MUDGY RIVER REACHES NEW FLOOD STAGE

Whole Trees Come Flooding Down With Crest. Familiar Forced to Evacuate Homes in Bottom Lands as Shingle Shelter Is Provided, It's an alligator's head is turned in at least twenty-one of the state's geological, structural, soils and streams by men trained to observe and know what they have observed.

Readings to Be Taken on river gauges will be instilled on many of the United States geological survey stations. The state, department, to obtain Accurate and water resources moldings, and any information, area and that is will be increased in the future, according to a Leah Rolla, Miss., who has just installed the first such gauge at Fort Smith-Van Buren highway bridge.

Austin said he found that 129,000 million gallons of water flood stage Monday. The speed of the current has been measured with an instrument resembling a crossbow.

Gauges Are Used

The flow of the Arkansas here will be studied several times a year, Austin said, the river has been a possible by the state's climate and being done under the State, state geologist.

The use and control of the state's water resources are subject to the direction of the State Water Resources Board, which has been adopted as standard practice for all private parties interested in the regulatory function of the State, Federal General Geological Survey.

Stations to Be Established

Under this cooperative arrangement None of the many stations have been made possible since the completion of the state's geological, structural, soils and streams by men trained to observe and know what they have observed.

Whole Trees Come Flooding Down With Crest. Familiar Forced to Evacuate Homes in Bottom Lands as Shingle Shelter Is Provided, It's an alligator's head is turned in at least twenty-one of the state's geological, structural, soils and streams by men trained to observe and know what they have observed.

U.S. Experimental Concretes Will Be Made at Little Rock

Louisiana, Aug. 31—Exhibitions of the American Concrete Institute will be made at Little Rock, Aug. 31, at 2 p.m. at the Little Rock-Southwestern railway station.

Use and Control of Waters of Arkansas Is Important, Timely Subject, Report of Department Says

At this time, 200,000 acres are in water power projects and 40,000 acres are in reservation and 20,000 acres are in irrigation. A few miles from the Little Missouri, one of the Missouri's main tributaries, Osage River is at high water. The river is 70 feet wide the Arkansas geological survey.

The use and control of Arkansas waters are subject to the direction of the State Water Resources Board, which has been adopted as standard practice for all private parties interested in the regulatory function of the State, Federal General Geological Survey.

Chains Gauges Installed

At each of these gauging stations a staff or chain gauge is installed which the state, state geologist.

Geological Survey Starts Water Flow Tests in Ozarks

Special to the Gazette

Henderson, Aug. 31—A large force of geologists as work at this place putting in a new water flow test at the mouth of the St. Francis river, which is to be made by the Geological Survey, which has been put by a force of men this season.

Power Company Measures Flow of Three Streams

Short Sept. 2. The water power company has been put by a force of men this season.


G. V. Austin of the water department, director of the chemical work, reveals that 12,200 acre feet of water are not available for the chemical work, and that the chemical work is not available for the chemical work.
Opposes Levee Construction as Means of Preventing Overflows

Henry Thane of Arkansas City, Who Has Given Much Thought to Subject, Convinced General Jadwin’s Plan Will Not Prove Successful

By Henry Thane.

Levees have been built from the first days of the history of the Mississippi River because of the great rainfalls that have occurred on the back of the fast food height, adding to the Mississippi's flow and making a small little more water, should it come. In the early days of the river, when it went with breaks in the leves here and there and another two or three feet added there, that was the beginning of the levee and levee building. The same thing happened in the days here and there of the various counties.

The writer came here in 1937, found plenty of levees and plenty of talk about building more and more of them. There has been no overflow for seven years now, no danger of flooding has been reported. Our levees will take care of the water, so far as we have them. When we were going through the flood in 1937 the water was over the top of the levee here and there and it has not recurred to those levels in any way since.

All this reminds me of what an old riverman once said to me when I met him and I was bringing my wife to a levee. He said, 'Thane, the levee is simply a dyke, a wall that keeps the water over the levee. When you build and build and build there's only a limited means of getting it down.'

"And what does this mean then?" I asked.

"Well, the levee is going to break again, and the water is going to go over the levee and destroy all the land and property back of the levee."

I have been trying to do something about levees for the last 20 years, and this is why I have been working here and there.

The levee is a dyke, a wall that keeps the water over the levee.

