

REPORT ON THE WATER-POWER

OF THE

EASTERN GULF SLOPE,

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LETTER OF TRANSMITTAL.

BOSTON, MASS., *July 9, 1883.*

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Columbia College, New York, N. Y.

SIR: I have the honor to submit a report upon the water-power of the eastern Gulf slope, based upon investigations carried on under your direction during the spring of 1881. Sufficient time was at command for only a hasty reconnaissance of some of the more important streams, which is the more to be regretted as this section was found to be extremely attractive, not only by reason of its extensive and varied natural resources, including a large amount of available water-power, but also because of the frequent evidence that was met of an increasing interest in the development of those conditions. It is desired to call attention to the principles observed in the estimates of flow and power, which are fully explained in connection with the report on the region tributary to Long Island sound.

Very respectfully,

DWIGHT PORTER.

THE EASTERN GULF SLOPE.

Although the section thus indicated might properly embrace all the gulf slope east of the Mississippi river, it is here for convenience limited to that portion east of and including the basin of the Alabama river. As thus defined it stretches over 600 miles along the coast, from Mobile bay to cape Sable, and extends inland a distance varying from about 80 miles in the Florida peninsula to 350 miles in northern Georgia, comprising an area, in round numbers, of 92,000 square miles. The principal rivers are, in order from the west, the Alabama, Perdido, Escambia, Yellow, Choctawhatchee, Appalachian, Ocklockonee, Ocilla, Suwannee, Withlacoochee, Hillsborough, Chilcochatchee, and Caloosahatchee, with their affluents. But of these main rivers only the Alabama and Appalachian reach, through their tributaries, far enough inland to include within their basins any important water-powers. The remainder are comparatively sluggish, and are bordered by lowlands subject to overflow. They drain a region accessible only to a limited extent by railroad, and find but little use except for the rafting of timber, and, where navigable, a small amount of transportation of lumber and agricultural products. They are usually obstructed by snags and shoals, but in most cases have been surveyed and found susceptible of improvement for navigation at moderate expense.

The land along the immediate coast is often swampy, and in Florida seems to retain that character even to the upper waters of the streams. In the cases of those streams heading in southern Georgia swamps are less noticeable, but yet frequently border their courses, even 50 miles or more from the Gulf. Although this region evidently can have but little value for water-power, that resource is not entirely lacking, and it is asserted that there are numerous short streams, reaching back but a little way from the coast, which are nevertheless characterized by a remarkably full and uniform flow, and, being often navigable to the very points where it would be natural to improve them by dams, offer unusual advantages for small powers. They are clear streams, running over sandy beds, and are free from dangerous rises. A striking example of this class is found in the case of bayou Minette, which empties into the bay directly opposite the city of Mobile. It heads back but little more than a dozen miles and drains only 72 square miles, yet near the mouth a framed dam has been built on a pile foundation, and a fall of 10 feet obtained, with a minimum, it is claimed, of not far from 200 horse-power. By the power thus secured there are run a cotton factory of 2,000 spindles, a woolen factory of 50 looms, and a saw-mill. Navigation extends directly to the dam.

Receding northward from the Gulf, the land gradually rises, and in Alabama to a distance inland of 100 or 125 miles we are upon the Tertiary formation. In Georgia this reaches still farther to the north, and, excepting a narrow strip in the west, is limited approximately by a line running from Columbus northeasterly through Macon to Augusta. This southern division is distinguished by a gently-undulating surface, a thin sandy soil, capable, however, of easy and great improvement, an extremely healthful climate, and perhaps is most noted as including the great pine-belt. Almost everywhere there is a magnificent growth of the long-leafed pine, with much hard wood also intermingled. The cutting and rafting of timber is an active and growing industry along most of the streams, but has not yet been in general so far prosecuted as seriously to diminish the supply.

The northern limit of this belt in Alabama does not attain an elevation of more than 350 or 450 feet. It is succeeded to the north by the Cretaceous formation, which stretches from west to east across the state but extends not over 30 miles into Georgia. In Alabama this formation has a general width from north to south of about 50 miles, and constitutes the so-called cotton-belt. It is but moderately timbered, and is in fact a prairie region with a level or gently-undulating surface. The black soil is underlaid by the rotten limestone, is heavy and calcareous in nature, splendidly adapted to the production of cotton and corn, and also yields well in tobacco, potatoes, various small grains, and grasses. The climate is less healthful than either to the north or to the south, there being a liability to fevers in summer and autumn. Springs are almost entirely lacking. The streams rise quickly after rains and then rapidly sink away, and often go nearly or quite dry.

Passing beyond this belt still farther north we come upon the elevated and mountainous portions of Alabama and Georgia, the region in which principally lie their resources in the way of water-power. The great Appalachian system which follows down the Atlantic coast throws out spurs into these states, reaching well toward, and at

points even below, their centers, and giving to the streams hard enduring channels in which to flow, and rapid fall. The southern boundary of this elevated section, geologically known in Alabama as the Middle region, and geographically subdivided in Georgia into the Middle and Northern regions, may very well be shown by a curving line passing from Fayette, in northwestern Alabama, southeasterly through Tuscaloosa, Centerville, Wetumpka, Tallassee, and on to Columbus, Georgia, and thence in an approximately straight course northeasterly to Augusta. In Alabama the line which should mark the boundary between this region and the cotton-belt, or Cretaceous formation, already described, is covered by a belt of stratified drift material—gravels, sands, and clays—stretching in an east-and-west direction across the state, with a width, transversely, varying from 5 to 40 miles. This belt is well supplied with springs, and contains numerous short streams, of which Autauga county furnishes notable examples, that are finely suited to powers of moderate size.

The average elevation of the mountainous portions of Alabama and Georgia would be difficult to state with much accuracy. What is described as the Middle region of Georgia, the southern boundary of which has been defined, and the northern limit of which is roughly shown by an east-and-west line through Atlanta and Athens, is estimated to have an average altitude above the sea of 750 feet, which is also given for northwest Georgia, lying to the west of the Cohutta range. Northeastern Georgia, extending from the Cohutta range easterly to the Savannah and Tugaloo rivers, has an estimated mean elevation of 1,500 feet, and includes peaks which attain heights of nearly 5,000 feet. In the metamorphic region of eastern Alabama the general elevation is said to lie between 800 and 1,200 feet.

The natural resources of this section are wonderful in extent and variety, and are as yet but slightly developed. The bituminous coal which is found is confined mainly to Alabama, where it covers a vast district in the northern central part of the state, embracing, it is estimated, 5,500 square miles. Three principal fields are recognized—the Warrior, Coosa, and Cahaba—the first including of itself about 5,000 square miles. The Coosa coal-field stretches northeasterly along the river of the same name, and its prolongation in Georgia takes in the three counties of Dade, Walker, and Chattooga; otherwise Georgia is without deposits of coal. Magnificent beds of iron ore occur throughout northeastern Alabama and northern Georgia, and in the former state there are at certain localities combined the unusual advantages of ore, coal, and limestone within a short distance on either side of a single valley. Gold is largely and profitably mined in the section drained by the upper Tallapoosa river in eastern Alabama and the adjacent portion of Georgia, and in the upper basins of the Etowah and Chattahoochee rivers in northeastern Georgia. Copper, lead, asbestos, and other minerals are also found.

In describing the elevated portions of these states it is especially important, with reference to their water-power, to notice the boundaries of the metamorphic formation. In Alabama, it is confined within a line drawn as follows: From Columbus on the Chattahoochee river, westerly through Tallassee to Wetumpka, thence northerly, a little west of the Coosa river, nearly to Shelbyville; the boundary line then turns to the northeast toward Georgia again, and follows the general course of the Selma, Rome, and Dalton railroad, but distant from it from 5 to 10 miles southward, until it reaches the state line. In Georgia, the metamorphic region includes every thing north of a line running from Columbus to Augusta, excepting eight or ten counties in the extreme northwest corner of the state. While the coal districts that have been noticed have a sandy and loamy soil, difficult to improve, easily washed, and with little agricultural value, the metamorphic region has a large amount of fine farming land, the staple productions of which are cotton in the less elevated sections, corn, wheat, oats, rye, barley, clover, grasses, fruits, and vegetables. The soils are red and gray, with clay subsoil. Building-materials, including granite and gneiss, abound, and there is some marble. The hills are covered with splendid oak forests, besides which pine, ash, elm, walnut, and hickory are common. Springs and clear running streams are everywhere plentiful, and the climate is very healthful.

The southern boundary of the metamorphic formation is very clearly indicated by a series of shoals, rapids, and falls, which fill the courses of the principal streams as they cross its borders and finally escape from its firm grasp. These falls mark the head of navigation, and constitute some of the finest water-powers in the South. On the streams to be considered they occur in the Coosa at Wetumpka, there being a descent of 80 feet in 12 or 15 miles above the city; on the Tallapoosa at Tallassee falls, where there is a fall of 52 feet in 300 feet, and a total of 84 feet in about 2 miles; and on the Chattahoochee at Columbus, where within 4 or 5 miles the descent is 120 feet. Generally speaking, the larger streams are free from abrupt falls of much magnitude, these being much less common than on rivers of corresponding size in New England and New York, and their descent is accomplished, above the fall-line, by rapids and occasional low pitches.

These rivers may be contrasted with those of the northeastern states, which elsewhere come within this report, in three important respects—fall, volume, and accessibility. As just noticed, the fall is usually less concentrated, and is, accordingly, less attractive for improvement than in the latter section. Excepting Tallassee and Columbus, there are no falls on the main portions of the larger rivers under discussion to be compared with those occurring on the Connecticut and Housatonic rivers in western New England, and on the Hudson, Black, and Genesee rivers in New York state.

As regards the steadiness with which their volumes are maintained in the dry season, there are but few reliable data to be found for the water-power streams of the eastern Gulf slope, and such as do exist indicate a considerable

range in value among different ones; it appears probable, however, that as a class they are in this respect, also, at some disadvantage as compared with the manufacturing rivers of the New England states and New York. There are scarcely any records of long series of observations upon temperature and rainfall in northern Georgia and Alabama within the limits of the region we are considering, but some idea as to those phenomena may perhaps be gained from the following table, compiled from the Smithsonian publications. For the sake of comparison, two points on the immediate gulf coast are added, and several in the northeastern states:

Table of rainfall and temperature.

Locality.	Elevation above sea.	RAINFALL.						TEMPERATURE.					
		Years of observation.	Spring.	Summer.	Autumn.	Winter.	Year.	Years of observation.	Spring.	Summer.	Autumn.	Winter.	Year.
	<i>Fect.</i>		<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>		°	°	°	°	°
Atlanta, Georgia.....	1,050	9	14.69	12.42	10.56	15.13	52.80	5	58.27	74.87	58.44	41.80	58.30
Coosa basin above Wetumpka (a).....			14.50	14.00	10.00	15.50	54.00		60.00	76.00	60.00	41.00	59.00
Tallapoosa basin above Tallassee (a).....			14.00	13.50	10.50	14.50	52.50		61.00	75.00	66.00	44.00	61.00
Chattahoochee basin above Columbus (a).....			12.50	13.00	9.50	14.00	49.00		58.00	74.00	58.00	42.00	58.00
Mobile, Alabama.....	15	5	16.62	21.21	11.42	13.40	62.65	10	66.87	79.00	66.27	52.43	66.14
Cedar Keys, Florida.....	35	10	5.50	20.43	11.78	8.09	45.78	11	69.64	81.05	71.70	57.87	70.08
Springfield, Massachusetts.....	200	12	11.09	12.52	11.72	8.85	44.18	9	46.46	71.40	50.72	26.24	48.71
Claremont, New Hampshire.....	539	8	11.92	12.11	10.44	9.08	43.55	9	43.09	67.01	47.37	21.50	44.74
Albany, New York.....	130	36	9.69	12.34	10.50	8.03	40.56	46	46.54	70.43	49.56	25.20	47.95
Rochester, New York.....	500	44	8.05	9.12	9.27	7.21	33.65	38	44.72	68.04	49.02	28.46	47.08

a Estimated.

The average temperature is greater in the water-power region of the gulf states than in New England and New York, being at Atlanta from 10 to 14 degrees more for the year than at the northern cities mentioned, and it seems probable that the annual loss by evaporation is rather greater in the former section than in the latter. The annual rainfall on the three basins of the Coosa, Tallapoosa, and Chattahoochee rivers exceeds that on most of the New England streams, but its distribution through the year is less favorable. As may be seen from the table below, the downfall on the interior region of the gulf slope is least in summer and autumn, when it ought to be greatest in order to meet the draughts made by evaporation, while at the north the least precipitation is in winter and spring.

Table showing relative distribution of rainfall during the year.

Locality.	Mean annual rainfall.	Rainfall, winter and spring.	Ratio to mean annual rainfall.	Rainfall, summer and autumn.	Ratio to mean annual rainfall.
	<i>Inches.</i>	<i>Inches.</i>		<i>Inches.</i>	
Atlanta, Georgia.....	52.80	29.82	0.56	22.98	0.44
Coosa basin above Wetumpka (a).....	54.00	30.00	0.56	24.00	0.44
Tallapoosa basin above Tallassee (a).....	52.50	28.50	0.54	24.00	0.46
Chattahoochee basin above Columbus (a).....	49.00	26.50	0.54	22.50	0.46
Mobile, Alabama.....	62.65	30.02	0.48	32.63	0.52
Cedar Keys, Florida.....	45.78	13.59	0.30	32.19	0.70
Springfield, Massachusetts.....	44.18	19.94	0.45	24.24	0.55
Claremont, New Hampshire.....	43.55	21.00	0.48	22.55	0.52
Albany, New York.....	40.56	17.72	0.44	22.84	0.56
Rochester, New York.....	33.65	15.26	0.45	18.39	0.55

a Estimated.

The streams at the South are free, it is true, from the dangerous ice-freshets which sometimes occur farther north, but they are subject during winter and spring to freshets caused by heavy rains, and in their less rapid portions are at such times visited by rises which are almost unparalleled on the streams with which they are being contrasted. The Coosa has reached a height of 54 feet above low water at the head of navigable waters at Wetumpka; the Chattahoochee has been known to rise 42 feet at Columbus below the falls, and at points on the river above the extreme oscillations have ranged from 25 feet down, according to locality. In its upper course, even, the Flint river is said to have risen 25 feet in the spring of 1831. On the other hand, the highest freshet-rise ever known in the Connecticut river at Hartford, entirely below all the falls, and where the ordinary slope is extremely small, with a tributary drainage area above of over 10,000 square miles, did not exceed 30 feet.

The southern streams which we are discussing are at a disadvantage in another important condition, namely, the opportunities for extensive storage in one season to meet the demands of another. There seems to be for this

purpose an entire absence of large natural lakes, ponds, and swamps, which are of such value as regulators of flow, even when unimproved, and which acquire great additional importance when capable, as they usually are in New England, of being raised and controlled by dams. Of course, the ordinary mill-dams along a stream hold back, in the aggregate, a large amount of water; but as to facilities for storing extensive supplies in spring for use during summer and autumn, such as exist throughout New England and northern and central New York, they appear to be entirely lacking on the eastern gulf slope. It is, to be sure, conceivable that in the latter section dams should be thrown across the valleys of the minor streams, and artificial storage reservoirs of the character mentioned thus be formed; but, unless by this means an unusual widening of a valley where there is an expanse of swampy or otherwise worthless land can be overflowed, the expense and danger of improvements are usually out of proportion to the storage obtained, and would not be attempted on an important scale.

In the third place, the streams tributary to the Gulf in Alabama and Georgia are by no means so conveniently accessible as would in New England be considered essential to a suitable development of their water-power. The head of navigation on the Alabama river is over 300, and on the Chattahoochee 400 miles from the Gulf. There are numerous well-equipped lines of railroad, and many more will in the future be built, but the present lines do not usually reach directly the streams in those portions where there is valuable power. Sometimes they follow the water-sheds, and again they run parallel to the rivers, but at distances of from 5 to 25 miles, near enough to discourage the building of new roads, and yet far enough away to render necessary a vexatious amount of transfer by teams. Spurs can be run to the streams, but they would accommodate only limited sections.

What has been said is not intended to detract in the least from the manifestly great value for power of the streams of upper Georgia and Alabama. While perhaps wanting in certain advantages enjoyed by the rivers of other sections, they offer many magnificent powers and are surrounded by almost unexampled agricultural and mineral resources. Especially for the manufacture of cotton and woolen goods do the conditions seem favorable; and that the fact has become recognized is proved by the frequent construction of new mills and by the encouragement given by the state of Georgia to such enterprises. By an act of the legislature passed in 1872, it was declared that—

Any mill or mills within said state, for the manufacture of fabrics out of cotton or wool, or both, whether such investment be applied in the establishment of a new factory or in the extension or enlargement of a now existing factory, shall be exempt from taxation for state, county, and municipal purposes, on the capital so invested, and on any property purchased or erected therewith, intended for and necessary to such manufacture, for the term of ten years from and after the laying of the foundation of the mills so to be erected.

Without going into a discussion of the relative advantages for cotton-manufacturing of the South and of New England, it is evident that a great, and possibly the most prominent, point in favor of the former is the fact that the cotton factories and sources of supply of the raw material are brought very close together. The climate is equable and mild, and on account of its humidity is favorable to certain of the processes of manufacture. While the summer temperature is claimed not to be so great in northern Alabama and Georgia as to be enervating, the absence of severe cold in the winter season materially reduces the cost of heating factories and the living expenses of operatives. As a rule, the labor in the mills is now performed by native whites, who are said to work contentedly long hours for low wages, without a thought of organizing strikes. As to whether this state of things will continue unchanged after manufacturing has become more developed here, and even as to whether the hands employed are as efficient as a similar class of labor at the North, there may be some question. The profits earned in late years by the Georgia and Alabama mills, usually exceeding 20 per cent. per annum, are a very good indication that cotton-manufacturing in those states is a successful industry.

THE ALABAMA RIVER AND TRIBUTARIES.

THE ALABAMA RIVER.

This important river is formed a short distance above Montgomery, Alabama, and somewhat southeast of the center of the state, by the union of the Coosa and Tallapoosa rivers, its principal tributaries. It runs westerly and then southwesterly, passing through or bordering upon the counties of Elmore, Montgomery, Autauga, Lowndes, Dallas, Wilcox, Monroe, Clarke, and Baldwin; about 50 miles by water from Mobile it joins the Tombigbee to make up the Mobile river, which flows southerly into the bay of the same name.

The Alabama river comprises in its drainage basin 23,700 square miles, of which 17,970 lies in Alabama, 5,620 in Georgia, and a little over 100 square miles in Tennessee. It is 150 miles long by general course, but is a very tortuous stream, and taking into account the bends has a length by survey of 312 miles.^(a) Along its borders are rich alluvial lands, and large tracts of timber are also accessible from the river and its tributaries. Navigation extends throughout the year for boats of not over 3 feet draught, and during the high water of fall and winter is open

^a According to Berney's *Hand-book of Alabama*.

to almost any draught. The principal obstructions are bars and snags, and to remove these and to provide a navigable channel of 4 feet depth in low water, and a minimum width of 200 feet, plans have been developed under the direction of Captain A. N. Damrell, Corps of Engineers, U. S. army. The improvement described is designed to extend over the entire length of the river, to Wetumpka on the Coosa, and is estimated to cost \$230,000. From 1878 to 1881, inclusive, \$100,000 was appropriated by Congress to this work, which has steadily been prosecuted. The principal points on the river are Montgomery, population 17,000, and Selma, 7,500. Steamers ply regularly between Montgomery and Mobile, and transport large amounts of cotton, lumber, and other products. Mobile has, in round numbers, 30,000 inhabitants, and though the business at that point in cotton has declined from the prominence once enjoyed, a fine trade in lumber is said to be growing up.

In 1875 the flow of the river was gauged at a point some 28 miles below Montgomery, by Mr. Gavin B. Yuille, United States assistant engineer. The measurement was made at a stage about 1 foot above ordinary low water, and gave a discharge of 3,711 cubic feet per second. The drainage area at the locality of gauging being about 16,650 square miles, the above discharge corresponds to 0.22 cubic foot per second per square mile. The river is subject to heavy oscillations from freshets, and there is reported to have been in 1874 a rise near the mouth of 20 feet above low-water mark, increasing farther up stream, and reaching between 50 and 60 feet on the Coosa river a little way above the head of the Alabama.

TRIBUTARIES OF THE ALABAMA RIVER.

With the exception of the Coosa, Tallapoosa, and Cahaba, the Alabama river has no large tributaries; but flowing into it at various points are creeks which appear unimportant on the map, but which really carry considerable water and would prove reliable for powers of moderate size. At present they are used only in a small way by occasional saw-mills, grist-mills, and cotton-gins. Very few of them are conveniently reached by railroad, and no special information as to their fall or volume is at hand.

