

A RESERVOIR ACTION

Not Only a Fact, but Such Action Can Be Much Augmented by Art.

ANY NUMBER OF EXAMPLES

From the Smallest Brooklet to the Mighty Father of Waters.

AN ILLUSTRATION FROM ARIZONA,

Which Fortunately Came Under the Observation of an Engineer.

ONE SUGGESTION FOR THE FARMERS

PAPER NO. 8.

The proposal to utilize and augment by art the reservoir action of water courses, and thus to mitigate flood conditions, and at the same time develop inland navigation to the fullest possible extent, was expected to be regarded as a recombination and extension to larger uses of well-established principles of hydraulics.

It was of course expected and desired that engineers would criticize the devices suggested to be employed, and advise the locations of the floors and the reservoir volumes practicable to obtain in the river channels; in other words, the efficiency of the proposed measure.

Most valuable facts not generally known—data not accessible to the most laborious research—would be brought out in this way, and probably in no other.

It was not, however, anticipated that any engineer would more than question the fact of reservoir action in water courses, or regard it as a new idea or discovery. That this has occurred seems to justify a more technical treatment of the subject than was originally contemplated.

Reservoir action is a fact; and it is a fact that such action can be greatly and most beneficially augmented by art. How much, in what ratios to flood volumes, with what good results, are questions of fact for practical men to determine by surveys, observations and calculations. Criticism on these lines is practical and must be beneficial to the public interest.

Floods Make Reservoirs.

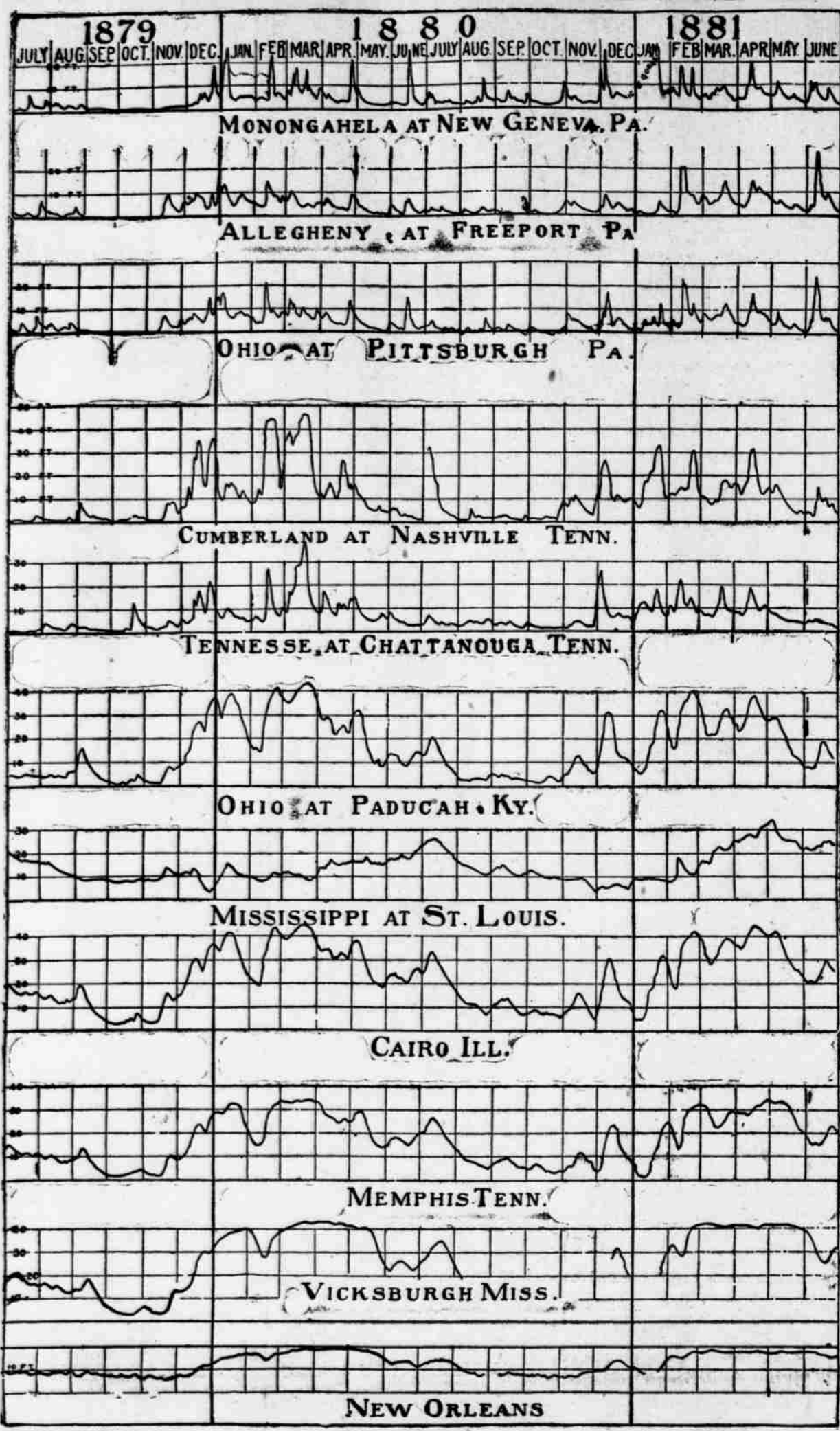
No observant person can deny that the dimensions of a water course are mainly dependent upon flood conditions. The effort of streams to enlarge their channels to accommodate the extreme flood wave, is a fact easily recognized. Everyone has seen a stream, at some point, overflowing the surface of a gentle sloping meadow, at noon become a raging torrent by a cloudburst or unprecedented rainfall, and next day, shriveled to its original proportions, trickle along the bottom of a deep gully, yards in width and depth, sink in a few hours by the torrent of flood water, and the next day, the same stream is taken for illustration, because relatively great changes in the bed of such streams are quite common. Large streams and rivers, under similar conditions, as is instanced in the constant changes in the bed of the Mississippi, and most strikingly in the recent great changes in the San Pedro river in Arizona.