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STREAM GAGING IN STATE DEPENDENT


All information about streams in Arkansas, collected since 1857 and continuing through 1897, is contained in the Arkansas Stream Gaging Report No. 1, issued by the United States Geological Survey. This report, which has just been released from the printing presses, is ready for distribution.

The Arkansas Stream Gaging Report No. 1, issued by the United States Geological Survey, was obtained by collecting the required information, however fragmentary, from the files of various offices, or groups of offices, or persons who have had charge of the information in various parts of the state. Each office or group of offices was asked to furnish the information in the form of a report. Each report was then compiled and the result is the report now issued.

The starting of this work was not easy, for the maps of the country were not available, and the men of science who had made the maps were not available. The only maps available were those made by the United States Geological Survey, and these were not very suitable for the purpose. The only men of science available were the men who had made the maps, and these were not available. The only way to get the information was to send out a party of men to the field and to get the information from them.

The work is now being done by the men who have been working on the maps, and the results are being published in a series of reports. The first report is now issued, and the rest will follow in due course.

Covers With Branner.

John C. Hoyt, assistant chief by senior

hazardous engineer of the United States Geological Survey, and John H. REA

Large, engineer, in charge of the

stream-gaging work in Arkansas and

Missouri, presented a blank map of the

state to Mr. C. Branner yesterday, who

agreed to use it in the future work in Arkansas.

New Stream Measurement Program To Be Conceived.

Arranged for the future, it will be a

state-of-the-art program for the fiscal year 1990.

The program has been conceived for the state of Arkansas.

The state of Arkansas has a need for a state-of-the-art program for the fiscal year 1990.

The program has been conceived for the state of Arkansas.

An outline of the state-of-the-art program is as follows:

1. A state-of-the-art program for the fiscal year 1990.

2. The state of Arkansas has a need for a state-of-the-art program for the fiscal year 1990.

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Building Stream Gaging Station

Work Under Way at South End of Main Street Bridge.

A rock gaging station has been completed at the south end of the Main Street Bridge in Little Rock, Arkansas.

The station was built by the federal government for an 85-year-old public works project for rehabilitation of river measurement stations in Arkansas.

The station is being operated by the United States Geological Survey, and is maintained by the state government.

The major cost of the work will be for labor hire, which is being handled by the office of W. A. Crum, state reemployment officer.

The Little Rock station will be in the form of a wall with eight-inch-reinforced concrete walls, the bottom tending about three feet below minimum flood, and the top extending about two feet below minimum flood.

The work began in 1937.

The work in this state was begun in 1937, and the station was completed in 1939.

The station will be used for routine measurement of water levels, and will be maintained by the state and the federal government.

Method of Operation.

The instruments are located at a point on the water surface, and will be maintained at a level as low as the water level in the river.

The records obtained will constitute the requirements of United States Army Engineers, Geological Survey, and the Weather Bureau in the

How Stream Gaging Servs.

The joint budget commission has issued a report on the state's financial condition for the fiscal year ending June 30, 1990.

The report contains a statement of the state's financial condition for the fiscal year ending June 30, 1990.

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The report contains a statement of the state's financial condition for the fiscal year ending June 30, 1990.
Methods of stream gauging for the utilization of water power in Arkansas are depicted in the photographs above. More than one-tenth of the available water power in Arkansas is now developed, or will be developed in the near future, according to Arkansas geological survey No. 1, which has just been released by the Arkansas geological survey. At the left is shown how high water measurements are made from cable cars. This scene was made on the Buffalo river. At the right above is shown an engineer taking measurements by wading out into Mulberry river.
Checking the River Flow


By GEORGE C. BRANNER
(State Geologist)

Two drainage districts, one in Poinsett county and the other in Mississippi county, co-operate with the state federal stream gauging program in order to obtain stream-flow records in their territory.

The technical work of stream gauging consists of a series of discharge measurements and a gauge-height record. A discharge measurement is made by taking at least 10 or more intervals of current, and obtaining an average of the depth of water available for navigation. According to the War Department definition, there are 1,904 miles of navigable streams in the state, exclusive of the Mississippi river.

The technical work of stream gauging consists of a series of discharge measurements and a gauge-height record. A discharge measurement is made by taking at least 20 or more intervals of current, and obtaining an average of the depth of water available for navigation. According to the War Department definition, there are 1,904 miles of navigable streams in the state, exclusive of the Mississippi river.