Those south of the latitude of Camden lie in the pine-belt, the country being covered with a splendid growth of long-leafed pine. The surface is hilly, the soil is light and sandy and well suited to the production of fruit and vegetables. The climate of the higher lands is healthful; springs abound and the streams are well sustained.

Lowndes and Dallas counties are in the cotton-belt, and some idea may perhaps be formed of the streams draining them from the nature of the country. The surface is comparatively level, with a rich black soil, a moderate amount of timber, and but few springs. Cotton and corn are the main products, but the soil also does well with wheat, rye, oats, tobacco, potatoes, barley, buckwheat, sugar-cane, millet, and grasses. Some limestone answering fairly well for building and burning is said to be found. The streams are scarcely at all used for power, and are probably unreliable.

In Autauga county there are several streams which are used to some extent by saw- and grist-mills, while at Prattville and Autaugaville there are cotton factories. The streams here referred to would doubtless furnish numerous good privileges; Autauga and Swift creeks were especially mentioned as valuable, but the others are close at hand and presumably possess the same general features. The main courses lie within the so-called cotton-belt, but the Autauga County streams differ from the prairie streams of Montgomery, Lowndes, and Dallas counties in that they are upon a strip of gravel, sands, and clays, which follows along the northern border of the cotton-belt, and which is well supplied with springs, thus contributing to their steadiness.

Autauga creek is perhaps a good representative of the streams just mentioned. It runs southerly through Autauga county, and empties into the Alabama river 8 miles west of Montgomery. It is not over 25 miles long, and drains 125 square miles, the country having a tolerably level surface, well timbered with pine. The creek has a moderate current and flows between rather low banks; its bed is sandy and its water is very clear and pure. At Prattville the average width is perhaps 40 feet. The volume is remarkably well maintained, owing to the presence of many springs in the section drained, and scarcely any hinderance is experienced at Prattville, the principal point where power is used, from either low or high water.

On the upper course of the creek there are small saw-mills, but the timber near at hand has largely been cut away. Quite an important power, however, is in use at Prattville, a thriving place of 1,000 inhabitants, about 12 miles from Montgomery, with which it is connected by rail. Manufacturing was begun here about the year 1845, and four establishments are now run by the water-power of the creek. The Prattville Cotton Manufacturing Company makes coarse white ducks, and has made, and still has the facilities for making, sheetings and shirtings. The company employs 140 hands, native whites mostly, and runs 128 looms and 5,600 spindles. The Daniel Pratt Cotton Gin Company has quite extensive works, and there is also a sash-and-blind shop and a small grist-mill. All of these concerns are run from the same privilege, using together about 250 horse-power with a fall of $17\frac{1}{2}$ feet. The supply of water is sufficient at all times of the year for running at full capacity, though there is not much surplus in a low stage.

The dam was built at least 30 years ago, and is of brick laid in cement. It rests on a bed of marl, is 150 feet long, 12 or 15 feet high, 18 feet wide at the base and 3 feet wide at the top. A plank apron protects the stream-bed, and the dam is surmounted for its whole length by a stout timber bulkhead containing waste-gates. The pondage above the dam is estimated at 30 acres.

A short distance up stream there is an unoccupied fall of $8\frac{1}{2}$ feet, formerly in use; the mill was burned, but the dam remains. A little way below the Prattville factory a 3-set woolen-mill has a fall of 5 feet, but was not in

WATER-POWER OF THE UNITED STATES.

operation at the time it was visited. Swift creek, to the westward, in the same county, is reported to have a larger volume than Autauga creek, which might be expected from the fact that its drainage area is a third greater.

Minor tributaries of the Alabama river.

Name of stream.	Drainage area.	Remarks.
	<i>Sq. miles.</i>	
Autauga creek	125	These lie in Autauga county mainly, in a district well supplied with springs, and are good streams, with clear waters and well-maintained volume.
Swift creek	168	
Little Mulberry creek	109	
Polecat creek	58	
Mulberry creek at Callierville	141	
Mulberry creek above Polecat creek	229	
Mulberry creek at mouth	288	
Cotoma creek	383	
Pintlala creek	308	
Big Swamp creek	264	
North branch of Cedar creek	147	These may be classed as prairie streams. They lie in the cotton-belt, in a district deficient in springs, and with a flat open surface. With the exception of Pine Barren creek none are reported to be used for power, and they are probably not favorable for such use.
South branch of Cedar creek	285	
Cedar creek at mouth	497	
Bogue Chitto at Martin's	259	
Bogue Chitto at mouth	377	
Chilatchee creek	140	
Pine Barren creek at Selma and Gulf Railroad crossing	236	
Pine Barren creek at mouth	860	
Dickinson's creek	55	
Turkey creek	245	
Parsley creek (including Gravelly creek)	111	Situated in the pine-belt, where the surface is undulating and sandy, and springs abound.
Bear creek (including Duck creek)	59	
Cane creek	43	
Silver creek	80	
Flat creek	315	
Limestone creek	104	
Pigeon creek	45	
Lovet's creek	108	
Little river	153	
Major's creek	46	

THE CAHABA RIVER.

The source of the Cahaba river is near the boundary between Saint Clair and Jefferson counties, Alabama, 90 miles north of Montgomery. The stream takes a southwesterly and then southerly direction, passing through portions of the counties of Saint Clair, Jefferson, Shelby, Bibb, Perry, and Dallas, and joins the Alabama river 15 or 20 miles below Selma. In former years the river was navigable for 88 miles from its mouth, to Centreville, which is now looked upon as the head of navigation, although in over 30 years no steamer has ascended to that point. This portion of the river was surveyed in 1874, and the 24 miles up stream from Centreville, to Shades creek, in 1880. From the report of Mr. C. B. Percy, United States assistant engineer, upon this latter survey, (a) most of the information here presented is drawn. As a result of these surveys it was estimated that a 3-foot channel could be secured from the mouth to Centreville at a cost of \$195,000, and that the improvement could be extended by locks and dams to the northern boundary of Bibb county at an additional expense of \$381,000.

The Cahaba has a length of about 115 miles, measured in the general direction of its flow, and a drainage area of 1,950 square miles. There are no places of importance directly upon its course. Cahaba, at the mouth, was once the state capital, but is now a little village of 100 or 200 inhabitants. Centreville has a population of about 300, and Marion, 4 miles west of the river, in Perry county, 2,100. A few miles from the river in its upper course is Birmingham, an important mining town. Although a considerable portion of the Cahaba valley is sparsely settled, the resources of the country tributary to the river are of great value. In Dallas, Perry, and Bibb counties the cotton production is large, being estimated at 50,000 bales annually. Farther up the river are magnificent deposits of iron and coal, the former especially noticeable along the Little Cahaba, where is found brown hematite ore in inexhaustible quantities, fuel and flux also lying close at hand.

In Berney's *Hand-book of Alabama* (1878) the following account is given of the fine deposits in the vicinity of Birmingham: "About 1 mile to the southeast of the corporation lies Red mountain, said to be, both as to quantity and accessibility, the most remarkable deposit of iron ore yet known. It extends in a northeasterly and southwesterly direction, parallel with the Alabama Great Southern railroad, for about 30 miles below and the same distance above the city, attaining its maximum depth of ore opposite the latter place, where it contains several seams of ore averaging nearly 50 per cent. of metal and aggregating about 25 feet of vertical depth. The ores

THE EASTERN GULF SLOPE.

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are red and brown fossiliferous. Besides these there are magnetic and black-band ores within reach and of easy access. On either side of Jones' valley, in which Birmingham is located, and which is here about 5 miles in width, lie to the southeast and northwest, respectively, the Cahaba and the Warrior coal-fields, both of which are traversed by the South and North Alabama railroad. A dozen or more mines are operated near Birmingham, along the latter road, to say nothing of others off the railroads, which are worked in a rather primitive way, the coal being hauled in wagons to market."

Marble suited to building-purposes is found along the stream within 10 miles of Centreville, and over all the upper basin there is a splendid growth of pine timber.

At present the only use of water-power on the Cahaba is by a few saw- and grist-mills in the extreme upper waters. Above Centreville there are reported to be good opportunities for developing power; the bed and banks are favorable, the volume is tolerably well sustained, the current is swift, and interrupted by numerous ripples and rapids. The stream is at the disadvantage, however, of having poor railroad facilities; its lower course is crossed by the Alabama Central railroad, and its upper portion by the South and North Alabama, but the intervening section is without convenient means of access. The country above Centreville is rugged, but with fine lands and excellent timber. For about 10 miles above the point mentioned the river is described by Mr. Percy as averaging 200 feet in width. The bed is rock, covered here and there with gravel and sand. The surrounding country shows considerable settlement and cultivation, which disappear in the main from the neighborhood of the river above. For the next 5 miles the rise averages nearly 11 feet per mile (53.8 feet of rise in 4.91 miles); the bed is rock, covered with bowlders, and the stream is more turbulent than below, with long shoals and frequent falls. The banks rise steep and high on both sides, and the adjacent country is heavily clothed with pine.

From Shades creek down to Centreville, 23.67 miles, the fall is 121.4 feet, or an average of 5.13 feet per mile; thence to the mouth, 88 miles, the fall is 127.4 feet, equal to 1.45 foot per mile. During Mr. Percy's survey the discharge of the stream was determined at two points, but the measurements seem to have been made at a stage considerably above low water, and are not therefore of much value for the purposes of this work. There are no records showing with accuracy the rainfall on the Cahaba basin, but at Greensborough, a little to the west, the average of twelve years is 13 inches in spring, 12 in summer, 10 in autumn, 16 in winter, and 51 for the year. Concerning that part of the river above Shades creek no information has been secured, but thence to Centreville there are several shoals of importance, the fall on which, as revealed by the government survey, is given in the following table, together with a rough estimate of the available power:

Estimate of power at the principal shoals on the Cahaba river, from Shades creek to Centreville.

Name of shoal.	Drainage area.	RAINFALL ON BASIN. (b)					Length of shoal.	Fall on shoal.	THEORETICAL HORSE-POWER. (c)		
		Spring.	Summer.	Autumn.	Winter.	Year.			Low water, dry year.	Low water, average year.	Available 10 months, average year.
	Sq. miles.	Inches.	Inches.	Inches.	Inches.	Inches.	Feet.	Feet.			
Half-Mile rapids	570	} 13	} 12	} 10	} 16	} 51	2,050	8.4	80	110	150
Long Island rapids							1,820	12.2	110	150	220
Lily shoals							8,800	8.9	80	120	170
Balley Reach rapids							2,300	14.5	150	210	300
Big shoals	a 860						5,050	22.3	280	330	480
Centreville shoals	1,080						5,000	8.4	130	190	290

a Above Little Cahaba river.

b Record for twelve years at Greensborough.

c Based on the average flow for the twenty-four hours.

Drainage areas of the Cahaba river and tributaries.

Name of stream.	Drainage area.	Name of stream.	Drainage area.
	Sq. miles.		Sq. miles.
East Cahaba river	48	Blue Gut creek	39
West Cahaba river	163	Legroon creek	40
Shades creek	140	Ockmulgee creek	251
Little Cahaba river	292	Cahaba river at junction of East and West forks.	211
Hill's creek	75	Cahaba river at South and North Alabama Rail-	
Sandy creek	35	road crossing	331
Haysoppy creek	65	Cahaba river below Shades creek	563
Affiance creek	43	Cahaba river at mouth	1,950

THE TALLAPOOSA RIVER.

The main branch of this river rises in Paulding county, in northwestern Georgia; it flows through that and Haralson counties into Alabama, and then continues in an irregular southwesterly direction, until it unites with the Coosa to form the Alabama river. The main portion of its course lies in the region of metamorphic rocks, but at Tallassee, 50 miles from its mouth, it leaves these and, descending a series of beautiful falls and rapids, enters

upon the Cretaceous formation. The area drained by the Tallapoosa comprises 4,935 square miles, of which about 700 are in Georgia. This region is distinguished in the main by a healthful climate and by the possession of valuable mineral and agricultural resources. The portion south of the latitude of Tallassee is in the cotton-belt; it is cultivated successfully for wheat, rye, oats, and a variety of other crops, but the great and staple productions are cotton and corn. To the northward the soil is reddish or gray, with clay subsoil, and is especially suited to the raising of grain, fruits, and vegetables, though cotton can be grown to advantage. The granite and gneiss of this section afford good building-material, and the gneiss has been used for the Tallassee cotton factory. Soapstone, asbestos, mica, and corundum are found. Gold is profitably obtained from the gravels and sands at Arbacoochee, in Cleburne county, and at other points; copper occurs in the same county. There are extensive beds of iron pyrites in Clay county, and in Randolph and Chambers counties are met considerable quantities of magnetite. A limited settlement and poor railroad facilities have prevented any great development of these resources.

The almost entire absence of suitable railroad communication throughout that portion of the river having value for power is, of course, a hinderance to its immediate use for that purpose, but will be remedied as the country grows and new lines are built. The Savannah and Memphis railroad runs northwesterly from Opelika and crosses the river in Tallapoosa county, but the main stream is not accessible by railroad at any other point above Tallassee; below there, most of the way to the mouth, it is followed at a moderate distance by the Western Alabama railroad.

By map measurement the main Tallapoosa has an extreme length of about 225 miles. For nearly 50 miles from the mouth it is susceptible of being made navigable at a moderate outlay. In 1880 a survey was made as far as the Tallassee falls by Mr. Gavin B. Yuille, United States assistant engineer; (a) upon this were based estimates that a low-water channel of 3 feet depth and 60 feet width could be secured for 48 miles from the mouth, to the foot of the Tallassee reefs, for \$40,000, and that at a total cost of \$275,000 the channel could be made 80 feet wide, 4 feet deep, and extended to the foot of the Great falls, 2 miles above.

At the time of this survey the discharge of the river was gauged at Fort Decatur bluffs, 41 miles from the mouth, and found to be 1,420 cubic feet per second; the stage of the river was considered to be mean low water. The drainage area above this point being 4,040 square miles, the above discharge corresponds to 0.35 cubic foot per second per square mile.

The only important place directly on the main river is Tallassee, the town containing about 1,200 inhabitants. Dadeville, county-seat of Tallapoosa county, is distant a few miles from its course, and has a population of 700, and Carrollton, Georgia, near the head-waters of the Little Tallapoosa, 900. The main portion of the district drained by the Tallapoosa is elevated and quite hilly, heavily timbered with oak and yellow pine. In Paulding and Haralson counties, Georgia, the upper waters are used for power by a few small grist- and saw-mills, but the only important manufacturing place on the whole stream is at the Tallassee falls, 65 or 70 miles by river from Montgomery and about 400 miles from Mobile. Here the river, which above is a rough and rapid stream, spreads out to a width of a quarter of a mile or more and incloses several islands, some of them of considerable extent. Through the "sloughs" thus formed it has a rocky bed more or less overlaid by gravel. As it approaches the falls it narrows, and through two or three principal channels pours down a foaming torrent, descending 52 feet in about 300 feet. Immediately below the Great falls it decreases in width to from 200 to 400 feet and then passes on through a deep pool with an average breadth of from 400 to 600 feet. The pool is a quarter of a mile long, and is succeeded by rough water, which continues at intervals for perhaps a mile and a half down stream. In this distance the bed appears to be mainly of solid rock, with many bowlders; the stream pitches over numerous low ledges, and falls 10 feet at one point. In the $1\frac{1}{2}$ or 2 miles from the foot of the Great falls to the lower end of the rapids there is a total descent of 32 feet, below which quiet water continues. All along this section the immediate banks are abrupt and high, rising probably from 25 to 50 feet above low water. Near the falls they are very rocky, while at other points they appear to be of loam, gravel, or sand. They are wooded with pine, oak, and other timber, and from their summits the country stretches out, almost a dead level, largely covered with pine woods, but broken here and there by extensive patches of cultivated ground devoted to the raising of corn and other grains.

At the Great falls the river descends, as has been said, through several sloughs or channels. Huge masses of weather-worn rock form a sort of natural dam, almost closing the course; they are composed of gneiss, the strata dipping about 25 degrees to the northward. It is supposed that this natural dam was at some time continuous across the river, but having become honeycombed with pot-holes, many of which are to be seen, either entire in the unbroken portion of the rock or in half-section on the side-walls of the channels, portions of it gave way and left openings for the water as at present.

In 1845 two South Carolina planters started a cotton-mill at this place. They erected a low building, which is still used, and in which fire-arms were manufactured during the civil war. In 1854 the main building was constructed, 210 by 50 feet in size, with an L of 48 by 50 feet; the structure is of stone and is five stories in height. The site of the mills and the little village is in a vale which puts back on the west side of the river, the ground rising rapidly to an elevated plateau which commands a charming view of the valley below.

The present company is known as the Tallassee Falls Manufacturing Company, and has a capital stock of \$400,000. Sheetings, shirtings, duck, cotton rope, and cotton yarn are made, and a ready sale is found for the bulk of the goods at Montgomery. In the spring of 1881 there were run 18,000 spindles, and 500 hands were

a See Appendix K, Report of Chief of Engineers, 1881.

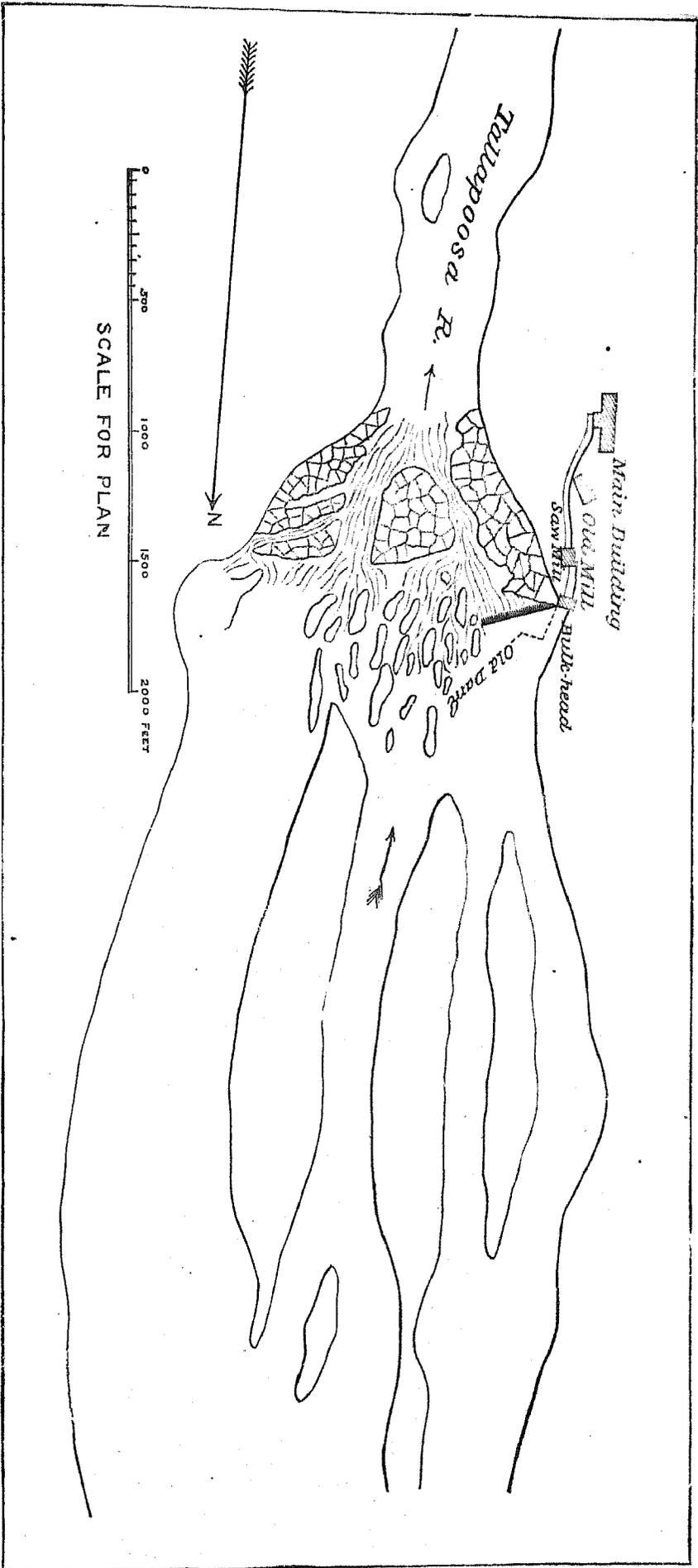


FIG. 1.—Plan of the Tallassee Falls, Tallapoosa river.

