VII.—THE SANTEE RIVER AND TRIBUTARIES.

Drainage-basins of the Santee and Edisto rivers, South Carolina.

DRAINAGE AREAS.

	Square miles.
Santee river, at mouth	14,725
Congaree river, at mouth	7,965
Congaree creek, at mouth	115
Edisto river, at mouth	2,883
North fork Edisto river, at mouth	745
South fork Edisto river, at mouth	790
Shaw's creek, at mouth	119
Rocky creek, at mouth	195

THE SANTEE RIVER.

The Santee river is formed by the junction of the Congaree and the Wateree rivers at the angle of the four counties of Richland, Sumter, Orangeburgh, and Clarendon, South Carolina, whence it flows in a general direction nearly southeast between Clarendon, Williamsburgh, and Georgetown counties on its left, and Orangeburgh and Charleston on its right, emptying into the Atlantic ocean about 10 miles north of Cape Romain. Its total length, in a straight line, is about 90 miles, and by the river about 184 miles. There are no towns on the river, although it is navigable for its entire length, it being considered practicable to secure a depth of 7 feet at low water for 154 miles and 5 feet for the remaining distance. The river flows through a fertile country, cotton being the principal staple on the upper part and rice on the lower, and the banks, more or less subject to overflow, are lined with extensive forests and swamps. As the river lies entirely below the fall-line, and as its general character corresponds exactly with that of the Great Pee Dee below Cheraw, it need not be described further. The total area drained by the stream is about 14,700 square miles, and it has no tributaries of much importance below the junction of the Wateree and the Congaree. The width of the stream varies from 200 to 500 feet, and its fall averages about half a foot to the mile. The utilized power on its tributaries is tabulated herewith.

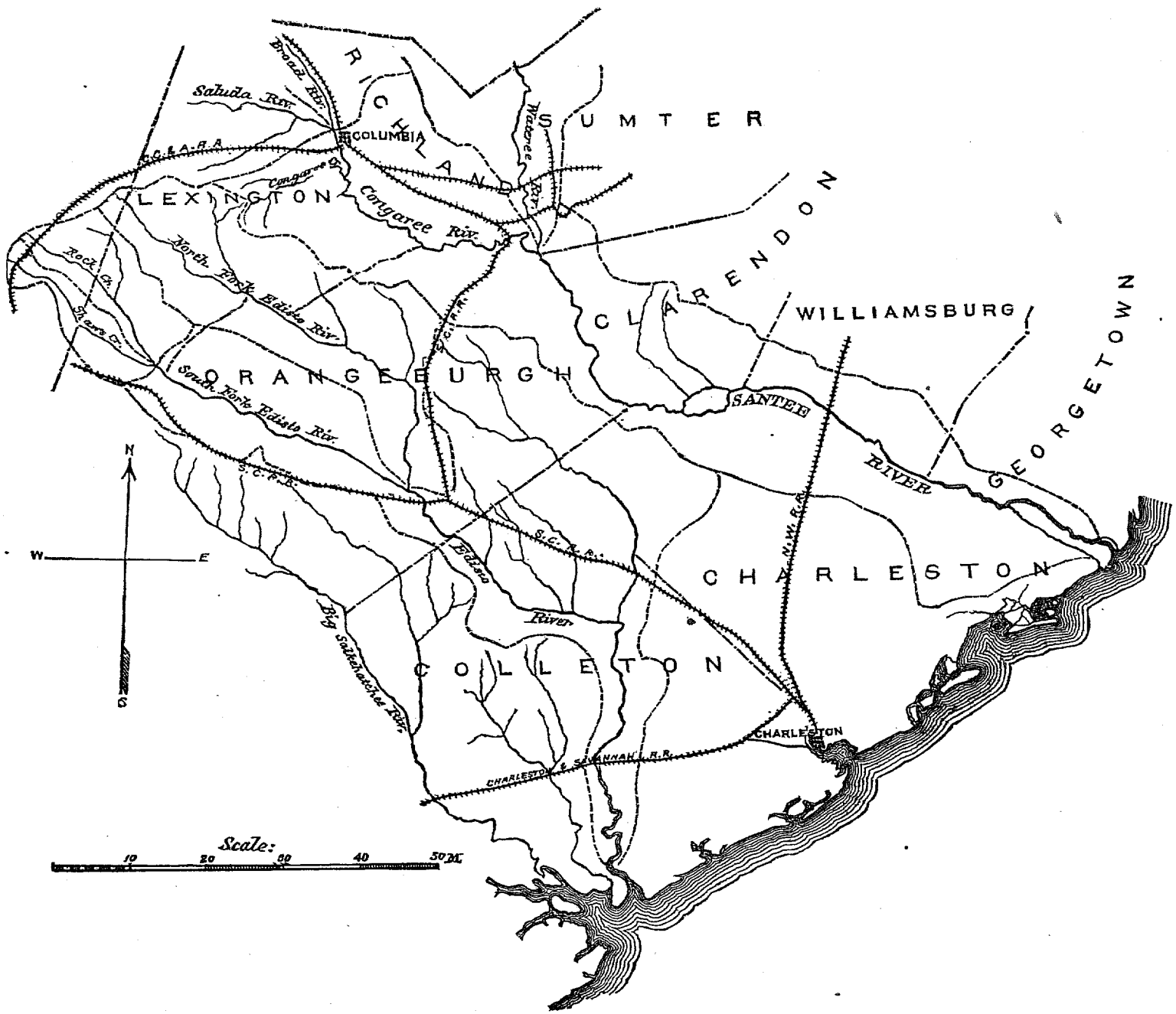
THE WATEREE (OR CATAWBA) RIVER.

The Catawba river rises on the eastern slope of the Blue Ridge, in McDowell county, North Carolina, its main source being between the Blue Ridge and a spur of the same known as Bald mountain. It first flows nearly northeast into Burke county, and then nearly east between Caldwell and Alexander on its left and Burke and Catawba counties on its right. It then bends quite abruptly toward the south, and flows in a direction a little east of south between Iredell and Mecklenburg counties, North Carolina, and Lancaster, Kershaw, and Sumter counties, South Carolina, on its left, and Catawba, Lincoln, and Gaston counties, North Carolina, and York, Chester, Fairfield, and Richland counties, South Carolina, on its right, uniting with the Congaree to form the Santee. It also flows for a short distance through Kershaw county, South Carolina. Its general course is seen to be nearly parallel to that of the Yadkin and the Great Pee Dee. The river is known as the Catawba down as far as the mouth of the Big Wateree creek, in Fairfield county, South Carolina, below which point it is known as the Wateree. Its total length, in a straight line, is about 160 or 170 miles, but by the general course of the river it is nearly 225 miles, and over 300 miles if all its windings are followed. The length of the Wateree is about 105 miles,* and the total length in South Carolina about 160 miles. The principal town on the river is Camden, South Carolina (population 1,780), there being no important ones above.

The stream is navigable as high as Camden, it being probably practicable to secure a depth of 2 feet and over up to this place. One light-draught steamer now plies upon the river. Above Camden the fall of the stream is so great that navigation is not practicable. About the year 1826 the state of South Carolina attempted to render the river navigable by means of locks, dams, and canals, and several very extensive and important works were constructed at great expense; but the undertaking is said to have been given up before the works were completed.

The total area drained by the stream embraces about 5,225 square miles (of which 3,085 are in North Carolina), and the drainage-basin resembles in many respects that of the Yadkin, so that it need not be described here in detail. Like the Yadkin, the upper part of the river flows between parallel ranges of mountains, from which it receives a number of tributaries, affording considerable water-power, and with a rapid fall, the width of the valley being about the same as that of the Yadkin. In the lower half of its course in North Carolina the valley of the Catawba is very narrow—not over 15 or 20 miles in width—and it receives only one important tributary, the South fork, which enters from the west near the South Carolina line, after draining an area of about 730 square miles. Below this point the valley is wider, but there are no tributaries of much importance. A few miles above Camden the river crosses the fall-line, and below that point it partakes of the general character of the streams of the eastern

* Annual Report Chief of Engineers, 1880, p. 915.


RICHLAND
SUMTER
Saluda Riv.
Broad Riv.
COLUMBIA
C. & A. R. R.
Wateree Riv.
Congaree
LEXINGTON
Congaree Riv.
North Fork Edisto Riv.
Rock Cr.
Shaws Cr.
S. C. R. R.
CLARENDON
WILLIAMSBURG
GEORGETOWN
ORANGEBURG
South Fork Edisto Riv.
SANTEE
RIVER
S. C. R. R.
N
W
E
S
S. C. R. R.
C. W. R. R.
Edisto
River
CHARLESTON
Big Salkehatchie Riv.
COLLETON
CHARLESTON & SAVANNAH R. R.
Scale:
10 20 30 40 50 M.

division. The country drained by the river is very fertile and well populated, the productions being about the same as in the Yadkin valley. The valley abounds in building-stone of the best kind, and in Gaston, Lincoln, and Catawba counties there are fine deposits of iron ore.

As regards bed, banks, freshets, and bottoms, the river resembles the Yadkin, except that the bottoms are narrower in the lower half of its course in North Carolina. There are no lakes in the basin, but in the upper part the facilities for storage are said to be good.

The average rainfall in the basin is about 50 inches, of which about 12 fall in spring, 14 in summer, 10 in autumn, and 14 in winter. Toward the upper part of the stream, however, the rainfall in winter increases, and is probably greater than in the summer.

The elevation of the stream at different points is given in the following table, from which it will be seen that the fall is very great for such a large stream; and it is this large fall which has prevented the river from having ever been made navigable, although, as already remarked, many years ago the state of South Carolina expended a great amount of money endeavoring to make it navigable by means of locks, dams, and canals:

*Table of declivity of the Catawba and Wateree rivers.**

Place.	Distance from mouth.	Elevation above tide.	Distance between points.	Fall between points.	Fall between points.
	Miles.	*Feet.*	*Miles.*	*Feet.*	*Feet per mile.*
Junction with Congaree	0	80±			
			125	285	2.28
Crossing of Chester and Cheraw railroad	125	365			
			25	131	5.24
Crossing of Charlotte, Columbia, and Augusta railroad	150	496			
			20	104	5.20
Crossing of Charlotte and Atlanta Air-line railroad	170	600			
			55	210	3.82
Crossing of Western railroad of North Carolina	225	810			
			25	168	6.70 (?)
Five miles northwest of Hickory	250	978			
			18	41	2.28 (?)
Morganton	268	1,019			
			50	491	9.80
Mill creek at Old Fort	318	1,510			
			8+	540	67.50
Mill creek, last crossing of Western railroad of North Carolina	326±	2,050			
			8+	608	76.00
Swannanoa gap (headwaters)	334±	2,658			

* From some discrepancies in the data obtained from various sources I am inclined to believe that some of these elevations are those of the rails, and not of the water surface. On this account this table must be considered as only a rough approximation.

The flow of the river was measured by Professor Kerr near Hickory, giving 2,156 cubic feet per second, which is evidently not the low-season flow, as the drainage area above this point is not much over 1,000 square miles.

The map shows the railroads which cross the stream, from which it will be seen that it is easily accessible in almost all of its parts.

I proceed to describe the powers in detail, ascending the river.

Formerly the head of navigation was 5 miles above Camden, at which point the river crosses the fall-line in a long shoal extending through several miles. When the river was made navigable by the state, in 1826 or thereabout, this fall was overcome by a canal 5 miles in length, with 6 locks, aggregating 52 feet fall,* the position of the canal being shown on the map. I visited the place from Camden, from which town it is distant by road about 12 miles, for the purpose of ascertaining the availability of the power. The canal is on the west side of the river, which it leaves just below a rocky bluff, from which a dam extended out into the river. This old dam is entirely gone, and I could not ascertain what its height had been; but the fall for the next mile above is probably 10 or 12 feet, according to the pocket-level, although the stream is not rocky except for a few hundred feet. The canal had a guard-lock about a quarter of a mile from its head, and below that it passes through nearly level or gently rolling bottom-lands, and is now entirely overgrown with underbrush and filled up with deposits of all kinds, so that it is in some places scarcely distinguishable. It retreats some distance from the river, the bottom between them being on the average several hundred yards wide, and parts of it are subject to overflow in times of high water. Near the foot of the canal is a flight of three locks, and a little farther down the canal passes out into Sawney's creek by an outlet-lock. I was unable to find the sixth lock mentioned by Mills. The principal part of the fall in the river occurs near the lower end, or about two-thirds of the distance from the head, and is utilized for a small grist-mill, with two pair of stones, by means of a rough wing-dam and a race a quarter of a mile long, affording a fall of 6 or 7 feet and a fall to the tail-race sufficient to avoid the trouble occasioned by ordinary rises of the water. In a distance of rather over a mile, from a little above the head of the race leading to the grist-mill, the fall, as ascertained by the pocket-level, is in the neighborhood of 20 feet. Above this the bottom bordering the river is subject to overflow to a considerable extent, while below it is only occasionally flooded. Below the mill, too, the bottom becomes narrower, and is more undulating than above. As regards the most advantageous method of utilizing the power, my examination was too superficial to permit of any definite conclusions being reached. To clear the old canal out would require considerable work, although of an easy kind. The capacity of the canal, too, could be easily enlarged if it were considered desirable to utilize the entire power, which might be done by locating

* Statistics of South Carolina, including a view of its natural, civil, and military history, general and particular. By Robert Mills

the mills at the lower flight of locks, where, if we accept Mills' statement, a fall of some 50 feet could be obtained; and the location here is probably as safe and as favorable as anywhere along the canal. A smaller power could be much more easily secured probably by building a dam somewhere near the head of the grist-mill race (whether the bed and banks there would be found very favorable I cannot say) and leading a canal down near to the old locks, in which way a fall of 20 feet might probably be secured, the race being a mile or so long. As regards the amount of power available, I have tabulated it below, basing it, like all my others, on estimates, in the entire absence of any data regarding the flow:

Table of power at "Wateree canal".

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.	Horse-power available, gross.
	Sq. miles.	*Feet.*	*Cubic feet.*	1 *foot fall.*	52 *feet fall.*
Minimum	4,376	*52	963	109.4	5,700
Minimum low season			1,320	150.0	7,750
Maximum, with storage			3,500	398.0	20,700
Low season, dry years			1,500	170.5	8,850

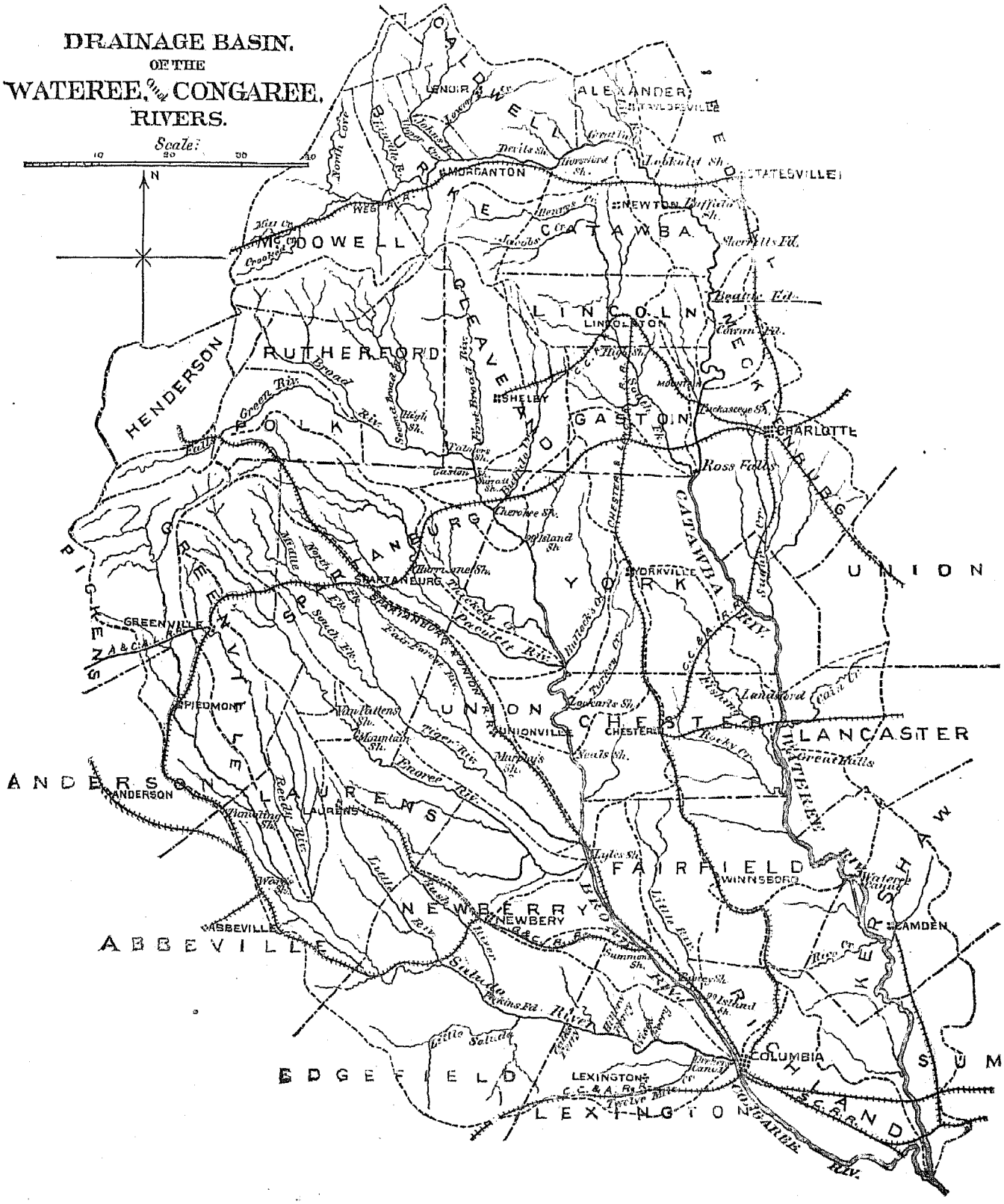
*Mills.

I did not have time to look at the other side of the river, and only cursorily at the west side; but as the canal was built on the west side, it may be presumed that the "lay of the land" there is more favorable for canals and buildings than the other. The fall in the river is not accompanied by any violent commotion, being gradual, and the river wide, with a large volume of water. This power is the first of the four great powers on the Catawba (Wateree) river.