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Checking the River Flow

(Continued from Page 13)

Stream-flow data places the Arkansas resources in a position where they can compete with other states. While the water resources of this state may be of less value, they can, because of their more complete stream gauging records, offer more protection to capital investment.

Statistics on Water Power

### TABLE I.

<table>
<thead>
<tr>
<th>Stream</th>
<th>Number of Dams</th>
<th>Primary Power Available 100% of the Time (H. P.)</th>
<th>Economic Secondary Power Available Less than 100% of the Time (H. P.)</th>
<th>Total (H. P.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>White River</td>
<td>1</td>
<td>146,000</td>
<td>74,000</td>
<td>220,000</td>
</tr>
<tr>
<td>North Fork</td>
<td>2</td>
<td>68,000</td>
<td>4,000</td>
<td>72,000</td>
</tr>
<tr>
<td>Caddo River</td>
<td>3</td>
<td>34,000</td>
<td>6,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Buffalo River</td>
<td>2</td>
<td>23,000</td>
<td>3,000</td>
<td>26,000</td>
</tr>
<tr>
<td>Little Red River</td>
<td>2</td>
<td>6,000</td>
<td>46,000</td>
<td>52,000</td>
</tr>
<tr>
<td>Strawberry River</td>
<td>3</td>
<td>6,000</td>
<td>3,000</td>
<td>9,000</td>
</tr>
<tr>
<td>Spring River</td>
<td>3</td>
<td>5,000</td>
<td>3,000</td>
<td>8,000</td>
</tr>
<tr>
<td>Cache River</td>
<td>3</td>
<td>3,000</td>
<td>3,000</td>
<td>6,000</td>
</tr>
<tr>
<td>Fouche LaPare</td>
<td>2</td>
<td>2,000</td>
<td>3,000</td>
<td>5,000</td>
</tr>
<tr>
<td>Caddo River</td>
<td>2</td>
<td>1,000</td>
<td>3,000</td>
<td>4,000</td>
</tr>
<tr>
<td>Little Mo. River</td>
<td>1</td>
<td>1,000</td>
<td>2,000</td>
<td>3,000</td>
</tr>
</tbody>
</table>

**TABLE II.**

<table>
<thead>
<tr>
<th>Developed Water Power in Arkansas (H. P.)</th>
<th>Estimated Potential Economic Water Power Available in Arkansas (H. P.)</th>
<th>Per Cent Developed Water Power</th>
<th>Estimated Potential Water Power Available in Arkansas (H. P.)</th>
<th>Per Cent Developed Water Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary 6,400 (1)</td>
<td>304,700 (1)</td>
<td>1.2</td>
<td>209,300 (2)</td>
<td>31.9</td>
</tr>
<tr>
<td>Secondary 46,615 (2)</td>
<td>193,000 (2)</td>
<td>29.5</td>
<td>109,000 (4)</td>
<td>11.3</td>
</tr>
<tr>
<td>Total 71,015</td>
<td>497,700</td>
<td>30.7</td>
<td>318,300</td>
<td>11.2</td>
</tr>
</tbody>
</table>

(1) Per water available 100 per cent of the time.
(2) Per water available less than 100 per cent of the time.
(3) Per water available 80 per cent of the time.
(4) Per water available 50 per cent of the time.

### TABLE III.

<table>
<thead>
<tr>
<th>Year</th>
<th>By Fuel Power</th>
<th>By Water Power</th>
<th>Total K. W. H.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1920</td>
<td>31,837,000</td>
<td>31,980,000</td>
<td>63,817,000</td>
</tr>
<tr>
<td>1921</td>
<td>33,600,000</td>
<td>33,700,000</td>
<td>67,300,000</td>
</tr>
<tr>
<td>1922</td>
<td>33,000,000</td>
<td>33,000,000</td>
<td>66,000,000</td>
</tr>
<tr>
<td>1923</td>
<td>32,000,000</td>
<td>32,000,000</td>
<td>64,000,000</td>
</tr>
<tr>
<td>1924</td>
<td>30,000,000</td>
<td>30,000,000</td>
<td>60,000,000</td>
</tr>
<tr>
<td>1925</td>
<td>30,000,000</td>
<td>30,000,000</td>
<td>60,000,000</td>
</tr>
<tr>
<td>1926</td>
<td>30,000,000</td>
<td>30,000,000</td>
<td>60,000,000</td>
</tr>
<tr>
<td>1927</td>
<td>25,600,000</td>
<td>25,600,000</td>
<td>51,200,000</td>
</tr>
<tr>
<td>1928</td>
<td>25,600,000</td>
<td>25,600,000</td>
<td>51,200,000</td>
</tr>
<tr>
<td>1929</td>
<td>25,600,000</td>
<td>25,600,000</td>
<td>51,200,000</td>
</tr>
<tr>
<td>1930</td>
<td>25,600,000</td>
<td>25,600,000</td>
<td>51,200,000</td>
</tr>
</tbody>
</table>

* Partially estimated.