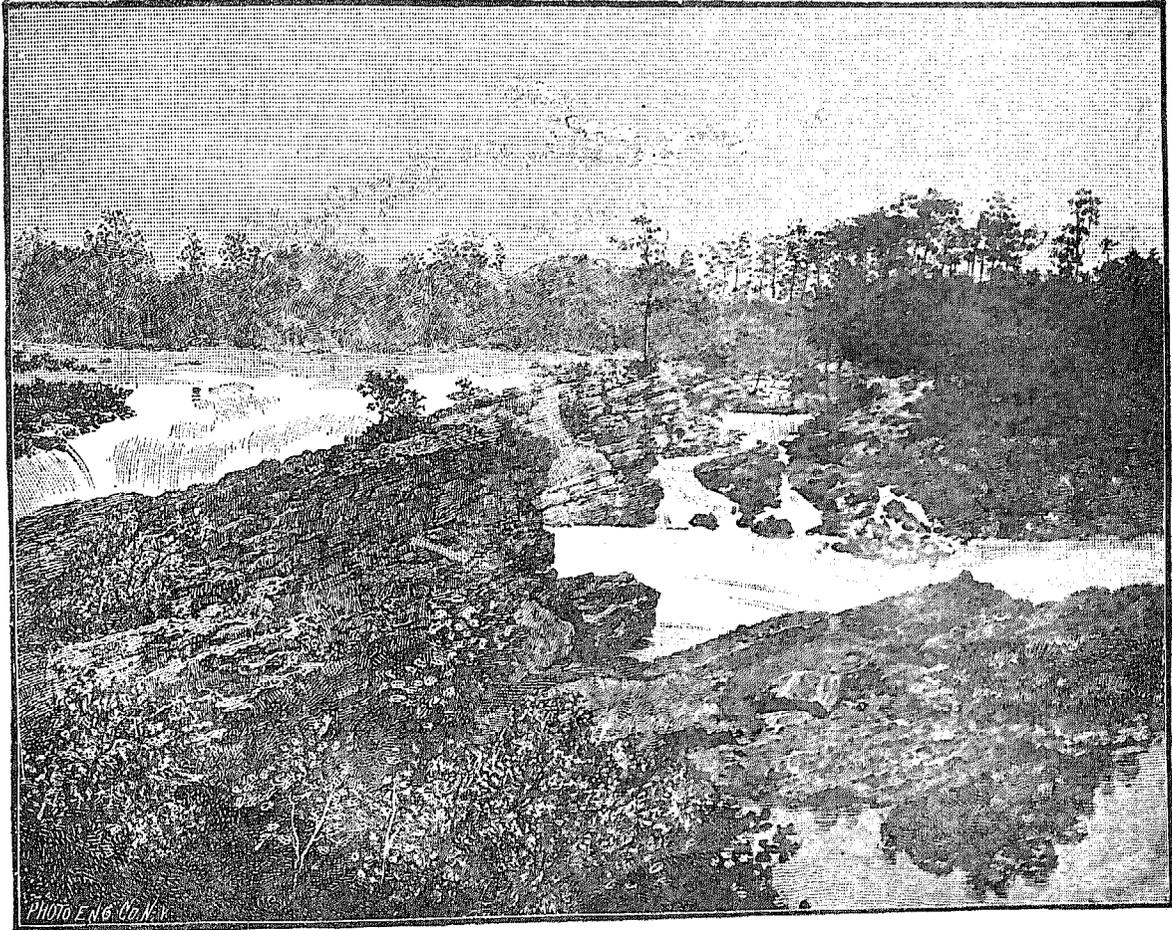


FIG. 2.—View of the Tallassee Falls Manufacturing Company's water-privilege.

employed. The latter are nearly all white people from the surrounding native population, who are said to learn quite readily and to do their work well. The officers of the company state that they find labor cheap, employ mainly girls, and are never troubled with strikes. The enterprise is of great advantage to the surrounding country, not only giving employment to many people, but affording a convenient home market for agricultural products. At the time these mills were visited the daily consumption of cotton was 21 bales, and was shortly to be increased to 32 bales. The shipping facilities at this point, however, are not good, there being but one railroad—the Western Alabama—accessible, and in order to reach that, goods have to be carried 6 or 7 miles by team and to be ferried across the river. The establishment of navigation from Montgomery to Tallassee would prove of great value to the manufacturing interest there.

Only a portion of the flow of the river is controlled for power at the falls. One or two old dams, which did not serve their purpose well, remain in the stream just above the present structure, which is simply a wing-dam running from the west shore out to an island. It is built of stone in cement, rests upon solid rock, and is some 300 feet in length; in cross-section it is 9 or 10 feet wide at the base, 6 feet wide at the top, and varies in height above foundation from 6 to 15 feet. An iron strap runs along the coping, and drift-bolts extend down to bed-rock. The dam has a masonry abutment, and water is admitted through a timber bulkhead to the canal. This follows along the side-hill, having a heavy retaining-wall on the river side, and ranges from 15 to 30 feet in width and from 5 to 7 feet in depth.

The extreme fall now in use is 32 feet, which may easily be increased to 40 feet. Uppermost on the line of the canal are a saw-mill and carpenter-shop, using together perhaps 60 horse-power from old scroll wheels. Then follow, in order, an overshot wheel running a pump which supplies the factory and village; a 3-run grist-mill taking power from a 32-foot overshot; and the cotton-mills, where power is used as follows:

	Horse-power.
Old mill, one 40-inch Leffel wheel, 24 feet head, rated at.....	118
Main mill, one 56-inch Leffel wheel, 24 feet head, rated at.....	290
Main mill, one 66-inch Leffel wheel, 24 feet head, rated at.....	433
New mill, one 48-inch Leffel wheel, 32 feet head, rated at.....	264
Total rated power of 4 wheels.....	1,105

The superintendent of the factory estimates that about two-thirds of the rated power, or say from 700 to 750 horse-power, is actually in use. Last in order is a foundery and blacksmith-shop, with a small overshot wheel. It is probable that altogether not far from 900 effective horse-power is in use on the privilege, and the surplus volume of the river always represents a large additional power which is wholly unemployed. The Tallassee Falls company owns the land on the west side of the river, both above and below the falls, covering a distance of several miles. It also owns a two-sixths interest in the power on the opposite side of the river at the falls. That site is capable of being developed into a fine privilege, but it is considered that its improvement would be expensive on account of the rock-cutting which would be necessary for a canal.

Below the main falls the principal disadvantage to the development of power lies in the exposure to a somewhat heavy freshet-rise, and consequent trouble from backwater. The Tallapoosa is a stream subject to large, and sometimes extremely sudden, oscillations, brought about by winter and early spring rains. At such times it becomes a turbid and dangerous flood, though commonly a clear and beautiful stream. The rise in this vicinity varies much at different points; at the head of the Great falls it is only 5 or 6 feet, at their foot 14 feet, and for a mile and a half down stream about 20 feet, never reaching the top of the banks, however. Still below, the slope of the river becomes much reduced, freshet-waters are less readily carried off, and the rise is great enough at times to submerge the banks. It is generally considered that for at least a mile below the main falls the water-power can be improved advantageously. With only one record of the discharge, and hardly any data concerning the rainfall on its drainage basin, it is difficult to make a reliable estimate as to the power of the Tallapoosa in this vicinity, nor can it here be stated with accuracy how much fall would be found practically available; but under various assumptions as to the fall it is probable that the powers expressed in the following table could be realized:

Estimate of power at Tallassee falls and vicinity.

Stage of river.	RAINFALL ON BASIN. (a)					Drainage area.	Flow per second, average for the 24 hours.	THEORETICAL HORSE-POWER.					
	Spring.	Summer.	Autumn.	Winter.	Year.			1 foot fall.	32 feet fall (extreme fall now in use).	40 feet fall (easily available at cotton factory).	52 feet fall (total at Great falls).	75 feet fall.	84 feet fall (total from head of falls to foot of reefs, probably not all available).
	Inches.	Inches.	Inches.	Inches.	Inches.	Sq. miles.	Cu. feet.						
Low water, dry year.....	} 14	} 13½	} 10½	} 14½	} 52½	} 3,520	1,140	120.5	4,140	5,180	6,730	9,710	10,880
Low water, average year.....							1,430	162.4	5,200	6,560	8,440	12,180	13,640
Available 10 months, average year..							2,000	227.2	7,270	9,090	11,810	17,040	19,080

a Roughly estimated from Smithsonian records.

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Ascending from the Tallassee falls, the river is described as having a generally rough character. It flows with rapid current over a rocky bed, and is frequently crossed by low ledges forming natural dams. The banks are high, rocky, and wooded with pine and other timber. The surrounding country is very hilly, and cultivated only to a limited extent. As previously remarked, there is no manufacturing above Tallassee except by a few saw- and grist-mills, mainly in the extreme upper waters. There can be little question, however, that when the section drained by the Tallapoosa shall have become more developed, the splendid water-powers furnished by the stream will be made to support extensive industries.

The main river receives numerous tributary streams which are used by small saw- and grist-mills, and which are said to offer many fine opportunities for manufacturing. The Songahatchee, emptying from the east a few miles above Tallassee, was especially referred to as a good representative of these tributaries, which have generally rocky or gravelly beds, high banks, and a very steady discharge.

Estimate of power of the Tallapoosa river at different points in its course.

Locality.	RAINFALL ON BASIN. (a)					Drainage area. Sq. miles.	THEORETICAL HORSE-POWER PER FOOT OF FALL. (b)		
	Spring.	Summer.	Autumn.	Winter.	Year.		Low water, dry year.	Low water, average year.	Available 10 months, average year.
	Inches.	Inches.	Inches.	Inches.	Inches.		Sq. miles.	Sq. miles.	Sq. miles.
Tallapoosa, Haralson county, Georgia.....	14	12	10	15	51	205	5.7	9.1	13.6
Below Ketchepedrakee creek.....	14	12	10	15	51	725	22.7	34.1	47.7
Below Little Tallapoosa river.....	14	12	10	15	51	1,470	51.1	70.4	93.8
Below Hillabee Hatchee creek.....	14	12½	10	15	51½	2,570	97.7	122.7	170.4
Below Kiolijah creek.....	14	13½	10½	14½	52½	3,177	119.3	150.0	200.0
Tallassee falls.....	14	13½	10½	14½	52½	3,520	120.5	162.4	227.2

a Roughly estimated.

b Based on the average flow for the 24 hours.

Principal tributaries of the Tallapoosa river (in order from its source).

Name of stream.	Drainage area.	Name of stream.	Drainage area.
	Sq. miles.		Sq. miles.
Cane creek.....	65	Elkehatchee creek.....	72
Ketchepedrakee creek.....	56	Sandy creek at Dadeville.....	49
Mad Indian creek.....	36	Sandy creek at mouth.....	126
Little Tallapoosa river at Carrollton.....	75	Blue creek at Savannah and Memphis Railroad crossing.....	86
Little Tallapoosa river at state line.....	346	Blue creek at mouth.....	176
Little Tallapoosa river below Cat Nese creek.....	480	Kiolijah creek.....	181
Little Tallapoosa river at mouth.....	650	Songahatchee creek north of Notasulga.....	156
Cat Nese creek (tributary to Little Tallapoosa).....	23	Songahatchee creek at mouth.....	247
Piney creek (tributary to Little Tallapoosa).....	26	Arapa creek at Chehaw.....	361
Wedowee (?) creek (tributary to Little Tallapoosa).....	49	Arapa creek at mouth.....	452
Fox creek.....	50	Wallahatchee creek.....	82
Crooked creek.....	82	Tomgahatchee creek.....	46
Chillisando creek.....	90	Calebee creek (a).....	158
Cohensanersa creek.....	69	Cupia Hatchee creek (a).....	127
Hooethlocoo creek.....	124	Oakfuskee creek (a).....	383
Hillabee Hatchee creek at junction of East and West forks.....	167	Intchee Chubbee creek.....	72
Hillabee Hatchee creek at mouth.....	287		

a Lie in the cotton-belt, and are not used for power.

THE COOSA RIVER.

This river, the most important tributary of the Alabama, is formed at Rome, in northwestern Georgia, by the union of the Etowah and Oostenaula rivers. It passes westerly across Floyd county, and entering Alabama pursues a southwesterly and then southerly direction, till it joins the Tallapoosa a few miles below Wetumpka. In its passage through Alabama it either runs across or borders the counties of Cherokee, Etowah, Saint Clair, Calhoun, Talladega, Shelby, Chilton, Coosa, and Elmore. Although, measured along its general course, this river is only about 165 miles long, yet its actual length, following the many windings, is not far from 335 miles.

As described by Professor Tuomey, the Coosa, from its source to Greensport, Saint Clair county, runs along the strike of the rocks, following a valley between the strata. It then turns more to the southward and crosses the edges of the strata, forming rapids where the rock is hard and indestructible, alternating with quiet pools where the softer limestone is met. The lower course, from the latitude of Shelbyville to Wetumpka, is along the inner edge of the region of metamorphic rocks. These, with the accompanying rapids, are left at Wetumpka,

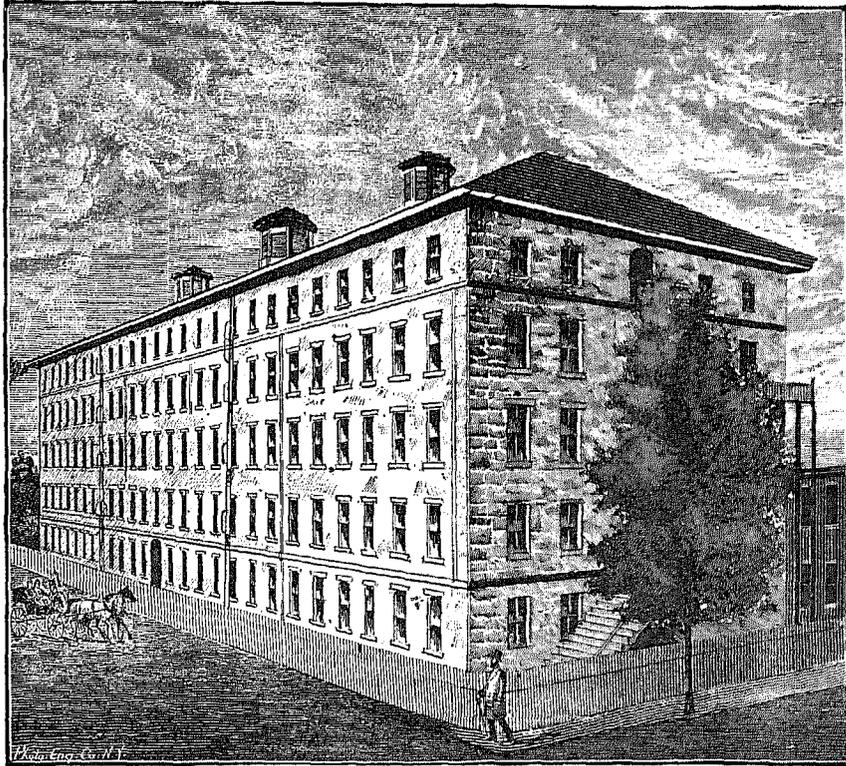


FIG. 3.—Talesse Falls Manufacturing Company's mill.

and for the remaining short distance to the mouth there is deep and quiet water. The Coosa thus comes to present the unusual condition of a stream navigable at its head and foot, but for a long intervening distance filled with impassable rapids. From the mouth navigation is shut off by the falls at Wetumpka, but from Greensport for about 180 miles to Rome it is practicable and is availed of; half a dozen steamers ply over this portion for nine months in the year, and three of them throughout the year. A great deal of lumbering is done along the stream, and large amounts of timber are towed to Gadsden in rafts, transferred to the railroad, and shipped north.

With a view to the improvement of the 145 miles, more or less, of river between Wetumpka and Greensport, several surveys have been made by the general government. If navigation could be secured over this stretch, then it would extend uninterrupted for about 800 miles from Mobile to northwestern Georgia and the southern boundary of Tennessee. In order to bring about this desirable result a series of locks and dams must be built, the expense of the improvement from Wetumpka to the Selma, Rome, and Dalton Railroad crossing being estimated at \$2,650,000,^(a) and for the remaining portion above at \$550,000,^(b) or about \$3,200,000 for the entire distance. Up to the spring of 1881 the work actually undertaken had been confined to a stretch of about 35 miles below Greensport. The improvement of this section, under charge of Major W. R. King, Corps of Engineers, comprises the construction of three dams and accompanying locks, one of the former reaching across the river, 1,100 feet, a second closing a chute, and a third extending 2,000 feet up stream as a wing-dam.^(c) The completion of another dam, at what are known as the Broken Arrow shoals, is to give navigable water to the coal-fields of Saint Clair county. Up to March, 1881, inclusive, \$285,000 had been appropriated to this part of the Coosa river.

Drainage areas.

	Square miles.
Etowah river	1,940
Oostenaula river.....	2,190
Coosa river below junction of Etowah and Oostenaula rivers	4,130
Coosa river at mouth.....	10,610

The section of country lying within the Coosa basin has rich resources which are as yet scarcely touched. Bituminous coal, iron, and limestone abound, often in close proximity. The Coosa coal-field is one of the three great coal-fields of Alabama, and along its southeastern border extends what is described by Prof. E. A. Smith as the "wide limestone valley" of the river we are studying. As stated in Berney's *Hand-book of Alabama*, the main deposits of brown hematite ore in the state lie along the course of the Selma, Rome, and Dalton railroad (*d*) from Brierfield across and to the east of the river, and along the line of the Alabama Great Southern railroad to the westward of the river; while, stretching to the northeast from Tuscaloosa through Birmingham and into Georgia, there is a wonderful mass of red hematite, the Red Mountain deposit of which has already been described in speaking of the Cahaba river. The principal iron mining in the Coosa basin in Alabama is at Shelbyville, in Shelby county, and at various points in Cherokee county. Several other minerals are found in this section, including gold, copper, lead, plumbago, and manganese. Slate of fine quality, pottery and fire-brick clay, and soapstone occur, while the limestone, granite, and gneiss afford excellent building-materials. There are extensive forests of pine, oak, and other varieties of timber. The agricultural resources are also valuable, the soil in the lower basin being best adapted to cotton, and in the upper portion to grain. The most important points along the river are Wetumpka, some 10 miles from the mouth, with a population of 800; Gadsden, in Etowah county, with 1,700; and Rome, Georgia, with 3,900.

From what has been said it may be seen that the only portion of the river to be considered with reference to water-power is that lying between Greensport and Wetumpka, covering in the neighborhood of 145 miles. So far as can be learned there is at present no power used in this distance except by a small flouring- and grist-mill in Saint Clair county, obtaining a fall of 3½ feet, probably by a wing-dam. In the report by Major Walter McFarland, Corps of Engineers, U. S. army, embodied in the *Chief of Engineers' Report for 1872*, the fall from Greensport to Wetumpka is stated as 360 feet; and the total fall upon rapids between the Selma, Rome, and Dalton Railroad crossing and Wetumpka as 260 feet. The superintendent of the East Tennessee, Virginia, and Georgia railroad gives the elevation at its Rome crossing, at the head of the Coosa, as 652 feet above tide.

Although from lack of time the river was not personally examined, it is judged from government engineers' descriptions of it that at many points on the rapids power might be developed to advantage; and since it contains numerous long islands forming chutes between themselves and the adjacent banks, it is not improbable that at such points, as is the case on the Chattahoochee river, good powers might be obtained at slight expense. The width of the river is large on the shoals, ranging from 650 to 2,000 feet above the Selma, Rome, and Dalton Railroad crossing, and from 1,000 to 3,000 feet on the section below. The control of the entire flow of the stream would therefore in many cases involve heavy expense for a dam, and certainly no such enterprise would be undertaken without having regard to the possible improvement of the entire river by the United States government.

a Senate Ex. Doc. No. 42, Forty-sixth Congress, third session.

b See Report of Chief of Engineers, U. S. army, 1881, p. 1873.

c See Appendix X 9, Report of Chief of Engineers, 1881.

d Alabama division of the East Tennessee, Virginia, and Georgia railroad.

As has been said, the design is to extend the system of locks and dams so as ultimately to overcome all the rapids by slack-water navigation. If that design should be carried out, the surplus water at the dams above the requirements of lockage would probably be available, under proper restrictions, for power; and the opinion is expressed by those engineers having charge of the river, that favorable sites for manufacturing would undoubtedly thus be created.

Probably the principal disadvantage that would be experienced in the actual use of power would be an occasional hinderance from backwater during freshets, which are sometimes very heavy and sudden. Regarding the rises in the river, Mr. Gavin B. Yuille, United States assistant engineer, in his report upon a survey of the 68½ miles above Wetumpka, (a) remarks as follows:

The oscillation of the river-surface during freshets was found to be very variable, being governed by width and inclination of the channel. On the shoals where the river-channel is from 1,000 to 3,000 feet wide and there is an inclination of 10 or 12 feet in a mile, the oscillation ranges from 6 to 8 feet, while at Wetumpka, where the river has a width of 700 feet between high banks, and situated at the head of slack-water river below, we find an extreme oscillation of 53.71 feet, and at all points where the river is of contracted width and deep slack-water channel the oscillation is from 20 to 40 feet.