The second of these powers, and the next one above the Wateree canal which necessitated any extensive navigation works, is at the great falls of the Catawba, near Rocky Mount. Between the two places, however, there is a very considerable fall, it being stated by Mr. Wolbrect, United States assistant engineer, that the fall in the upper 17 miles of the Wateree river is 75 feet, or 4.5 feet to the mile.* Nevertheless, no particular water-powers between the two referred to were brought to my notice, although I obtained information of a few small grist-mills.

The fall at the Great falls is similar in some respects to that on the Yadkin at the "narrows", described on page 80. The navigation works planned were very extensive. In ascending the river the course of the canal is as follows: Leaving the river about opposite Rocky Mount, on the west side, it rises to the level of the bottom (which borders the river at this place) by a flight of two locks, aggregating about 18 feet lift, crosses the bottom, and after passing around a steep and rocky bluff, at which place it was necessary to build the outer wall of the canal of solid masonry for a distance of half a mile or thereabout, within which distance occurs one intermediate lock, with a lift of about 9 feet, it debouches into Rocky creek, a small stream which flows into the Catawba at a point in the neighborhood of a half or a quarter of a mile above its mouth, opening into it by a guard-lock, with a lift of about 8 feet, situated at one end of a wooden dam, which extended across the creek, backing up the water, with a navigable depth, to a distance of about a mile. This first canal is about a mile in length, and has a total rise, according to what has been said, of about 35 feet from low water in the Catawba at the outlet-lock to the crest of the dam across Rocky creek. Between the canal and the river is a bottom, in which the lower part of the canal itself lies, and which is subject to overflow in times of freshet. It was probably on this account that the canal was carried so closely around the bluff. In fact, this part of the river, just below the principal fall, is subject to large rises, much larger than within the next few miles above, where the declivity is great, and down which the water rushes so rapidly that the smaller declivity below is insufficient to carry it off without a considerable rise. This part of the canal, as well as that above, is so overgrown with brush and by trees of half a century's growth that its original dimensions cannot be accurately determined. The lock-chambers are about 70 feet by 10 feet, and the canal was perhaps 20 or 25 feet wide at the top and 3 or 4 feet deep. The dam across Rocky creek was probably about 12 or 13 feet high, and its pool, as before mentioned, was navigable for about a mile, at which point the second portion of the canal commenced, leaving the river by a flight of 4 locks, with together 32 feet lift, by which it rises to the level of a narrow valley running about parallel with the Catawba, but separated from it by a ridge. Along the side of this valley, out of sight of the Catawba, although the latter is only a quarter of a mile distant, and with a ridge nearly a hundred feet high between them, passes the canal for a distance of about 2 miles, at the end of which the valley that it has been following opens out into the river, but at an elevation above it of 20 or 30 feet, having gradually become narrower as the river was approached, and at its upper end being very little more than wide enough to carry the canal without cutting into the hill-sides. Within this two miles, from the point where it leaves Rocky creek till it again reaches the river, the canal has, in addition to the 4 locks already mentioned, two flights of locks, one with 4 locks, aggregating 36 feet lift, and another with 3 locks, and in all 27 feet lift, as far as could be ascertained. Both of these flights of locks are situated in the lower part of the valley followed by the canal, and at points where it is several hundred yards wide. The ridge between the river and the canal is interrupted at a point about a quarter of a mile below where the canal again comes in sight of the river by a narrow ravine, which retreats down to the river, and is not over 100 feet wide. From the point where the canal reaches the bank of the river it proceeds about a mile further, first skirting the face of a steep and rocky bluff, and

*Annual Report Chief of Engin., 1880, p. 915.


DRAINAGE BASIN.
OF THE
WATEREE, and CONGAREE,
RIVERS.
Scale:
10 20 30 40
N
CALDWELL
WATAUGA
ALEXANDER
IREDELL
LENOIR
MORGANTON
STATESVILLE
NEWTON
CATAWBA
McDOWELL
LINCOLN
LINCOLNTON
RUTHERFORD
HENDERSON
POLK
SHELBY
GASTON
CHARLTTE
MECKLENBURG
Ross Falls
GREENVILLE
SPARTANBURG
YORKVILLE
UNION
YORK
CHESTER
UNIONVILLE
LANCASTER
SPIEDMONT
ANDERSON
LAURENS
NEWBERRY
FAIRFIELD
WINNSBORO
CAMDEN
ABBEVILLE
EDGEFIELD
LEXINGTON
COLUMBIA
RICHLAND
SUMTER
Broad River
Saluda River
Catawba River
Pacolet River
Tiger River
Enoree River
Reedy River
Little River
Wateree River
Congaree River

then across a bottom, and after rising about 9 feet, by a lock situated in the latter, it opens into the river by a guard-lock and a dam, which seems to have extended across to an island, backing up the water between it and the right bank of the river, as well as some distance up Fishing creek, which enters a short distance above, and enabling boats to pass out into the river, up between the island and the shore, and up Fishing creek, just as they did below up Rocky creek. The third portion of the canal, which I did not have an opportunity to examine, leaves Fishing creek at a point a mile or so from its mouth (according to the map), and after a length of a mile or a mile and a half, in which distance, according to Mills, the fall is 56 feet, opens into the river again, which is navigable from this point to Landsford, a distance of 12 miles or thereabout. As regards the river itself, its fall in a distance of a mile and a half or thereabout, down to the point where the second portion of the canal passes in behind the ridge, as ascertained by the pocket-level, is about 35 or 40 feet. At this point there was formerly a small mill. Below this the river is narrower, and the water rushes with great velocity between steep, rocky, and almost vertical banks, falling about 25 feet in less than a quarter of a mile, down to the mouth of the ravine already referred to as running up to the canal, making a total fall to this place from a point not far from the head of the second portion of the canal of, say, 60 feet in a distance of about one and a half miles. Just below the ravine was located a cotton factory, using a fall of some 5 to 7 feet, with a wing-dam, and built almost over the water. The banks in this portion of the river are so steep and rocky as to preclude the construction of a canal or of extensive buildings, at least on the west side of the river. The cotton factory was a small building, not more than 50 by 25 feet. From the mouth of the ravine the river falls about 30 feet in the next quarter of a mile, making nearly 100 feet in about 2 miles. These are the great falls of the Catawba. The total fall is stated to be 173 feet in 8 miles.* The largest fall in a short distance occurs between the old mill-site and the ravine, the river at this point being not over 150 feet wide, while its average width for half a mile is not over 200 feet perhaps, and at the narrowest part it rushes with tremendous force over its rocky bed—a sheet of foam, falling some 10 or 15 feet in 150 or 200 feet.

The enormous power at this place is entirely unutilized at present, but a considerable portion of it could be rendered available without much difficulty, I think, in various ways. I have already mentioned the fact that except for small falls and small buildings there is no opportunity for the utilization of power along that part of the river opposite the second portion of the canal. A building might be erected on the site of the old factory and a fall of 10 feet obtained with ease, but only room for a small building. It may be mentioned that the dwellings of the factory operatives were on the top of the ridge between the river and the canal. But any scheme for the extensive utilization of the power must, I think, include the use of the old canal, and in this respect various methods may be employed, as follows:

1st. By rebuilding the dam at the head of the second portion of the canal, raising that portion of the canal below the first lock and locating the mills in or near the ravine already described, discharging the water through the same into the river, a fall of at least 50 feet could be obtained, necessitating, however, considerable work in cutting out the ravine for a tail-race, and with poor building facilities. The quantity of water will vary, of course, according to the dimensions given to the canal. If the canal is not raised to the level of the former dam, or nearly so, but is left at the ravine, as it was originally, the fall available will be at least 30 or 35 feet.

2d. At any or all of the three flights of locks mentioned above Rocky creek the facilities for utilizing a large power are very good, there being ample building-room, and the water being discharged into Rocky creek. This is, in my opinion, the best way of utilizing the power. The available fall of all three flights is 95 feet, and the fall of Rocky creek would doubtless prevent any danger whatever from freshets or any trouble from backwater; of course there would be no trouble with ice. If the level of the canal were raised, so that it ran (nearly) level from its head to these flights of locks, the available fall would be increased to about 110 feet.

3d. As regards the power on the first (lowest) portion of the canal, below Rocky creek, the total amount of water brought through the second portion, together with the entire flow of Rocky creek, could be turned into the canal, provided it were of sufficient capacity and utilized lower on the stream. By raising that portion of the canal below the first lock, an available fall of about 30 or 35 feet could be secured at the lower end; but as this whole bottom, through which the canal passes, is subject to overflow, the facilities for building are not so good as in the last case. Still, there is no reason why this fall could not be utilized, if desired. This site would suffer also more trouble with backwater than the last one described, which would be, in fact, almost absolutely free from it. Summing up the lifts of all the locks in the first and second portions of the canal we see that the total fall is 130 feet and over, as follows:

	Feet.
One guard-lock at upper end of second portion, lift, say	—
One lock half a mile below, lift, say	9
Flight of 3 locks, 9 feet each, behind ridge, lift, say	27
Flight of 4 locks, 9 feet each, behind ridge, lift, say	36
Flight of 4 locks, 8 feet each, behind ridge, lift, say	32
Guard-lock at head of first portion (lowest), lift, say	—
Lock, half a mile below, close to bluff, lift, say	9
Two locks, outlet to river, 9 feet each, lift, say	18
Total	131+

* Mills' statistics of South Carolina.

Mills states the fall as 121 feet, and the number of locks as 13; but as this part of the canal was in process of construction when his book was written, some changes were evidently made thereafter.

The accompanying sketch of the Catawba river at the Great falls, South Carolina, while it makes no pretensions to accuracy, will at least give some idea of the general situation.

The upper portion of the canal, from Fishing creek through to the river, I was unfortunately unable to examine. The power there is said to be available, and any persons seeking a location will, of course, thoroughly examine this as well as the lower portion of the canal.

As regards the amount of power available, I have estimated it as follows:

Table of available power at the great falls of the Catawba.

State of flow (see pp. 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.	Horse-power available, gross.	Remarks.
	Square miles.	*Feet.*	*Cubic feet.*	1 *foot fall.*	173 *feet fall.*	
Minimum	*3,600	173	793	90	15,500	Drainage area for second portion of canal is 3,830, and for lower portion 4,015 square miles, taking in Fishing and Rocky creeks.
Minimum low season			1,080	123	21,000	
Maximum, with storage			2,900	330	57,000	
Low season, dry years			1,230	140	24,000	

*Without Fishing creek.

To render the whole of this flow available would require a canal of considerably larger dimensions than the existing one, as will be seen by reference to the table of capacity calculated for the canals at Weldon, on the Roanoke, and Buckhorn falls, on the Cape Fear.

The power just described is about 25 miles from Chester, the nearest point on the Charlotte, Columbia, and Augusta railroad, and about 8 miles below where the Chester and Cheraw railroad crosses the river. The upper portion of the canal, above Fishing creek, is not more than five or six miles from the latter road, so that it has the advantage in point of location, and should by no means be overlooked by persons wishing to find power.

Proceeding up the river, there is no power of much importance till we arrive at Landsford, about 4 miles above the railroad, where the third canal was built by the state. This canal was nearly 2 miles long, and had a guard-lock and 4 lift-locks, with about 35 feet lift in all. It passes through a bottom for its entire length, retreating in some places about 300 yards from the river, leaving abundant room for building purposes, and is not liable to be often overflowed. At the head of the canal a curved dam of loose rock extends across to an island, its length being about 1,500 feet, and its height 4½ feet. It raises the water only about 2½ feet. About a mile below is a pair of locks with a lift together of 18 feet, over which Mr. W. R. Davie has a grist-mill, using a fall of 18 feet, with a turbine-wheel giving 25 horse-power, discharging the water into the river through a break in the bank of the canal below the locks, and having a fall of 6 or 7 feet to the tail-race. The total fall from the ordinary level of water in the canal to low water in the river at this place is nearly 29 feet. The mill is not often troubled by high water, owing to the rapid fall in the river for some distance below. Five hundred yards or over below this mill are two outlet-locks, with a total lift of about 17 feet from low water, and making the total fall in the canal, exclusive of that in the guard-lock, about 35 feet. With a tight dam at the head of the canal a fall of 40 feet could be obtained, which, however, could not all be utilized, except perhaps at low water, unless the dam were made over 6 or 8 feet high. The stream is quite wide opposite the canal, and the rise in freshets not great.

The drainage area above Landsford is about 3,425 square miles. The available power I estimate as follows:

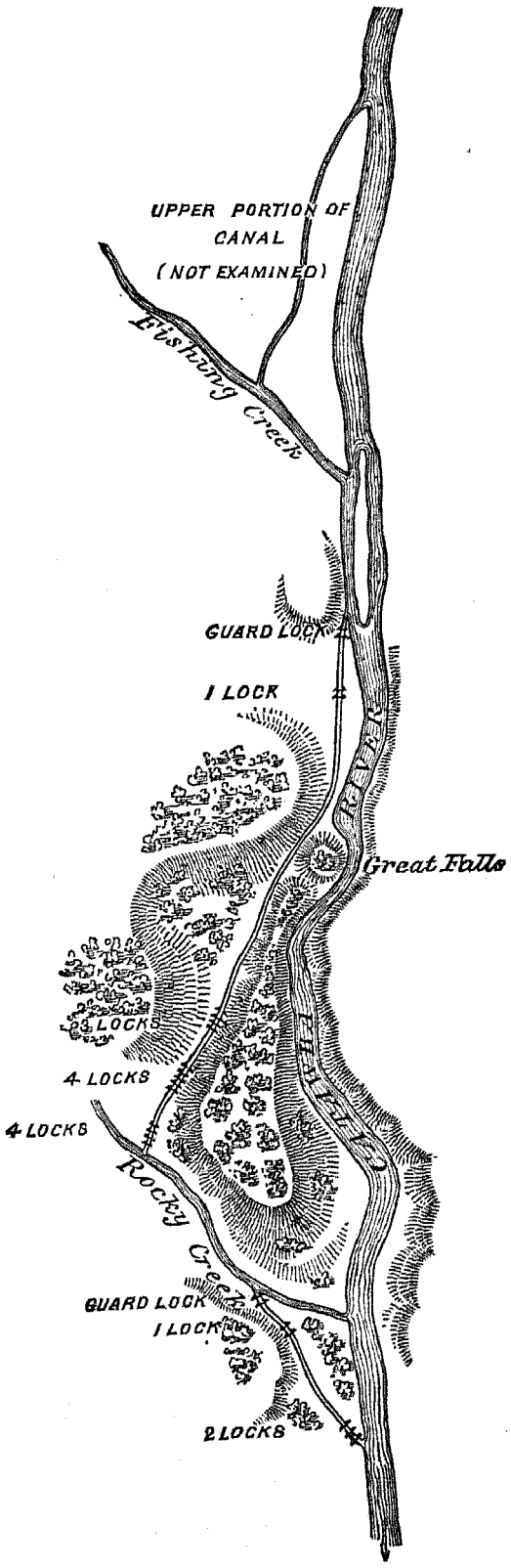
Table of power at Landsford.

State of flow (see pp. 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.			Remarks.
	Square miles.	*Feet.*	*Cubic feet.*	1 *foot fall.*	18 *feet fall.*	40 *feet fall.*	
Minimum	3,425	40	750	85.3	1,540	3,400	25 horse-power (net) utilized.
Minimum low season			1,027	116.7	2,100	4,650	
Maximum, with storage			2,900	330.0	5,900	13,000	
Low season, dry years			1,160	131.8	2,370	5,270	

This site is within 4 miles of the Chester and Cheraw railroad, from which a branch road can be easily extended to it.* It is 22 miles from Chester, and about 20 miles below the crossing of the Charlotte, Columbia, and Augusta railroad. It will be found, I think, to be the most available site which we have thus far met upon the river, although I cannot speak of the upper part of the canal below, near Fishing creek, not having visited it. Opposite the canal, on the east side of the river, is a small grist-mill, with a wing-dam and a small fall.

Above Landsford there are no powers of importance in South Carolina, although there is a small mill just below where the Charlotte, Columbia, and Augusta railroad crosses. There are several shoals, with falls of from 3 to 5 feet, some of which have been used, but the trouble with high water is so great that they are of no value. A mile or so above the mouth of the South fork there was a grist-mill with a fall of 3 or 4 feet, and above it

* Liberal propositions are made for the development of this power with an 8-foot dam at the head of the canal.


UPPER PORTION OF
CANAL
(NOT EXAMINED)
Eva Hung Creek
GUARD LOCK
1 LOCK
POTOMAC RIVER
Great Falls
5 LOCKS
4 LOCKS
4 LOCKS
Rocky Creek
GUARD LOCK
1 LOCK
2 LOCKS

the cotton factory of the Rock Island Manufacturing Company, which was moved because the high water was so troublesome, the fall having been 5 feet. Both of them were on the Mecklenburg side.

It may be mentioned here that the width of the Catawba between the North Carolina line and the mouth of the Wateree creek varies between 300 and 3,000 feet, while the banks vary in height from 10 to 100 feet.

The river was surveyed in 1824, under authority of the state of North Carolina, between the state-line and Moore's shoals, 10 miles below Morganton, by Mr. Hamilton Fulton, a portion of whose map and profile is in the office of the state geologist in Raleigh, from which the table of shoals further on is condensed.* Beside the shoals mentioned in the table, there are numerous others of smaller fall, but which, however, may be more favorable for power than those named, being perhaps more favorably located, and permitting the erection of high dams. All these points can only be determined by a survey.

After Ross's falls, which is probably one of the shoals referred to as having been used by a small mill, or perhaps a factory, the next important shoal is Tuckasegee shoal (also called Powder-Mill shoal), close to the crossing of the Carolina Central railroad. It is only utilized on the west side by a grist-mill, with about 4 feet fall.

Three miles above it is the fourth large power on the Catawba, at Mountain Island shoal, about 3 miles above the railroad, and above the mouth of Dutchman's creek. The fall in the river between a point one mile above the factory, or a little above the head of the shoal, and the railroad bridge below is 38 feet,† but of this fall nearly 30 feet occurs in one mile near the factory. The bed of the stream is rock, the banks on the east side very bluffy, while they are shelving on the west and very favorable for building, with no danger in high water. The power is utilized to a small extent by the cotton factory of G. K. Tate & Brothers. At the head of the shoal is a series of three small islands near the right bank, with a distance of only a few feet between them and the shore, and between the islands and the shore a certain amount of water flows naturally, with no dam to turn it in. This water is all that is used by the factory, there being no dam at the head of the islands, and the only dams being three slough-dams, connecting the islands with each other and the lowest one with the shore, the two former of which are of rough stone and the third of crib-work, and about 40 feet long and 8 feet high. From the foot of the lowest island an artificial race about 600 feet long leads to the factory, where a fall of 22 feet is used and about 190 horse-power; in addition to which there is a grist- and saw-mill and a cotton-gin, using together 50 to 60 horse-power and 15 to 16 feet fall. Full capacity can be secured all the time. The total distance between the head of the small islands referred to and the factory is about three-quarters of a mile, below which the fall continues for a short distance. The fall in the canal is considerable, and I think that the total fall down to the factory is in the neighborhood of 26 feet.