### TABLE IV.

<table>
<thead>
<tr>
<th>Stream</th>
<th>Location</th>
<th>Minimum Cu. Ft. per Sec.</th>
<th>Maximum Cu. Ft. per Sec.</th>
<th>Ratio Max. - Min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arkansas</td>
<td>Little Rock</td>
<td>3,000</td>
<td>853,200</td>
<td>284.10</td>
</tr>
<tr>
<td>White</td>
<td>Clinton</td>
<td>4,000</td>
<td>658,000</td>
<td>164.50</td>
</tr>
<tr>
<td>Red</td>
<td>Denison, Tex.</td>
<td>142</td>
<td>132,000</td>
<td>910.60</td>
</tr>
<tr>
<td>Caddo River</td>
<td>Hot Springs</td>
<td>22</td>
<td>143,000</td>
<td>6,410</td>
</tr>
</tbody>
</table>
Here's Answer to Question: How Low Is 3.1 Feet Below Zero on Gauge Used to Measure Arkansas River Stages?

The sketch, which Harvey S. Cole, meteorologist of the Little Rock Weather Bureau, prepared yesterday at the request of the Gazette, gives an idea of just how low a stage of 3.1 feet below zero yesterday afternoon's record reading is when compared to a normal stage for July, which is known as "Flood stage" to the highest stage of 1917 year of the last great flood), and to the record high of all time. The gauge which Mr. Cole is using to read the river stage is shown in the photograph. It is on a west pier of the main street bridge. Another gauge is used when stages are above zero, but the river already has dropped below it. If the river fails another three inches at this point, it will be necessary to set up an auxiliary gauge.

WEATHER FORECAST

Arkansas: Generally fair Tuesday, Wednesday; partly cloudy in unsettled area.

Louisiana: Partly cloudy Tuesday and Wednesday; possibly local showers in south portion.

Oklahoma: Partly cloudy to somewhat unsettled Tuesday and Wednesday; possibly local thundershowers in northeast portion.

Texas: Partly cloudy Tuesday and Wednesday, possibly showers near east coast.

Local Record Yesterday:

Data from U.S. Weather Bureau:

<table>
<thead>
<tr>
<th>Year</th>
<th>Date</th>
<th>Stage</th>
<th>1 a.m.</th>
<th>5 a.m.</th>
<th>9 a.m.</th>
<th>1 p.m.</th>
<th>3 p.m.</th>
<th>5 p.m.</th>
<th>7 p.m.</th>
<th>9 p.m.</th>
<th>11 p.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1927</td>
<td>12/24</td>
<td>34.08</td>
<td>34.10</td>
<td>34.11</td>
<td>34.11</td>
<td>34.11</td>
<td>34.11</td>
<td>34.11</td>
<td>34.11</td>
<td>34.11</td>
<td>34.11</td>
</tr>
</tbody>
</table>

Depreciation from normal precipitation since January 1st: 4.2 inches.

RIVER STAGE FALLS AS MERCURY RISES

Record Low Water Mark of 3.1 Feet Below Zero on Gauge Set.

Highest Reading of Summer Reported, With Other Sections Also Suffering From Heat.

While the Arkansas river fell another three feet at Little Rock yesterday, the temperature climbed to 103 degrees at 4:30 p.m., to a new high record for the summer, as readings of 100 degrees or more were reported from many sections of the state where crops already have been damaged seriously by drought.

The river stage of 3.1 feet below zero at 7 p.m. was a new all-time low water mark at Little Rock. Until the river registered three feet below zero on the gauge Sunday morning, the record low was 2.9 feet below zero, October 1-2, 1902.

Yesterday was the eleventh consecutive day that the temperature has registered 96 degrees or above in Little Rock, and the third day this month it has been 100 or more, while the Weather Bureau has reported 102 degrees July 17 and 105, July 18.