On the section of river below and adjacent to Greensport, where a system of locks and dams is being completed, the most favorable sites for power are mentioned as being Whistenant's Mill shoals, where there is a fall of 5½ feet available; Ten-Island shoals, where the fall is 12 feet in a mile and a quarter; and Broken Arrow shoals, where it is designed to erect a dam 12 feet high.

The upper Coosa is bordered by a considerable amount of bottom-land, beyond which rise high hills well wooded with pine. The lower valley is more contracted, and shows only occasional narrow strips of bottom-land, subject to overflow during extremely high freshets; in this section, where the banks are not of the character described they are usually high and rocky, and even at times precipitous. The channel shows "a succession of confined level pools of deep water, connected by sloping reaches of broad and shallow reefs and shoals, filled with numerous islands and rocks, with narrow and shoal runs of water between". The pools are very deep, sometimes from 40 to 60 feet, and the river-bed is almost entirely of bare solid rock, with scarcely any deposit covering it.

Undoubtedly the finest power to be obtained on the Coosa river is at Wetumpka, within 10 miles or so of the mouth. Ascending from the city, a succession of shoals and pools, ranging usually from 4,000 to 6,000 feet each in length, is encountered, after which there is a continuous shoal stretching 7 miles up stream. The river-banks in the section below are high and rocky. The head of the shoals mentioned is at a distance of nearly 15 miles by river above the Wetumpka bridge, and is said to offer a favorable site for a dam. By bringing a canal from that point down the east bank to Wetumpka, security from the reach of high water would be obtained, and a fall made available at the city of not far from 80 feet in the most favorable stage of river. During freshets this fall would be liable to be reduced one-half, and even more in extreme cases. The expense of constructing a canal of proper capacity 12 or 15 miles in length, even if the cost of a dam could be avoided by taking advantage of one erected by the government in case of the improvement of the stream for navigation, would be very great—sufficiently so, perhaps, to forbid the undertaking. The power to be obtained, however, would be magnificent, and calculated to build up an important manufacturing city.

Estimate of power available at Wetumpka.

Stage of river.	RAINFALL ON BASIN. (a)					Drainage area.	Flow per second, average for the 24 hours. (c)	Theoretical horse-power.			
	Spring.	Summer.	Autumn.	Winter.	Year.			1 foot fall.	40 feet fall.	60 feet fall.	80 feet fall.
	Inches.	Inches.	Inches.	Inches.	Inches.	Sq. miles.	Cubic feet.				
Low water, dry year.....							2,130	242.0	9,680	14,520	19,360
Low water, average year.....	14½	14	10	15½	54	b 10,235	2,560	290.8	11,630	17,450	23,200
Available 10 months, average year.....							3,560	404.4	16,180	24,260	32,350

a Roughly estimated.

b At a point 15 miles by river above Wetumpka.

c In case of the improvement of the stream by locks and dams for navigation, Mr. Yuille estimates the demand for lockage at an average of 56 cubic feet per second, assuming a lock 210 x 40 x 8 feet to be emptied once in 20 minutes throughout the day; and estimates the total loss by lockage and waste at 124 cubic feet per second, which is neglected in the above table.

Notwithstanding the large amount of undeveloped power presented by the Coosa, the limited extent to which manufacturing is carried on in this section seems to have prevented any special demand for it, and even if manufacturing enterprises were more common many would doubtless avail themselves of the opportunities for obtaining coal cheaply and would use steam-power. For establishments to be located directly upon the main river railroad facilities are poor. About midway between Greensport and Wetumpka is the crossing of the Selma, Rome, and Dalton line; but, except in that vicinity, the course of the river between the two points mentioned is distant from 5 to 15 miles from the nearest railroad.

Estimate of power at the principal shoals on the Coosa river (in order below Greensport [a]).

Name of shoal.	Drainage area (approximate).	Length of shoal.	Fall on shoal.	THEORETICAL HORSE-POWER. (b)			Remarks.
				Low water, dry year.	Low water, average year.	Available 10 months, average year.	
	Sq. miles.	Miles.	Feet.				
Whistenant's Mill shoals	6, 870		5. 50	1, 020	1, 220	1, 710	Immediately below Greensport; 5½ feet is the fall said to be available for power.
Ten-Island shoals		1. 40±	12. 00	2, 370	2, 850	3, 950	Eighteen or twenty miles below Greensport; 12 feet is the fall said to be available for power.
Broken Arrow shoals	7, 320	1. 70±	12. 00±	2, 370	2, 850	3, 950	Forty-eight miles above the Selma, Rome, and Dalton Railroad crossing. To be improved for navigation by a dam with lock of 12 feet lift.
Chocholoco shoals		1. 30±	5. 00	990	1, 190	1, 650	Thirty-eight miles from the Selma, Rome, and Dalton Railroad crossing. Shoals occur between an island and the mainland, the west channel being 1,200 and the east 150 feet wide.
Claunche's shoals		0. 06	12. 00	2, 520	3, 010	4, 200	One-half mile above Claunche's ferry. Shoals caused by a reef of rock.
Drake's Mill shoals		0. 95±	7. 00	1, 470	1, 700	2, 450	Reef of rock crosses river midway of shoal.
Turner's Mill shoals	8, 020	0. 38	4. 00	840	1, 000	1, 400	River 800 feet wide at head of shoals.
Shoals down stream from head of Weduska shoals.	9, 180	7. 30±	55. 75	12, 350	14, 820	20, 580	Weduska shoals begin about 18 miles below the Selma, Rome, and Dalton Railroad crossing. Thence downstream the river is described as "one mass of shoals, rapids, reefs, filled with rocks, islands, and willows growing in the water, and varying in width from 1,000 to 1,800 feet".
Tuck-a-league shoals	0, 420	5. 25	30. 00	8, 090	10, 700	14, 980	Head of shoals about 32 miles below the Selma, Rome, and Dalton Railroad crossing.
Duncan's ripple	10, 050	0. 66	8. 38	2, 000	2, 400	3, 330	Channel width, from 700 to 1,200 feet.
Fish-Trap reef		0. 57	10. 00±	2, 400	2, 870	4, 000	Dam proposed with lock of 10 feet lift; river about 1,600 feet wide, and runs swiftly over rocky reefs.
Hell's Gap reef			10. 00±	2, 400	2, 880	4, 010	Dam proposed with lock of 10 feet lift.
Reef below Huffman's ferry			9. 00±	2, 170	2, 600	3, 620	Dam proposed with lock of 9 feet lift.
Welonee Creek reef			9. 00±	2, 170	2, 810	3, 630	Do.
Reef ¼ mile below Grey's ferry	10, 235		8. 00±	1, 940	2, 330	3, 230	Dam proposed with lock of 8 feet lift.
Staircase falls		0. 49	8. 00	1, 950	2, 340	3, 260	River widens to 3,600 feet, is very shoal, and is filled with reefs and masses of rock.
Staircase falls (lower)		0. 57	8. 00	1, 960	2, 350	3, 270	
Reef above Closet reef			8. 00±	1, 960	2, 350	3, 270	Dam proposed with lock of 8 feet lift.
Closet reef			8. 00±	1, 960	2, 350	3, 270	Do.
Sofkahatchee reef			8. 00±	1, 960	2, 360	3, 280	Do.
Grey's Island shoals			8. 00±	1, 960	2, 360	3, 280	Do.
Rose's reef		0. 26	4. 14	1, 020	1, 220	1, 700	
Corn Creek reef		0. 95	7. 63	1, 880	2, 250	3, 130	
Wetumpka rapids		0. 76	12. 60	3, 120	3, 740	5, 180	
Total for above shoals, with falls as assumed.			277. 00±	61, 600	73, 870	102, 710	The only utilization of power reported is made by a single small grist-mill.
Total power assumed to be available at Wetumpka by canal from first reef below Grey's ferry, a distance of nearly 15 miles.		15. 00±	80. 00	19, 300	23, 200	32, 350	

a Data concerning shoals are taken from report by G. B. Yullo (*Senate Ex. Doc. No. 42, Forty-sixth Congress, third session*), and from report of James C. Long (*Report of Chief of Engineers, 1872*). The table is intended to show approximately the power corresponding to the natural fall, in the main, on various shoals; the fall practically available at the different localities would doubtless vary much from the figures here employed, being governed by the height of dam and length of canal. The real value of the shoals for manufacturing use is to be determined only by careful examination.

b Based upon average flow for the 24 hours. With good wheels, from 60 to 80 per cent. of the theoretical power can be realized.

NOTE.—The rainfall on the basin may be taken roughly at 14½ inches in spring, 14 in summer, 10 in autumn, 15½ in winter, and 54 for the year.

TRIBUTARIES OF THE COOSA RIVER.—Below the point of its formation by the Etowah and Oostenaula rivers the Coosa receives many minor tributaries, ranging in size of drainage area from about 500 square miles downward, and to which the same general remarks would apply as to the corresponding tributaries of the Tallapoosa, which have elsewhere been spoken of. Two of these were visited—the Chattooga river and Cedar creek, streams of medium size—and a description of them may serve to give an idea as to the capabilities of the rest.

The Chattooga river rises 35 miles northerly from Rome, in northwestern Georgia. From its source in Walker county it runs southwesterly across Chattooga county, into Alabama, joining the Coosa a short distance beyond the state boundary, in Cherokee county. It drains the valley lying between Pigeon mountain, a spur of the Lookout Mountain range, on the west, and Taylor's ridge on the east, and includes within its basin 375 square miles.

This river has the usual characteristics of a mountain stream; it receives its supplies from a rough, hilly, well-wooded section, flows over a rocky bed and between banks that are usually high and rocky, though now and then there occur stretches of productive bottom-land. It is subject to high freshets, with rapid rise and fall. Good sites for power abound, and are generally improved by framed dams, and occupied by small saw-mills, grist-mills, and cotton-gins. The Tryon factory, distant some 25 miles by carriage-road from Rome and 15 miles from any railroad, is the only important manufacturing establishment on the stream. The mill is a fine structure of brick, and is surrounded by a small village, where dwell the operatives, numbering 250 or more. The Tryon Manufacturing Company has a capital stock of \$225,000, and runs 9,000 spindles and 258 looms in the manufacture of sheetings,

shirtings, and drills, using 14 or 15 bales of cotton per day. At this locality the Chattooga river is 75 or 100 feet wide, has a rapid current, and its waters are colored a greenish hue by the presence of lime. The site was a favorable one for improvement; where the dam is situated one bank rises abruptly from the stream, rocky and very high, while the other, composed of gravel and having a gentle slope, afforded a convenient course for the canal. The present dam was built in 1877, at a cost of from \$1,200 to \$1,500, and replaced one which, owing to faulty construction, had been carried out in high water. It is a framed structure, about 250 feet long and 12 feet high, resting on a bed of solid rock. One abutment is a natural ledge, and the other a timber crib-work filled with stone ballast. The back-slope is longer than it was in the old dam, and the space underneath is filled in with loose rock, the omission of which, and a too abrupt slope, are thought to have been responsible for the failure of the first structure. The dam sets back the river for about 2½ miles. A canal perhaps 1,500 feet long and 30 feet wide runs to the factory, and on the way supplies power to a small saw-mill, 3 cotton-gins, and a 2-run grist-mill. At the cotton factory the fall is 16 feet; three Risdon turbines, with an aggregate of 300 rated horse-power, are employed, and about 250 horse-power is estimated to be actually in use. For four months in the year the supply of water runs short, and steam-power has then to be resorted to in part. The drainage area of the river above the Tryon factory is 160 square miles.

Cedar creek empties into the Coosa from the south a few miles above the Chattooga river, and drains an area of 225 square miles lying in Polk and Floyd counties, Georgia. It is a short mountain stream, with a length of only 22 miles, and at Cedartown, at which point its drainage area amounts to 80 square miles, averages about 70 feet in width and 4 feet in depth, and has a good current. Like the Chattooga, it is very rapid in rise and fall. But a short time before it was visited, in the spring of 1881, it had risen, overflowed its banks, damaged the hydraulic canal at Cedartown, and receded within its channel again, all in the space of twelve hours. During the same season the city of Rome was partially inundated by high water from the Etowah and Oostenaule rivers, at the junction of which it is situated. Northwestern Georgia is an elevated region, having an estimated average altitude of 750 feet above the sea. It is frequently visited by very heavy rains in winter and spring, and most of the streams are liable at such times to overflow their banks extensively in those portions of their courses where they are not kept within bounds by high banks or a large slope.

Cedar creek falls quite rapidly, is tolerably well sustained in the dry season, and offers good unimproved sites for power. It is also considerably used by small mills, but the only manufacturing of importance is at Cedartown, where are the extensive works of the Cherokee Iron and Railroad Company. This company was started in 1872, and has now made an investment of over \$600,000 at Cedartown and vicinity. It owns a very large tract of land, and is also proprietor of a 3-foot narrow-gauge railroad running 35 miles to Cartersville, said to be very profitable from the outside business obtained, as well as a great convenience to the company, since at Cartersville it is brought into connection with the Western and Atlantic railroad. The narrow-gauge road passes close by one of the company's ore-beds and extends 5 miles to another. The Cherokee company manufactures pig-iron for market, and also makes the rolling-stock for its railroad. In its furnaces it had produced, previously to the spring of 1881, 22 tons of pig-iron per day, under a pressure of from 1½ to 2 pounds per square inch, and the capacity was then increased to 35 tons, under a pressure of from 4 to 4½ pounds.

A fall of 4 feet, obtained by a dam across Cedar creek, is utilized for power at the company's shops. The dam is substantially built of limestone laid in hydraulic cement. It is about 70 feet long, 10 feet high, and 5 feet thick both at base and top; it was constructed in 1873 at a cost of \$5,300. Water is conveyed from above the dam in a canal 500 or 600 feet long, and supplies two water-wheels, yielding together about 70 horse-power; this is used in a 3-run grist-mill, blacksmith-shop, wood-working shop, machine-shop, and foundry, wire cables being employed to transmit a part of the power from one shop to another. The volume of water is always sufficient to furnish the power required in these works, but in dry weather there is no surplus.

Minor tributaries of the Coosa river (in order below Rome).

Name of stream.	Drainage area.	Name of stream.	Drainage area.
	<i>Sq. miles.</i>		<i>Sq. miles.</i>
Cedar creek	225	Kelley's creek	200
Spring creek	115	Talladega creek	193
Chattooga river	375	Tallassee Hatchee creek (Talladega county)	168
Little river	310	Yellow Leaf creek (Shelby county)	170
Terrapin creek	276	Hatchet creek at Hanover	196
Ball Play creek	78	Hatchet creek below Pinthlocco creek	881
Big Wills creek	413	Hatchet creek at mouth	521
Canoe creek	281	Pinthlocco creek (tributary of Hatchet creek)	84
Tallassee Hatchee creek (Calhoun county)	217	Weogufka creek (tributary of Hatchet creek)	105
Cane creek	114	Waxahatchee creek	238
Broken Arrow creek	85	Chestnut creek	98
Cheekcheeke creek at Silver run	225	Wewoka creek	92
Cheekcheeke creek below Cheshawhaw creek	421	Elmore (?) creek	114
Cheekcheeke creek at mouth	486		

THE ETOWAH (a) RIVER.

Rising upon the southern slope of the Blue ridge, in northern Lumpkin county, Georgia, this river pursues a westerly course to the Coosa at Rome, passing in the mean time over portions of the counties of Lumpkin, Dawson, Forsyth, Cherokee, Bartow, and Floyd. The section drained comprises 1,940 square miles, and above Cartersville it is but thinly settled; this upper portion, however, has valuable mineral resources, of which the most important are iron, manganese, and gold. Baryta and kaolin are also found, as well as traces of silver, copper, and plumbago, but there is no coal. The valleys are well stocked with timber, and below Cartersville the main valley, which above is quite narrow except where at intervals a patch of a few hundred acres of bottom-land is found in a bend of the river, widens out and contains fine stretches of extremely productive land, which is largely cultivated in grain and cotton. The railroad facilities are good along the lower river, but in the portion farther up, which is best suited to use for power, the stream is directly accessible by railroad at Canton only, to which point there extends a short road from Marietta, to the southward. There is no navigation on the river. A government survey was made in the summer of 1879 to determine upon the probable expense of establishing a navigable channel; but it was found that an improvement by locks and dams—the only practicable method—would cost \$2,277,000 for the 63 miles from Rome to the mouth of Little river, and an adverse report was therefore made, it being considered that a heavy outlay of money was not at all warranted by the business likely to be furnished. (b) Above the mouth the largest towns are Kingston and Cartersville, in Bartow county, having respectively about 500 and 2,000 inhabitants, and Canton, in Cherokee county, with a population of 400.

In its lower course the fall of the river averages about 3.7 feet per mile, amounting to 232 feet in the 63 miles below Little river. This descent is not uniform, however, being distributed among reefs and rapids, with short intervening pools. From Cartersville up, the Etowah is quite closely hemmed in by mountains, which rise rapidly from its banks, and which, being thickly covered with pines, except where an occasional precipitous crag shows itself, bare of vegetation, give rise to very picturesque scenery. The water of the stream was once remarkably clear, but cultivation of the soil and washing the hill-sides for gold have given it a generally turbid appearance. The oscillations are very rapid and heavy after rains, owing to the steep drainage slopes, and the full height of a freshet is often reached in a few hours. As reported in the government survey, the highest rises have ranged from 12 feet in the upper course to 28 feet at Rome. The lower bottom-lands toward the mouth are liable to overflow, but in the upper and more rapid portion of its course the river seldom rises at all above its immediate banks.

In a list of gaugings of various of the Georgia streams, (c) the discharge of the Etowah at the mouth of Allatoona creek, in Bartow county, is given as 1,308 cubic feet per second in minimum low water, corresponding to 1.08 cubic foot per second for each of the 1,213 square miles of drainage area above that point. This discharge certainly appears too large for the stage mentioned, being more than half as great as the volume assumed, on good authority, for average low water at the mouth of the Coosa, although the drainage area there is nearly nine times as great as at the locality mentioned on the Etowah river. Lieutenant Marshall, Corps of Engineers, U. S. army, in his report upon the survey of the river states that "at low water its discharge is slight".

In Lumpkin county the Dahlonga Gold Mining Company has constructed a ditch 3 feet deep, 3½ feet wide at the bottom, and 30 miles in length, to serve the purposes of hydraulic mining. Water is taken from several small creeks tributary to the upper Etowah, and will supply 5 mines with 25 miner's inches (d) each.

The fall of the river is rapid in its upper course, and those familiar with the valley consider that it there presents numerous good sites for power, favorable for development and accessible. Between the point where the public road from Dahlonga to Dawsonville crosses, and Simmons' mill-pond, a distance of some 12 miles by road, there is stated to be a fall of 210 feet. Of this amount only 28 feet is utilized, part by a saw-mill, grist-mill, and tannery combined, and part by a 10-stamp mill of the Dahlonga mine; there are several other points, however, which are available for use. The Franklin mine, in Cherokee county, takes power from the Etowah for a 20-stamp mill, using, it is said, a fall of about 15 feet. A narrow-gauge line to run from Gainesville, on the Atlanta and Charlotte Air Line railroad, to Dahlonga had been surveyed and partly graded in the spring of 1881, and if completed will be of great advantage to the extreme upper part of the river. Efforts were about to be made also for the establishment of a cotton factory in this section, it being claimed that the cheapness of water-power, land, fuel, and rents would permit of more profitable manufacture, even with the expense of shipping by team to and from Gainesville, than at Atlanta. Such an enterprise would be of much value in giving employment to the families of the men engaged at the mines. Farther down stream, at High Tower, in Forsyth county, two mills, one of 10 and one of 20 stamps, were reported to have been projected; but, except at the points mentioned and at an occasional site elsewhere occupied by a small saw-mill or grist-mill, no actual use was found to be made of the power of the river.

a Indian pronunciation, Ē-tō-wāh', meaning in Cherokee "beautiful water".

b See *Report of Chief of Engineers*, 1880.

c See *The State of Georgia*, by Francis Fontaine.

d A miner's inch is said to be taken as the discharge through a 1-inch aperture under a head of 6 inches, or about 17,000 gallons per

The descent of the Etowah for a considerable distance below Little river, as determined by government survey, is shown in the following table:

Table showing the fall in the Etowah river for 41.4 miles below the mouth of Little river.