The drainage area above this shoal being about 1,538 square miles, I have estimated the power as follows:

Table of power at Mountain Island shoal.

State of flow (see pp. 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.		
	Sq. miles.	*Feet.*	*Cubic feet.*	*1 foot fall.*	*25 feet fall.*	*30 feet fall.*
Minimum	1,538	*30	300	34.1	850	1,000
Minimum low season			380	43.2	1,080	1,300
Maximum, with storage			1,350	153.4	3,800	4,600
Low season, dry years			450	51.1	1,275	1,500

*See description.

The whole of this large power is easily available on the west bank, with good facilities for buildings and canals. A series of mills could be built, using an average fall of 25 feet or more, and with little trouble from high water, and none from ice. The west side is not so favorable. It is to be remarked that the pond would probably be small, and the power could not be concentrated into fewer than 24 hours except by reservoirs elsewhere. The shoal is 12 miles from Charlotte and 3 miles from the Carolina Central railroad, with which it might easily be put in communication by rail. It is in the cotton-belt, and in a most healthy part of the country. It is one of the most available powers I visited.

Just above Mountain island the river makes a remarkable bend, or horse-shoe, the distance by land across the chord being 1½ miles, while it is 7½ miles around by the river.‡ This bend has been talked of as a site for water-power, which would afford a large fall if the bend were cut through. According to Professor Kerr, however, the river is sluggish along the bend, and the total fall is small, some 9 or 10 feet only.

I did not visit any of the shoals above Mountain island, and can therefore give no particulars regarding them beyond what is in the table. The next utilized power, however, if we pass over a few small saw- and grist-mills, is in Catawba county, where there are two cotton factories, located between Buffalo shoals and Lookout shoals, and within a few miles of the railroad. The Granite shoals mill, or the factory of the Catawba Manufacturing Company (A. M. Powell, president), uses a fall of 5½ feet and 35 or 40 horse-power. The dam is of wood and stone, built in 1871, costing $1,000, and the main part of it extends across to an island, being 200 feet long and 5.5 feet high, while a wing-dam 700 feet long and 2 feet high extends from the island, reaching only about half way across the river. There is no race. Full capacity can be secured all the time (except during high water). The other factory, Long

*Extract from Annual Report Chief of Engineers, 1876, p. 33, *et seq.* †From information furnished by B. S. Guion, C. E., Lincolnton, N. C.

Island factory, owned by Powell & Shuford, uses 7 feet fall and 35 or 40 horse-power, which can be obtained at all times. The dam extends half way across the river, was built in 1872, cost $3,000, and is of wood and stone, 500 feet long and 4 feet high. The race is 200 feet long.

The next improved power of importance is the mill of Ramsour, Bonnewell & Co., in Caldwell county, three miles from Hickory, but on just what shoal I do not know, although the location corresponds very well with that of Horseford shoals, the largest shoal on this part of the river. They have a dam made of logs, built in 1853, extending nearly half way across the river, being about 250 feet long and 18 inches high. A race one-half mile long leads to the mills (grist and saw), where the fall is 8 feet. Not over 40 or 50 horse-power is used, which can be obtained all the time. If this power is really at Horseford shoals, it is a valuable one, as the estimate of power shows.

Devil's shoals is said to be a very fine site, situated 6 miles from Hickory (on the Carolina Central railroad) and 12 miles south of Lenoir. It is not improved at all. A ledge of rock is said to extend entirely across the river, offering a fine site for a dam.

Above this I have no detailed information of the shoals, but there are doubtless other sites for power. The stream is rapid, the bed rock, and the low grounds on either side subject to overflow. The only mills in this part of the state are saw- and grist-mills. Near Morganton, at Rocky ford, Major J. W. Wilson has a good site, used for a grist-mill, the fall being 9 feet and over, with a dam 2 feet high, 400 feet long, and a head-race of 1,400 feet. The wheel gives 60 or 70 horse-power, and there is never lack of water.

Above Morganton the river has a rapid fall, but it is more gradual than below, the shoals being more numerous, but not with such great descents. Between Morganton and the mouth of Mill creek there are 197 shoals, with an average fall of about 2 feet, the distance being 50 miles. The valley narrows to two, one, and one-half miles in width.

In McDowell county the river forks into Mill creek, which the Western North Carolina railroad follows, and the South Catawba, on which occur the Catawba falls, where the fall is said to be several hundred feet in a short distance, but the stream is too small to be used much for power. Both of these streams, as well as the others which enter the Catawba in McDowell county, are mountain streams, with a large fall and often abrupt descents of many feet, forming cascades and cataracts of great beauty. Some of them are used by small grist- and saw-mills.

Summary of power on the Catawba and Wateree rivers.

Locality.	Distance from mouth.	Drainage area.	Rainfall.					Total fall.		Horse-power available, gross.*				Utilized.		Per cent. of minimum utilized.	Remarks.
			Spring.	Summer.	Autumn.	Winter.	Year.	Height.	Length.	Minimum.	Minimum low season.	Maximum, with storage.	Low season, dry years.	Horse-power, net.	Fall.		
	Miles.	*Sq. m.*	*In.*	*In.*	*In.*	*In.*	*In.*	*Feet.*	*Miles.*						*Feet.*		
Wateree canal	85±	4,375	12	14	10	14	50	52.00	5.00	5,700	7,750	20,700	8,850	25	7.0	0.8	
Great falls	117±	3,600+	12	14	10	14	50	173.00	8.00	15,500	21,000	57,000	24,000	0	0.0	0.0	
Landsford shoals	130	3,425	12	14	10	14	50	40.00	2.00	3,400	4,650	13,000	5,270	25	18.0	1.2+	
Ross' falls	161	1,725	12	14	10	14	50	8.13	0.90	300	400	1,400	450	.....	.....	.....	
Tuckasegee shoals	169	1,670	12	14	10	14	50	11.22	1.02	425	525	1,900	600	.....	.....	.....	
Mountain Island shoals	175±	1,538	12	14	10	14	50	46.52	3.10	1,600	2,000	7,000	2,300	250	22.0	30.0—	
Abernathy's falls	178	1,500±	12	14	10	14	50	3.93	0.22	130	170	600	200	.....	.....	.....	
Cowan's ford shoals	188	1,455	12	14	10	14	50	27.25	4.17	900	1,125	4,000	1,300	.....	.....	.....	
Beattie's ford shoals	194	1,420	12	14	10	14	50	13.00	2.38	420	520	1,850	600	.....	.....	.....	
Sherrill's ford shoals	210	1,342	12	14	10	14	50	13.13	1.88	400	500	1,700	600	.....	.....	.....	
Crawford Island shoals	212	1,307	12	14	10	14	50	23.44	1.69	700	870	3,000	1,000	.....	.....	.....	
Small shoals	214	1,290	12	14	10	14	50	3.93	0.05	120	150	500	175	.....	.....	.....	
Buffalo shoals	215	1,287	12	14	10	14	50	11.41	0.66	325	400	1,450	485	.....	.....	.....	
	222	1,205	12	14	10	14	50	9.71	2.18	250	325	1,200	375	.....	.....	.....	Utilized, 80 horse-power and 12.5 feet fall.
	224	1,200	12	14	10	14	50	8.64	1.32	225	300	1,000	350	.....	.....	.....	
Lookout shoals	225	1,184	12	14	10	14	50	54.25	3.20	1,450	1,850	6,400	2,100	.....	.....	.....	
Lower Little river shoals	231	1,180	12	14	10	14	50	9.70	1.16	260	325	1,150	375	.....	.....	.....	
Canoe landing shoals	233	1,125	12	14	10	14	50	8.94	1.87	225	280	1,000	325	.....	.....	.....	
Great falls	235	1,100±	12	14	10	14	50	14.82	1.02	375	475	1,650	525	.....	.....	.....	
Horseford shoals	245	964	12	14	10	14	50	31.43	2.91	700	875	3,000	1,000	.....	.....	.....	
Shoal	249	935	12	14	10	14	50	8.88	1.82	190	240	850	275	.....	.....	.....	
Devil's shoals	251	918	12	14	10	14	50	13.78	1.01	290	360	1,275	425	.....	.....	.....	
Rocky ford shoals	262	557	12	14	10	14	50	9.50	0.30	100	140	575	160	.....	9.5	.....	
Between head of Wateree canal	90	4,376															
and crossing of Chester and Cheraw railroad.	125	3,450	12	14	10	14	50	200±	35.00	19,500	24,000	70,000	28,000	.....	.....	.....	
Between crossing of Chester and Cheraw railroad—	125	3,450															
and crossing of Western North Carolina railroad.	225	1,200	12	14	10	14	50	445	100.00	22,500	28,000	90,000	32,500	.....	.....	.....	These figures are of no practical value.
Between crossing of Western North Carolina railroad—	225	1,200															
and Morganton	262	557	12	14	10	14	50	209	37.00	4,000	5,200	18,500	6,000	.....	.....	.....	
Total between Camden	75	4,500															
and Morganton	262	557	12	14	10	14	50	854±	187.00	52,000	65,000	199,000	75,000	607	257.5	2.0—	

*See pages 18 to 21.

TRIBUTARIES OF THE CATAWBA (WATEREE) RIVER.

The point where the Wateree and the Congaree meet is nearly on the lower limit of the belt of sand-hills already referred to, perhaps a little below it. As a consequence, the tributaries of the Wateree for a distance of upward of 30 miles in a straight line belong to the class of sand-hill streams. Regarding them but little is to be said, none of them having been utilized except to a small extent. Some of them are swampy and of no value, while others might be made to afford large powers. The most prominent of these streams are Big and Little Pine Tree creeks, the latter a tributary of the former, which passes close by the town of Camden; and they are said to be the best of the sand-hill tributaries of the Wateree. The water-bearing stratum of the sand-hill streams in this neighborhood is stated to be an impervious white clay, while nearer the surface of the ground is a layer of pervious red clay. The valleys of the two streams above referred to are said to be very favorable to the production of large ponds, so that by damming large storage-room can be obtained. They are utilized by saw- and grist-mills, and offer some available sites for power, regarding which I gained the following information: Big Pine Tree creek has five sites, of which all have at some time been improved. The lowest mill, a grist-mill and cotton-gin, uses only a part of the creek, and is subject to stoppage from backwater, the river (Wateree) being said to rise 30 feet at times. The available fall here is said to be 18 feet, subject to reduction by high water. Farther up the stream, and just above the mouth of Little Pine Tree creek, there was formerly a mill, using, it is said, a fall of 16 feet, and above it was a second mill with 15 feet, neither of which is now in existence. The fall in the six miles just above the mouth of Little Pine Tree is stated, and doubtless accurately, at 30 feet, and these two sites are said to be the best on the stream. The lower one had a race a mile long, but the upper one had none. Above the latter there are two grist-mills in operation. There is no doubt that this stream is an excellent one for manufacturing purposes, and that large amounts of power could be obtained from it at the two sites near Camden, especially as it would probably be practicable to secure ponds sufficiently large to store all the water during the night. According to what has been said on pages 61, 62, 84, and 85 regarding these sand-hill streams, and the data which have been obtained regarding their flow in the cases of the tributaries to the Cape Fear, Yadkin, and Savannah (see page 87), it would seem a fair allowance, if we assume them to discharge at their minimum about half a cubic foot per second per square mile, at their low-season flow 0.65, and at their ordinary flow 0.75 to 1 cubic foot. If this is correct, the flow of the Big and Little Pine Tree creeks would be as follows:

Table of estimated flow and power of Big and Little Pine Tree creeks.

Place and stream.	Drainage area.	Rainfall.					Flow per second.			Horse-power, gross.		
		Spring.	Summer.	Autumn.	Winter.	Year.	Minimum.	Low season.	Average.	Minimum.	Low season.	Average.
	Sq. miles.	*In.*	*In.*	*In.*	*In.*	*In.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*1 foot fall.*	*1 foot fall.*	*1 foot fall.*
Big Pine Tree at mouth	55	12	14–15	10	13	50	28	36	55	3.2	4.1	6.3
Big Pine Tree above junction of Little Pine Tree	43						22	28	43	2.5	3.2	4.9
Little Pine Tree at mouth	12						6	8	12	0.7	0.9	1.4

It must not be forgotten that these powers can be doubled by storing the water during the night, which would be doubtless practicable. Neither must it be forgotten that the maps are not accurate, and the drainage areas are subject to error. The above estimates were made independently, by comparison with other streams. It may be remarked, however, that Mr. J. Millar Williams, the owner of the mill below the mouth of Little Pine Tree creek, and a civil engineer by profession, gauged the stream once, and found that the whole stream would afford 6.25 horse-power per foot, which agrees almost exactly with my estimate in the last column. John McRae, esq., of Camden (civil engineer), estimates the flow of the stream above Little Pine Tree creek at 100 cubic feet per second. At the time I saw the stream (February, 1881) it was discharging a little more than two-thirds of this, according to a rough measurement. The two sites above mentioned—above the mouth of Little Pine Tree—are doubtless worthy of attention, and are probably the best sites in the vicinity of Camden.

Little Pine Tree creek, although a strong, constant stream, like the Big Pine Tree, is much smaller, and its available power is not of very much value. It was at one time used to run a cotton factory using 20 feet fall and 30 or 35 horse-power, and the same site is now used by a grist-mill (1 run) and 2 cotton-gins, using 16 to 17 feet fall and perhaps 20 horse-power. The pond is 1 mile long and 400 feet wide, and the dam of earth 18 feet high. On these streams good foundations for dams can always be had on the impervious stratum forming the bed.

The other tributaries to the Wateree furnish also good powers no doubt, but regarding them no detailed information could be obtained. Toward the upper limit of the sand-hill belt the streams become very variable in their flow, and are notably inferior in capacity to the sand-hill streams. The next creek worth speaking of is Rocky creek, which flows for its whole length in Chester county. Draining an area of about 185 square miles, and situated

entirely above the sand-hill belt, it has a considerable fall, especially in the lower part, where it passes over the same rock formation which gives rise to the Great falls on the Catawba, and where there are several fine sites not used. There are several grist- and saw-mills on the stream, but none of much importance, and they are sometimes obliged to stop at low water. In the table on page 101 I have given my estimate of the available power per foot fall on this stream at its mouth.

Fishing creek, which enters the Catawba a few miles further up, is similar in many respects to Rocky creek. It rises about the center of York county and flows southeast through York and Chester, draining a total area of about 223 square miles. It is utilized for several grist- and saw-mills, and at present two cotton factories are being built on it. At Cedar shoals, a few miles from the mouth of the stream, Captain O. Barber is erecting a mill, to be run with the Clement attachment, and to use a fall of 10 feet, with a dam of the same height, built of wood and stone, and 300 feet long. I have estimated the available power at this place at about 25 horse-power at its minimum and 54 horse-power at low seasons in dry years. Further up the stream Mr. F. Barber is putting up a second factory, to use 29½ feet fall. The dam is of wood and stone, 200 feet long and 6 feet high, and the race is 750 feet in length. The available power will probably not exceed 75 horse-power at low water in dry years. The grist-mills on this stream have generally two pair of stones, and can run nearly all the time. Estimates of the flow of this stream will be found in the table.

There are no other tributaries to the Catawba worthy of special mention till we come to the South fork, which enters the main stream just at the state-line, and which is noted for its water-power. It is formed near the center of Catawba county by the union of two forks, Henry's and Jacob's forks, both of which take their rise among the mountains in the southern part of Burke county and flow nearly east into Catawba county. From the junction of these forks the river pursues a course a little east of south through Catawba, Lincoln, and Gaston counties, entering the Catawba river at the southeastern corner of the latter, after draining a total area of about 730 square miles. Its tributaries, with the exception of the forks above mentioned, are all small streams, not worthy of special notice. The river passes within a mile or two of Lincolnton and within 3 or 4 miles of Newton, the county-seats of Lincoln and Catawba counties, respectively, and the most important towns in the vicinity. The character of the drainage area and of the stream, differing in no particular respect from that of the Catawba river in its course in North Carolina, need not be described in detail. The rainfall is about 51 or 52 inches, distributed as follows: spring, 12; summer, 14; autumn, 10; winter, 16.

The stream has a rapid fall from Lincolnton down to its mouth, as will be seen from the following table, and in fact it is nothing but a series of rapids between those points, with few bottoms subject to overflow. From Lincolnton up to the junction of Henry's and Jacob's forks it is flat, with no large powers, and with considerable areas subject to overflow.

Table of declivity on the South fork of the Catawba.

Locality.	Distance from mouth.	Elevation above tide.	Distance between points.	Difference of level between points.	Fall between points.
	Miles.	*Feet.*	*Miles.*	*Feet.*	*Feet per mile.*
Crossing of Charlotte and Atlanta Air-line railroad	8	610	17	94	5.5
Crossing of Chester and Lenoir railroad	25	704	6	45	7.5
Crossing of Carolina Central railroad	31	749			

There are no reliable records of gaugings of the river. The stream is subject to heavy freshets, which overflow the banks in places, but the fall is so rapid below Lincolnton that the rise is not extreme in that portion of its course. The bed is uniformly rock at the shoals, overlaid between by gravel, clay, and sand. The stream is easily accessible from three railroads, as the map shows. The Chester and Lenoir narrow-gauge road, now in course of construction, will do much toward opening up the resources of the region along this stream, as well as on the Catawba and the Yadkin.

The powers on this stream are as follows, in their order, ascending:

1. Stowesville cotton factory (T. A. Gaither, Charlotte), 3 miles from Garibaldi, a station on the Atlanta and Charlotte Air-line railroad. The dam is of crib-work, extending in a broken line across the stream between islands, its total length being about 800 feet, and its height 4 feet. It was built in 1858, and cost $1,000. It backs the water half or three-quarters of a mile with a width of 150 to 200 feet, the natural width of the stream. A race 500 to 600 feet long gives a fall at the wheel of 11 to 12 feet, the power used being perhaps 25 to 30 horse-power for the factory. Near the latter is a grist-mill, and on the opposite side of the river a saw-mill and cotton-gin, the total power used being perhaps 70 to 80 horse-power. The factory is run night and day, and there is always waste of water. My estimate of the power available at this place will be found in the table.