The maximum temperature was the highest in the last three years. The highest recorded here by the Weather Bureau was 103 degrees July 19, 1922. The highest in 1921 was 109, in 1920, 98.6, and in 1919, 105, all occurring in July.

Once the mercury touched 100 degrees at 2 p.m. yesterday, it did not go below that point until after 7 p.m., when the Weather Bureau made its last reading until this morning.

Fort Smith reported a maximum temperature yesterday of 104, Memphis, 104, and St. Louis, a new all-time record of 108.

Comments on River Record:

Although the low water mark yesterday afternoon establishes a new record for Little Rock, Harvey S. Cole, meteorologist in charge of the Little Rock Weather Bureau, said there was nothing unusual about the water running past Little Rock as in 1877 when the low mark was only 1.4 feet above zero, since the river had shortened its course here and dug in deeper, leaving more water below zero on the gauge now.

He said that the river had fallen to within two or three inches of the bottom of the gauge and that if it continues to fall, a marked slack would have to be driven between the gauge to take river readings.

Low water marks for the past 11 years were listed as follows by the Weather Bureau:

<table>
<thead>
<tr>
<th>Year</th>
<th>Date</th>
<th>Stage</th>
<th>1 a.m.</th>
<th>5 a.m.</th>
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<td>34.11</td>
<td>34.11</td>
<td>34.11</td>
</tr>
</tbody>
</table>

The highest river stage recorded in the Weather Bureau files, 4.4 feet in June, 1923, was measured by William E. Woodruff, founder of the Arkansas Gazette. Mr. Cole said. Mr. Woodruff measured the height of the water above the "Little Rock" located east of the lower Missouri Pacific bridge on the south side of the river, at the highest point of the rock.

Later, United States government engineers took the reading, corrected it to the Weather Bureau gauge set up here, and recorded it as the highest at Little Rock in history.

Makes Drought Worse

A drought survey of the state, compiled yesterday by Mr. Cole, showed that not even a trace of rain had been reported to the Weather Bureau from any part of the state in the last five days. The last rainfall reported was 5 of an inch last Wednesday at Portland.

Little Rock has had no rain since July 17, while Fort Smith, center of the drought in northwest Arkansas, has had only 18 of an inch of rain in 34 days.

For Branch, Van Buren county, has reported only 0.4 of an inch since June 18, and Calebo Rock only a trace since June 11. Cooter has had only 20 of an inch since June 11, Jonesboro, 14 since the same date, and Pine Bluff only 20 since June 17.

Arkansas City has had only 23 of an inch since June 18 while Newport has had no rain since July 1 and Panguitch since July 1, with other towns in many sections suffering as badly.
River Entirely Too Low-Down
For New Gauge to Be Utilized

Geological Survey Engineer
Hopes to Have Convenience Working Soon.

The Arkansas river played a low trick on Uncle Sam, literally and figuratively.

Last fall the United States Geological Survey built a handsome and expensive gauge on the bank of the river just east of the Main street bridge.

This $2,000 improvement was intended to take the place of the simple 141 tall of cypress which has served the United States Weather Bureau these many years.

But the old Arkansas has fallen so low-down to 3.5 feet below zero, an all-time record— that the modern gauge cannot function. The metal pipe that makes the gauges go around in the observation room was left high and dry by several feet.

Pipe Being Lowered.

However, that defect is being remedied, and the gauge should be in service by this week. Under the direction of J. H. Groffman, director-engineer of the United States Geological Survey, Fort Smith, the pipe is being lowered four feet.

In order to get the pipe down to where it could still draw water from the river, it was necessary to dynamite through several banks of hard rock.

It should make it mighty nice for Harley B. Cole, meteorologist of the Weather Bureau, for when the pipe is ready for service, it will be wired to the bureau in the Federal building, and the readings on the gauge will be scientifically transmitted.

This will obtain the daily visit to the river bank that has been the custom of Weather Bureau employees for decades.

How It Functions.

The modern gauge consists of a well, about five feet square, extending from the high water mark of the river until the river level. A plate is sunk in the well, with a weight on it, and a recorder marks the rise and fall of the water on one of three cross-section charts that abound in Weather Bureau offices.

That is, it will, it is hoped, when the well has been sunk as low as the Arkansas river has sunk.

Construction of this and similar gauges in Arkansas was done as a FWA project, for which the Arkansas allotment was somewhere between $35,000 and $40,000.