Locality.	Distance below Little river.	Distance between points.	Fall between points.	Fall per mile between points.
	Miles.	Miles.	Feet.	Feet.
Mouth of Little river	0.000			
Boundary between Cherokee and Bartow counties .	9.091	9.091	19.0	2.09
Head of Maddox island	10.227	1.136	2.5	2.20
Foot of Pugh's island	12.027	1.800	18.5	10.28
6,500 feet below Pugh's island	13.258	1.231	22.0	17.87
Stamp creek	13.882	0.624	10.5	16.88
6,700 feet below Stamp creek	15.152	1.270	27.5	21.65
11,700 feet below Stamp creek	16.098	0.946	11.0	11.63
Western and Atlantic Railroad bridge	17.879	1.781	1.5	0.84
Reynolds' ford	41.420	23.541	α 97.5	2.87

α Fall quite uniformly distributed.

It will be noticed that from the boundary between Cherokee and Bartow counties down to the Western and Atlantic Railroad crossing there is a heavy fall, amounting to 92 feet in 7 miles of the distance. This portion of the stream, lying but a few miles to the east of Cartersville, offers perhaps the most valuable power to be found anywhere on the course, and before the war was largely utilized by extensive manufacturing works, which stretched for half a mile along the river, and which represented an investment of \$500,000 or more. There were three blast-furnaces, a rolling-mill, a foundery, a nail factory, and a flouring-mill with a capacity of 300 barrels per day. The flouring-mill and rolling-mill are said to have been the first of any importance established south of Richmond. Previously New York flour, known here as "Canal flour", had monopolized the southern markets, and in this section commanded \$20 per barrel; but with this the new product competed, with the greatest success, in all the southern markets, and finally in New York city. Immediately preceding the war, arrangements had been completed between Major M. B. Cooper, owner of the property on the Etowah, and still residing near by, and Colonel Samuel Colt, of Hartford, Connecticut, to engage jointly in the manufacture of fire-arms at the locality here described, but the breaking out of hostilities prevented the removal of any part of Colonel Colt's works, although it is stated that the necessary papers had been signed, and that a month more of time would have seen the undertaking carried out. In 1864, during Sherman's campaign, the buildings here were all burned, and only the ruins of what were very substantial structures now remain.

The property embraces 15,000 (?) acres of land, extending more than 5 miles along the Etowah river, on both sides, and probably covering a fall of at least 80 feet on that stream, though the exact amount could not be ascertained. It also includes Allatoona and Stamp creeks, tributaries of the Etowah, each with large fall and abundant power. Running from the old works down the river-bank to the line of the Western and Atlantic railroad was a branch track, the graded line of which still remains in good condition, and which, though now without ties or rails, might easily be put in condition for traffic. The property is owned by an incorporated company, the Etowah Manufacturing & Mining Company, with offices in Savannah, and is offered for sale, in one piece only, at a nominal price of \$100,000.

Estimate of power at the Etowah Mining & Manufacturing Company's privilege.

Stage of river.	RAINFALL ON BASIN.					Drainage area. Sq. miles.	Flow per second, average for the 24 hours. Cubic feet.	Theoretical horse-power.			
	Spring.	Summer.	Autumn.	Winter.	Year.			1 foot fall.	10 feet fall.	20 feet fall.	80 feet fall.
	Inches.	Inches.	Inches.	Inches.	Inches.						
Low water, dry year.....	15	13	10	15½	53½	1,060	370	42.0	420	840	3,860
Low water, average year.....							500	63.6	636	1,272	5,088
Available 10 months, average year.....							750	85.2	852	1,704	6,816

The large fall in this section of the river occurs where the latter has cut its way through a spur of the Blue ridge. The stream flows with rapid current and almost constant ripples, now and then pitching abruptly over a low ledge. The bed is generally rock and contains numerous large bowlders, and here and there a small island appears. The average width between banks is probably 200 or 300 feet, although in places it increases to 500 or 600 feet. As the power was formerly developed there were two dams across the river, built of logs, each structure 10 feet high; they were about half a mile apart, the upper dam at the rolling-mill and the lower at the flouring-mill. The entire 80 feet or more of fall could perhaps best be improved in several successive privileges of say 20 feet each. The abundance of timber and stone should render the expense for dams reasonable, and perfectly secure foundations

could be obtained without difficulty. The ground rises rather abruptly on the south side of the river; the old works were on the north side, where the immediate bank is succeeded by a level stretch, elevated from 8 to 20 feet above the water and extending back from 75 to 150 feet before reaching the abrupt ascent of the mountain. The power to be obtained here is large, and the site well deserves attention.

No power was learned of as in use below Cartersville. There had been a dam and a small grist-mill a short distance down from the Western and Atlantic Railroad crossing, but they were in the main carried away during the exceptionally high freshet in the spring of 1881. For the remainder of the distance to its mouth the river has a quite uniform and moderate slope, with an average width of perhaps 250 feet. The bed is rocky, and the banks are of tolerably good height. This part of the stream is more under the influence of backwater than that above, but could probably be utilized for falls of from 5 to 8 feet.

The tributaries of the Etowah are small, no one draining more than 240 square miles. A list of the principal ones is given below. The districts through which they run abound in large springs and brooks of fine "freestone water", and are well adapted to the cultivation of cotton, corn, wheat, oats, barley, fruits, and vegetables. Although the streams are not large, many of them have sufficient volume and fall to support manufacturing works of some importance, at least during the greater part of the year. Stamp creek has one or two small furnaces, and there is a small cotton factory on Shoal creek.

Drainage areas of the Etowah river and principal tributaries.

Name of stream.	Drainage area.	Name of stream.	Drainage area.
	<i>Sq. miles.</i>		<i>Sq. miles.</i>
Etowah river at Aurama, Lumpkin county	100	Mountain creek	77
Etowah river at High Tower, Forsyth county	356	Shoal creek	66
Etowah river at Canton, Cherokee county	677	Little river	239
Etowah river below Shoal creek	769	Allatoona creek	100
Etowah river at Etowah Iron Works	1,060	Pettis creek	56
Etowah river below Allatoona creek	1,213	Pumpkin Vine creek	131
Etowah river near Cartersville (railroad crossing)	1,226	Raccoon creek	60
Etowah river at mouth	1,940	Euharlee creek	205
Armacolola creek	116	Two-Run creek	47

THE OOSTENLAULA RIVER AND TRIBUTARIES.

The *Oostenaula river*, which unites with the Etowah at Rome to form the Coosa, is in turn made up, near Resaca, in Gordon county, Georgia, by the junction of the Coosawattee and the Conasauga. It flows thence in a crooked southwesterly course, having a length of about 60 miles. It is navigable, but is very little navigated. The area drained above its head is 1,606, and above the junction at Rome 2,190 square miles.

The *Coosawattee river* heads in Gilmer county, Georgia, running southwesterly to Resaca. For 45 miles above its mouth, to Carter's Landing, the river is navigable during six months in the year, and some work has been done by government engineers in improving the channel, but the actual amount of traffic carried on is slight. In this 45 miles the fall is moderate and the stream winds about among exceedingly rich bottom-lands, on which corn, wheat, and cotton are raised. Just above Carter's Landing the meadows cease and the river issues from a narrow valley in the mountains. Here is met the first dam, a log structure 400 feet, more or less, in length and 8 feet high. A fall of 9 feet is obtained and power used for a 2-run grist-mill, a saw-mill, a tannery, and a cotton-gin. There is a large surplus power here, even with the present head, and, except that the railroad facilities are poor (the nearest railroad station is Calhoun, on the Western and Atlantic railroad, 18 miles distant by wagon-road), the site is well suited to more extensive improvement. On one side the mountain rises several hundred feet almost vertically from the water, while on the other side, on which the mills are located, there is a gradual ascent at first, favorable to carrying a canal, if desired. The hills recede immediately below and leave abundant room for mills of any size and a village.

Estimate of power near Carter's Landing.

Stage of river.	RAINFALL ON BASIN.					Drainage area.	Flow per second, average for the 24 hours.	Theoretical horse-power.	
	Spring.	Summer.	Autumn.	Winter.	Year.			1 foot fall.	9 feet fall.
	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Sq. miles.</i>	<i>Cubic feet.</i>		
Low water, dry year	15	13	10	15½	53½	550	190	21.6	190
Low water, average year							200	32.9	300
Available 10 months, average year							300	44.3	400

Mr. Samuel Carter, of Dalton, is the proprietor of the privilege described, and also owns for some 2 miles along the river in this vicinity. The dam sets the water back for half a mile, beyond which the stream becomes rapid, with hardly a stretch of smooth water more than a few hundred feet in length. A railroad survey has been extended

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some little way above, and the fall thus ascertained is said to range from 10 feet in 900 feet to 10 feet in half or three-quarters of a mile. For some distance above Carter's Landing the width between banks is stated to be from 200 to 300 feet, and the fall to be sufficient to furnish, within 2 miles, several privileges of about 10 feet each. At the end of 2 miles there are two abrupt falls, one of 18 and the other of 20 feet; but the river is described as being there so closely wedged between high and almost vertical cliffs that it would be very difficult to improve. Above this point the river winds its way among the mountains, which rise steep, wooded, and high directly from its banks. The bed is mostly freestone, the fall rapid and constant, but there are no mills, certainly up to the junction of the Ellijay and Cartecay which are the principal branches of the Coosawattee. The wagon-road which leads to Carter's mill also extends up to the falls, and there stops, the rocky obstructions being impassable; and for any mills using power for some distance above, a new road would have to be constructed up over the bordering mountains, although that is not impracticable.

This stream holds its own very well in the dry season, but rises and falls rapidly after heavy storms, especially in late winter, when the ground has become thoroughly soaked; the height of a freshet is usually reached within 12 hours from the beginning of the rise, and the fall is nearly as rapid. At Carter's Landing the water has in an extreme case reached a height of 15 or 20 feet above a low stage, but this was largely backwater from below, and farther up stream the rise was much less. The Coosawattee drains 929 square miles.

The *Conasauga river* has its source in Fannin county, Georgia, a little below the Tennessee boundary; it takes a short turn into the latter state and then flows southerly into Georgia again, forming the division between Murray and Whitfield counties, and in Gordon county uniting with the Coosawattee. It drains 677 square miles, but appears to have little importance for power. It is in general a flat stream, with rather sluggish flow, running wide and shallow, and in summer almost dry, at any rate scarcely more than 20 feet wide in places. Toward the extreme head-waters it has more fall, and may be of slight value. It is used by only a few scattering saw- and grist-mills. Being rather a long stream with slight fall, it runs out much more slowly than the Coosawattee, so that after the latter has discharged its surplus water it is liable to be kept up for some time by backwater from the Conasauga.

Drainage areas of the Oostenaula river and tributaries.

Name of stream.	Drainage area.	Name of stream.	Drainage area.
	<i>Sq. miles.</i>		<i>Sq. miles.</i>
Conasauga river below Cooychuttee creek	485	Mountain Town creek (tributary to Coosawattee)	79
Conasauga river at mouth	677	Talking Rock creek (tributary to Coosawattee)	165
Cooychuttee creek (tributary to Conasauga)	174	Free Bridge (?) creek (tributary to Coosawattee)	262
Rocky creek (tributary to Conasauga)	88	Oostenaula river at Resaca (below junction)	1,606
Coosawattee river at Ellijay (below junction)	233	Oostenaula river at Rome (above junction)	2,190
Coosawattee river at Carter's Landing (below Talking Rock creek)	550	Adairsville (?) creek (tributary to Oostenaula)	76
Coosawattee river at mouth	929	Armucha creek (tributary to Oostenaula)	233

Table of utilized power on tributaries of the Alabama river.

Stream.	Tributary to what.	State.	County.	Kind of mill or manufacture.	Number of mills.	Total fall utilized.	Total water-power utilized.	Auxiliary steam-power.	Remarks.
						<i>Feet.</i>	<i>H. P.</i>		
Alabama river	Mobile river	Alabama							River navigable.
Sundry small tributaries.	Alabama river	do	Autauga	Cotton	1				Prattville.
Do	do	do	do	Cotton-gins manufactured.	1	17½	250		
Do	do	do	do	Flouring and grist	1				
Do	do	do	do	Sashes, doors, and blinds	1				
Do	do	do	do	Cotton-gins	6	34+	46		
Do	do	do	do	Flouring and grist	19	173+	174		
Do	do	do	do	Flouring and grist, and cotton gins.	5	57	53		
Do	do	do	do	Saw	5	97	120		
Do	do	do	Baldwin	do	1	12	100		
Do	do	do	Butler	Flouring and grist	1	7	6		
Do	do	do	Chilton	do	1	8	8		
Do	do	do	Clarke	do	3	32	26		
Do	do	do	Elmore	do	6		36		
Do	do	do	do	Saw	5	10+	62		
Do	do	do	Lowndes	Flouring and grist	1	20	10		
Do	do	do	Marengo	do	1	15	40		
Do	do	do	Monroe	do	11	31+	78		

Table of utilized power on tributaries of the Alabama river—Continued.

Stream.	Tributary to what.	State.	County.	Kind of mill or manufacture.	Number of mills.	Total fall utilized.	Total water-power utilized.	Auxiliary steam-power.	Remarks.
						Feet.	H. P.	H. P.	
Sundry small tributaries.	Alabama river	Alabama	Monroe	Saw	3	27	35		
Do.	do	do	Wilcox	Flouring and grist	4	15+	65		
Cahaba river and tributaries.	do	do	Perry	do	7	51	48		
Do.	do	do	Bibb	do	4	37½	59		
Do.	do	do	Shelby	do	7	62	144		Three of these are on the Cahaba and East branch.
Do.	do	do	do	Saw	1	10	8		East Cahaba.
Do.	do	do	Jefferson	Flouring and grist	3	30	30		Head-waters of main river.
Tallapoosa river	do	do	Elmore	Cotton	1				
Do.	do	do	do	Cotton-gin	1				
Do.	do	do	do	Carpenter-shop	1				
Do.	do	do	do	Flouring and grist	1				
Do.	do	do	do	Foundry and blacksmith shop.	1	24-32	900±		Tallassee falls; over 1,100 rated horse-power of wheels in place.
Do.	do	do	do	Pump for village water-supply.	1				
Do.	do	do	do	Saw	1				
Do.	do	do	Tallapoosa	Flouring and grist	1	9	10		
Do.	do	Georgia	Haralson	do	3	16	67		
Do.	do	do	do	Saw	1	7	12		
Do.	do	do	Paulding	Flouring and grist	1	10	10		
Tributaries	Tallapoosa river	do	Haralson	do	7	71½	92		
Do.	do	do	do	Saw	1	6	5		
Do.	do	do	Carroll	Cotton-gin	1	6			
Do.	do	do	do	Flouring and grist	10	142+	151		
Do.	do	do	do	Saw	3	32	36		
Do.	do	do	do	Tannery	1	24	6		
Do.	do	do	do	Woolen	2	20	9		
Do.	do	Alabama	Macon	Flouring and grist	3	36+	33		
Do.	do	do	Bullock	do	1	27	8		
Do.	do	do	Elmore	do	5	72	112		
Do.	do	do	do	Cotton-gin	1		30		
Do.	do	do	Tallapoosa	Flouring and grist	8	144	118	25	
Do.	do	do	Lee	do	3	67½	74		
Do.	do	do	do	Furniture works	1	8	6		
Do.	do	do	Chambers	Flouring and grist	8	103	98		
Do.	do	do	Clay	do	14	128+	168		
Do.	do	do	do	Saw	3	32	38		
Do.	do	do	Cleburne	Flouring and grist	9	74	91		
Do.	do	do	Randolph	do	13	171	291		
Do.	do	do	do	Saw	3	42	65		
Do.	do	do	do	Wheelwrighting	1	7	15		
Coosa river	Alabama river	do	Saint Clair	Flouring and grist	1	3½	15		
Sundry small tributaries.	Coosa river	do	Elmore	do	4	32+	104		
Do.	do	do	do	Cotton-gins	2		18		
Do.	do	do	Coosa	Flouring and grist	15	253	282		
Do.	do	do	do	Saw	3	61	51		
Do.	do	do	Shelby	Flouring and grist	9	101	185	35	
Do.	do	do	do	Saw	2	30	41		
Do.	do	do	do	Tannery	1	11	29		
Do.	do	do	Talladega	Flouring and grist	10	56½	264		
Do.	do	do	do	Saw	4	23	57		
Do.	do	do	do	Blacksmith-shop	1	6	6		
Do.	do	do	Clay	Flouring and grist	7	65	89		
Do.	do	do	do	Saw	2	17	33		
Do.	do	do	Saint Clair	do	4	41	115		
Do.	do	do	do	Flouring and grist	4	46	68		
Do.	do	do	Calhoun	do	12	116½	261		
Do.	do	do	do	Saw	2	16	25		
Do.	do	do	do	Tanneries	2	11	18		
Do.	do	do	do	Flouring and grist	4	36	67		
Do.	do	do	Cleburne	do	1	8	5		
Do.	do	do	do	Saw	1	8	5		
Do.	do	do	Etowah	Flouring and grist	8	92½+	180		
Do.	do	do	do	do	5	46½	44		
Do.	do	do	De Kalb	do	1	4½	8		
Do.	do	do	do	Saw	1	14	28		
Do.	do	do	Cherokee	do	2	14	28		
Do.	do	do	do	Tannery	1	8	5		

Table of utilized power on tributaries of the Alabama river—Continued.

Stream.	Tributary to what.	State.	County.	Kind of mill or manuf- acture.	Number of mills.	Total fall utilized.	Total water-power utilized.	Auxiliary steam- power.	Remarks.
						<i>Feet.</i>	<i>H. P.</i>	<i>H. P.</i>	
Sundry small trib- utaries.	Coosa river	Alabama	Cherokee	Flouring and grist	14	140	196		
Do	do	Georgia	Floyd	do	14	183	204		
Do	do	do	do	Saw	3	37	48		
Do	do	do	do	Woolen	2	15½	17		
Do	do	do	do	Cotton-gins	2	23	20		
Do	do	do	Polk	Blacksmith-shop	1				
Do	do	do	do	Flouring and grist	1				
Do	do	do	do	Machine-shop and foundry	1	4	70		Cedartown.
Do	do	do	do	Wood-working shop	1				
Do	do	do	do	Flouring and grist	6	125	168		
Etowah river	do	do	Dawson	Carpenter-shop	1				
Do	do	do	do	Flouring and grist	2	18	58		
Do	do	do	do	Saw	1				
Do	do	do	do	Tannery	1				
Do	do	do	do	Stamp-mill	1				
Do	do	do	do	Flouring and grist	4	83	50		
Do	do	do	do	Saw	2	42	27		
Tributaries	Etowah river	do	Polk	Flouring and grist	2	30	40		
Do	do	do	Floyd	do	2	16	47		
Do	do	do	Bartow	do	14	156	318		
Do	do	do	Paulding	do	9	107	79		
Do	do	do	do	Saw	2	24	34		
Do	do	do	do	Woolen	1	12	4		
Do	do	do	Cobb	Flouring and grist	2	26	26		
Do	do	do	Cherokee	do	12	195	187		
Do	do	do	do	Cotton	2	25½	56		
Do	do	do	do	Saw	5	78	64		
Do	do	do	Pickens	do	5	54	50		
Do	do	do	do	Furniture	2	15	20		
Do	do	do	do	Flouring and grist	13	179	129		
Do	do	do	Milton	do	2	28	16		
Do	do	do	do	Wheelwrighting	1	12	6		
Do	do	do	do	Saw	4	68	74		
Do	do	do	Dawson	Flouring and grist	2	38	40		
Do	do	do	do	Woolen	1		8		
Oostenaula river	Coosa river	do	do	do					River navigable.
Coosawatee river and tributaries.	Oostenaula river	do	Bartow	Flouring and grist	5	50	74		
Do	do	do	Gilmer	do	3	61	48		
Do	do	do	Gordon	Flouring and grist	5	44	160		
Do	do	do	do	Cotton-gin	1				
Do	do	do	do	Saw	1				
Do	do	do	do	Tannery	1				
Do	do	do	Pickens	Cotton	1	18	432		
Do	do	do	do	Flouring and grist	10	141	116		
Do	do	do	do	Saw	1	12	10		
Do	do	do	do	Woolen	1	18	20		
Conasauga river and tributaries.	do	do	Murray	Flouring and grist	8	93	105		
Do	do	do	do	Saw	2	28	30		
Do	do	do	Whitfield	do	2	20	22		
Do	do	do	do	Flouring and grist	12	161½	151		
Do	do	do	do	Boots and shoes	1	7	6		
Other tributaries	do	do	Bartow	Flouring and grist	4	50	62		
Do	do	do	do	Woolen	2	17	13		
Do	do	do	Chattooga	Cotton-gin	1	10	7		
Do	do	do	do	Flouring and grist	6	74	112		
Do	do	do	do	Saw	3	43	50		
Do	do	do	Floyd	Flouring and grist	3	24	141		
Do	do	do	Gordon	do	3	43	24		
Chattooga river and tributaries.	Coosa river	do	Chattooga	Cotton	1	16	300		
Do	do	do	do	Cotton-gins	4	24+	40+		
Do	do	do	do	Flouring and grist	7	92	145		
Do	do	do	do	Saw	5	63	102		
Do	do	do	do	Woolen	1	13½	8		
Do	do	Alabama	Cherokee	Flouring and grist	3	21½	60		
Do	do	do	do	Iron-works	1	8			

THE APPALACHICOLA RIVER AND TRIBUTARIES.