2. Spring shoals (R. Y. McAden, Charlotte), 1½ miles from Lowell, on the Charlotte and Atlanta Air-line railroad, and above the mouth of Duhart's creek. This is one of the best sites on the river, and is now being improved by Mr. McAden, who is putting up a cotton factory there. The fall of the shoal is about 24 feet in all,

and in less than half a mile there is said to be nearly 30 feet fall over a ledge of solid rock, with rock banks, very favorable for building on one side. The dam extends diagonally across the stream, and is of timber bolted to the rock, the new dam having been built in 1881, at a cost of $1,200. It is 600 feet long and only 2½ feet high, backing the water three-fourths of a mile. A race 350 feet long, 50 feet wide, and 6 feet deep leads to the factory, where the fall is 23 feet. It is intended to use 200 horse-power, which it is expected to get at all times. The table gives my estimate of the power available. This shoal is in the middle of the cotton-belt, with good building-stone (gneiss) near by, an abundance of timber, and in a very healthy country.

3. The Massey shoal, an unimproved site, a mile above Spring shoal, with a fall of about 4 or 5 feet in a distance of 1,000 feet. This, with the two succeeding powers, belong together, as will be noticed below.

4. Mill of the Lawrence Manufacturing Company, a cotton factory (5,000 spindles), using a fall of 8 feet and about 60 horse-power. The dam is of wood, 600 feet long, 5 feet high, extending diagonally across the river, and ponds the water about a third of a mile, to the next dam above. It was built in 1877, and cost $1,750. The race is about 400 feet long. Water always wastes. Opposite it stood once an old mill, now almost all washed away.

5. Mills of the Woodlawn Manufacturing Company, a cotton factory (2,500 spindles and 50 looms), cotton-gin, grist- and saw-mill, with a fall used of 8 or 9 feet, and in all 100 horse-power. The dam is of logs, 600 feet long, 5 feet high (on both sides of an island), and backs the water 3 miles. It was built in 1852. Full capacity can always be secured, and water always wastes. Both factories are run 23 hours out of the 24.

The three powers last mentioned belong to the Woodlawn and Lawrence Manufacturing Companies and the Lawrence Water-Power Company, of Lowell, Gaston county, North Carolina, of all of which C. J. Lineberger is president, and they really form one continued shoal, with a gradual fall over a gravel bottom of 26 feet in a distance of a little over a mile, from the Woodlawn dam to the foot of the Massey shoal. The site is not far from Lowell, which is 16 miles southwest of Charlotte, on the Atlanta and Charlotte Air-line railroad. The fall from the Woodlawn pond to the tail-race of the Lawrence mill is 16.9 feet, and to the foot of the Massey shoal 25.9 feet, according to a recent survey, the results of which were furnished by Mr. N. Dumont, the manager of the companies. It is proposed to utilize some of the surplus power at this place, if possible, and the company promises liberal inducements to capitalists. My estimate of the available power (which, by the way, is considerably smaller than that of the company) will be found in the table.

6. Island Creek cotton-mills (J. H. Wilson, jr., Gastonia), 3 miles further up, and just below the mouth of Long creek, a considerable tributary, using a fall of 14 feet and 75 horse-power.* The dam is a wooden-frame dam, 600 feet by 4 feet, built in 1874, from which a race 190 feet long leads to the wheel. The mill is run 14 hours out of the 24, and there is always a surplus of water. The fall here might be increased, it is said, the available fall being stated at 16 to 18 feet, and even more. There is considerable fall below the mill, which is therefore never troubled with high water.

7. The next is an unimproved site with about 4 feet fall, where there was formerly a mill.

8. Friday shoals, not improved—a rock shoal, said to have 10 feet fall and to be a good power. It is below the mouth of Kettle Shoal creek, and 1 mile from the Chester and Lenoir railroad.

9. The next power is High shoals, one of the best powers on the stream. It is situated between the mouths of Kettle Shoal creek and Hynes creek, 7 miles from Lincolnton and 1 mile from the Chester and Lenoir railroad, which crosses the river just below it. The stream here flows over a ledge of solid gneiss-rock, the fall being about 22 feet in 300; but the fall continues below for some distance, amounting to 27 feet in 600, and probably 35 feet in a quarter of a mile or a little over. The banks are quite abrupt on both sides, but there is still abundance of room for building, the best location being on the left bank. The whole flow of the stream can easily be controlled, the facilities being in all respects most excellent. The width of the stream is 300 feet above the fall, and probably greater below, the channel being cut up with islands and rocks. Just below the principal fall a small creek enters the river from the left, which could be utilized well as a tail-race if the mills were situated on the hill by which it flows. This power was used till about ten years ago to drive iron works—rolling-mill, nail-factory, and others—together with a grist- and a saw-mill, situated on the left bank, and using together 180 horse-power. Now it is used by a small grist- and saw-mill, with a rough wing-dam at the head of the falls, and using a fall of about 20 feet. The ruins of the old iron works are still to be seen, and it is evident that they utilized a fall of between 22 and 27 feet. In the table I have given the drainage area above this place and the estimated available power. In the immediate vicinity of this place are some of the most noted deposits of iron ore in the state, and the place is especially adapted for the iron manufacturer. The Chester and Lenoir railroad will afford the best facilities for transportation.

10. Paper-mill (W. & R. Tiddy, Charlotte), called Long Shoal mills, situated below the mouth of Indian creek, and within a few miles of Lincolnton. The banks are favorable for building on the left, where the mill is situated. The dam is of wood and stone, about 1,200 feet long and 8 feet high, with a pond of 30 acres and a head-race of 300 feet. The fall used is 11 feet, and the power 150 horse-power, which can only be obtained nine months of the year, the average for the remaining three being about 112 horse-power. In dry weather there is no waste at all, the mill running 24 hours.

* In statistics by special agent on cotton-mills, fall stated as 25 feet and 40 horse-power.

11. Mosteller's shoals, unimproved, about half a mile above this, have a fall of 7 feet or so over a rock bottom.

12. Paper-mill (W. & R. Tiddy, Charlotte), 4 miles from Lincolnton. The dam is of wood and stone, 276 feet long and 8 feet high, with a head-race of 100 feet, the fall used being 10 feet, and the power 120 horse-power, which can always be obtained, but with no waste in summer. The mill is run 24 hours.

13. Half a mile above the last mill is the site of the old Lincoln factory, with a fall of about 8 feet and good building facilities. It is now utilized to drive a chair factory. A log dam, 560 feet long and 4½ feet high (built in 1875 at a cost of $1,000), turns the water into a race 300 feet long. The fall used is 8 feet, and the power 50 horse-power, the mill running 10 to 15 hours out of 24, and the water being partially stored during the night in very dry weather. This power (as well as No. 12, probably) is above the mouth of Indian creek, but below that of Sand branch.

14. The next power is the cotton factory of Phifer & Allison, using a fall of 6½ feet and about 50 horse-power, which can be obtained all the time. Above it is a saw-mill, grist-mill, and cotton-gin, using 4½ feet fall and 30 horse-power, subject to stoppage by backwater, and farther up are small grist-mills and saw-mills, which it is not necessary to refer to.

It will be seen that the south fork of the Catawba is an excellent stream for power, a large amount of which is already utilized. The climate in the vicinity is salubrious, the agricultural and mineral resources of the country very large, and the facilities for manufacturing in all respects hardly to be excelled.

Summary of power (estimated) on the south fork of the Catawba.

[Powers are for natural flow, without drawing down water at night in pond.]

Locality.	Distance from mouth.	Drainage area.	Rainfall.					Total fall.		Horse-power available, gross.*				Utilized.		Per cent. of minimum utilized.	Remarks.
			Spring.	Summer.	Autumn.	Winter.	Year.	Height.	Length.	Minimum.	Minimum low season.	Maximum, with storage.	Low season, dry years.	Horse-power, net.	Fall.		
	Miles.	*Sq. ms.*	*In.*	*In.*	*In.*	*In.*	*In.*	*Feet.*	*Feet.*						*Feet.*		
Stowesville cotton factory, etc...	6±	720	12	14	10	16	52	12.0	.....	180	240	875	280	70–80	11–12	55	
Spring shoal.....	8±	688	12	14	10	16	52	24.0	500±	350	450	1,700	500	200	23.0	78	Solid rock.
Massey shoal.....	9±	675	12	14	10	16	52	25.9	5,000±	375	480	1,800	550	0	0.0	60	
Lawrence Manufacturing Company.	9.5	675	12	14	10	16	52							60	8.0		
Woodlawn Manufacturing Company.	10±	675	12	14	10	16	52							100	8.0		
Island Creek mills.....	13±	640	12	14	10	16	52	18.0+	.....	240	320	1,200	375	75†	14.0†	42	
Unimproved site.....	.....	600±	12	14	10	16	52	4.0	.....	50	70	240	75	0	0.0	0	
Friday shoal.....	20±	550	12	14	10	16	52	10.0	.....	100	150	560	175	0	0.0	0	
High shoal.....	22±	518	12	14	10	16	52	27.0	600	280	380	1,400	450	25	20.0	21	Rock.
W. & R. Tiddy's paper-mill.....	.....	498	12	14	10	16	52	11.0	.....	100	140	550	150	150	11.0	200	112 horse-power, three months; mill runs 24 hours.
Mosteller's shoal.....	.....	450±	12	14	10	16	52	7.0	.....	60	85	325	100	0	0.0	0	Rock.
W. & R. Tiddy's upper mill.....	.....	430	12	14	10	16	52	10.0	.....	80	115	450	130	120	10.0	192	No waste in summer, 24 hours run.
"Old Lincoln factory".....	.....	400+	12	14	10	16	52	8.0	.....	60	80	325	90	50	8.0	118	Mill run 12 hours. No waste in dry weather.
Phifer's cotton factory.....	.....	325	12	14	10	16	52	6.5	.....	40	55	200	60	50	6.5	183	

* See pages 18 to 21. † See description.

Dutchman's creek enters the Catawba just above the crossing of the Carolina Central railroad, and is the next tributary worth mentioning above the South fork. It rises in Lincoln county and flows nearly south, and is a small stream, with only one power worth referring to, viz, Rhyne's cotton factory, close to the mouth, where a fall of 8 feet is used, 50 horse-power being obtained for nine months and 35 for the rest of the time, a steam-engine being used during that time; no water waste in dry summers, the mill being run all the time. There is some trouble with high water, the stream being subject to heavy freshets, and there not being many low grounds subject to overflow. The stream drains an area of about 88 square miles. Above Rhyne's factory are only saw- and grist-mills, the latter generally with two pair of stones. There are some sites not occupied where there have formerly been mills. The dams are all wood, founded on rock, and sometimes bolted down. The stream averages 100 feet in width for some distance from its mouth. On one of the tributaries of the stream a small amount of power is used for an iron-furnace.

There are no important tributaries to the Catawba in Mecklenburg, Catawba, and Iredell counties, the small streams which join the river being only capable of running small grist-mills with one or two pair of stones, for which purpose they are in some cases used. The tributaries from the north are more important. The three Little rivers—Upper, Middle, and Lower—have considerable fall, but are very small streams, draining, respectively, 31, 31, and 53

square miles. On Lower Little river there are several grist-mills and one cotton factory near Taylorsville, with a fall of 12 feet and a small amount of power, and the other two are utilized by grist- and saw-mills. These streams can probably hardly be depended on for one horse-power per foot fall in dry seasons at their mouths. The tributaries in Caldwell and Burke counties are of more importance. Gunpowder creek, from the north, drains an area of about 31 square miles, and is about like the Little rivers. Lower creek, from the same side, drains 117 square miles, but is said to have little power. John's river, also from the north, drains 120 square miles, but is not used except for one mill, although it has considerable fall. Upper creek (north side) drains 45 square miles, and has a cascade about 18 miles from Morganton, but of no value for power. Linville river (north side) drains 61 square miles, flowing through a very narrow valley, and has a cascade about 28 miles from Morganton, but which, like that of Upper creek, is of no value for power. It has one mill near the mouth. The tributaries from the south are more sluggish, but on Hunting creek there is a grist-mill. Silver creek is very sluggish.

In McDowell county the character of the streams is the same. Those which rise in the mountains are small, and are subject to considerable fluctuations in volume, but have a very large fall. Major Wilson, for example, has a mill on Mill creek with a fall of 46 feet, and he calculates that the power is 75 horse-power at all times. There are many other similar sites in the mountains. North Cove creek, which drains about 83 square miles, is said to be a good stream, and it has one good shoal not far from its mouth, where there were formerly iron works. All these streams are, in fact, a succession of shoals, but the powers are all small, and many are very inaccessible. That they have a rapid fall will be seen from the fact that the elevation of the gap at the head of Linville river is 4,100 feet, and that of the gap at the head of the North Catawba 3,407 feet.

Before leaving the Catawba river it must be remarked that few rivers present so many fine powers and so many advantages of all kinds for manufacturing. The stream seems destined, with the great interest now being taken in manufactures in the South, to become a great manufacturing river.

Table of flow and power (estimated) on the tributaries to the Wateree and Catawba rivers.

Name of stream.	Drainage area.	Rainfall.					Flow per second.*				Horse-power available, gross.			
		Spring.	Summer.	Autumn.	Winter.	Year.	Minimum.	Minimum low season.	Maximum, with storage.	Low season, dry years.	Minimum.	Minimum low season.	Maximum, with storage.	Low season, dry years.
	Sq. ms.	*In.*	*In.*	*In.*	*In.*	*In.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*1 ft. fall.*	*1 ft. fall.*	*1 ft. fall.*	*1 ft. fall.*
Big Pine Tree creek	55	12	15	10	13	50	(†)							
Little Pine Tree creek	12	12	15	10	13	50								
Rocky creek	185	12	13	10	14	49	18	25	160	30	2.0	3.0	18.2	3.4
Fishing creek	223	12	13	10	14	49	25	40	200	50	2.8	4.5	22.8	5.6
South fork, at mouth	730	12	14	10	16	52	130	175	650	200	14.7	19.8	73.8	22.7
Dutchman's creek	88	12	14	10	16	52	10	15	75	20	1.1	1.7	8.6	2.3
Sugar creek	380	12	14	10	15	51	50	60	330	70	5.6	6.8	37.5	8.0
Lower Little river	53	Flow in dry seasons only sufficient to run small mills with the falls in use: varies from one-tenth to one-fifth of a cubic foot per second per square mile in dry seasons.												
Middle Little river	31													
Upper Little river	31													
Gunpowder creek	31													
Lower creek	117													
John's river	119													
Upper creek	45													
Linville river	61													
Mill creek	24													
North Cove creek	83													

*See pages 18 to 21. †See page 97.

THE CONGAREE RIVER.

The Congaree is formed by the junction of the Broad and the Saluda rivers between Lexington and Richland counties, South Carolina, whence it flows in a general southeasterly direction, forming the boundary between Richland county and the adjacent counties of Lexington and Orangeburgh, uniting with the Wateree to form the Santee. Its course is quite tortuous, and its length, measured in a straight line, is about 32 miles, while it is 60 by the course of the river. The principal town on the stream is Columbia, the capital of the state, with a population of about 10,000, and situated just below the junction of the Broad and the Saluda. The stream is navigable up to Granby, between 2 and 3 miles below the city, and its course lies almost entirely through the sand-hill belt, which extends up to Columbia, at which place the river crosses the fall-line, giving rise to the only power on the stream, and below which the stream resembles the Wateree below Camden, or the Pee Dee below Cheraw, in all essential points. The swamp-lands on the Congaree are, however, more extensive than on the Wateree, and from Granby

down to McCord's ferry, 28 miles, they average 4 miles in width and cover 50,000 acres, while on the Wateree they are not over 2 miles wide. The rainfall on the drainage-basins of the Broad and the Saluda is about 51 inches, distributed as follows: spring, 13; summer, 13; autumn, 9 to 10; winter, 15 to 16. The elevation of the river at the crossing of the Charlotte, Columbia, and Augusta railroad, below the falls at Columbia, is 129 feet above tide. The total drainage area of the stream is 7,965 square miles.

It only remains to describe the power at Columbia. About sixty years ago, the state of South Carolina having appropriated a million dollars for rivers and canals, a canal was built on the north side around these falls extending from Granby to the junction of the Broad and the Saluda rivers, at the upper end of the city of Columbia, and subsequently extended for more than two miles up the Broad river, the object being to secure an uninterrupted water communication from that stream, which was navigable for bateaux, to the sea, the original dimensions of the canal being as follows: width at top, 15 feet; at bottom, 8 feet; depth, 4 feet. This canal was gradually abandoned as railroads were introduced, and is now only used as a race to supply a small amount of power to the city water-works and to the state penitentiary, and occasionally navigated by bateaux down as far as the center of the city, the remainder being filled up and overgrown with trees, some of which are even 6 inches in diameter. Until 30 years ago it was much used by pole-boats and "match" boats. In 1868 the canal, with all its appurtenances, was sold to William Sprague, of the A. & W. Sprague Manufacturing Company, of Providence, Rhode Island, on condition that he should improve it, in default of which the property should revert to the state. A company was incorporated under the name of the Columbia Water-Power Company, but no improvements being made up to 1878 for various reasons, among which was the failure of the A. & W. Sprague Manufacturing Company, the state took possession of the property, agreeing to give to the Water-Power Company 500 horse-power whenever the power should be developed. The state proceeded to take steps toward the development of the power, and a survey and report were made by Byron Holly, civil engineer, who proposed to build a dam on the Broad river at the head of the canal, carrying the water to the city by a canal 150 feet wide at the top, 110 at the bottom, and 10 feet deep. While the matter was under discussion a new plan was proposed by Thompson & Nagle, architects and mill-engineers of Providence, Rhode Island, and finally, in December, 1879, a bill was passed by the legislature and a charter granted incorporating the Columbia and Lexington Water-Power Company, the state granting to Thompson & Nagle various rights, lands, and franchises, including the exclusive right to build dams on either the Broad or the Congaree river, exemption from taxation for 10 years on all improvements, and the free use of 250 able-bodied convicts for 3 years, together with other privileges. They prepared very elaborate plans and estimates for the work, and issued an elaborate "Prospectus of the Columbia and Lexington Water-Power Company", containing all the available information regarding the power, history of the canal, maps and views of the river, and details of the proposed improvements, all prepared at great cost. They have permitted me to make free use of this prospectus in the preparation of this report, and from it I have obtained these notes regarding the history of the power, as well as what follows regarding its technical features. But notwithstanding these elaborate and costly preparations the power remains undeveloped, fine as it is, and favorable as are all the collateral advantages.