Arkansas River Has Shrunk Clear Away
From Even Low Water Gauge on Bridge

With the stage of the Arkansas river lowered in the history of the Weather Bureau here, 3.5, the low water gauge on the Main street bridge is high and dry and almost forgotten.

An auxiliary gauge—really just an unplanned stake with a house mark on it—is the instrument that the Weather Bureau uses to determine the “normal” reading of the river from day to day. In the above photograph, the old low water gauge, fastened to the pier, is shown rising several inches above the water, while in the foreground is the new gauge, almost out of water itself.

Sandbars Fill River Channel

The low stage of the Arkansas river, which now is at a new all-time low, has caused sandbars to pop up at many points in the stream between Little Rock and North Little Rock. In the picture above, a sandbar east of the Main street bridge is shown. The picture was made from the Missouri Pacific Rock bridge, looking westward.

The river has fallen to a stage 3.5 feet below zero on the gauge, the lowest stage ever recorded here. The lack of rain in the western part of the state and in Oklahoma and Kansas is responsible for the drop in the river.

The previous low record was 2.9 feet below zero in October, 1920, while the latest low level has been recorded since the middle of last week.

They Wade the Arkansas River Here,
and Hardly Get Swimming Suits Wet

The once-powerful and dangerous Arkansas river, already humbled by the drought, was subjected to further humiliation yesterday when two youthsters waded across it and hardly got wet. The boys, Warren Bray (left), aged 15, son of Mr. and Mrs. W. C. Bray, 1008 Scott street, and Ralph Middleton (right), 14, son of Mr. and Mrs. A. N. Middleton, 2317 Rock street, paced near the Little Rock side of the river for this picture to be made, after they had straddled across to North Little Rock and then walked back. The water was ankle deep at most places, and at no point was it more than waist deep. They started their walk from near the foot of Foster street, which is in the east end of the city.
Measuring a River's Value

Engineers Say That Basic Records on Arkansas Streams Are Necessary if They Are to Be Developed. Compiling This Information Is Interesting Work.

By EDGAR CHESNUTT

There is a very definite and yet something indescribable fascination about a stream of running water. The babbling brook strikes the poet to unshackled heights of inspiration; the roaring river lends a colorful crescendo to the lyrics of the song writer.

But aside from the aesthetic, rivers and creeks have a definite practical value. For centuries man has used them to transport his worldly belongings, has harnessed their hurryng energies to turn mills or generate power for other purposes.

The practical value of the rivers and streams in Arkansas has never been estimated; the only available data regarding their hidden wealth has been gathered to a large extent in a haphazard manner. At no time has complete information been obtained on any one stream and on most of them there is no record available at all. It did appear for a while—after the disastrous flood of 1927—that enough interest had been aroused to assure a complete study, but this work was discontinued by the state in 1932.

Measurement Essential.

Since it seems evident that reliable information on the flow of the river and streams of Arkansas should be secured now, let us see what is involved.

Engineers say 60 river measurement stations are needed, located at strategic points on the various streams for which there is a potential water use or other need for knowledge of flow. Data secured is published in the form of daily discharge in cubic feet per second and applies for a considerable length of the stream in the vicinity of the station location. The records should be continuous for at least 16 years and preferably for 30 or 50 years, adequately to cover all cycles of flow in seasonal and periodic changes. Such a program is carried on by co-operation with the federal government, the work done by competent, trained hydraulic engineers of the Water Resources Branch of the United States Geological Survey, an agency with a 45-year-old reputation for thorough and reliable work which has the confidence of the entire nation.

Engineers Specialize.

The engineers who perform this work must be thoroughly grounded in a knowledge of hydrology and engineering; for this reason all such employees are required to have an engineering degree from a recognized college or university in addition to passing a rigid Civil Service examination. They do all the field and office work.

Data is secured by the establishment of a gauge on a stream at a point where the flow is to be determined. Gauges are of two kinds. One the staff or weight-gauge, is read morning and evening by a local man or woman referred to as an observer. The observer is selected for honesty and intelligence and a small monthly sum is paid for such service. The second, the water stage recorder gauge produces a continuous record of flow. It is an instrument housed in a tower or well, constructed on the bank of a river, or attached to a bridge pier. The water in this well operates a float which acts as the recorder above to record the river stage on graph paper. This paper is pulled under a pen by a clock, recording a continuous stage for time and height of water.

Initial Cost Largest.