Unusual natural phenomena seldom occur under the immediate observation of scientific men, as questions of fact in this case. A distinguished engineer, who was on the ground, related to the writer what is here put down from memory. On the night of the occurrence Dr. P. and his party spread their blankets in the champaign about a quarter of a mile from the town of Dudleyville, and as far from the San Pedro, as they could get, to observe the foreshall of a wide flat, on the opposite side of which flowed the river. During the night the party were compelled to move down the river, and when morning dawned, they found the entire flat having been washed away.

All night and on the next day the banks fell with a noise of thunder, melted away in the torrent, and the entire tract several hundred yards wide, by several miles long, was washed out to an average depth of 14 feet, millions of tons being removed in the process.

An Arizona Illustration.

This occurrence well illustrates the extent to which a single unexplained flood will alter and enlarge a water course, as has been seen in Arizona this year by the unprecedented rainfall. The natural action of water on a river bed is to establish it with the slope at which erosion ceases; and extreme flood conditions, if repeated at longer intervals, will not only to enlarge the channel, but also to enlarge it laterally; so that if the original fall be great enough, the banks and bed sufficiently erodable, and the length of the reservoir capacity finally attained, to accommodate the entire volume of the greatest floods. The cyclic uncomprehended natural



retard the reservoir development as in the Ohio, the Yosemite, and other well-known streams. The effect of the length of the water course related to the duration of the flood is well illustrated by comparison of the Niagara with the Mississippi. The Niagara is a very short river, and its moderate discharges are practically continuous—therefore its reservoir volume is trifling relatively to its discharge. The Mississippi, on the contrary, has sufficient reservoir action to moderate almost to obliteration at Carrollton the extreme flood oscillations at Cairo. The Columbia is a good example of reservoir action, as is shown by its extremely smooth flood diagram.