Such is the history of the canal. It remains to present its technical features. Its total length is 5½ miles, and its fall 36 feet. Thompson & Nagle proposed two plans for developing power, and submitted estimates for the same. The first contemplated the construction of a dam across the Congaree just below the junction of the Broad and the Saluda, giving a fall at the foot of Gervais street of 22 feet at mean low water, and by carrying the canal 11,160 feet farther down an average fall of 27½ feet (the fall in the river between Gervais street and Granby being 13 feet), in addition to which a canal on the opposite side of the river was projected. The dam was to be 1,330 feet long between abutments, the bulkhead 200 feet long, and the total length of canal (on the Columbia side) 3 miles. The estimated cost of the whole improvement (not including the canal on the other side of the river, which was not intended to be built at first), including a mill with 864 looms and 26,112 spindles, was $1,699,848. It was considered best, however, to extend the canal at first only seven-eighths of a mile below Gervais street, the cost for this project being $1,555,764. The second plan proposed the erection of a dam across the Broad river alone at the head of the navigation canal, the canal being carried to a point seven-eighths of a mile below Gervais street. The length of the dam would be 650 feet between abutments, the bulkhead, as before, 200 feet long, the canal 4 miles long, and the fall at Gervais street 34 feet at mean low water, the total cost of this plan being estimated at $1,711,124. Both plans proposed a canal 200 feet wide. If in the last plan, however, the canal be assumed to be 150 feet wide, the estimated cost is $1,594,124.

The river opposite Columbia flows over a bed composed of ledges of rock, overlaid in places with deposits of sand and gravel. The stream is subject to heavy freshets, the most notable ones having occurred as follows: in May, 1840; in August, 1852; in 1856 the water rose 25 feet at Columbia; and in January, 1865, it rose 30 feet at the same place.

The drainage area of the Broad river is about 4,950 square miles, and that of the Saluda 2,350; so that the total drainage area of the Congaree above Columbia is about 7,300 square miles. The rainfall on the basin of the Broad is as follows: spring, 13; summer, 13; autumn, 10; winter, 15; total, 51 inches; and on that of the Saluda as follows: spring, 13; summer, 13; autumn, 9; winter, 16 inches. In regard to the flow of these streams I have no

accurate data; but it has been estimated by other engineers, and in regard to these estimates I feel constrained to say a few words, as well as to make a few general remarks on the subject of estimates of flow. In making my own estimates, hitherto given, I have proceeded according to principles which have been fully explained on pages 16 to 21. I have repeatedly called attention to the fact that they are only to be regarded as rough approximations, and I believe them myself to be rather under than over the mark. Without a single series of gaugings in this part of the country, with few extended observations of rainfall, and with by no means a perfect knowledge of the country, it is impossible to present anything very accurate. Before presenting my estimates for the Broad and the Saluda rivers I desire, therefore, to show briefly by what considerations I am led to them, principally on account of the fact that my estimates are very much lower than those which have been heretofore made. For this purpose I select a few typical streams for comparison and present in tabular form the various facts which are to be taken into consideration (page 104). From this table it will be clear that in estimating the minimum flow of the Broad and the Saluda the Merrimac and the Connecticut cannot serve as guides, on account of their large flow, probably due to the lakes and artificial reservoirs in their basins. It is further clear that from the size of the drainage area, when it exceeds about 1,000 square miles, no sure conclusion can be reached, for the Potomac, with the largest drainage area, has the smallest flow. It is difficult to explain the small flow of this river, considering the large area drained, although it may be due to the topography of the country and to the way in which the rainfall is distributed through the year, as will be shown when that river is considered; but whether the low flow is to be ascribed principally to these causes it is impossible to say. Comparing all these points, it would seem reasonable to take the minimum flow of the Broad and Saluda at 0.20 to 0.25 cubic feet per second per square mile. I have taken 0.23 for the Broad and 0.21 for the Saluda. As regards the minimum low-season flow, the rainfall being 51 inches, perhaps 14 or 15 inches may be considered as flowing off in a dry year (nearly $0.7 \times 0.40 \times 51$), or 1.3 inches per month, equal to 1.15 cubic feet per second per square mile, for which we take 1.10. It remains to determine the proportion of this flow in the driest month. Compared with the Merrimac and Connecticut, the flow of the Schuylkill appears very large, considering that it has no lakes. On these water-sheds more rain falls in summer than in winter, while on the Broad and Saluda the opposite is the case. There being no lakes to regulate the flow, these last streams will therefore get proportionately lower in summer, so that under these circumstances 0.27 to 0.30 does not seem too small a fraction for the driest month. We take 0.28, giving 0.30 cubic feet per second per square mile for both streams. For dry years, but not the driest, we take 0.35. Finally, as regards the maximum with storage, it is clear that the figures for the Merrimac and Connecticut cannot be applied to the Broad and Saluda on account of the influence of the lakes on the former streams. On the other hand, the climatic and other conditions in the Schuylkill basin seem quite similar to those of the latter streams, except that the rainfall in the former basin is greatest in summer (when the evaporation is greatest), while in the latter it is greatest in winter (when the evaporation is probably least). From this it seems legitimate to conclude that a larger proportion of the rainfall would be available in the latter case (supposing the conditions of evaporation to be the same in both cases); but, on account of the larger drainage area of the latter streams, and the fact that storage is only practicable in their upper parts without overflowing fertile bottom-lands (counted as the best farming-lands in the state), and that consequently the stored water would have a considerable distance to pass over before reaching Columbia (losing thereby considerably in volume by evaporation), it would seem safe to take the proportion of the rainfall available in the latter case as the same or even a little smaller than in the case of the Schuylkill. I take 22 per cent., or about 12 inches, as available.

Such are the considerations on which the estimates are founded. In fact, 8,000 cubic feet per second, which has sometimes been taken as the low-season flow of the Broad river, would be nearly the average flow of the stream, supposing half the mean annual rainfall on the drainage-basin to be discharged, a quantity which it would be impossible to utilize. The following table gives the results of the calculations:

Table of power of Congaree river at Columbia.

State of flow (see pp. 18 to 21).	Drainage area.			Flow per second.			Horse-power, gross.			Horse-power available, gross.	
	Broad.	Saluda.	Both.	Broad.	Saluda.	Both.	Broad.	Saluda.	Both.	Broad.	Congaree.
	Sq. miles.	*Sq. miles.*	*Sq. miles.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*1 foot fall.*	*1 foot fall.*	*1 foot fall.*	*84 feet fall.*	*22 feet fall.*
Minimum	4,950	2,350	7,300	1,140	500	1,680	130	57	191	4,400	4,200
Minimum low season				1,480	700	2,200	168	80	250	5,700	5,500
Maximum, with storage				4,200	2,000	6,200	477	227	705	16,000	15,500
Low season, dry years				1,730	825	2,550	197	93	290	6,700	6,400

Nevertheless it is evident that the power at Columbia is very fine, with every collateral advantage. There is an abundance of room for buildings, with safe locations; railroad communication in four different directions; fine building-stone (granite of excellent quality) within the city and for several miles up and down the river, and a fine brick clay along the canal. Of the large power available only about 75 horse-power is used, there being one small

grist-mill, with a wing-dam and 3 to 4 feet fall, situated on the river, and on the canal the city water-works, using about 12 feet fall and 40 to 50 horse-power, and a small amount of power being also used from the canal at the city penitentiary to run a grist- and saw-mill and for hoisting rock from a quarry, the fall being 18 feet. At the head of the canal is a rough wooden wing-dam extending across to an island.

It is to be hoped that this magnificent power may soon be developed, and the hopes of the city of Columbia, so long deferred, at last consummated.

Comparative table of drainage areas of various streams.

Name of stream.	Drainage area.	Rainfall.					Minimum flow per second per square mile.	Proportion of mean monthly flow in driest month.	Rainfall available in very dry years.	Per cent. of mean annual rainfall available in very dry years.	Remarks.
		Spring.	Summer.	Autumn.	Winter.	Year.					
	Sq. miles.	*In.*	*In.*	*In.*	*In.*	*In.*	*Cubic feet.*		*Inches.*		
Merrimac	4,136	11	11	12	10	44	0.53	0.38	21.13	48.0	Flow regulated by large lakes. Well wooded.
Connecticut	10,234	11	11	12	10	44	0.51	0.41	19.16	43.5	Many lakes in drainage-basin. Quite well wooded.
Schuylkill	1,800	11	14	10	9	44	0.21	0.38	9 to 12	20.5 to 27.3	No lakes. Tolerably well wooded.
Passaic	981	12	14	12	10	48	0.23	.....	.....	.....	Several lakes of considerable size. Not very thickly wooded.
Delaware	6,500±	10	13	10	8	41	0.30	.....	.....	.....	Many small lakes and ponds in basin. Very well wooded.
Potomac	11,476	11	12	9	8	40	0.09	.....	.....	.....	No lakes. Narrow valleys. Considerable limestone formation.
James	6,800	12	11	8	10	41	0.19	.....	.....	.....	No lakes. Valleys narrow in mountains. Well wooded.
Neuse	1,000	12	12	10	10	44	*0.16	.....	.....	.....	No lakes. Soil much deeper than in rivers above. Very well wooded.
Broad	4,950	13	13	10	15	51	*0.23	*0.28	*12.00	*22.0	No lakes. Deep soil. Well wooded. Mountains not bald, but covered with soil. Evaporation probably smaller than on James.
Saluda	2,350	13	13	9	16	51	*0.21	*0.28	*12.00	*22.0	No lakes. Deep soil. Well wooded. Mountains covered with soil. Evaporation probably less than on James.

*Estimated.

TRIBUTARIES OF THE CONGAREE RIVER.

The Congaree river has no very important tributaries, only one of them, Congaree creek, being worthy of mention. Like the other and smaller streams flowing into the river, it is a sand-hill stream, and is only about 15 miles long, flowing for its entire length in Lexington county, and joining the river about 3 miles below the Columbia bridge. It is not a rapid stream, and flows for a considerable part of its course through swamps, over a sandy bed, and it is only on the upper half of its course that it offers any facilities for power. There are two sites now not improved, but formerly used for saw-mills, with brush-dams and races about a mile and a half long, the falls being about 5 to 8 feet. The stream drains an area of about 115 miles, according to the map I have used. If we take its flow, as in the case of the Pine Tree creeks (see p. 101), at a half to one cubic foot per second per square mile, it will afford at its mouth a power of 6.6 and 13.2 horse-power per foot fall, without storage during the night. The sites above named are 5 or 6 miles from Columbia, and 1 to 3 miles from the Charlotte, Columbia, and Augusta railroad. The owner, Mr. John Taylor, of Columbia, states that an engineer's survey found the flow to be 500 to 800 cubic feet per second, or 625 on the average—an evident impossibility, provided the drainage area above stated is correct, or it would correspond to an annual rainfall of 72 inches, all of which flowed off by the stream.

Red Bank creek, a tributary of Congaree creek, is another sand-hill stream, and on it is the Red Bank cotton factory, with a fall of 12 feet, and using 40 horse-power for nine months of the year and about 30 for the rest of the time, the water being drawn down in the pond at night, so that the natural flow of the stream in dry weather does not afford over 1 horse-power per foot fall. There are also two saw-mills on the stream. All the dams are of dirt, that of the factory being 25 feet wide at the bottom, 12 at the top, and 8 high. It may be mentioned as an interesting fact that wood can be obtained in this neighborhood at 75 cents a cord.

On some of the other sand-hill streams in the vicinity, such as Berry creek, power can be obtained to a small extent.

THE BROAD RIVER.

This stream takes it rise on the eastern slope of the Blue Ridge near Hickory-Nut gap, in the southwestern part of McDowell county and the northeastern part of Henderson county, North Carolina, and after flowing in a general southeasterly direction through Rutherford county and a corner of Cleveland county, North Carolina, and in South Carolina between the counties of York, Chester, Fairfield, and Richland on its left, and Spartanburgh, Union,

Newberry, and Lexington on its right, it unites with the Saluda river just above Columbia to form the Congaree. The length from source to mouth, measured in a straight line, is about 128 miles, but following the course of the river it is very considerably greater. There are no towns of any importance on the river. The stream is navigated to a certain extent by bateaux (carrying 30 to 40 bales of cotton, and drawing 20 inches when loaded and 4 inches when empty), the present head of navigation being about 141 miles above Columbia (by the river) and 28 miles above the North Carolina line. A survey was made of the river by the government in 1879–'80 for the purpose of ascertaining the practicability and probable cost of improving the navigation, and the report is found in the annual report of the chief of engineers for 1880, p. 1010, in which the cost of rendering the river navigable for pole-boats carrying from 70 to 90 bales of cotton is estimated at $90,000.

The Broad river drains a total area of about 4,950 square miles, of which 3,550 are in South Carolina and 1,400 in North Carolina. The river receives a number of important tributaries, as follows:

	Square miles.
From the west, ascending the stream:	
Enoree river, draining an area of	730
Tiger river, draining an area of	720
Pacolett river, draining an area of	475
Thicketty creek, draining an area of	100
Green river, draining an area of	198
From the east:	
Little river, draining an area of	203
Sandy creek, draining an area of	63
Bullock's creek, draining an area of	73
King's creek, draining an area of	72
Buffalo creek, draining an area of	178
First Broad river, draining an area of	302
Second Broad river, draining an area of	193

The general character of the drainage-basin resembles that of the Catawba. It lies entirely above the fall-line; is well wooded, especially in the upper parts; is without lakes; affords fine building-stone in numerous localities; and as regards soil, etc., is just like the valley of the Catawba. The rainfall and the flow of the stream have been discussed in detail in speaking of the power at Columbia. The bed of the stream is rock, clay, sand, or gravel, and in many places the banks are low and the bottoms overflowed in freshets. The declivity of the stream will be seen from the following table, which shows the fall to be less than that of the Catawba, but still very large:

Table of declivity of Broad river, South Carolina.

Place.	Distance from Columbia.	Elevation above tide.	Distance between points.	Fall between points.	Fall between points.
	Miles.	*Feet.*	*Miles.*	*Feet.*	*Feet per mile.*
Congaree river, crossing of Charlotte, Columbia, and Augusta railroad	—2±	129.0			
Congaree river, foot of Gervais street, Columbia	0.00	135.5	2.0±	6.5	3.25
Bull sluice	2.75	162.0	2.75	26.5	9.36
Ninety-nine islands	11.50	176.2	8.75	14.2	1.60
Ninety-nine Islands shoal	14.25	193.4	2.75	17.2	6.40
Foot of Summers' shoal	26.25	229.1	12.00	35.7	2.97
Head of Summers' shoal	27.19	240.7	0.94	11.6	12.26
Foot of Lyle's shoal	41.00	269.7	13.81	29.0	2.09
Head of Lyle's shoal	41.93	281.1	0.93	11.4	12.15
Foot of Neal's shoal	58.50	322.1	16.57	41.0	2.47
Head of Neal's shoal	59.12	331.9	0.62	9.8	15.60
Foot of the Gravel	68.25	339.9	9.13	8.0	0.87
Foot of Lockhart's shoal	69.00	346.0	0.75	6.1	8.14
Head of Lockhart's shoal	70.41	393.7	1.41	47.7	33.80
Foot of Ninety-nine islands	94.25	426.0	23.84	32.3	1.31
Head of Cherokee shoal	100.50	530.0	6.25	104.0	16.63
Crossing of Atlanta and Charlotte Air-line railroad	104.75	542.0	4.25	12.0	2.83
Green river	141.00	758.5	36.25	216.5	6.00

The average fall between Columbia and the crossing of the Atlanta and Charlotte Air-line railroad (104.75 miles) is nearly 3.9 feet per mile, and thence to the mouth of Green river it is, as by the table, 6 feet per mile. Above that point the stream is a mountain torrent, the elevation of its headwaters being not less than 2,500 feet.

It will be seen from the map that the lower part of Broad river is very accessible, while that part above the mouth of the Pacolett is quite the contrary.

Proceeding up the river, the water-powers met with will now be named. Almost all the information I have regarding them is obtained from the report on the river above referred to. The shoals are tabulated below, and regarding most of them very few remarks can be made.

At Bull sluice the river is 200 yards wide, but exposed rocks extend from either side, leaving a straight sluice in the middle only 100 feet wide, through which the whole volume of the river pours at ordinary stages. Just above the sluice a ledge of rock extends across the river, which widens to 900 feet. The head of the Columbia canal is just above this sluice.

Ninety-nine Islands shoal is the next one of importance, the fall being 17.26 feet in 2¾ miles. It is used for power to a small extent, driving a grist- and saw-mill on the left bank, with a fall of 5 feet. The banks are favorable for building, and the power is no doubt easily available. The river is very wide, in some places over half a mile. The shoal is just above the mouth of Cedar creek, but its head is just below that of Little river.

Boney shoal, 17¾ miles above Columbia, is a mile long, with a fall of 6 feet, and is utilized by a small grist-mill.

At Alston, 25 miles from Columbia, the Greenville and Columbia railroad crosses the river, which is here 300 yards wide.

Summers' shoal begins 26¼ miles above Columbia and extends for a mile, the fall being 11.61 feet, part of which is used by a grist-mill. This shoal is said to be a fine site for power. It is 13 miles below the mouth of the Enoree river.

Lyle's shoal (41 miles) has a fall of 11.36 feet in 4,930 feet. It is situated 3 miles below the mouth of the Tiger river, and 1 mile above the mouth of the Enoree.

At Shelton, where the Spartanburgh and Union railroad crosses the river, the rise of freshets is 27 feet, the width of the stream being 250 yards.

Neal's shoal (58½ miles) has a fall of 9.75 feet in 3,300, and there is a grist-mill on each bank of the river, which is from 250 to 350 yards in width. This shoal is said to be favorable for power. It is situated 14 miles above the mouth of Tiger river, and about 9 miles below the mouth of Turkey creek.