Although more expensive initially, it is obvious that the water-stage recorder record is more valuable and desirable than a gauge read twice a day by a local observer. To translate this record into discharge, an engineer visits each station frequently and makes a discharge measurement with his current meter by taking soundings and meter velocity observations across the stream. He determines his area of cross-section and his velocity of flow for a particular river stage. The area multiplied by the velocity gives him his discharge for that stage.

Many technical problems are involved, both in the office and field work, so these engineers must have a thorough knowledge of their work.

In addition, they must be physically strong, for a discharge measurement takes from two to four hours and involves the handling of sounding weights, weighing from 15 to 50 pounds by hand, and from 50 to 500 pounds by boom and reel. Try careful meter placing and raising and lowering 30 pounds through 40 feet of water at definite points across a stream for two or three hours in any kind of weather, jump into a car and drive 50 miles to another station and repeat the operation, and you will agree it's no snap.

Brave Hazards.

These engineers are required to know how to swim; accidents happen and they have to act fast to keep from being swamped into the river, and to be able to swim out if caught. Once an engineer had a hazardous experience when measuring from a cable. A measuring cable is erected by design and for a tag such that when loaded with a car, men and equipment, the loaded elevation is definitely known. On an earlier installation at a stage higher than any experienced, this engineer underestimated his clearance with the result that in midst of the river caught the bottom of the car and whipped it downstream.

The cableway tightened and snapped the car back upstream where the water again caught it. This unpleasant experience was repeated several times before the engineer managed to haul himself clear. Heavy loads sometimes will snag the meter line. If unable to throw this drift clear the engineer may have to cut the line to save himself from being pulled into the stream. As this means a loss of about $100 in equipment, there always is a hard right wage before cutting free.

All instruments used in this work have been developed by or at the instigation of the United States Geological Survey. The work is handled from district offices, of which there are now 37 in the United States and Hawaii. The office for Oklahoma and Arkansas is located geographically at Fort Smith. Considerable work is now being performed in which the federal government has a main interest and is operated purely on federal funds. Much of the work needed in the state is not touched because no state funds are appropriated. Such an appropriation will be matched dollar for dollar by the federal government, but until made the records needed by the state, its engineers and inventors, and its cities and institutions, will not be provided.

Reasons for Disinterest.

There are several reasons that might be advanced for a lack of general interest in the subject of river measurement. The first in all probability is that the public is not in direct contact with the rivers and their value. "What practical value can there be in knowing just how fast and how much a river is flowing at a certain point?" the average layman would ask. What, then, is essential to assure the work? On the very surface it is evident that those directly associated with river measurement work and its value should present the subject, educate the public to its practicability, and insist upon its being carried out.

Examples of Value.

There are so many concrete examples of the value of a complete record of river measurements in Arkansas that argument based on them should be far more impressive than any opposition that might be put forward. The great hydro-electric dam

Pictured here are two methods of obtaining information on river flow. Above is a specially designed boom and reel with a stream measurement apparatus attached, for use from a bridge. At the left an engineer is shown in a cable conveyor over Buffalo river taking a discharge measurement.

On the Ouachita near Hot Springs, REMM and Carpenter, never could have been constructed without a comprehensive knowledge of the flow in the river offered, Capt. Faye Carpenter of Arkansas, the man who conceived the idea of the dam, spent a good part of his life in the study of this river, and in 1927 the Water Resources Branch of the United States Geological Survey was brought into the picture to secure reliable unbiased records of river flow.

It was their combined facts and figures, presented to Harvey C. Couch that resulted in the construction of the present dam and the planning of still a third. This data also provided for the recreational resorts of Lake Hamilton and Lake Catherine to be pictured exactly long before they came to existence.

St. Francis Valley Project.

Another example of the practical value of records of stream flow is seen in the St. Francis river basin; because data was available on which to make calculations and surveys, a new levee system was constructed to afford flood protection and greatly improved navigation on the river.

The saving of $100,000 on a water supply project in Crawford county, because the sponsors had facts on which to plan, in itself would carry on the stream measurement work in Arkansas for 30 years.

Right now development of White river's resources looms as a near reality. When this development does come it will be for nearly 30 years a systematic study and survey of this stream has been under way by Capt. Charles L. LeVasseur, a French engineer of note, who was selected by this picturesque stream in 1904 and has been living his life along its shore. The fact that he has been retained as engineer while the power rights on the upper reaches of the river have passed from one to another company clearly indicates that his knowledge is valuable. Of course, if done systematically and under the proper supervising agency, such studies could be greatly shortened and widened in scope.