A river of little original fall has deficient power of erosion, generally meanders through a marsh, and its reservoir action is naught. Such rivers as the Allegheny, the Connecticut, the Potomac, and in fact most rivers, exemplify the normal relation, in which the river, at high flood, fills or nearly fills its banks, and there is neither great excess of channel capacity nor excessive erosion or destructive floods. In any such stream the portion T divided by D of the flood volume, would if congealed, be very nearly or entirely contained within and fill the water course; and where T divided by D equals 1, or the flood duration is equal to the time of traverse, the entire flood volume would be so contained as is probably the case with the Missouri river and many of its tributaries. The accompanying diagrams show the effect of channel reservoir action in a very interesting manner. The flood oscillations in the smaller tributaries are short and sharp, extending over but a day or two; further down

to drive mills and electric light plants suggest that the reservoir action of water bearing strata can be considerably augmented. Flowing artesian wells, especially if large enough to use profitably for power, for water supply or for extensive irrigation, are very profitable to their owners; nearly as much so, in fact, as oil or gas wells, for they do not play out. It is reasonably to be supposed that such wells as sources of profit, geologists and drillers would explore for them, the artesian reservoirs would be tapped and drained, their capacity developed to the utmost, without expense to the Government, and what is very nearly or entirely contained within and fill the water course; and where T divided by D equals 1, or the flood duration is equal to the time of traverse, the entire flood volume would be so contained as is probably the case with the Missouri river and many of its tributaries. The accompanying diagrams show the effect of channel reservoir action in a very interesting manner. The flood oscillations in the smaller tributaries are short and sharp, extending over but a day or two; further down

General Humphrey's Testimony. Such rivers as the Allegheny, the Connecticut, the Potomac, and in fact most rivers, exemplify the normal relation, in which the river, at high flood, fills or nearly fills its banks, and there is neither great excess of channel capacity nor excessive erosion or destructive floods. In any such stream the portion T divided by D of the flood volume, would if congealed, be very nearly or entirely contained within and fill the water course; and where T divided by D equals 1, or the flood duration is equal to the time of traverse, the entire flood volume would be so contained as is probably the case with the Missouri river and many of its tributaries. The accompanying diagrams show the effect of channel reservoir action in a very interesting manner. The flood oscillations in the smaller tributaries are short and sharp, extending over but a day or two; further down

There are about 32,000 acres, or 143,750 square miles of farm lands in the Ohio Valley. If every farmer would plow his land in deep furrows, at right angles with the slope as is practiced on the hill-side farms in New England, the flood outfall would be very materially diminished, possibly to the amount of 4 1/2 cubic miles. This would not only mitigate flood conditions, but also prevent denudation of the soil, and silting up of the rivers. This may be thought a rather strong state-

ment of what may seem to some a trivial thing. Let anyone who thinks it trivial walk in rainy season across a newly plowed bottom where the furrows run with the fall; and then walk, ankle-deep in water, up a steep hillside properly plowed, as he may do on any New England farm, and he will be convinced that this is a "trivial thing" of such vast proportions as to be of national concern. The addition of two inches to the amount of water retained by the soil of the farm lands in the Ohio Valley is equal to the reservoir effect of a basin 4,600 square miles in area flooded five feet deep.

READ F. Marion Crawford's new story, "THE WITCH OF PRAGUE." Opening chapters in TO-MORROW'S DISPATCH.

REV. J. T. RILEY FOUND GUILTY.

Another Methodist Preacher Convicted of Embezzlement and Unlawful Conduct.

The Riley trial ended yesterday after a ten days' session. The Methodist preacher was found guilty of embezzlement and unlawful conduct. The finding will be brought up before the conference at its next meeting. The charges against him are as follows: "First—Impudent and unministerial conduct as revealed in the practice of improper familiarity with women other than his wife. Second—Immorality, based upon the alleged fact that Mr. Riley's conduct with Mrs. Minnick contributed to the strained relations which culminated in Mr. and Mrs. Minnick's separation."

MOTHERS, do not be without Shiloh's Cure in your house. It will cure cough and whooping cough. Sold by J. C. Fleming & Son, 412 Market St.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.

As the postoffice in Allegheny carries \$45,000 a year, which is the interest at 4 per cent on \$1,000,000, it is thought the Government could at least spend \$500,000 on a new building.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.

As the postoffice in Allegheny carries \$45,000 a year, which is the interest at 4 per cent on \$1,000,000, it is thought the Government could at least spend \$500,000 on a new building.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.

As the postoffice in Allegheny carries \$45,000 a year, which is the interest at 4 per cent on \$1,000,000, it is thought the Government could at least spend \$500,000 on a new building.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.

As the postoffice in Allegheny carries \$45,000 a year, which is the interest at 4 per cent on \$1,000,000, it is thought the Government could at least spend \$500,000 on a new building.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.