Being a navigable river, the Appalachicola is not itself to be considered with reference to water-power. It is formed on the northern boundary between western Florida and Georgia by the union of the Chattahoochee and Flint rivers. From their junction it runs in a southerly direction to the Gulf, having a length, by straight course, of about 70 miles.

Drainage areas.

	Square miles.
Chattahoochee river	9,100
Flint river	8,420
Appalachicola river below junction	17,520
Appalachicola river at mouth	19,580

THE CHATTAHOOCHEE RIVER.

The sources of this river are in Habersham and White counties, in northern Georgia, whence it takes a very direct southwesterly course across the state; in Heard and Troup counties it turns southerly, and continues in that direction until at the extreme southwest corner of the state it unites with the Flint river. From West Point down to the junction of the Soquee and Sautee rivers to its mouth the Chattahoochee has a length by general course of about 315 miles, but the actual distance by water is probably twice as great. Rising and flowing as far as Columbus upon the metamorphic rocks, the stream is frequently obstructed by shoals, rapids, and low falls, creating valuable opportunities for the development of water-power. At Columbus the falls come to an end, and below that point the river is navigable throughout the year to the Gulf, an estimated distance by water of about 400 miles, for steamers of 2½ or 3 feet draught, carrying as high as 750 bales of cotton. Immediately at the head of navigation a fall of 25 feet is in use by large cotton-mills, and within 4¼ miles there is a total descent of about 120 feet, mainly unimproved. It is fortunate for manufacturing-purposes that the fall of the river is heaviest well down in its course, where the volume is large and navigable waters are near at hand. Within 34 miles above Columbus, measuring from the head of navigation, there is a fall of 362 feet, or as much as occurs in the entire 170 miles succeeding, reaching nearly to the head-waters.

Table showing the fall in the Chattahoochee river.(a)

Locality.	Approximate distance from Gulf.	Elevation above tide.(b)	Distance between points.	Fall between points.	Fall per mile between points.
	Miles.	Feet.	Miles.	Feet.	Feet.
Thompson's bridge, near Gainesville.....	615	989	} } } } }	78	3.11
Western and Atlantic Railroad crossing near Atlanta....	542	762		108	1.50
Atlanta and West Point Railroad crossing at West Point.	434	600		34	10.65
Columbus, head of navigation.....	400	238		400	0.59½
Mouth of Appalachicola river	0	0			

a Data taken from report of survey made under direction of Major W. R. King, Corps of Engineers, U. S. Army.

b Elevations are for low-water surface of river.

Almost the entire course of the river in that portion having value for power is upon a bed of solid rock, with scarcely any sand or gravel bars. For 30 miles above Thompson's bridge, in Hall county, there are said to be few shoals, but farther up they appear more frequently and there is a rapid current. At Seven-Island ford, near Beltou, the stream is wide, and there is a long shoal where it was proposed to take out water for a canal to secure navigation by a cross route from the Mississippi to the Atlantic. A few miles from Mount Airy, in Habersham county, there is stated to be a fall of some 75 feet in 3 miles, about 20 feet occurring in rapid pitches in a short distance. The place is described, however, as being not especially favorable for improvement, since the river flows between high and steep rocky bluffs; but it is said that by running a canal or a flume, at considerable expense, below the narrows an open and very favorable site for buildings might be found.

The entire river between Thompson's bridge and Columbus, a distance of 215 miles, was surveyed in 1879 by government engineers under the direction of Major W. R. King, and the results of their examinations are to be found in the *Report of the Chief of Engineers for 1880*. The only practicable method of extending navigation over this stretch was found to be by a system of locks and dams, the estimated expense of which—\$4,870,000 for construction alone—is so great that there is little probability of the work being undertaken. Over the portion of the river surveyed the width in the narrower places gradually increases from 200 to 600 or 700 feet, while on the shoals the width runs as high as 600 feet between Thompson's bridge and the Western and Atlantic Railroad crossing, 1,200-

or 1,300 feet thence to West Point, and even reaches half a mile in places between West Point and Columbus. A considerable portion of these extreme widths is usually taken up by islands, which are common at the shoals and are an especially valuable feature of the river with reference to its water-power. The width and volume, anywhere except in the extreme upper waters, are generally so great as to render the control of the entire stream too costly except for enterprises of magnitude; but by taking advantage of chutes or narrow channels occurring between the islands and the main shores, or between the islands themselves, powers of much variety, both as regards fall and volume of water, may be secured at reasonable outlay, and sometimes at a ridiculously small expense. In the vicinity of Columbus and West Point three powers have been obtained in the manner indicated, each serving to run a cotton factory of 4,000 or 5,000 spindles, and farther up stream there are said to be grist-mills supplied in the same manner.

As stated in the report of the engineers' survey, the Chattahoochee above Columbus has usually a gentle current except where interrupted by shoals and falls; these are frequent, however, especially in the section below West Point. The banks are quite uniform and of good height, here and there varied by fertile bottoms, and occasionally rising to precipitous rocky heights, as between Roswell and the Western and Atlantic Railroad crossing. The oscillations between low and high water are sudden and heavy, though varying, of course, according to the section of river and the local slope. Assistant Engineer D. L. Sublett, of the government surveying party, mentions that early in January, 1879, there was a rise of 14 feet in 12 hours at Thompson's bridge. The extreme oscillation at that point is given as 24 feet; at Garner's bridge, 17 feet; at Roswell bridge, 11 feet; at the Atlanta and West Point Railroad crossing, 25.6 feet; and at Columbus, below the falls, 42 feet.

Very little, comparatively, of the great power offered by the Chattahoochee has yet been put to employment. At Columbus are the famous Eagle & Phoenix mills, and moderate powers are also in use in that city and the vicinity by two other cotton-mills, and by an equal number near West Point, carrying a few thousand spindles each. Farther up stream there are reported to be occasional grist-mills, but the entire aggregate of power utilized on the river is insignificant in proportion to the amount available. The freedom from ice and drift is a favorable feature of this stream. Its supplies are largely derived from springs, which give it a tolerably uniform flow. The very large fall occurring within 30 miles or so of the head of navigation, and indeed even within 5 miles; the situation in the midst of a cotton-growing section; the possession of an extremely healthful climate by the adjoining country, and the impetus already gained by the establishment of successful enterprises, should combine to render that portion of the river of great future importance in cotton-manufacturing. It is to be borne in mind also that the state of Georgia exempts from taxation for 10 years all new mills devoted to that industry. One present disadvantage to the development of power is the lack of suitable railroad facilities for the immediate river. The latter is crossed by lines at Columbus, West Point, northwest of Newman, and a few miles from Atlanta, but is nowhere else directly reached by railroad above the head of navigation; and though for 180 miles above West Point its general course is followed by the Atlanta and West Point and the Atlanta and Charlotte Air Line railroads, yet they are usually at distances from it of from 4 to 10 miles.

The only places of special importance immediately upon the river are Fort Gaines and Eufaula, on the lower course, with populations of 900 and 3,800, respectively; Columbus with 10,000, and West Point with 1,200. The country drained is rich, and is fairly well settled along the railroads. It bears a large amount of timber, including the long-leaved pine, white oak, hickory, chestnut, poplar, and in southwestern Georgia cedar and cypress also. The bottom-lands along the river yield valuable crops of corn and cotton. In the upper basin, particularly in the section drained by the Santee and Chestatee branches, in the Nacoochee and Yahoola valleys, hydraulic gold-mining is extensively and profitably conducted. Copper is said to be found to some extent in Carroll and Fulton counties, and iron in Harris county.

Power at Columbus and vicinity.—The shoals and rapids which characterize all the upper river, and which are formed by the hard metamorphic rocks belonging to this part of the Appalachian system, reach the southern boundary of that extensive range and cease at Columbus. A few hundred feet below the Eagle & Phoenix dam the last outcrop appears, and it is said that no rock is to be seen on the river below. The material over which the stream takes its final plunges is granite and gneiss, claimed to be much harder than Quincy granite, and rendering difficult and expensive the construction of hydraulic works. The immediate banks in this vicinity are in general high, steep, and rocky, rising farther back to hills, beyond which stretches, on the Georgia side at least, a level tract well cultivated in corn and cotton.

The fall which is usually classed as lying near Columbus begins at a point some 4 miles above the city, on property owned by the Columbus Manufacturing Company. A fall of 48 feet 8 inches is covered by its possessions, which extend for a mile along the stream.^(a) The only improvement of this fall is by the company itself, which manufactures sheetings and shirtings, utilizing 18 feet and about 150 horse-power. At the site of its factory the river spreads out to a width of from a quarter- to a half-mile, is full of rapids, and is dotted by numerous rocky islands. The banks are generally abrupt, and are perhaps from 75 to 150 feet high. Advantage has been taken of an old slough of the river on the east side, and, by throwing a few logs across between a couple of islands, sufficient

^a The ownership of property on the Georgia side also extends by law to high-water mark on the Alabama side.

water has been diverted to the mill, below which the continuation of the channel of the slough serves as a tail-race. The Columbus Manufacturing Company has a capital stock of \$250,000, and runs 4,100 spindles and 134 looms. It is considered that, by building a dam across the river farther up stream within the company's lines, water could conveniently be brought down the Georgia side in a canal, and the greater part of the fall, if not the entire amount, rendered available for manufacturing. The dam need not be more than 4 feet high, and would rest upon a natural ledge which crosses the river.

The next below is known as the "Cooke privilege" and is entirely unimproved. It embraces a total fall of about 38 feet, which is naturally divided into two falls of 26 and 12 feet, respectively. The upper fall, of 26 feet, is formed by a long shoal. At its foot a natural dam, perhaps 8 or 10 feet high, extends out from the Georgia side, opposite a precipitous point called Lover's Leap, nearly to the Alabama shore. A channel is left on that side, through which the whole ordinary flow of the stream rushes, afterward following along the lower face of the obstructing ledge, nearly to the Georgia side, when it turns south again and passes on toward Columbus. If the Cooke privilege were to be improved in two separate falls a dam would probably be built upon the upper shoal and a canal run down the Georgia bank. To take advantage of the lower fall the channel on the Alabama side, opposite Lover's Leap, would naturally be closed or cut off from above, and water carried in a flume from the Georgia end of the natural dam a short distance down the bank. It is thought that a fall of 20 feet could thus be secured, and the slough in the river would serve as a tail-race. It is considered by good judges, however, that the best plan would be to develop the privilege as a whole, by bringing water down from the upper shoal far enough to render available the entire fall. In any case this power would probably prove an expensive one to develop thoroughly, and, on account of the high, steep, and rocky banks, is not favorably situated for use. It has been suggested that power might be transferred to the top of the banks from below by cable; but although this plan might answer for powers of moderate size, say 100 horse-power or less, experience elsewhere seems to indicate that for those of as high as 200 or 300 horse-power it is not well suited. As regards transportation, either of three courses is open; goods may be transferred by team half a mile to and from the North and South Georgia narrow-gauge railroad, or a spur-track may be carried that distance, or a track may be run a mile or two down the river-bank to Columbus. The privilege here described is for sale, and is worthy of careful attention.

The third privilege in order is occupied by Phillips' grist-mill, carrying 8 runs of stones and using about 100 horse-power. The dam was built in 1871, and cost about \$4,000. It is a framed structure resting on a rock foundation, and is probably 500 feet or more in length by an average of 8 feet in height. The fall obtained at the mill commonly ranges from 6 to 8 feet, according to the stage of water. The rapid fall in the river above prevents much of a rise in that section during freshets; but at Phillips' mill we come within the influence of backwater from the lower river, though trouble from this source is not of long duration.

The remaining privilege to be noticed, and the one which brings us to the smooth water marking the head of navigation, is owned by the Eagle & Phoenix Manufacturing Company, and embraces a fall of about 25 feet. Cotton-manufacturing was begun here as early as 1850. The first dam was carried away, but the present one, built in 1865, has stood securely. It is a framed structure of the usual pattern, with a back-slope of perhaps 35 degrees. It is some 700 or 800 feet in length, and for the greater part of that distance ranges from 5 to 15 feet in height, according to the contour of the river-bed; but in one place the height above foundation is probably 30 or 40 feet. It rests throughout upon rock and has heavy masonry abutments. It originally ran quite directly across the river, but the washing of the bank on the Alabama side rendered it necessary to extend the dam with an offset up stream. The main mill of the Eagle & Phoenix company is on the Georgia side just below the dam. Its other mills, and the mill of the Muscogee Manufacturing Company, which leases power, are located at intervals along the bank above, opposite the pool formed by the dam. Between the mills and the pool runs the tail-race, protected on the river side by a splendid masonry wall perhaps 8 or 10 feet wide at the top. Spanning this race are heavy timber flumes conveying water from the pool to the mills. As has been stated, the extreme hardness of the rock at this point rendered work expensive, and the cost of the dam and the race-wall alone is estimated to have been \$125,000.

The Muscogee mill, the uppermost along the race, uses a fall of 11 or 12 feet, and 130 or 140 horse-power; 4,500 spindles are run in the manufacture of sheeting, shirting, duck, and cottonade. The remainder of the privilege is occupied by the works of the Eagle & Phoenix company, comprising three principal mills and a large dye-house. This concern started up since the war, and in the spring of 1881 had a capital stock of \$1,250,000, a surplus of \$550,000, and a total investment of \$1,925,000. There were at that time in employment 1,800 hands, and 53 bales of cotton, of 450 pounds each, were used per week. The machinery in the mills includes 44,000 cotton-spindles, 1,530 looms, and 7 sets of cards. Colored cotton goods, woolens, and cordage are manufactured, the production of cordage alone amounting to 3,000 pounds per day. The Eagle & Phoenix works use a total of about 1,700 horse-power for the principal mills, under heads of 16 and 25 feet. For electric lighting a 70 horse-power wheel is employed, and 100 horse-power is available for fire-pumps. Seven 80 horse-power boilers furnish steam, though not for power. At the new or main mill there is a head of 25 feet, and power is taken from 4 water-wheels—Swain turbines of 400 horse-power each. These wheels are in pairs, each pair geared upon a single shaft. Two wheels, one of each pair, give sufficient power with a full head, but the others are for additional use during backwater.

The slope of the river is very small below this point, and freshets cause a heavy rise, commonly forcing a stoppage of work at the mills for one or two days in the year. In the spring of 1881 there was a rise of 35 feet, and work was suspended for 15 days.

It may be seen from what has been said that there is a large amount of undeveloped power in the vicinity of Columbus. Its value is certainly great and the locality has important natural advantages. Considering, however, the size of the river and the nature of its banks, the extensive improvement of the fall would demand a heavy original outlay, and would probably be undertaken only by companies possessed of abundant capital. Hitherto the lack of this necessary resource, and an absence of special interest in manufacturing among the people of this section, have prevented, except in the notable instance of the Eagle & Phoenix company, the formation of such enterprises as the splendid powers to be obtained would warrant. As nearly as can be ascertained, the fall in that part of the river lying near Columbus is as follows:

Fall in the Chattahoochee river within about four miles of navigable water at Columbus.

Section of river.	Fall.	Remarks.
	<i>Feet.</i>	
Columbus Manufacturing Company's property	48. 07	Only 18 feet of fall and a small part of the flow of the river utilized.
From Cooke's upper line to head of falls at Lover's Leap.	25. 95	
Thence to Cooke's lower line	11. 03	} Entirely unimproved.
From Cooke's lower line to surface of Phillips' mill-pond.	1. 19	
From Phillips' mill-pond to city line	7. 86	Small power used by grist-mill. Utilized.
Eagle & Phoenix Manufacturing Company's privilege ...	25. 00	
Total fall, about	120. 30	

With no continued series of gaugings, and with but few data regarding the rainfall, or the flow in neighboring rivers, it is impossible to determine with much accuracy the power corresponding to this fall, but it may be estimated as follows: (a)

Estimate of power in the vicinity of Columbus, Georgia.

Stage of river.	RAINFALL ON BASIN.					Drainage area.	Flow per second, average for the 24 hours.	THEORETICAL HORSE-POWER. (a)					
	Spring.	Summer.	Autumn.	Winter.	Year.			1 foot fall.	8 feet fall (Phillips' grist-mill privilege).	38 feet fall (Cooke's privilege).	49 feet fall (Columbus Manufacturing Company's privilege).	95 feet fall (aggregate of Phillips', Cooke's, and Columbus company's privileges).	120 feet fall (aggregate within say 5 miles of navigable water).
	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Sq. miles.</i>	<i>Cubic feet.</i>						
Low water, dry year.....	} 12½	} 13	} 9½	} 14	} 49	} 4,800	2,500	284.0	2,270	10,790	18,920	26,080	34,080
Low water, average year							3,000	340.8	2,730	12,950	16,700	32,380	40,900
Available 10 months, average year..							3,500	397.6	3,180	15,110	19,480	37,770	47,710

a With good wheels, from 60 to 80 per cent. of this may be realized in ordinary practice.

Power near West Point.—Above the upper line of the Columbus Manufacturing Company's property there is an "eddy", or quiet water, for three-quarters of a mile, and shoals then succeed for 3 or 4 miles. The river is said to preserve this general character all the way up to West Point, there being no abrupt falls of magnitude, but frequent rapids, constituting a valuable section for power. In this distance the river is reported to be usually wide, probably at least 1,000 feet, flowing through a district well covered with pine timber, amid hills similar to those at Columbus, the banks now high and steep and again low and flat. The bed is generally rocky. What is known as Jack Todd's shoal begins about 4 miles below West Point, and extends down stream 7½ miles, with a fall in that distance of 51.31 feet. In his report upon the survey of this portion of the river, (b) Mr. B. W. Frobel, assistant engineer, states that "the river varies here from 600 feet to half a mile in width, the channel being divided by numerous islands. The banks are high and formed of rock, and so are the islands".

Power is used at two different points on this shoal, both on the Georgia side. At the lower, distant about 7 miles by road below West Point, is the cotton factory of the Alabama & Georgia Manufacturing Company, running

a It should be stated, however, that during the construction, in 1882, of a new dam to supplant the old structure belonging to the Eagle & Phoenix Manufacturing Company, the river was so controlled that its volume could approximately be determined; and from a consideration of the data thus obtained, kindly furnished to the author by Mr. John Hill, engineer in charge of the work, it is believed that the discharge of the river has not been overestimated.

b See *Annual Report of the Chief of Engineers*, 1880 (p. 1713).

3,500 spindles and 100 looms. Some little distance up stream a dam has been thrown across between two islands to deflect the current to the east side; another dam runs from the mill to an island adjacent and secures sufficient water for use, though there is not commonly much surplus. Both these dams are crib-work structures partially filled with stone. The lower is several hundred feet long, and has an extreme height above foundation of 15 or 16 feet, averaging perhaps 11 feet; it was built in 1867. About 130 horse-power is in use under a head of 9 feet. Slight trouble is experienced from backwater, and during the spring of 1881 the mill was stopped six days from that cause. The company has a capital stock of, in round numbers, \$260,000, and manufactures 8- and 10-ounce duck, using 9 bales of cotton per diem.

Two miles farther up stream is the next power in use. There, as at the privilege just described, the river is wide, studded with islands, bordered by high hills, and runs over a rocky bed. A dam has been thrown out from the Georgia side, controlling about one-third the width of the river. It was built in 1870-'73, and is quite long, running diagonally up stream, first to one island and then to another. In construction it is a dry-stone wall, 10 or 15 feet wide at the base, 6 feet wide at the top, and averaging about 5½ feet in height. Seven feet of fall and 50 horse-power are first used at Lanier's grist-mill. A separate short canal conveys water to the cotton factory of the West Point Manufacturing Company, where a fall of 8 feet and 160 horse-power are obtained. This company runs 5,000 spindles and 100 looms in the manufacture of cotton duck. At the time it was visited the mill was not running, but was being stocked with new machinery and was expected soon to be in operation again. Both the mills near West Point ship goods and material to and from that town, and are sometimes seriously inconvenienced by impassable roads.

Above this locality we come upon a section of the river where the fall is much less rapid than below. As far as Franklin it is described as having a good current, with occasional shoals, banks usually of but moderate height, and frequently low. The only use of power is by two or three small grist-mills, but it is said there are available unoccupied sites where falls of 7 or 8 feet may conveniently be obtained. The remainder of the river above has already been described in a general way, and there will only be added a list of the principal shoals, with their length and fall as determined by the government survey, and an estimate of the available power.