The next shoal, really the first of great importance as a water-power, and perhaps the best site on the river, is Lockhart's shoal, situated less than 2 miles above the mouth of Turkey creek. This shoal is preceded by a short shoal called the Gravel shoal, which has a fall of 6.11 feet in 2,673 feet, just above which is Lockhart's shoal proper, which is "formed by the intrusion of two trap-dikes 500 yards apart, causing the bed of the river to be a field of jagged rock, much resembling the crater of an old volcano". The lower shoal is 2,955 feet long, with a fall of 15.80 feet, and the upper shoal is 3,000 feet long, with a fall of 31.86 feet; so that the total length of the shoal is 1.41 miles, and the fall 47.66 feet. The width of the stream above the shoal is 200 yards, and the depth 25 to 30 feet. Near the foot of the upper shoal the width is 500 yards. At the foot of the lower shoal the west bank is very hilly, and the east bank not quite so much so. The hills gradually recede on the west side, leaving a bottom 800 yards wide along the river, and gradually returning to the river near the head of the upper shoal. On the east bank the shore-line is irregular, and there are many high bluffs along the river. On the upper shoal there is in one place an abrupt fall of 5 feet, and two mills—one on each side of the river—utilize a small amount of the power.

These shoals being the most difficult on the river, a canal was built around them on the west bank by the state between the years 1818 and 1825, at a cost of $130,000, and it was used till 1852, when it was abandoned. Leaving the river a little below the head of the upper shoal, with a guard-lock of ordinarily small lift, it passes through the bottom above described, and after descending about 14 feet by a flight of two locks it meets the hills near the foot of the lower shoal and follows them to the river, into which it descends by four locks with about 28 feet lift. The total length of the canal is 7,869 feet, and the fall 45.78 feet. Its original dimensions were: width on top, 16 feet; at bottom, 8 feet; depth, 4 feet. At present the width at the bottom is 5 feet, and the depth 2.5 feet; and it is estimated that it would cost $3,794 to restore it to its original dimensions and to put the locks in order, the gates being gone and some of the masonry having been removed. These locks were 10 by 76 feet, and were built of first-class cut-stone masonry. The canal is now filled up with deposits and overgrown with trees.

As regards the availability of Lockhart's shoal for power, it must be stated that its extensive utilization is only possible on the west bank. The canal for the lower 600 yards of its course is built along the side of the hills on an embankment about 12 feet high, with small building-room between it and the river, the outlet-lock being only 16 feet and the lower flight of 3 locks (115 feet above the outlet-lock) only 110 feet from the river, while the upper flight of 2 locks is, perhaps, 400 yards from the same. Hence it would not be easy to utilize the whole fall of the shoal, but it is said that the fall of the upper shoal could easily be utilized, with abundance of building-room.

In the following table I have estimated the flow and the available power at this place, and the latter will be seen to be very large. The whole amount would, of course, only be rendered available by digging a large canal; for the present canal, if cleaned out to its original dimensions, would only carry about 70 cubic feet per second, with a fall of a foot to the mile.

This shoal is located in a very healthy part of the state, in the midst of the cotton-belt, and 8 miles from Union, the nearest railroad point. It is, without doubt, one of the finest powers in the vicinity.

Table of power available at Lockhart's shoal.

State of flow (see pp. 18 to 21).	Drainage area.	Fall.		Flow per second.	Horse-power available, gross.		
		Upper shoal.	Lower shoal.				
	Square miles.	*Feet.*	*Feet.*	*Cubic feet.*	*1 foot fall.*	*15.80 feet fall.*	*31.86 feet fall.*
Minimum	2,400	15.80	31.86	540	61.3	970	1,950
Minimum low season				720	81.8	1,300	2,600
Maximum, with storage				2,100	240.9	3,750	7,500
Low season, dry years				830	94.3	1,500	3,000

Above this shoal there is no power of importance for nearly 25 miles, the next of importance being a long shoal, 6¼ miles long, generally subdivided into two, the Ninety-nine Islands shoal, 3.2 miles long, with a fall of 50.62 feet, and Cherokee shoal, 2 miles long, with a fall of 50.95 feet. The head of the latter shoal is only about 3 miles below the crossing of the Atlanta and Charlotte Air-line railroad. Notwithstanding the large amount of power theoretically available at these shoals, only a small part of it can practically be utilized according to all that I could learn, the hills coming abruptly up to the river on both sides for almost the whole distance, and leaving no building-room except a small amount in a few isolated places, where power can be used to a certain extent. There are several grist-mills along the shoals in these places with small wing-dams and generally small falls, and there have been others, which are now abandoned. Of these sites for power probably the best is the one formerly utilized by the King's Mountain Iron Company, on the west side of the river, about 2½ miles above the foot of Ninety-nine Islands shoal. A branch of the river, about 80 feet wide, passes here between the shore and an island, the fall in the main river above the head of the island being about 5 feet in 500, and the fall in the branch about 16 feet in 800 to 1,000, making in all about 20 feet, which could be used with a 5-foot dam above the head of the island and favorable ground for building—not very high, but probably not often overflowed, on account of the rapid fall of the stream below. Not more than one-quarter or one-fifth of the volume of water in the river flows naturally to the west of the island, but more could be turned in by a dam. Were it not desired to utilize a large fall, 12 feet could be obtained very easily.

The fall between this place and the foot of the shoal, 2½ miles below, is about 28 feet, which has only been used in part by a few grist-mills. Above there is one place on the east side where there is a little building-room, and where it is proposed to erect a cotton factory, to use a fall of 9 feet, with a wing-dam 6 feet high and 120 feet long, the mill to be a yarn-mill, with 3,000 spindles. This site was formerly used by the King's Mountain Iron Company for their forges and furnaces, and is 1 mile below Cherokee ford. Opposite it there was once a saw-mill, using a fall of 5 or 6 feet. Both sites are on the lower part of Cherokee shoal.

About 300 yards above Cherokee ford, at the head of Cherokee shoal, were formerly located the works of the Magnetic Iron Company, now abandoned. The dam was a curved one, extending entirely across the river, being the only dam quite across, and was about 440 yards long and 10 feet high, built of crib-work bolted down to the rock foundation. It was first built in 1837, and was washed out in 1875, the works having been abandoned in 1870. The canal was 200 yards long, the fall at the lower end being 10 feet and the average fall 8 feet, and along it were situated the various mills, as follows: stamp-mill (8 to 10 horse-power), grist-mill (40 horse-power), machine-shop (20 horse-power), trip-hammer (40 horse-power), blast for forges (40 horse-power), rolling-mill (120 horse-power), nail factory (20 horse-power), blast-furnace (50 horse-power), or a total of 340 horse-power, and with a surplus of water at all times. The dam backed up about a mile, with a width of 300 yards. The banks at this place are very favorable for building, and the available fall is greater than was used, amounting to some 16 feet in three-quarters of a mile, all of which is available, although the land is more favorable for building at the point where the old works were located. Below this the hills close in upon the river on both sides, and continue from there down to the foot of the shoal.

To recapitulate, then, regarding these two shoals, their complete utilization is impracticable on account of the abruptness of the banks, the impossibility of building a canal, and the small amount of building-room. In fact, it is said that there are only two places along the whole shoal, over 6 miles, where it is possible to get a road down to the river without considerable difficulty. At the head of Cherokee shoal, and in perhaps half a dozen places below, small areas of favorable building-ground are found where small mills might be located and some power obtained, the best place of the kind being, perhaps, the site of the works of the King's Mountain iron-works.

Surratt's shoal is the first shoal above the railroad, and is 1¾ miles long, consisting of a continuous series of ledges, the fall being stated to be not less than 20 feet to the mile. The river is 200 yards wide above the shoal, which is 3 miles above the mouth of Buffalo creek.

Gaston's shoal is 2¼ miles beyond, and is 1 mile long, with a fall of about 10 feet, of which 6 feet occur in the first 400 yards. The river is 300 yards wide.

Palmer's shoal, 6¼ miles further up, is said to be the best site above Cherokee shoal, the fall being 18 feet in half a mile. It is used by a grist-mill, with 6 feet fall, and there are fine building-sites on both sides of the river, the entire fall being available for power. It is situated about a mile above the mouth of the First Broad river.

Above Palmer's there is said to be no shoal of much importance till the mountains are reached, the fall of the stream being gradual, although considerable. Above Green river there may be some good sites, and also below; but none were specially mentioned by persons acquainted with the river.

The most noticeable fact connected with the water-power of the Broad river is that there is not a single dam entirely across the stream, notwithstanding its large fall and the large amount of power available on it.

The following table contains estimates of the power at the shoals of the river:

Table of power on Broad river.

Locality.	Distance from Columbia.	Drainage area.	Rainfall.					Total fall.		Horse-power available, gross.*				Utilized.		
			Spring.	Summer.	Autumn.	Winter.	Year.	Height.	Length.	Minimum.	Minimum low season.	Maximum, with storage.	Low season, dry years.	Horse-power, net.	Fall.	Per cent. of minimum utilized.
	Miles.	*Sq. m.*	*In.*	*In.*	*In.*	*In.*	*In.*	*Feet.*							*Ft.*	
Nigger shoal	1.25	4,950	13	13	10	15	51	2.5	750ft	(†)	(†)	(†)	(†)	(†)	(†)	
Bull sluice	2.75	4,950	13	13	10	15	51	4.37	1,050ft	(†)	(†)	(†)	(†)	(†)	(†)	
Ninety-nine Islands shoal	11.50	4,760	13	13	10	15	51	17.26	2.75m	2,150	2,800	7,950	3,250	50—	5	2.5—
Boney shoal	17.75	4,525	13	13	10	15	51	6.0+	.....	700	925	2,600	1,075	50—	6	7.0—
Summers' shoal	26.25	4,480	14	13	10	15	52	11.61	0.94m	1,350	1,775	5,000	2,000	50—	....	4.0—
Lyle's shoal	41.00	3,490	14	13	10	15	52	11.36	4,930ft	1,050	1,350	3,800	1,600	.....	.....	.....
Neal's shoal	58.50	2,590	14	14	10	15	53	9.75	3,300ft	650	850	2,550	1,000	75—	....	12.0—
Lockhart's shoal	69.00	2,400	14	14	10	15	53	47.66	1.41m	2,900	3,900	11,000	4,500	50—	....	3.0—
Ninety-nine Islands shoal	94.25	1,357+	14	14	10	16	54	50.62	3.20m	1,800	2,350	6,900	2,700	.....	.....	.....
Cherokee shoal	98.50	1,357	14	14	10	16	54	50.95	2.00m	1,800	2,350	6,900	2,700	.....	.....	.....
Surratt's shoal	108.00	1,142	14	14	10	16	54	35.0(?)	1.75m	1,000	1,250	4,000	1,450	0	0	0.0
Gaston's shoal	110.25	1,133	14	14	10	16	54	10.00	1.00m	280	360	1,150	400	0	0	0.0
Palmer's shoal	116.50	821	14	14	10	16	54	18.00	0.50m	350	420	1,500	475	50—	6	15.0—
Between mouth and foot of Lockhart's shoal‡	2.75 69.00	4,950 2,400	14	13	10	15	52	184.00	66.25m	17,500	23,000	65,000	27,000	.....	.....	.....
Between head of Lockhart's shoal and foot of Ninety-nine Islands shoal‡	70.40 94.25	2,400 1,370	14	14	10	15	53	32.00	23.85m	1,600	2,000	5,700	2,300	.....	.....	.....
Between head of Cherokee shoal and mouth of Green river‡	100.50 141.00	1,357 236	14	14	10	16	54	228.00	40.50m	4,000	5,000	18,000	6,000	50—	6	1.5—
Total between mouth and mouth of Green river‡	2.75 141.00	4,950 236	13	13	10	15	51	596.00	138.25m	30,000	39,000	114,000	45,000	225	....	1.0—

*See pages 18 to 21. †Included in estimate for Columbia. ‡Estimates in these lines of no practical value.

TRIBUTARIES OF THE BROAD RIVER.

The first important tributary of the Broad is the Enoree river, the largest one below it, viz, Little river, from the east, having no powers worthy of special mention.

The Enoree river rises in the northern part of Greenville county and flows southeast, forming the boundary between the counties of Greenville, Laurens, and Newberry on the south, and Spartanburgh and Union on the north, joining the Broad 40 miles above Columbia, after flowing a distance of about 70 miles in a straight line and draining an area of about 730 square miles. There are no towns on the stream, which flows through a hilly country, gently rolling but not very broken, the principal productions of which are grain and cotton. The bed of the stream is rock at all the shoals, but between them sand, clay, or gravel. The prevailing rock in all this upland country drained by the tributaries of the Congaree and of the Savannah is gneiss, the streams crossing the ledges nearly at right angles. Almost all of the water-powers of this part of the state are formed by the streams passing over these ledges of gneiss, and the falls are very often quite sudden. It is to be remarked, however, that the rivers in this section of the country are in many places rapidly filling up with detritus—sand and mud—which is washed in from the hill-sides, so that many shoals are being rapidly obliterated, and at many places, where within the memory of middle-aged men there were shoals with falls of from 5 to 10 feet, at present scarcely any shoals can be noticed. The cause of this is probably to be attributed, to a large extent, to the cutting down of the forests, by which the soil is divested of the roots, fibers, and mosses, which serve in so great a degree to hold it together and prevent its being washed away by sudden showers; also partly due, it is said, to a superficial method of cultivation, by which the soil is also rendered less cohesive and more liable to washing. This phenomenon is also noticeable in North Carolina, but not to such a marked extent as in the portion of the country we are now considering. It is very important to notice also that one effect of this silting up of the streams is to diminish the facilities for storage; for if artificial reservoirs are constructed, they soon fill up, and their capacity is greatly diminished. This effect will be noticeable on small streams, where artificial reservoirs could be located; and, in fact, it is said that many mill-ponds fill up so rapidly that they have to be cleaned out at short intervals.

The valleys of these streams are not especially favorable for reservoirs from a topographical point of view, although some sites could, no doubt, be found.

The Enoree has considerable bottom-land on its lower parts, more than most streams in this vicinity, and the banks are not often steep and hilly. In fact, along the banks of this stream are some of the finest and most fertile bottom-lands in the state. The stream is 75 feet wide at its mouth, and is navigable for pole-boats for a distance of 10 miles, the shoals which formerly existed in this distance being filled up. The rainfall on the valley is about 53 inches: 15 in spring, 13 in summer, 10 in autumn, and 15 in winter.

The elevation of the stream at the crossing of the Atlanta and Charlotte Air-line railroad is 842 feet, and at its mouth about 269 feet, giving a fall between these points of 573 feet, or about 7 feet to the mile. The stream is at present very inaccessible, but the new railroad from Spartanburgh to Greenwood, now being built, will cross the stream about the middle of its course.

The shoals on the lower part of this river are rapidly filling up, and in the first 25 miles there are only two small mills, with falls of 5 feet each. At "Musgrove's mill",* about 10 miles from Laurens, there is a grist-mill with 6 feet fall, the dam being 4 feet high, and there is said to be a fall of 4 feet additional below the mill. Four miles above is the first power of importance on the river, and between the two is a small shoal—Flat shoal—with a fall of 4 feet or so. At the other shoal, just referred to, the fall is said to be 16 feet, which is utilized by a small grist-mill. I am not able to locate this place exactly on the map, but as nearly as I can find the drainage area above it is between 350 and 400 square miles. I have therefore estimated the power to be as follows:

Power at Yarbrough's mill.

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power.	Horse-power.	Remarks.
	Sq. miles.	*Feet.*	*Cu. ft.*	*1 foot fall.*	*16 feet fall.*	
Minimum	375	16	62	7.0	112	Only 20 to 30 horse-power utilized.
Minimum low season			80	9.0	144	
Maximum, with storage			400	45.4	725	
Low season, dry years			97	11.0	176	

In regard to my estimates of the power on these streams of western South Carolina it must be remarked that they are liable to considerable error on account of lack of data for comparison. The powers stated to be utilized by various mills and factories are, in many cases, very large in proportion to the fall and the drainage area, and if they were taken as correct, the conclusion would be inevitable that these streams have a much larger flow per square mile of drainage area than those farther north, or even than those in New England, notwithstanding the lakes in the latter part of the country; and it may be that the effect of the depth of the soil and of the forests in South Carolina is larger than would be expected, and that the streams in question are quite constant in flow and are fed by perennial springs. But in the first place the powers stated to be used generally have reference to ordinary years, and even if water is scarce for a month or so in summer, it is rarely mentioned; secondly, the rated power of turbine-wheels is generally much too large; and thirdly, people generally have a tendency to overrate their powers, especially if they do not use quite the full power of the stream. I have therefore prepared my estimates from comparisons with streams of similar drainage area, and they must be looked upon as giving simply the power and flow which would be expected, reasoning from analogy, and not taking into account any abnormal circumstances, such as large springs, which may exist in some cases.

The next shoal above this one is Mountain shoal, the most important power on the Enoree. It is situated about 12 miles from Laurens, which is the nearest railroad point. The stream pours here over a ledge of gneiss-rock, falling nearly 70 feet in a quarter of a mile, but divided into two parts. At the head of the upper shoal a natural dam extends nearly across the stream, which is some 200 to 300 feet wide, and the stream falls 16.5 feet in 500, the whole of which fall can be easily used on the left bank, with safe building-sites, the right bank not being so favorable. A fall of 6 feet is used here by a cotton-gin with a wing-dam. After flowing 200 yards with a fall of only a couple of feet, the river flows over a second ledge of gneiss, falling 52 feet in 250 yards. At the head of this fall the stream is 300 feet wide, and a wing-dam, consisting simply of a log bolted to the rock, turns the water to the left bank, where a race 300 feet long affords a fall of 16.5 feet at the grist- and saw-mill below, although 25 feet could be obtained. The banks on the left are steep and rocky, while on the right they are lower, and at the foot of the shoal is a bottom which is sometimes overflowed to a depth of 5 or 6 feet. The channel of the stream is interspersed with islands, one at the foot of the shoal, on the left side, covering 12 acres at low water, and one at the head, on the right, covering 6 acres, with a narrow branch between it and the right bank. Some power could

*Mills states that at Musgrove's ford there is a fall of "26 feet in 14 chains". The falls have, however, doubtless changed considerably since his book was written.

be used at the site of the grist-mill with a fall of 20 to 30 feet, but the entire power could best be used on the right bank, with a canal 750 feet long, and without a dam of any consequence. The water could not be stored during the night, except above the upper shoal. Thus it would seem best to utilize the two shoals separately, by which means all the fall could easily be rendered available.

The following table gives my estimate of the power here, together with the drainage area and rainfall:

Table of power at Mountain shoal.