As the postoffice in Allegheny carries \$45,000 a year, which is the interest at 4 per cent on \$1,000,000, it is thought the Government could at least spend \$500,000 on a new building.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.

As the postoffice in Allegheny carries \$45,000 a year, which is the interest at 4 per cent on \$1,000,000, it is thought the Government could at least spend \$500,000 on a new building.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.

As the postoffice in Allegheny carries \$45,000 a year, which is the interest at 4 per cent on \$1,000,000, it is thought the Government could at least spend \$500,000 on a new building.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.

As the postoffice in Allegheny carries \$45,000 a year, which is the interest at 4 per cent on \$1,000,000, it is thought the Government could at least spend \$500,000 on a new building.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.

As the postoffice in Allegheny carries \$45,000 a year, which is the interest at 4 per cent on \$1,000,000, it is thought the Government could at least spend \$500,000 on a new building.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.

As the postoffice in Allegheny carries \$45,000 a year, which is the interest at 4 per cent on \$1,000,000, it is thought the Government could at least spend \$500,000 on a new building.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.

As the postoffice in Allegheny carries \$45,000 a year, which is the interest at 4 per cent on \$1,000,000, it is thought the Government could at least spend \$500,000 on a new building.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.

As the postoffice in Allegheny carries \$45,000 a year, which is the interest at 4 per cent on \$1,000,000, it is thought the Government could at least spend \$500,000 on a new building.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.

As the postoffice in Allegheny carries \$45,000 a year, which is the interest at 4 per cent on \$1,000,000, it is thought the Government could at least spend \$500,000 on a new building.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.

As the postoffice in Allegheny carries \$45,000 a year, which is the interest at 4 per cent on \$1,000,000, it is thought the Government could at least spend \$500,000 on a new building.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.

As the postoffice in Allegheny carries \$45,000 a year, which is the interest at 4 per cent on \$1,000,000, it is thought the Government could at least spend \$500,000 on a new building.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.

As the postoffice in Allegheny carries \$45,000 a year, which is the interest at 4 per cent on \$1,000,000, it is thought the Government could at least spend \$500,000 on a new building.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.

As the postoffice in Allegheny carries \$45,000 a year, which is the interest at 4 per cent on \$1,000,000, it is thought the Government could at least spend \$500,000 on a new building.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.

As the postoffice in Allegheny carries \$45,000 a year, which is the interest at 4 per cent on \$1,000,000, it is thought the Government could at least spend \$500,000 on a new building.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.

As the postoffice in Allegheny carries \$45,000 a year, which is the interest at 4 per cent on \$1,000,000, it is thought the Government could at least spend \$500,000 on a new building.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.

As the postoffice in Allegheny carries \$45,000 a year, which is the interest at 4 per cent on \$1,000,000, it is thought the Government could at least spend \$500,000 on a new building.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.

As the postoffice in Allegheny carries \$45,000 a year, which is the interest at 4 per cent on \$1,000,000, it is thought the Government could at least spend \$500,000 on a new building.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.

As the postoffice in Allegheny carries \$45,000 a year, which is the interest at 4 per cent on \$1,000,000, it is thought the Government could at least spend \$500,000 on a new building.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.

As the postoffice in Allegheny carries \$45,000 a year, which is the interest at 4 per cent on \$1,000,000, it is thought the Government could at least spend \$500,000 on a new building.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.

As the postoffice in Allegheny carries \$45,000 a year, which is the interest at 4 per cent on \$1,000,000, it is thought the Government could at least spend \$500,000 on a new building.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.

As the postoffice in Allegheny carries \$45,000 a year, which is the interest at 4 per cent on \$1,000,000, it is thought the Government could at least spend \$500,000 on a new building.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.

As the postoffice in Allegheny carries \$45,000 a year, which is the interest at 4 per cent on \$1,000,000, it is thought the Government could at least spend \$500,000 on a new building.

THE APPROPRIATION TOO SMALL.

A Site for the Allegheny Government Building Will Cost About \$300,000.

Inspector Will is still examining sites for the new Government building in Allegheny. The two sites which he favors most are the Central Hotel property, and the Rhoades Hotel, corner of West Diamond street.

As each of these sites will cost about \$300,000, it will nearly consume the present appropriation of \$250,000.