During the last six years the levee system of Arkansas has been revised almost in its entirety. Dikes have been highed at

(Continued on page 11)
Measuring a River's Value
(Continued from Page 1)

of the book test breaks out of the water when the height measured
from the level of the gauge attached to

Weather Bureau Adds Water
Evaporation Measurements
To Its Many Other Duties

With installation of a water evap-
oration measurement station at Rus-
ssvilleville and installation of another
at Hope, the Little Rock Weather
Bureau in the near future will be
able to give additional information
regarding stream flow, run-off from
reservoirs, losses of water in irri-
ation and in soil conservation.
Records of the two stations will be
published by the Weather Bureau
which has been in opera-
tion since 1870.

H. B. Colie, meteorologist in charge
of the Little Rock Weather Bureau,
yesterday told of the advantages to
be obtained from observations at
evaporation measurement stations
and said many engineers, business-
men and farmers derived the infor-
mation so to determine amount of
water lost and amounts of water
needed in various operations. Re-
ports of evaporation also enable
the weather bureau to make a more
accurate forecast of river stages
and stream flow.

One of the stations has been in
operation seven years at the Rice
Branch Experimental Station, nine
miles east of Stuttgart, through
the cooperation of the Agricultural Ex-
periment Service. Although no record
amounts have been published, a
private station has been in opera-
tion a year at the Friesenburg cir-
cle, six miles northeast of Stutt-
gart. Both stations have been in
operation in conjunction with stan-
ds of rice growing which requires
large amounts of water.

A station was put in operation
on September 3 at the George Evers
Forest Service Station at Russellville.
It will be operated as soon as
installed at the Fruit and Truck
Branch Experiment Station of the
Extension Service at Hope. The
stations at Russellville is a mile
north of the town and at Hope will
be about a mile northeast. The latter
is expected to be in place in operation
within a week.

The measurements taken at
these stations will furnish prac-
tical information as to the
amounts of evaporation in different
parts of the state. A record of
the wind's velocity and meteorologi-
cal data is usually recorded. Mr.
Colie said. In order to obtain the
necessary information relating to
the amount of evaporation on large
bodies of water, percentages will be
computed that will provide the de-
sired result.

In computing water levels and
run-off in reservoirs, the results ob-
tained from evaporation measure-
ment stations will be of value, Mr.
Colie said. By determining the rate
of evaporation under certain weather
condition, it will be possible to learn
the total amount of water
stored from large bodies.

In irrigation, particularly in rice
production, the data will show the
amount of evaporation from the
water and the amounts of water
needed to provide proper moisture
in the ground.

In forecasting stream flow and
river stages, evaporation may be
taken into consideration. By con-
structing certain tables and actual
measurements of the amount of water
needed to maintain rainfall and
maximum and minimum temperatures
bodies of water in the

Evaporation measurements have
been conducted in various parts of
the state for several years. Mr.
Colie said, and with the three
stations in Arkansas and possibly
a fourth, monthly and annual amounts
will be published hereafter in the
annual climatological summary of
the state.

The record at Stuttgart is to be
published soon and the record at a
station at West Memphis conducted
a year in 1933 and 1934 also will
be published. In addition, five "in-
minute" parts of the state will be
included with the evaporation
information.

Evaporation measurements
are made by means
of a book gauge, which is
placed in a platform
of water and operated
by a screw to the proper
water level.

The book gauge extends into
the water when the height is measured
with a level until the point

One of the most expensive features noted
so far, and which can be traced directly
to a lack of river information, is bridge
building. More than one case is on record
where bridges—expensive ones, too—
have been twisted and torn into tumbled
masses of concrete and steel because they
were built sufficiently high to cover the
flood stage, but with insufficient openings
to carry the quantity of water that had
to flow under them.

There is no estimate of how much money
has been spent unproductively in small power
stations which were constructed with a mere
hope as to the water's availability; but suffice
it to say that those who are in a position
now to declare the sum is enormous.

Probably the most striking example of
the cost of not having data, was brought
forth by the drenchings of 1930 and 1931.
Cities and towns were forced to turn to
new sources of supply for their water. And
where were they to turn? Nowadays, there
are records to consult; surveys were nec-
essary, and such undertakings were
expensive when conducted individually. Many
communities have felt the absence of wa-