by classic concepts of straining, sedimentation, and to a small degree, adsorption.

Recharge tests will be continued at Beardsley. Unsaturated flow will be followed in the sediments below the pit by means of the neutron probe method.

Research will be conducted to determine the relative effectiveness of various filters to maintain high recharge rates with low soil moisture tension, during recharge with turbid water.

Additional experiments on the removal of sediments from turbid water by filtering through grass stands.

Investigation of the feasibility of injecting "blowdown" water for cooling towers at the Tucson Gas, Electric Light & Power Company, into unsaturated sediments above the water table.

Continued work in cooperation with agencies interested in the design and operation of ground water recharge projects utilizing flood water and sewage effluent.

2. REDUCTION OF EVAPORATION LOSSES BY USING MONOMOLECULAR FILMS.

Project Number: 507. Funds: State. Personnel: C. Brent Cluff (Leader), Sol Resnick, Howard Goldstein.

Initial selection and chemical testing where necessary of the commercial fatty alcohols to be used were accomplished.

Calibration of field and laboratory equipment was completed.

The laboratory phase of the program is almost completed especially with regard to the determination under controlled conditions of spreading and healing rates with time for varying temperatures and humidities.

The evaporation pan testing phase is also providing useful data for application in pond testing program.

Testing in the field ponds is well underway using chemical in the following physical forms; Solid, flakes, powders, emulsions, and solutions. Considerable attention is being given to the development of dispensers for alcohols in the various physical forms.

Evaporation losses are very important where only limited quantities of water are available. The results of these experiments will be of benefit wherever water is scarce. In some areas of Arizona stockmen are buying water for \$1500.00 an acre foot. By reducing evaporation losses there is a direct dollar saving to the water user.

Pan Tests: The pan tests will continue to be used for screening purposes. Measurements will be made of evaporation, durability, temperature, and algae and bacterial growth.

Pond Tests: Measure evaporation, extent and pressure of film, healing ability, rate of spreading, algae and bacterial growth, temperatures, durability and quantities of chemicals required in different physical forms. Development of equipment will continue.

3. SELECTION AND TESTING OF MATERIALS FOR SURFACING WATERSHED AREAS.

Project Number: 508. Funds: State. Personnel: Sol Resnick (Leader), C. Brent Cluff, Ervin Schmutz, Richard Shaw

Analysis was completed of recording rainfall and runoff data collected for the tenth and eleventh years of operation of the Page Ranch asphalt-paved runoff area.

Twelve plots with concrete borders and volumetric measuring tanks are nearing completion. Besides conventional paving materials as plastics, chemicals selected through a screening program by the U.S. Water Conservation Laboratory will be tested.

The data from the Page Ranch project provides an economic basis for the determination of the usefulness of asphalt-paved runoff areas for providing water for cattle and game.

Plots will be established to determine costs, water yields, durability, and erosion potential using materials commonly available, such as plastics, cement, and bitumen in addition to low-cost chemicals and soil stabilizers as recommended by researchers, U.S. Water Conservation Lab. ARS.

4. CLIMATIC PATTERNS AND THEIR EFFECT ON ARIZONA AGRICULTURE.

Project Number: Hatch 541 (W-48). Funds: Federal. Personnel: S. D. Resnick, Consultants: P. C. Kangieser, State Climatologist, U.S. Weather Bureau, W.D. Sellers, Prof. Meteorology, Univ. of Ariz., Christine Green, Statistical Analyst, Univ. of Ariz.

Weekly summaries of precipitation, maximum temperature, and minimum temperature data for the selected net work of 19 climatological stations for the period, March 1, 1931 through February 28, 1961 were tabulated on cards for machine analysis. The Weather Bureau's procedure was used for estimating missing data.

The findings will eventually lead to a weather forecasting service for agriculturists, shippers, etc.

Probability studies for weekly periods and combinations of weekly periods will be made using the above tabulated precipitation data.

5. THE EFFECTS OF ALGAE AND MOLDS UPON SOME HYDROLOGIC PROCESSES OF MOISTURE EXCHANGE.

Project Number: Hatch 523 (W-73). Funds: Federal. Personnel: Sol D. Resnick, William F. Faust.

One phase of the past year's work was a study of the algal-mold crusts as they occur in wild land areas with special emphasis on molds present. A second phase of the past year's work was the construction of suitable equipment for investigating the effects of algae and molds upon the hydrologic processes of runoff, infiltration, and evaporation and erosion at soil surfaces.

The justification for this project lies in the possibility of controlling water yield from watersheds. The need for better control of our watersheds becomes obvious when consideration is given to the magnitude of losses due to flood damage and the serious limitations being placed upon the growth and development of regions which are short of water or are facing a future water shortage.

Artificial rainfall will be applied to paired field plots with a SCS Modified Type F rain simulator. Starting with barren uniform textured soil on the paired plots, algal-mold crusts will be encouraged to develop; a soil sterilant will be used on the control plot of the pair.

An attempt will be made to develop a standard to measure areal extent and density of the crusts.

The applicability of data, drawn from small areas, to large watersheds will be investigated.