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Rainfall.					Flow per second.	Horse-power available, gross.		Utilized.	
			Spring.	Summer.	Autumn.	Winter.	Year.				Net horse-power.	Fall.
	Sq. miles.	*Feet.*	*In.*	*In.*	*In.*	*In.*	*In.*	*Cu. ft.*	*1 ft. fall.*	*70 ft. fall.*		*Feet.*
Minimum	280	70	15	14	10	16	55	42	4.8	330	50	23.
Minimum low season								56	6.3	450		
Maximum, with storage								300	34.0	2,400		
Low season, dry years								64	7.3	500		

This power is eminently worthy of attention, for it is in all respects an excellent one. Building-stone is near at hand, and the only objection to the place—its inaccessibility—bids fair to be removed by the construction of the Spartanburgh and Greenwood railroad, which will probably cross the river just at the shoal. The place is owned by Mr. W. A. McClintock, Mountain Shoal post-office.

Above this place come several small shoals—Kilgore's, Yarbrough's, Flemming, Wofford's, and Leatherwood's; but they are gradually being filled up and are disappearing, especially Kilgore's and the Flemming shoal, which are said to be worthless. The other three, none of which are used, are said to have falls of from 6 to 12 feet available. But the most important power is Van Patten's shoal, about 300 yards above Leatherwood's shoal, 15 miles above Mountain shoal (by river), and over 20 miles from Laurens. The river here falls over a ledge of gneiss-rock, as at Mountain shoal, the fall being 55 feet in 900 feet. Both banks are steep, and both could be almost equally well used for building; but the left bank is probably the more favorable if only a small amount of power is to be used, while if the total available power is to be utilized the right is perhaps better. However, the whole fall could be easily utilized. At present only a small portion is used by a small mill on each side. The river is about 150 yards wide at the head of the shoal.

Leatherwood's shoal, just below, is also available, the natural fall being 10 to 12 feet in 150 yards.

The following table gives my estimate of power, with drainage area and rainfall for these two shoals:

State of flow (see pp. 18 to 21).	Drainage area.	Fall.	Rainfall.					Flow per second.	Horse-power available, gross.			Utilized.	
			Spring.	Summer.	Autumn.	Winter.	Year.					Net horse-power.	Fall.
	Sq. miles.	*Feet.*	*In.*	*In.*	*In.*	*In.*	*In.*	*Cu. feet.*	*1 ft. fall.*	*55 ft. fall.*	*10 ft. fall.*		*Feet.*
Minimum	234	Van Patten's, 55; Leatherwood's, 10–12.	15	14	10	16	55	35	4.0	220	40	50—	12 and 6
Minimum low season								47	5.3	290	50		
Maximum, with storage								250	28.4	1,550	280		
Low season, dry years								53	6.0	330	60		

Like Mountain shoal, this is a most excellent power, and worthy of attention.

The next shoal above Van Patten's is one belonging to the Pelham Manufacturing Company, and the fall available is 30 feet, with a 5-foot dam and a race 500 yards long through clay, according to the secretary, O. P. Jackson, esq. Just above it is the Buena Vista cotton factory, using a fall of 18 feet and 60 horse-power, with a dam 4 feet high, 120 yards long, and a race of 80 feet. In summer there is no waste except at night, when running full capacity, the mill being run 12 hours. In addition to the factory, there is a gin-, saw-, and grist-mill.

One mile above this is a shoal belonging to Dr. T. R. League, the fall being 23 feet in a distance of about 80 feet, with no dam, according to Mr. Jackson. These three shoals last mentioned are all about 11 miles from Greenville and 6 miles from the Air-line railroad at Greer's station.

Above this are several other shoals, one (Taylor's) about 8 miles from Greenville and half a mile above the railroad, and said to have a natural fall of 5 to 8 feet, capable of being increased by a dam. And there are several similar ones further up, including Bannister's, with a fall of 15 feet and a dam 9 feet high.

It will be seen that the Enoree river has a succession of considerable shoals affording excellent powers. Crossing the ledges of rock at larger angles than the Broad river, the falls of all these tributaries are more abrupt.

Table of power at Pelham for the three shoals mentioned.

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Rainfall.					Flow per second.	Horse-power available, gross.				Utilized.	
			Spring.	Summer.	Autumn.	Winter.	Year.						Net horse-power.	Fall.
	Sq. miles.	*Feet.*	*In.*	*In.*	*In.*	*In.*	*In.*	*Cu. ft.*	*1 ft. fall.*	*30 ft. fall.*	*18 ft. fall.*	*23 ft. fall.*		*Feet.*
Minimum	94	Pelham 30; Buena Vista factory, 18; League's shoal, 23.	16	14	19	16	56	16	1.1	33	20	25	60	18
Minimum low season								12	1.4	42	25	32		
Maximum, with storage								160	11.4	340	200	260		
Low season, dry years								15	1.7	51	31	39		

Mr. Jackson estimates the available power of these three shoals during nine months of an ordinary year at 200, 150 to 200, and 120 horse-power, respectively. My estimates above given amount to 63, 39, and 49 horse-power during, say, the driest month of an ordinary year, and about 180, 120, and 150 horse-power during nine months. I do not know that Mr. Jackson's estimates are founded on gaugings, but my own are, of course, liable to many errors. Mr. Jackson states that at the factory they run full capacity (60 horse-power) all the time, with water always wasting some, which would indicate the above results, based on analogy, to be too small.

THE TIGER RIVER.

The next important tributary of the Broad is the Tiger, which enters it only 4½ miles above the mouth of the Enoree, and from the same side. It is formed in Spartanburgh county by the union of three forks, the north, middle, and south, whence it flows into Union, and at its lower extremity forms for a short distance the boundary between that county and Newberry. Of its headwaters, the south and the middle forks rise in Greenville county and drain respectively areas of 108 and 65 square miles, the latter uniting with the north fork, which rises in Spartanburgh county, and drains 41 square miles; the total drainage area of the middle and north forks at their junction with the south fork being 121 square miles. The length of the Tiger from the junction of its forks to its mouth is about 36 miles, measured in a straight line, and its total drainage area 720 square miles, almost exactly the same as that of the Enoree. The principal tributary of the stream is Fair Forest creek, which rises in Spartanburgh county and enters the Tiger in Union, about 15 miles from its mouth, after draining about 203 square miles. The Tiger is very similar in all respects to the Enoree, to which it flows nearly parallel, the distance between the two varying from 4 miles in their lower parts to 7 or 8 near their headwaters, the ridge between them being low. Their drainage-basins are also exactly similar in character, and the Tiger is also being gradually filled up and the shoals obliterated in places. The elevations of the three forks at their crossings with the Air-line railroad are as follows: South Tiger, 728 feet; Middle Tiger, 792 feet; North Tiger, 712 feet. The elevation of the mouth of the stream being about 285 feet, the fall is perhaps at the rate of 6 or 7 feet per mile, or about the same as that of the Enoree. The rainfall is the same as on the latter stream; and as regards accessibility, the same remarks are true regarding both.

On account of the silting up of the stream there are no shoals of importance for 30 or 40 miles from the mouth, the first worth mentioning being the site of "Hill's factory", situated about 18 miles from Spartanburgh, Laurens, and Union. Four miles below it is a fall of 10 feet used by a grist-mill, the available power at which place can be seen from the following table for Hill's factory. Between this point (called Burnt factory) and the mouth of the stream there were formerly 4 mills, all now abandoned on account of the filling up of the shoals.

At "Hill's factory" the fall continues for about three-fourths of a mile, but may be divided into three parts, the lower one with a fall of about 12 feet, the middle one with 15 to 16 feet, and the upper one with 12 to 15 feet (according to Mr. Hill). The width of the stream is about the same as that of the Enoree at Mountain shoals. The bed is rock, and the banks said to be favorable. The lower shoal has been used for a factory, but is now used for a grist-mill, and there were iron works on the middle shoal sixty or seventy years ago. The following table gives my estimate of the power:

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Rainfall.					Flow per second.	Horse-power available, gross.		Remarks.
			Spring.	Summer.	Autumn.	Winter.	Year.				
	Sq. miles.	*Feet.*	*In.*	*In.*	*In.*	*In.*	*In.*	*Cu. feet.*	*1 ft. fall.*	*40 ft. fall.*	
Minimum	308	Perhaps 40 feet in all.	15	14	19	16	55	45	5.1	204	Fall according to Mr. Hill.
Minimum low season								60	6.8	272	
Maximum, with storage								330	37.5	1,500	
Low season, dry years								70	8.0	320	

Four miles above is a grist- and saw-mill (Nesbitt's), with a fall of 9 feet and a dam 5 feet high, subject to stoppage by backwater. The power available is probably about 70 horse-power in the low season of dry years, 86 in the low season of ordinary years, and over 200 during nine months in an ordinary year. The drainage area above is about 274 square miles. There are some powers above, below the junction of the forks, one of which is said to have a fall of 15 feet, and is not improved.

The North Tiger has one power below its junction with the Middle Tiger, used by a grist- and saw-mill (Ott's), with 14 feet fall. The dam does not extend entirely across, and is 3 feet high, the race being 200 feet long. The owner states that he has a fall of 36 feet in 300 yards, the bed and banks being rock; and it was very generally stated that this power is an excellent one. The drainage area above this place being about 112 square miles, I would estimate the power at about 2 horse-power per foot in the low season of dry years, 2½ in the low season of ordinary years, and perhaps 7 or 8 horse-power for nine months of ordinary years. It is said that there are three shoals not improved between this place and Nesbitt's, and the falls of the same are stated to be 10, 15, and 15 feet, the last below the junction of the south fork, and already referred to.

The North Tiger above the mouth of the Middle Tiger is so small a stream that it is not worth while to consider it in detail. There are several shoals and mills upon it, but the stream, even at its mouth, probably will not afford over 3 horse-power per foot for nine months in an ordinary year. The powers are excellent, although small, and are generally abrupt, with the best facilities for dams and buildings. There are some sites not used, one formerly used, belonging to Dr. Cleveland, with a fall of some 15 or 20 feet.

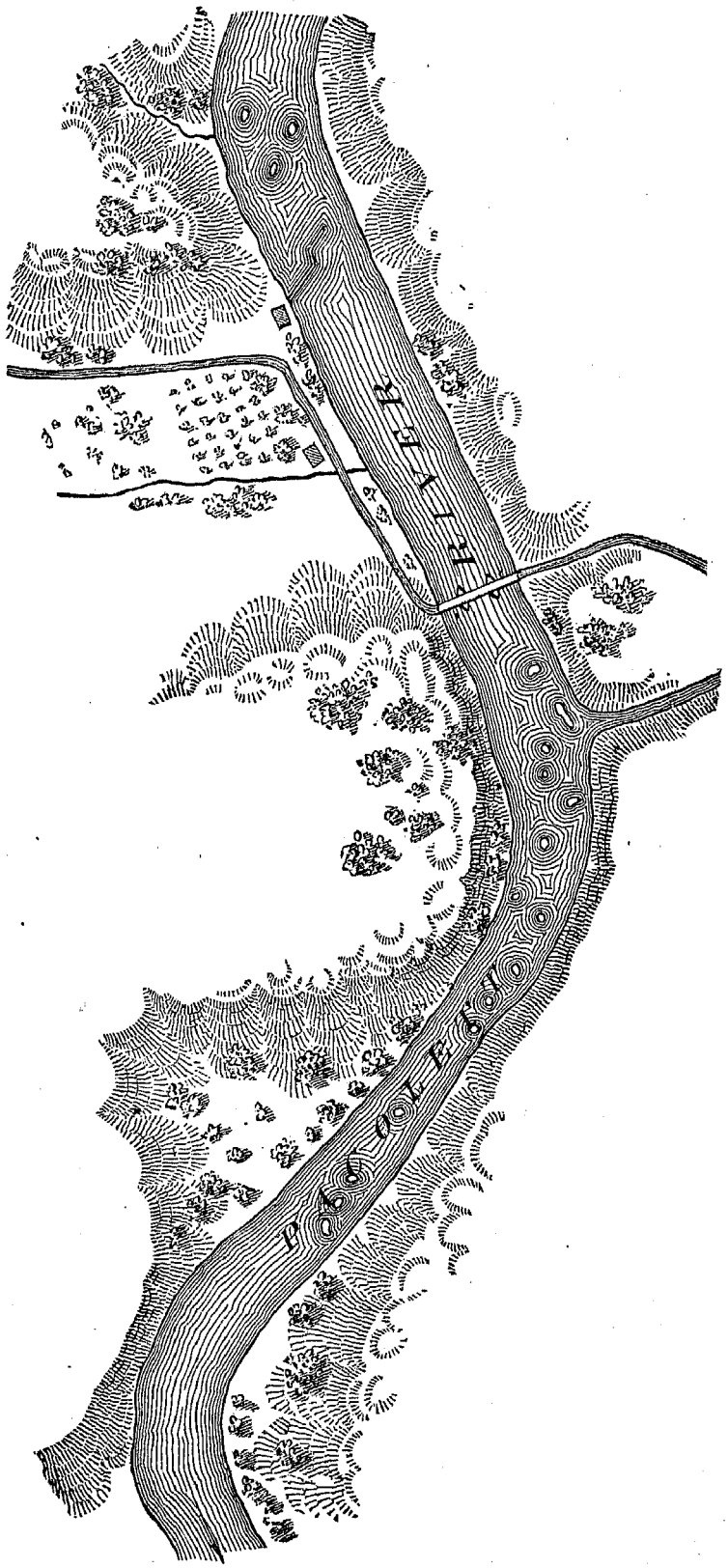
The Middle Tiger is also a small stream, its drainage area at its mouth being 65 square miles. It would therefore, in all probability, not afford over 5 or 6 horse-power per foot during nine months of an ordinary year. It has a number of shoals, where the stream pours over ledges of solid rock, falling from 10 to 20 feet in a short distance, and there are several grist-mills and a cotton factory on the stream. Dean's mill has a fall of 11 feet, and above it are 4 to 5 feet unimproved; the drainage area is about 50 square miles. At Ballinger's mills there is a fall of 14 feet; and at the Crawfordsville cotton factory a fall of 17½ feet is used, with 35 horse-power. There are three sites not used on the stream, of which the best is Penny shoal, one mile below Ballinger's mills, where there is a continuous fall for a distance of nearly a quarter of a mile over a layer of gneiss-rock, the total fall being about 35 feet. The banks are favorable for a canal and for building, but a high dam could not be erected at the head of the shoal, because it would reduce the fall at the mill above. The stream is from 100 to 150 feet wide. The drainage area above this shoal being about 50 square miles, the available power will probably not exceed 1.2 horse-power per foot in the low season of ordinary years (42 horse-power in all), and about 4 horse-power per foot during nine months of ordinary years (140 horse-power in all). This shoal is 2 miles from Wellford, on the Air-line railroad, and is owned by Dr. J. Jones, of that place. Below it, and a little above Crawfordsville, is a second unimproved shoal, said to be superior to the one at the latter place, it being equal in fall, and having better building facilities. Three miles below Crawfordsville is a third fall, not used, said to have a fall of 10 feet. I must once more state that the drainage areas I have calculated make no pretensions to accuracy, and I have more than once had occasion to notice great disagreements between those given by different maps. My estimates of power are likely to be in error one way or the other by fully 20 or 25 per cent.

The South Tiger is the largest of the three forks, and it resembles the other forks in all respects, and, like them, has a number of fine shoals, some used and some unimproved. It drains a total area of 108 square miles, and will therefore afford, in all probability, about 2 horse-power per foot in the low season of dry years, 2½ in the low season of ordinary years, and 6 or 7 for nine months of ordinary years. There is one cotton factory on the stream, with a fall of 17 feet, and several grist- and saw-mills. There is said to be one shoal, with a fall of about 10 feet, not used, not far from the mouth. Some of the shoals on this stream are being silted up.

Fair Forest creek, the principal tributary of the Tiger, flows within a mile or so of Spartanburgh, and within 5 miles of Union, and has a number of grist-mills. Being similar in character to the streams already described, it is necessary merely to describe the only important shoal on the stream, at present not utilized, viz, Murphy's shoal, about 5 miles from Union, and about an equal distance from the mouth of the stream. The fall is about 19 feet in a distance of 400, over a ledge of gneiss-rock; but the rapids continue below, the total fall amounting to about 27 feet in 1,000. Just above the falls the stream is 100 feet wide, and at the falls it is about 200 or 250 feet wide. The left bank is favorable for building, and the fall of 19 feet could be utilized very easily, and in fact 14 feet of it have been utilized until within a few months by a grist-mill and cotton-gin, with a low wing-dam about 300 feet long and 3 or 4 feet high and a wooden flume 150 feet in length. A high dam could not well be built without overflowing considerable bottom-land. The drainage area above this site being about 180 square miles, I have estimated the power in the following table:

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.		
	Sq. miles.	*Feet.*	*Cubic feet.*	*1 foot fall.*	*19 feet fall.*	*27 feet fall.*
Minimum	180	27	27	3.0	57	81
Minimum low season			36	4.0	76	108
Maximum, with storage			200	22.7	431	613
Low season, dry years			44	5.0	95	135

772


DELAWARE
POTOMAC

Hence in ordinary years, with 19 feet fall, about 110 horse-power could be obtained in the dry season, and over 300 during nine months.

The banks on the south side of the stream are high and rocky, so that the power can best be used on the other side, where the grist-mill was. The utilization of the total fall of 27 feet would not be so easy, the location not being so safe, on account of the presence of a bottom just below the main fall.

Less than a mile below this shoal is a small rift, with a fall of perhaps 6 feet in 600, with a favorable location on the south side. Between the two there are other shoals, which make up, with the one just referred to, a fall of 12 or 15 feet in a distance of three-eighths of a mile. This fall is available, and could best be utilized by building a dam about 8 feet in height, provided the bed should be found favorable. This place, however, is far inferior to Murphy's shoal.

On a little tributary to the Fair Forest river, about 5 miles from Spartanburgh, there is a perpendicular fall of 30 or 40 feet; but the stream is so small that the power is unimportant, though it is used by a small mill.

THE PACOLETT RIVER.

The next tributary of the Broad river which is worthy of special mention is the Pacolett river, which enters from the west in Union county, at a point about 75 miles above Columbia, and is one of the most important tributaries as regards water-power. It is formed by the union of two forks, the North Pacolett and the South Pacolett, the former rising in the southern part of Polk county, North Carolina, and the latter in the northern part of Greenville county, South Carolina, uniting in Spartanburgh county. The distance from the junction of these forks to the mouth of the river is about 37 miles in a straight line, and the total drainage area of the stream is about 475 square miles, of which the North Pacolett drains 80 square miles, the South Pacolett 82 square miles, and Lawson's fork, the other principal tributary, 82 square miles. The stream flows within 7 miles of Spartanburgh, Lawson's fork passing within 2 miles of that place.