Estimate of power at the principal shoals in the Chattahoochee river below Thompson's bridge, Hall county (in order passing down stream).^(a)

Name or location of shoal.	Approximate drainage area.	Length of shoal.	Fall on shoal.	THEORETICAL HORSE-POWER. ^(b)			Remarks.
				Low water, dry year.	Low water, average year.	Available 10 months, average year.	
	Sq. miles.	Miles.	Feet.				
Shallow ford.....	590	1.04	6.71	160	280	370	3 miles below Thompson's bridge. River 300 feet wide, and divided at the upper end of the shoal by an island 1,600 feet long.
Johnson's shoal.....		0.08	3.17	70	130	170	Three-quarters of a mile below Shallow ford. River 200 feet wide; minimum depth in channel, 3 feet.
Overby's shoal.....	600	0.06	6.92	170	300	300	Immediately above mouth of Chestatee river. Main river 350 feet wide.
Brown's Mill shoal.....	960	1.61	(?)16.92	600	1,150	1,500	1 or 2 miles below Chestatee river. Stream widens to 600 feet.
Windingshoals and Garner's Bridge shoals.	1,060	2.24	16.90	770	1,290	1,650	
Island shoal.....	1,280	0.95	9.00	400	820	1,000	12 miles below Jones' ferry. River from 400 to 800 feet wide, and channel divided by two islands.
Roswell shoal.....	1,300	1.97	13.28	770	1,240	1,580	Average width of river about 600 feet.
From foot of Roswell upper shoal to foot of Bull's sluice.		2.00	40.00	2,320	3,730	4,770	River varies greatly in width, and channel is divided by many small islands. Fall given as nearly 40 feet.
Devil's race-course.....		2.00	19.95	1,270	2,020	2,580	The "race-course" is 2 miles below Cochran's shoal, and the fall given is measured from the head of the latter. At the race-course the river is 450 feet wide.
Dimpsey's ferry.....		0.98	10.00	660	1,050	1,340	River 300 feet wide.
Face's ferry.....		0.81	6.50	430	690	860	River 300 feet wide and filled with sunken reefs.
Mederis shoal.....	2,280	1.40	8.42	980	1,330	1,660	32 miles or more below Western and Atlantic Railroad crossing. River from 500 to 600 feet wide. Shoal consists of narrow reefs separated by deep pools.
McIntosh's shoals.....	2,620	0.72	7.24	980	1,340	1,680	River suddenly widens from 200 to 1,200 feet.
Hollingsworth's mill.....		0.14	3.51	450	660	820	
Bush-head shoal.....		0.40	5.17	680	980	1,230	6 miles or so above Franklin. River from 700 to 1,000 feet wide.
Daniel's Mill shoal.....		1.01	8.85	1,190	1,710	2,130	River 1,600 feet wide at head of shoal, and 300 feet wide just below it.
Jackson's mill, upper shoal.....	2,930	0.09	4.78	690	990	1,200	River 830 feet wide. Fall measured from above dam.
Huguley's shoal.....			8.00±	1,520	2,000	2,440	River varies from 600 to 1,300 feet in width, and is divided by several small islands.

^a Owing to the lack of time and to the difficulty of reaching the stream directly by rail, the various falls not already described could not be examined in detail. The estimates of power here presented in connection with the different shoals pertain to the natural fall only; in case of the actual development of power the fall practically available would doubtless vary materially in individual cases from the figures here assumed, being dependent upon the location and height of dam and the length of canal employed.

^b Based upon average flow for the 24 hours. With wheels of good pattern, from 60 to 80 per cent. of the theoretical power can be realized in practice.

Estimate of power at the principal shoals in the Chattahoochee river below Thompson's bridge, etc.—Continued.

Name or location of shoal.	Approximate drainage area.	Length of shoal.	Fall on shoal.	THEORETICAL HORSE-POWER.			Remarks.
				Low water, dry year.	Low water, average year.	Available 10 months, average year.	
	Sq. miles.	Miles.	Feet.				
Pott's shoal.....	3,580	0.69	5.06	980	1,200	1,580	A few miles above West Point.
Jack Todd's shoals.....	3,820	7.50	51.31	10,720	13,700	16,610	Extend from a point 4 miles below West Point to reef below Houston's ferry. River varies from 600 feet to half a mile in width, and channel is divided by numerous islands. Banks high and rocky. Power used at two points by cotton factories.
Three miles below Houston's ferry.	4,800	0.19	4.00	1,000	1,200	1,480	The length and fall as stated for this section may not be exact, but are given as they appear from the estimates of locks and dams necessary to secure navigation. The shoals are 15 miles or more above Columbus.
Hargett's island, and down stream to a small island 1,000 feet below the foot of Round island.		2.00-3.00	60.00±	15,200	18,610	22,000	
From the foot of the small island to a point 4,000 feet below.		0.76	15.00	3,820	4,600	5,550	River contracts in width from 1,300 to 600 feet.
Thence down stream.....		0.66	16.00	4,110	5,040	5,960	River 1,100 feet wide.
Thence down stream.....		0.98	10.00	2,590	3,170	3,750	
Tate's shoals.....		1.02	22.00	5,700	7,000	8,300	From 11 to 12 miles above Columbus. River from 600 to 700 feet wide.
Mulberry Creek shoals.....	4,400	2.00	30.00	7,800	9,710	11,350	1 mile below Tate's shoals. River 1,000 feet wide.
Shoals from a point 4½ miles up stream down to navigable water at Columbus.	4,800	4.25	120.00	34,080	40,900	47,710	18 feet fall and moderate power obtained by wing-dam on upper part of shoals; 7 feet fall and small power used by grist-mill at Columbus; 25 feet fall and entire river controlled by dam of Eagle & Phoenix mills at Columbus. Fall is otherwise unimproved. River is wide and contains numerous islands.
Total of above shoals.....			528.04±	100,100	127,050	151,810	Total effective horse-power returned as in use on the entire main river in 1880, about 2,540.

NOTE.—The rainfall on the river basin may be taken as approximately 12½ inches in spring, 13 in summer, 9½ in autumn, 14 in winter, and 49 for the year.

TRIBUTARIES OF THE CHATTAHOOCHEE RIVER.

Although the drainage basin of the Chattahoochee has a length of over 300 miles, it is in comparison extremely narrow; at West Point it reaches a width of 35 miles, and at Columbus about 55, but elsewhere seldom exceeds 20 or 25 miles. From the upper waters down to Coweta county the southern water-shed is sharply defined, and is frequently but a few miles from the river. It passes through the city of Atlanta, the drainage of which is divided between the Chattahoochee river, running to the Gulf, and the Ocmulgee river, to the Atlantic. The elevated, hilly, and rocky character of the country above Columbus gives rise to numerous tributary streams which have considerable fall and furnish good opportunities for the use of power. The lower river, from Columbus to the mouth, is bordered by a narrow district, comparatively low and sandy, to the east of which is a region of marls and limestones. Where the small streams flow down from the latter formation to the first there are nearly always to be found falls—sometimes of great height—available for power. No information was gained of any important manufacturing in this section, although there are said to be one or two small cotton-mills in operation. Above Columbus the Chattahoochee receives thirteen tributaries draining upward of 100 square miles each, and seven below Columbus. Of the former, the Chestatee drains the largest area—330 square miles; while among the latter, and indeed among all the affluents of the main river, the Upatoi, which empties from the east a few miles below Columbus, ranks first, with a drainage area of 500 square miles. The limited time at command forbade direct examination of more than a very few of the affluents of the main river, but a description of some of those that have been developed by manufacturing enterprises of importance may be of value in conveying an idea of the probable character and capabilities of the rest.

Nickajack creek is a small stream, not more than 10 miles long, emptying from the north 8 miles to the west of Atlanta, and draining an area of 40 square miles. Its upper course lies in a rather flat country, after which it cuts through the hills and has a rapid descent. There are numerous small saw- and grist-mills on the creek, and power is also used by the Concord woolen-mill, running two sets of machinery on jeans and cassimeres. The dam is of rubble, without cement, and was built some 15 years ago at an estimated cost of \$1,200. It is about 80 feet long, 20 feet high, and 21 feet wide at the base. A wooden flume conveys water 100 feet to the factory, where a 21-inch Burnham wheel is run under a fall of 21 feet. At times there is a little scarcity of water.

Soap creek lies near Marietta, to the northward from Atlanta, and is a short mountain stream running down with rapid fall over a rocky bed. Toward the mouth it ranges from 25 to 100 feet in width, averaging perhaps 50 feet. The banks are wooded, steep, and rocky. The stream itself is rapidly swollen by heavy rains, and quickly subsides again. Power is used for sundry small grist- and saw-mills and cotton-gins, but the only important manufacturing is about three-quarters of a mile from the mouth, where the Marietta Paper Manufacturing Company

has a mill. This company has a capital stock of \$25,000, and manufactures news, book, and manila wrapping paper, turning out about 1,200 pounds per day. It does not make use of wood-pulp, and it is said that very little is employed in this section. The company owns land on both sides of the creek, embracing a fall of 65 feet in a quarter of a mile. The privilege at the mill is improved by a framed dam with stone abutments, the overflow about 100 feet long and 10 feet high. Water is carried 400 feet in a wooden flume, and used under a head of 22 feet on two breast-wheels, one 27 feet high and 18 feet wide, the other 22 feet by 5 feet. About 75 horse-power is estimated to be used, and it is thought that for six or eight months in the year 200 horse-power could be realized. During a protracted dry season, however, the creek runs very low, and the mill is sometimes more or less short of water for a period of three months. Much of this trouble occurs, though, at night, when water is held back in the mill-ponds farther up stream.

Neither this stream nor *Willeo creek*, which is near at hand, is of sufficient size to be indicated by name upon ordinary maps, and their drainage areas could not therefore be determined. Although they are small, it is evident that the aggregate of manufacturing which could be sustained by several such streams would reach very respectable dimensions. *Willeo creek* is of less importance than *Soap creek*, and is said to run nearly dry in summer. The only power worthy of notice is used at the *Willeo mill*, where a fall of some 30 feet is obtained, and about 1,200 spindles are run in the manufacture of yarns.

Vickery's creek enters the *Chattahoochee* from the right, 18 miles nearly due north of Atlanta. It drains an area of 94 square miles, including portions of Milton and Forsyth counties. Its course is entirely through a mountainous district, and it is hemmed in much of the way by high rocky banks, wooded and steep. The stream is a very rapid one, a succession of leaps and slides over ledges. As might be expected, sudden and violent freshets occur at times. In March, 1881, the creek was swollen by heavy rains to a furious torrent, with a volume estimated to have been twice as large as had ever before been observed, and swept away most of the dams and bridges along its course. It supplies power to the usual small saw-mills, grist-mills, and cotton-gins, besides a cotton factory and woolen factory. The latter are compelled to ship goods and material some 15 miles by team to and from Marietta, but a narrow-gauge spur is projected to run from Roswell southerly to the Atlanta and Charlotte Air Line railroad.

The lowest mill on the stream is close by the mouth, and belongs to the *Laurel Mills Manufacturing Company*, having a capital stock of \$34,000, and running 2 sets of cards on woolen goods, jeans, tweeds, and linseys. Water is brought several hundred feet in a canal and wooden flume to the factory, furnishing power on the way to a small flouring-mill. At the woolen factory a 60 horse-power wheel is used, with a fall of 19 feet. No trouble is experienced from either low or back water. This privilege was formerly improved by a framed dam, but in 1871 this was in a manner replaced, at an expense of \$5,000, by one of dry stone, cemented, however, on the face. The stone was laid in and upon the old dam without removing that structure. The new dam is 200 feet long and 18 feet high, with a width of 26 feet at the base. During the heavy March freshet already mentioned, water worked around one abutment and carried it and the bulkhead away, though the main portion of the dam was not injured.

This dam sets the stream back to the privilege occupied by the *Roswell Manufacturing Company*, about a mile and a quarter from the mouth. The company has a capital stock of \$260,000, and is a large owner of property along the creek. Its business is carried on in a fine brick factory, in which are employed 225 hands, all native whites, some of whom have been in the constant service of the company for twenty or thirty years. The manufacture is largely in yarns, which are shipped to Philadelphia, but also includes some colored goods—checks and plaids—as well as sheetings and shirtings; 124 looms, of which 30 are on colored goods, and 8,400 spindles are run, and 9½ bales of cotton are used per day. The *Roswell company* formerly had three dams on the stream, but the lower, near its mill, which had been depended upon mainly for auxiliary power in low water, was carried away in the freshet which has been described as so disastrous along *Vickery's creek*. The upper dam, 3 miles above the mill, is a framed structure, and forms a pond extending back 3 miles, thus giving a large storage and furnishing a fall of 12 feet and the necessary power to a 3-run grist-mill. The main dam is of dry stone, cased with wood at the top, and was built about 1865. It is 120 feet long, 30 feet high, 30 feet wide at the base, and runs out to an edge at the top. From the dam, water is carried about 300 feet to the factory in a wooden flume 5 by 8 feet in size. Power is taken from a 60-inch American wheel running under a head of 27 feet. No trouble is encountered from backwater and very little from drought.

At *Roswell* the creek has a width, where running freely, of perhaps 50 feet. There is no other important manufacturing on its course than has been described, but there are said to be good unimproved sites for power.

The *Chestatee river*, the largest tributary of the *Chattahoochee* above *Columbus*, joins that river from the north, 6 miles west of *Gainesville*. It heads in the counties of *Lumpkin* and *White*, besides which it drains small portions of *Hall*, *Dawson*, and *Forsyth* counties. Its basin includes 330 square miles. The stream carries a large volume of water, has a rapid fall, and is valuable for power, although utilized for that purpose by only one or two small saw-mills. *Bull's shoal* is especially mentioned as offering a fine site. The width between banks is 150 or 200 feet in the lower course, and in the eddies there is an ordinary depth of 10 or 15 feet. As with all the other mountain streams, the freshets are sudden and heavy, with a rise of 12 or 14 feet in places. Along the stream is considerable good farming-

land, but at many points the valley is narrow and the banks rise abruptly. In the upper basin the mining of gold is an important industry, and on the bank of the Chestatee itself a mill has been erected, with apparatus designed for sucking up the material of the river-bed and extracting the gold.

The *Yahoola river* and *Cane creek*, tributaries of the Chestatee, are both small mountain streams flowing rapidly down over rocky beds, and used almost exclusively in the operations of gold-mining. In the vicinity of Dahlonega neither of them is more than about 20 feet wide. They are fed by springs, and are tolerably steady in flow most of the year, yet they run quite low in summer. The fall in the Yahoola from the head of the Hand canal to a point on the river some 16 or 17 miles by road farther down, lying a short distance south of Dahlonega, is 380 feet. In the remaining $1\frac{1}{2}$ mile to the Chestatee there is a fall of 30 feet, with one or two good sites for power. Descending the Yahoola, there is first a small grist-mill, and then at Dahlonega the Benning mill, of 10 stamps; the Singleton mill, 10 stamps; the Hand Gold Mining Company's mill, 20 stamps, and the Findley mill, 40 stamps. These mills take power directly from the river, have timber and stone crib-work dams, as indeed the stamp-mills in this section generally do, and employ in most cases from 16 to 20 feet of fall. Two new mills had also been projected in the spring of 1881, of 24 and 40 stamps, respectively.

Although the stream is thus rendered very useful, its most important service is in supplying the canal of the Hand Gold Mining Company. Water is taken out from the Yahoola some 10 miles above Dahlonega and is brought along the side of the valley to the mines, where it is employed in washing for gold, but not for power. The main canal follows a sinuous course of 20 miles along the hill-sides, and then divides into two principal branches, which extend enough farther to give a total of about 40 miles of canal. Water is not drawn from the main canal, but only from the branches. The former is 6 feet wide, 3 feet deep, and has a grade of 4 feet to the mile. It was originally constructed about the year 1858, but was rebuilt soon after the war. For the most part its course lies in earth excavation, but there is also considerable rock-cutting. Until 1868 wooden trestles were used for crossing depressions, but they were then replaced by wooden and iron tubes. Of wooden tubing there is now in use 12,000 feet, including a single stretch a mile in length; 3,000 feet of 18-inch iron tubing is also in service. For 16 miles from its head the canal runs down the east side of the Yahoola, and then crosses. The transit is made in an iron tube which follows down and up the steep inclines that form the side-slopes of the valley. Over the stream which runs at the bottom the tube is supported, through a distance of about 160 feet, by wooden piers resting on stone foundations. The vertical depression overcome is 250 feet, and there is a fall of 6 feet between the ends of the pipe, which in a direct line are perhaps half a mile apart. The tube is of boiler-iron, 3,000 (?) feet long, 36 inches in diameter, and three-eighths of an inch thick at the bottom of the valley, gradually decreasing to half that thickness at the top.

Tributaries of the Chattahoochee river (in order from the source).

Name of stream.	Drainage area.	Name of stream.	Drainage area.
	<i>Sq. miles.</i>		<i>Sq. miles.</i>
Soquee river above junction with Sautee	149	Osannippa creek	127
Sautee river above junction with Soquee	151	Mountain creek	72
Mud creek	41	Big Hallewookee creek	98
Chestatee river at New Bridge	247	Wacoochee creek	39
Chestatee river at mouth	330	Mulberry creek	225
Suwanee creek	70	Standing Rock creek	75
Vickery's creek	94	Bull creek	70
Nancy's and Peachtree creeks	123	Upatoi creek	500
Nickajack creek	40	Uchee creek	325
Sweetwater creek	265	Hitchetee creek	73
Camp creek	76	Hannahatchee creek	98
Dog river	86	Hatcheechubbee creek	104
Snake creek	67	Nochefalooctee creek	52
Cedar creek	46	Cowikee river	475
Wahoo creek	34	Barbour creek	95
Sundalhatheo creek	59	Oketeeocheeneo creek	53
Hillabahatchee creek	123	Pataula (?) creek	425
New river	157	Comochechubbee creek	89
Yellow Jacket creek	185	Colomokee creek	82
Wchatkee creek	166	Yuttayabba creek	204
Ooeluhce creek	107	Ommussee creek	189
Long Cane creek	78	Sowahatchee creek	85
Flat Shod creek	225		

At Dahlonega the main canal divides, as has been said, into two branches. The larger of these supplies the Findley, Pennsylvania Consolidated, Bast & Ivey, Griscomb, Fish Trap, and Barlow mines, in the vicinity of Dahlonega, and the Chicago & Georgia mine at Auraria, 6 miles below. The other branch supplies the Benning, Hand, Hamilton, and Lockhart mines, the three former of which were not in operation at the time this locality was

visited. The total expenditure on account of the Hand canal is estimated to have reached \$300,000, although such a canal could now be built for a very much smaller sum. The Hand Gold Mining Company sells the water to the various users at the rate of 12 cents per day per miner's inch, taken as the flow through a 1-inch aperture under a head of 4 inches. The operations of hydraulic mining are familiar, and a description would be out of place here. Although the proportion of gold in the ore of this section is commonly small, the cheapness with which the latter is treated, not exceeding from 25 to 35 cents per ton, renders mining a profitable industry.

Cane creek is similar to the Yahoola river. It has a rapid fall, which at one point becomes almost vertical through 50 feet. It is utilized by a small flouring-mill, and also by the Barlow stamp-mill, at which 16 feet of fall and about 60 horse-power are obtained.

THE FLINT RIVER.

Rising in western Georgia, within a dozen miles to the southward of Atlanta, this river takes a southerly course, bending well to the eastward toward Macon, and joins the Chattahoochee near the village of that name. The only important towns on its banks are Albany, in Dougherty county, with 3,200, and Bainbridge, Decatur county, with 1,400 inhabitants. From the mouth to Montezuma, a distance of 182 miles by water, the stream has been examined by government engineers with a view to rendering it navigable, and for several years more or less work has been performed along the lower course. The design is to secure a channel of the minimum dimensions of 100 feet width and 3 feet depth as far as Albany at least, and in 1880 the sum of \$10,000 was appropriated by Congress for improvements between Albany and Montezuma. Up to June, 1880, inclusive, the entire appropriations to this river had amounted to \$37,000, and the channel had been opened to a point about 10 miles above Bainbridge.^(a) Above Albany the obstructions are snags and shallows, and, in particular, a series of rocky shoals stretching at intervals for some 18 miles up stream from the town.

The Flint river has a length by general course of about 230 miles and drains 8,420 square miles. But of this area not more than 1,200 square miles, or that part lying north of Talbot county, should be considered as contributing to available water-power on the main river. The interests of navigation would appear to forbid the damming of the stream below Montezuma, and above that point, as far up as Upson county, no important shoals were reported. According to the profiles of the Central Railroad of Georgia, between its crossings in southern Macon county and at Montezuma, a distance by water of not less than 22 miles, there is a fall in the stream of 41 feet.^(b) From Montezuma to Albany the fall is given as, approximately, 125 feet for the 77 miles.^(c) With a small average slope, and draining a section subject to heavy winter and spring rains, the river is visited by a large freshet-rise, ordinarily amounting to 10 or 15 feet as far north as the vicinity of Thomaston, in Upson county, but which was stated to have reached 25 feet in the spring of 1881. The river was visited at but one point, 8 or 10 miles from Thomaston. It was there found to be from 200 to 250 feet wide, flowing with a rapid current, being at the time somewhat above a mean stage. The banks were of sand and loam, with no appearance of rock; on one side they rose quite rapidly to a height of 50 or 75 feet, while on the opposite side they were not more than from 10 to 20 feet high, and were succeeded by a short stretch of bottom-land. It was said that this description would apply to many localities along the river in this section and below. But from the latitude of Thomaston up stream the slope becomes greater, the freshet-rise is less, the bed and banks display more or less rock, and there are frequent shoals with smooth water intervening. The upper river is not directly accessible by railroad, and is utilized only in a limited way for power by a few flouring- and grist-mills.

Drainage areas of the Flint river.

	Square miles.
At Erin, southwest corner of Spalding county, below junction with Lime and Whitewater creeks.....	560
Above Pigeon creek, northern boundary of Talbot county.....	1,190
Below Big Potato creek.....	1,690
At Montezuma, below Buck's creek.....	2,945
At Albany.....	5,430
At mouth of river.....	8,420

TRIBUTARIES OF THE FLINT RIVER.

As will be seen from a subsequent table, the Flint river receives two tributaries with a little over 1,000 square miles each of drainage area, one of between 600 and 700, while the remainder range from 260 square miles down. No special information has been obtained regarding any of these streams, excepting one or two in Upson county, but they do not appear to be used for important manufacturing. Above Thomaston they lie in the region of metamorphic rocks, and below mainly among the limestones and marls.

In a letter to the assistant engineer in charge of the Flint River survey ^(d) the secretary of the Albany board

^a Report of the Chief of Engineers, 1880.

^b Elevations above tide, 306 and 265 feet, respectively.

^c Report of the Chief of Engineers, 1879 (p. 820).

^d Report of the Chief of Engineers, 1873.

of trade mentioned that 2 miles north of that city, on Kinahatooshee creek, there was a fine unimproved water-power capable of running 100,000 spindles. This stream has a drainage basin of 1,075 square miles, and with sufficient fall ought to furnish an important power.

Tobler creek is a short stream confined entirely to Upson county. It runs through a hilly district, has a sandy bed, and near the mouth is from 50 to 75 feet wide, with a good current. Owing to the clearing and cultivation of the land the channel has become somewhat filled up by the soil which is washed in. A mile or two from the mouth the Flint River Manufacturing Company uses a fall of 14 feet, and about 25 horse-power, in the manufacture of cotton yarns, consuming 60 bales of cotton per month. There is one other cotton factory on the stream, making sheetings and shirtings, besides several small grist-mills and cotton-gins.

Big Potato creek heads to the eastward of Flint river in Spalding county, flows southerly, passing through Pike and Upson counties, and joins the main river 7 or 8 miles south of Thomaston, its drainage basin containing 246 square miles. This stream has its sources in the mountains, receives supplies from many springs, and is well sustained in volume. Flowing among high hills, with a rapid fall over a rocky bed, and between high rocky banks which only occasionally give way to patches of bottom-land, the conditions are favorable for power. The stream drains considerable cultivated land, but also runs through much pine timber. There are numerous small flouring- and grist-mills along its course, and also good unimproved privileges. The most important of these brought to notice was one owned by Dr. C. Rogers, of Thomaston, and located some 3 miles from that town. The creek is there 200 or 300 feet wide, contains several small islands, and tumbles over two or three successive ledges in small falls of from 3 to 5 feet each. Within perhaps a quarter of a mile there is asserted to be a total fall of 60 feet available in two shoals of 30 feet each. Before the war Dr. Rogers had here a cotton factory of 1,800 spindles, and claims that each shoal will carry 5,000 spindles the year around.

Estimate of power at Rogers' privilege, near Thomaston.

Stage of water.	RAINFALL ON BASIN.					Drainage area.	Flow per second, average for the 24 hours.	Theoretical horse-power.		
	Spring.	Summer.	Autun.n.	Winter.	Year.			1 foot fall.	30 feet fall.	60 feet fall.
	Inches.	Inches.	Inches.	Inches.	Inches.	Sq. miles.	Cubic feet.			
Low water, dry year.....	15	13	7½	15	50½	170	30	3.4	100	200
Low water, average year.....							50	5.7	170	340
Available 10 months, average year.....							75	8.5	255	510

Tributaries of the Flint river (in order from the source).

Name of stream.	Drainage area.	Name of stream.	Drainage area.
	<i>Sq. miles.</i>		<i>Sq. miles.</i>
Whitewater and Lino creeks.....	246	Hog-craw creek.....	97
Texas (?) creek.....	184	Lampkin's creek.....	185
Red Oak creek.....	150	Lino creek.....	73
Elkins creek.....	87	Gum creek.....	74
Cane creek.....	76	Cedar creek.....	43
Laxer creek.....	155	Swift creek.....	58
Big Potato creek.....	246	Chateaufichickee creek.....	76
Little Potato creek.....	104	Jones' creek.....	55
Hootensville (?) creek.....	109	Abram's creek.....	140
Parchelagee creek.....	135	Pinewoods creek.....	57
Spring creek.....	85	Kinahatooshee creek.....	1,075
Whitewater creek.....	260	Pond creek.....	102
Buck's creek.....	205	Coolewahee creek.....	105
Camp creek.....	64	Ichawaynocha and Kiokee creeks.....	1,033
Sweetwater creek.....		Spring creek.....	685

THE EASTERN GULF SLOPE.

31-469

Table of utilized power on tributaries of the Appalachicola river.(a)

Stream.	Tributary to what.	State.	County.	Kind of mill or manufacture.	Number of mills.	Total fall utilized.	Total water-power utilized.	Auxiliary steam-power.
						Feet.	H. P.	H. P.
Chattahoochee river (b)	Appalachicola river	Georgia	Muscogee	Cotton	c3	43	2,000	
Do	do	do	do	Flouring and grist	d1	8	106	
Do	do	do	Harris	do	e1		50	
Do	do	do	do	Cotton	e1		160	
Do	do	do	Troup	do	e1	9	130	
Do	do	do	Hall	Building-materials	f1		30	
Do	do	do	do	Flouring and grist	f1		60	
Do	do	do	Cobb	do	1	11	19	
Sundry tributaries	do	Alabama	Henry	do	3	21	32	
Do	Chattahoochee river	do	do	do	16	129	148	
Do	do	do	do	Saw	4	15	56	
Do	do	do	Barbour	do	1	60	30	
Do	do	do	do	Cotton-gins	3	12+	75	
Do	do	do	do	Flouring and grist	7	47+	81	
Do	do	do	Russell	do	5	45+	121	
Do	do	do	do	Cotton-gin	1	7½	20	
Do	do	do	Lee	do	2	28	36	
Do	do	do	do	Flouring and grist	14	231+	319	
Do	do	do	do	Saw	1	16	8	
Do	do	do	Randolph	do	1	12	20	
Do	do	do	do	Flouring and grist	2	40	38	
Do	do	do	do	Stone and earthen ware	1	18	4	
Do	do	do	do	Cotton	1	32½	160	
Do	do	do	do	Woolen	1	35	60	
Do	do	do	Chambers	Flouring and grist	10	180	191	
Do	do	Georgia	Early	do	6	56½	72	
Do	do	do	do	Saw	1		25	
Do	do	do	Clay	do	3	29	60	
Do	do	do	do	Cotton-gin	1	8	6	
Do	do	do	do	Flouring and grist	6	58+	77	
Do	do	do	Quitman	do	4	49	96	
Do	do	do	do	Saw	2	24	63	
Do	do	do	Randolph	Flouring and grist	1	9	8	
Do	do	do	Stewart	do	8	83	192	
Do	do	do	do	Saw	2	20	22	
Do	do	do	Chattahoochee	do	1	10	15	
Do	do	do	do	Flouring and grist	6	57	75	
Do	do	do	Muscogee	do	4	73	213	
Do	do	do	Marian	do	1	6	12	
Do	do	do	do	Cotton-gin	1	8	21	
Do	do	do	do	Saw	1	8	30	
Do	do	do	Harris	do	1	12	10	
Do	do	do	do	Flouring and grist	13	235	398	
Do	do	do	Talbot	do	2	36	47	
Do	do	do	do	Saw	2	36	43	
Do	do	do	Troup	do	4	57	65	
Do	do	do	do	Tannery	1	22	8	
Do	do	do	do	Flouring and grist	22	223½	506	
Do	do	do	do	Cotton	1	20	60	
Do	do	do	Meriwether	Flouring and grist	1	30	11	
Do	do	do	Heard	do	8	91	101	
Do	do	do	do	Saw	3	124	125	
Do	do	do	Carroll	Cotton	1	30	120	
Do	do	do	do	Flouring and grist	12	277+	160	
Do	do	do	do	Saw	3	58	26	
Do	do	do	Coweta	Cotton	1		60	
Do	do	do	do	Flouring and grist	14	275+	226	
Do	do	do	Campbell	do	7	124	130	
Do	do	do	Douglas	Cotton-gin	1	11	20	
Do	do	do	do	Flouring and grist	13	202	119	

a Not including power employed in mining-operations in northern Georgia.

b About a dozen small flouring- and grist-mills are included in the census enumerators' returns as taking power from the main river in Carroll, Forsyth, and Heard counties, but it is probable that they are really located on small tributaries of the Chattahoochee, and they have been so classified here.

c At and near Columbus.

d At Columbus.

e Near West Point.

f Possibly not on main stream.

WATER-POWER OF THE UNITED STATES.

Table of utilized power on tributaries of the Appalachicola river—Continued.

Stream.	Tributary to what.	State.	County.	Kind of mill or manufacture.	Number of mills.	Total fall utilized.	Total water-power utilized.	Auxiliary steam-power.
						Feet.	H. P.	H. P.
Sundry tributaries	Chattahoochee river.	Georgia.	Douglas	Saw	6	136	82	
Do.	do	do	do	Tannery	1	60	10	
Do.	do	do	do	Cotton	1		60	
Do.	do	do	do	Woolen	1	14	9	
Do.	do	do	Paulding	Flouring and grist	2	13	60	
Do.	do	do	do	Saw	1	20	8	
Do.	do	do	Cobb	Cotton	3	67	375	
Do.	do	do	do	Woolen	2	40	85	
Do.	do	do	do	Cotton-gins	9	135	111	
Do.	do	do	do	Flouring and grist	23	368	454	
Do.	do	do	do	Paper	1	22	75	
Do.	do	do	do	Saw	5	45	69	
Do.	do	do	Fulton	Cotton-gins	3	20+	22	
Do.	do	do	do	Flouring and grist	8	156	106	
Do.	do	do	do	Saw	3	30	31	
Do.	do	do	De Kalb	Flouring and grist	7	120	119	
Do.	do	do	do	Furniture	2	47	25	
Do.	do	do	do	Saw	2	24	40	
Do.	do	do	do	Tannery	1	15	10	
Do.	do	do	Gwinnett	Flouring and grist	9	116+	98	
Do.	do	do	do	Saw	4	47	44	6
Do.	do	do	Forsyth	Flouring and grist	8	154	137	
Do.	do	do	do	Saw	4	54	36	
Do.	do	do	Hall	do	4	45	90	
Do.	do	do	do	Carrriages and wagons	1	22	15	
Do.	do	do	do	Flouring and grist	11	151	175	
Do.	do	do	Milton	do	4	68	82	
Do.	do	do	do	Saw	2	28	32	
Do.	do	do	Lumpkin	do	7	141	75	
Do.	do	do	do	Flouring and grist	10	183	184	
Do.	do	do	do	Tannery	1	20	4	
Do.	do	do	Habersham	Flouring and grist	1	14	10	
Do.	do	do	do	Leather, curried	1	16	6	
Do.	do	do	do	Woolen	1	20	12	
Do.	do	do	do	Flouring and grist	1	10	15	
Flint river	Appalachicola river	do	Campbell	do	1	14	28	
Do.	do	do	Clayton	do	5	90	44	
Do.	do	do	Fayette	do	1	13	12	
Tributaries	Flint river	do	Campbell	do	3	70	50	
Do.	do	do	Clayton	do	8	148	136	
Do.	do	do	do	Saw	1	22	15	
Do.	do	do	Henry	Flouring and grist	1	18	15	
Do.	do	do	Spalding	do	2	13	40	
Do.	do	do	Fayette	do	5	40½	109	
Do.	do	do	Coweta	do	4	71	88	
Do.	do	do	do	Saw	1	5	12	
Do.	do	do	do	Tannery	1	30	16	
Do.	do	do	Meriwether	Flouring and grist	11	171	138	
Do.	do	do	do	Saw	1	16	15	
Do.	do	do	Pike	Wheelwrighting	1	8	12	
Do.	do	do	do	Flouring and grist	11	154½	276	
Do.	do	do	Crawford	do	3	25	43	
Do.	do	do	Upton	Cotton	2	29	115	
Do.	do	do	do	Flouring and grist	15	191½	373	
Do.	do	do	do	Saw	5	72	102	
Do.	do	do	do	Tannery	1	10	5	
Do.	do	do	Talbot	Flouring and grist	9	214	169	20
Do.	do	do	Taylor	Cotton	1	12	40	
Do.	do	do	Marion	Flouring and grist	4	33	52	
Do.	do	do	do	Saw	1	12	20	
Do.	do	do	Taylor	do	6	58	95	
Do.	do	do	do	Flouring and grist	10	84+	129	
Do.	do	do	Schley	do	6	53	70	
Do.	do	do	Macon	do	5	51	102	
Do.	do	do	do	Saw	1	8	30	
Do.	do	do	Dooley	do	2	14	15	7

Table of utilized power on tributaries of the Appalachicola river—Continued.

Stream.	Tributary to what.	State.	County.	Kind of mill or manufacture.	Number of mills.	Total fall utilized.	Total water-power utilized.	Auxiliary steam-power.
						Feet.	H. P.	H. P.
Tributaries	Flint river	Georgia	Dooley	Flouring and grist	2	8+	30	
Do	do	do	Sumter	do	7	51+	99	
Do	do	do	Lee	do	4	22½	41	
Do	do	do	Webster	do	8	66+	107	
Do	do	do	do	Saw	3	28	33	
Do	do	do	Randolph	Flouring and grist	6	69	84	
Do	do	do	Terrell	Saw	2	11+	30	
Do	do	do	do	Flouring and grist	2	14	15	
Do	do	do	Calhoun	do	3	10	50	
Do	do	do	do	Saw	1	6	12	
Do	do	do	Dougherty	Flouring and grist	1	12	40	
Do	do	do	do	Saw	1		20	
Do	do	do	Worth	do	1	10	20	
Do	do	do	do	Flouring and grist	3	25	23	
Do	do	do	Early	Cotton	1	40	45	
Do	do	do	do	Flouring and grist	5	57	62	
Do	do	do	do	Saw	1	9	10	
Do	do	do	Miller	do	1	8	12	
Do	do	do	do	Flouring and grist	1	8	40	
Do	do	do	Baker	do	5	14½	45	
Do	do	do	Decatur	do	1	5	8	

Table of utilized power on sundry streams tributary to the eastern Gulf.

Stream.	Tributary to what.	State.	County.	Kind of mill or manufacture.	Number of mills.	Total fall utilized.	Total water-power utilized.	Auxiliary steam-power.
						Feet.	H. P.	H. P.
Escambia river	Gulf of Mexico	Alabama			0			
Tributaries	Escambia river	do	Bullock	Flouring and grist	1	10	15	
Do	do	do	Butler	do	13	131	143	
Do	do	do	do	Cotton-gins	4	30+	58	
Do	do	do	do	Saw	1	10	20	
Do	do	do	Conecuh	do	7	65	141	
Do	do	do	do	Cotton-gin	1	8	6	
Do	do	do	do	Flouring and grist	6	53	42	
Do	do	do	Covington	do	4	40	37	
Do	do	do	do	Saw	1	4½	20	
Do	do	do	Crenshaw	Flouring and grist	23	237+	236	
Do	do	do	Escambia	Saw	7	64	240	
Do	do	do	Pike	do	1	6	10	
Do	do	do	do	Flouring and grist	5	45	69	
Do	do	do	do	Cotton-gins	2	17	16	
Yellow river	Gulf of Mexico	do	Covington	Flouring and grist	1	10	10	
Do	do	do	do	Saw	1	8	20	
Choctawhatchee river	do	do	Geneva	do	1	10	20	
Do	do	do	do	Flouring and grist	1		7	
Tributaries	Choctawhatchee river	do	Barbour	do	7	41+	84	
Do	do	do	do	Saw	1	10	10	
Do	do	do	Bullock	Flouring and grist	1	22	97	
Do	do	do	Coffee	do	12	104	121	
Do	do	do	do	Saw	3	22	39	
Do	do	do	Dale	Flouring and grist	7	50+	143	
Do	do	do	do	do	6	41+	50	
Do	do	do	Geneva	do	3	42	70	
Do	do	do	do	Saw	1	3	14	
Do	do	do	Henry	do	3	20	24	
Do	do	do	do	Flouring and grist	5	45	69	
Do	do	do	Pike	do	3	16	30	
Ochlockonee river and tributaries	Gulf of Mexico	Georgia	Colquitt	do	3	16	30	
Do	do	do	Decatur	do	4	64	50	

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Table of utilized power on sundry streams tributary to the eastern Gulf—Continued.

Stream.	Tributary to what.	State.	County.	Kind of mill or manufacture.	Number of mills.	Total fall utilized.	Total water-power utilized.	Auxiliary steam-power.
						Feet.	H. P.	H. P.
Ocklockonce river and tributaries	Gulf of Mexico	Georgia	Decatur	Saw	1	6	12	
Do	do	do	Thomas	Flouring and grist	4	32	34	
Ocella river and tributaries	do	do	do	do	4	60½	50	
Suwannee river	do	do	do	do	0			
Tributaries	Suwannee river	do	Berrien	Woolen	1	12	12	
Do	do	do	do	Flouring and grist	10	32	145	
Do	do	do	do	Saw	1	9	10	
Do	do	do	Brooks	Woolen	1		12	
Do	do	do	do	Saw	1	10	10	
Do	do	do	do	Flouring and grist	7	43+	54	
Do	do	do	Clinch	do	1	7	15	
Do	do	do	Echols	do	1	6	6	
Do	do	do	do	Cotton-gin	1	12	6	
Do	do	do	Lowndes	Saw	1	10	10	
Do	do	do	do	Flouring and grist	8	80	77	
Do	do	do	Wilcox	do	1	6	4	
Other streams	Gulf of Mexico	Alabama	Baldwin	Saw	1	10	40	
Do	do	do	Mobile	Flouring and grist	1	15	40	

Summary of power utilized on streams tributary to the eastern Gulf (not including any returns for Florida).

Stream.	COTTON-MILLS.			WOOLEN-MILLS.			FLOURING- AND GRIST-MILLS.			SAW-MILLS.			SUNDRY OTHER ESTABLISHMENTS.			TOTAL.		
	Number of mills.	Water-power utilized.	Auxiliary steam-power.	Number of mills.	Water-power utilized.	Auxiliary steam-power.	Number of mills.	Water-power utilized.	Auxiliary steam-power.	Number of mills.	Water-power utilized.	Auxiliary steam-power.	Number of mills.	Water-power utilized.	Auxiliary steam-power.	Number of mills.	Water-power utilized.	Auxiliary steam-power.
		H. P.	H. P.		H. P.	H. P.		H. P.	H. P.		H. P.	H. P.		H. P.	H. P.		H. P.	H. P.
Tributaries of the Alabama river	6	1,658		10	79		408	6,515	60	84	1,470		44	447		552	10,169	60
Chattahoochee river and tributaries	13	3,065		5	166		270	4,951		68	1,105	6	32	498		388	9,785	6
Flint river and tributaries	4	200					151	2,530	20	28	441	7	3	33		180	3,204	27
Sundry other streams				2	24		142	1,684		32	686		8	86		184	2,480	
Total	23	4,923		17	269		971	15,680	80	212	3,702	13	87	1,064		1,310	25,635	93

NOTE.—“Sundry other establishments” include cotton-gins (48), tanneries (14), paper-mills (1); blacksmithing, carpentering, machine, sash-, door-, and blind-, wheelwrighting, and general wood-working shops; founderies, iron-works, and pumping-works for water-supply (1 each); and establishments for the manufacture of cotton-gins, building-materials, furniture, carriages and wagons, stone- and earthen-ware.

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