The drainage-basin of the Pacolett river is mountainous in its upper part, and especially in that part drained by the North fork, which is a real mountain stream, tumbling down a narrow valley, from rock to rock, with a fall of 100 feet or over to the mile. The basin of the South fork, and of the main stream below the junction of the two, is very similar to that of the Tiger, or to that of the Enoree, except that it is more hilly and broken, especially toward the lower part, where there are fewer bottoms than near the foot of the mountains. The rainfall is about the same also. The elevation of the stream at the crossing of the Air-line railroad is 612 feet, and at its mouth about 400 feet; so that the fall between those points is at the rate of about 7 feet to the mile, or about the same as that of the Tiger and the Enoree. The stream is a succession of shoals, and affords considerable water-power; and it has one great advantage over the Tiger and the Enoree, viz, that it is easily accessible from the Air-line and the Spartanburgh and Union railroads.

The first shoal met with in ascending the river is Skull shoal, 4 miles from the mouth, but the fall is only 3 feet or so. It is to be remarked here that the Pacolett and the streams north of it suffer less from the silting up of shoals than the Tiger and the Enoree, perhaps due to the fact that the country is better wooded as the mountains are approached. The next shoal above Skull shoal is Grindall shoal, 14 miles from the mouth, with a fall of about 6 feet, used by a grist-mill. The next is Easterwood shoal, 17 miles from the mouth, mentioned by Mills as having a fall of 6½ feet in six chains; but it has filled up somewhat since his report, and is of no value. The first really important power on the stream is Trough shoal, the most notable fall on the river, 23 miles from its mouth, 12 miles from Spartanburgh, and 2 miles from Pacolett station, on the Spartanburgh and Union railroad. The total length of the shoal is nearly three-fourths of a mile, and the total fall in that distance 60 feet or thereabout, as ascertained by a pocket-level. At the upper end the stream is contracted for a distance of 100 feet or over between two vertical walls of rock to a width of from 10 to 15 feet, the depth being about 16 feet at ordinary stages of the water; but at high water these walls are overflowed, and the whole stream has a width of 200 or 300 feet. The bed of the stream is solid rock or bowlders for the entire length of the shoal, and the fall is distributed as follows, commencing at the head:

Twenty-two feet in 500, including the "trough"; width about 200 feet; banks on the right not bluffy, and favorable for building; on the left not so good.

Five and a half feet in 750, down to where the stream is crossed by a bridge; width, 200 feet. Bank on the right favorable; on the left rocky. This fall extends from the foot of the dam (a wooden wing-dam about 250 feet long and 4 feet high, extending in a broken line out into the stream) to the bridge, the dam supplying power to a saw- and grist-mill and cotton-gin, and having a fall of from 6 to 7 feet.

Five and a half feet in 350; a very steep and rocky bluff on both sides, especially on the right, and very difficult or impossible to canal along it.

Eleven feet in 500, and both banks are very rocky and steep. At the head of this distance a creek enters from the left.

Five and a half feet in 250, both banks being steep and rocky. It includes the narrowest part of the shoal below the trough, the stream being from 100 to 125 feet wide.

Five and a half feet in 750, the bank rocky on the right, except at the center of distance, where the hills recede, and the left bank is high and precipitous at the upper end, but low at the lower end. Width of stream at head, 150 feet; at foot, 200 feet.

Five and a half feet in 300, the right bank being very rocky and steep. This makes a total of about 60 feet.

The accompanying sketch, which makes no pretensions to accuracy, will make the location clearer.

From the above, it is clear that the utilization of the entire fall at one place would be impracticable, except at great expense. At the head, however, a fall of 20 feet could be used very easily, with no dam of importance, and with a favorable site for building on the south side. If the fall below were to be used, it could probably best be done by a dam near the middle of the shoal, and perhaps 15 to 20 feet high, which could be put in without doing any damage by overflowing. A canal one-quarter of a mile long would give a fall of perhaps 30 feet at the foot of the shoal. The drainage area and the estimated power for this place are given in the following table:

Table of power at Trough shoals.

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Rainfall.					Flow per second.	Horse-power available, gross.			Utilized.	
			Spring.	Summer.	Autumn.	Winter.	Year.					Horse-power, net.	Fall.
	Sq. miles.	*Feet.*	*In.*	*In.*	*In.*	*In.*	*In.*	*Cu. ft.*	*1 foot.*	*20 feet.*	*30 feet.*		*Feet.*
Minimum	380	60	15	14	10	16	55	62	7.0	140	210	25±	6
Minimum low season								88	10.0	200	300		
Maximum, with storage								420	47.7	950	1,430		
Low season, dry years								100	11.4	230	350		

This power is one of the best in the vicinity. As before stated, it is used now only by a small grist-mill. Building-stone can be had in the neighborhood, and the railroad is only two miles distant.

One mile above Trough shoals is Brown's mill, where there is said to be a fall of some 14 feet, and two and a half miles beyond is Hammett's mill, said to have a fall of 8 or 10 feet. This is above the mouth of Lawson's fork, and the drainage area is not much greater than that above Clifton. Just below the mouth of Lawson's fork is the Crocker Ford shoal (fall not known). Two and a half miles above it, and above Hammett's mill, is another shoal, at Thompson's ford, with a fall of perhaps 5 or 6 feet; and two miles further up is a third shoal, said to have a fall of about 10 feet. One mile above, and 30 miles from the mouth of the river, is Hurricane shoal, formerly occupied by iron works, but now the site of the Clifton cotton factory. This shoal is 7 miles from Spartanburgh, and only a mile or two from the Air-line railroad. The fall is 22 feet, and the estimated power is as follows:

Table of power at Clifton factory.

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.		Remarks.
	Sq. miles.	*Feet.*	*Cubic feet.*	*1 foot fall.*	*22 feet fall.*	
Minimum	220	22	33	3.7	80	The estimate of drainage area is particularly liable to error in the case of this stream.
Minimum low season			44	5.0	110	
Maximum, with storage			250	28.4	625	
Low season, dry years			53	6.0	130	

According to the estimate, in ordinary years 160 horse-power may be expected in the dry season, and 400 or over for nine months.

Two miles above Clifton is a fall of perhaps 8 feet, not improved, called the Lindner shoal. This is the last shoal on the main stream.

Mills gives the following shoals above the mouth of Lawson's fork: 3 miles from junction, 12 feet in 10 chains (this is probably Hammett's Mill shoal); 2 miles above, 10 feet in 3 chains (this is probably Hammett's upper shoal); a mile above, Hurricane shoal, 16 feet in 40 chains; 5 miles further up, 8 feet in 4 chains (this is perhaps the Lindner shoal). The chain referred to is probably 66 feet.

The South fork has only small saw- or grist-mills, and no large powers so far as could be learned. The North fork has a very large fall in its upper part, and below the mountains is a grist-mill with 12 feet fall, and a cotton factory with 12 feet fall. Both streams are of about the same size, draining about 80 square miles each, and will probably afford at their mouths 2 horse-power per foot fall in the dry season of ordinary years and 5 or 6 horse-power during nine months. The Spartanburgh and Ashville railroad follows the North fork for some miles in the mountains, where the stream is a roaring mountain torrent. There are numerous sites for small mills here, and there is one saw- and grist-mill, with a fall of 34 feet and scarcely any dam, and a race a quarter of a mile long.

Lawson's fork, which enters the Pacolett several miles below Clifton, has a drainage area of about 82 square miles, and will probably give 2 horse-power per foot during the dry season of ordinary years and 6 horse-power during nine months, according to my estimates. There are several falls on it: the first, just below Glendale, of 15 feet or so, not used, giving 90 horse-power most of the time; the second, at Glendale, 6 miles from Spartanburgh, used by the cotton factory of D. E. Converse & Co. The dam is of rock, rebuilt in 1879 at a cost of $1,200, and is 300 feet long

and 4 feet high. The head-race is 700 feet long, and the fall 35 feet, 200 horse-power being utilized by storing the water at night in a natural pond half a mile above, the factory being run 12 hours. The pond above is formed by a natural dam, which crosses the stream. This dam has been blasted through at one place for the gates, through which the water is drawn down during the day. The reservoir is half a mile long, 150 feet wide, and 5 feet deep, and is large enough to store all the water at low-water stage. This natural dam affords a fall of 12 feet in all, which is now unimproved, but would afford one-third the power at Glendale. According to my estimates, the gross power available at Glendale would be 210 horse-power for nine months of an ordinary year for the natural flow of the stream and 70 horse-power for the low season, or 140, with storage, during 12 hours. The shipping-point for Glendale is Spartanburgh.

Above Glendale there are several small grist-mills and one cotton factory on the stream, some with good shoals, but the stream is small.

Thicketty creek, a tributary of Broad river, enters from the west about 6 miles above the mouth of the Pacolett. It drains an area of 100 square miles, and has no large falls, so far as I could learn.

Bullock's creek and King's creek, both from the east, drain about 72 square miles each, and offer no large powers.

Buffalo creek, which rises in North Carolina and joins the Broad in York county, South Carolina, draining an area of 178 square miles, is a tributary of some importance. It has a considerable fall, and is utilized by a number of grist- and saw-mills and one paper-mill. It will probably afford at its mouth about 5½ horse-power per foot fall in the low season of ordinary years, and 15 or over during nine months. The stream is only 15 feet wide at its mouth.

FIRST BROAD RIVER.

This tributary rises in the extreme northern part of Cleaveland and Rutherford counties, North Carolina, and flows south through the former, passing within three miles of Shelby, joining the Broad a mile below Palmer's shoal. It drains an area of 302 square miles, and its fall from the crossing of the projected railroad from Shelby to Rutherfordton is about 105 feet, or at the rate of 8 feet or more per mile. The rainfall is the same as on the Pacolett and Tiger. The width of the stream at its mouth is 90 feet.

The first power on the river is Chambers' grist-mill, with a fall of 9 feet, though 15 feet are said to be available. The stream is almost as large here as at its mouth, and will probably afford 7 or 8 horse-power per foot fall in the low season of dry years, 9 or 10 in the low season of ordinary years, and 20 or 25 for nine months.

Above come two small grist-mills, and then a third (Loutze's), where there is said to be 12 feet fall available. The next important power is at Double shoals, at the cotton factory of E. A. Morgan & Co., a fall of 8 feet and 30 or 40 horse-power being used. It is said that double this amount of fall could be obtained with a canal 400 yards long. The place is some 15 miles from the mouth of the stream, and the drainage area is perhaps three-fifths what it is at the mouth. There are other mills above, and on a tributary (Knob creek) is the cotton factory of Schenck, Ramsour & Co., with 15 feet fall, and about 35 horse-power.

SECOND BROAD RIVER.

This river, the next tributary worth mentioning, rises in McDowell county, and flows through Rutherford county, draining an area of 193 square miles. It is a small stream, only 30 feet wide at its mouth, but there are several good powers on it, viz:

Tumbling shoal, 3 miles from the mouth, not now utilized, is the first, and it is said that a fall of 15 feet could be obtained, with good building-sites, in a distance of 200 yards. The stream would probably give from 4½ to 5 horse-power per foot in low seasons of dry years.

High shoal, one mile above, is said to be the best water-power in Rutherford county. It is not now utilized, but was formerly used for iron works. The fall is stated to be 29 feet in 400 yards, over a solid rock bed, all of which is available, with good building-sites. The stream is about as large as at Tumbling shoal, and will perhaps give 6 horse-power per foot in dry seasons of ordinary years, and perhaps 15 or more during nine months.

The "Burnt factory", 2 miles above, is the next site—a very good one, now used for a saw- and grist-mill, with a crib-dam 300 feet long, 9 or 10 feet high, a race 100 feet long, and a fall of 14 feet, capable of being increased to 16.

Farther up the river are other shoals, but they are of no great consequence, although in its upper parts the fall of the stream is very great.

Shelby is the nearest railroad point to all of the shoals mentioned on the Broad rivers, being 16 miles from High shoal and Tumbling shoal and 8 miles from Double shoals. There are numerous other water-powers in the vicinity on smaller streams; thus on Brushy creek, a tributary of the First Broad, there is within 2 miles of Shelby a fall of 36 feet in 600 yards, not improved, said to be capable of affording 50 horse-power in dry seasons; and on Muddy fork, a tributary to the Buffalo creek, there is an unimproved fall of 20 feet in 100 yards about a mile from its mouth, said to be good for 40 horse-power in dry weather. All these streams have, as a rule, rock beds and good banks, which are not often overflowed. They are subject to heavy but short freshets. The soil in all this region is clay and loam.

The projected railroad to Rutherfordton, the grading for which was done long ago, will pass nearer to some of the powers which have been mentioned; for instance, within 3 miles of High shoal.

GREEN RIVER.

This, the last important tributary of the Broad, rises in the mountains of Henderson county, and flows a little north of east into Polk county, where it joins the Broad. The upper part of its course lies in a narrow valley, not over 4 miles wide for 20 miles from the head of the stream, but below that the basin is much wider. The length of the stream in a straight line is about 36 miles, and its drainage area 198 square miles. It has a rapid fall, and considerable power is available, though very little is used. The bed is rock, and the banks in some places are nearly vertical rock walls, while at others the river winds through fertile bottoms, subject at times, though not extensively, to overflow, these bottoms being specially frequent in the lower part of its course. The stream is very inaccessible, being crossed by only one railroad—the Spartanburgh and Asheville—about 16 miles from its head. The stream is about 75 or 100 feet wide where this road crosses it, and 90 feet wide at its mouth.

I obtained information regarding three shoals on the stream, but on account of the rapid fall there are doubtless other places where power could be obtained by damming. The lowest point is at Green River cove, where there is said to be a considerable fall, not utilized, extending over some distance. This site is some distance from the railroad, and not easily accessible. Pott shoal, which is just below the railroad-crossing, is much more favorable, and is said to be the best site on the river. The falls commence just below the bridge, and continue for some distance, the fall being very rapid, with now and then an abrupt fall of several feet. The bed is solid rock, and the banks generally high; but near the foot of the shoal there is said to be a very good building-site. The shoal takes its name from a number of curiously worn-out holes in the rock forming the bed of the stream, almost circular, and looking very much like large auger holes.

About two miles above the railroad, and therefore not so favorably located as Pott shoal, are the falls of the Green river, the third site above referred to, and the only one I visited in person. The fall is about 30 feet in 100, preceded by rapids for three-eighths of a mile, making a total fall of over 45 feet. The banks are rocky and very steep, so that building facilities are not very good. The drainage area above this place is about 67 square miles, and the available power would perhaps be 1 horse-power or a little over per foot in the low season of dry years, and 3½ or 4 horse-power for nine months of an ordinary year. The building facilities at Pott shoal are said to be much better than at these falls, and the fall is also said to be greater.

THE SALUDA RIVER.

The Saluda is formed on the boundary between Pickens and Greenville counties, South Carolina, by the union of its north, south, and middle forks, whence it flows southeast, forming the boundary-line between Anderson, Abbeville, and Edgefield counties on its right, and Greenville, Laurens, and Newberry counties on its left, and after passing through Lexington county unites with the Broad to form the Congaree. The length of the stream, in a straight line, is about 110 miles, and its drainage area 2,350 square miles. All its important tributaries enter from the north side, viz: Bush river, Little river, and Reedy river. The general character of the Saluda is similar to that of the Enoree river and other tributaries of the Broad. The three forks rise in the mountains, the north fork very near to the North Carolina line and very near to the sources of the Pacolett, and all three are mountain streams. Down as far as the lower border of Anderson county the country is broken, and the banks of the stream are generally high, with few bottoms; below that the country is more open, and there are considerable areas of bottom-land subject to overflow. The facilities for artificial reservoirs are said to be rather poor, as on all the tributaries of the Broad, the fall of the streams being so rapid. The bed is rock, and the banks in places of the same material, and in other places alluvial. The rainfall in the basin is about 51 inches (see p. 121). The following table will show approximately the declivity of the stream:

Place.	Distance from mouth.	Elevation above tide.	Distance between points.	Fall between points.	Fall between points.
	Miles.	*Feet.*	*Miles.*	*Feet.*	*Feet per mile.*
Mouth	0	148			
			60	235	3.9
Crossing of Greenville and Columbia railroad	60	383			
			65	366	5.6
Crossing of Greenville and Columbia railroad	125	749			
			10	60	6.0
Crossing of Atlanta and Charlotte Air-line railroad	135	809			

The stream is accessible from the Greenville and Columbia railroad and from the Air-line railroad, as will be seen from the map.

The water-powers met with in ascending the stream will now be described:

At Beard's falls, 2 miles above Columbia, is the factory of the Saluda Manufacturing Company. The dam is of stone, 900 feet long and 9 feet high, and at the factory the fall is from 14 to 16 feet, the race being 200 feet long. The

power utilized is 150 horse-power, with always a waste of water. According to what has been said regarding the flow of the Saluda, the power at this place is estimated as follows:

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.	
	Sq. miles.	*Feet.*	*Cubic feet.*	*1 foot fall.*	*16 feet fall.*
Minimum	2,350	16	550	62.5	1,000
Minimum low season			700	79.5	1,275
Maximum, with storage			2,100	238.6	3,800
Low season, dry years			825	93.7	1,500

The Saluda river was made navigable many years ago by the state, and three canals were constructed, the lowest one being around Beard's falls. The canal was 2½ miles long, and had 5 locks, with 34 feet lift together, covering the fall of the river between its mouth (where there was a dam across the Broad, in the pool of which the boats were floated over to the Columbia canal) and the head of Lorick's falls, a mile and a half above the Saluda factory. At these falls there is a natural fall in the river of about 6 feet, and their head is 27 feet above the mouth of the river, according to a recent survey, from which it follows that there must have been a dam at the head nearly 10 feet high. The available power at the mouth of the Saluda may therefore be considered as that due to a fall of from 30 to 34 feet, and it is said that the old canal could be put in order without much difficulty.

The next site above Lorick's falls is above the mouth of Twelve-Mile creek, at Dreher's canal, the second state canal, which was a mile long, and had 4 locks, with a total lift of 21 feet.* The canal was on the north side, and the power is used now to run a grist- and saw-mill and a cotton-gin, using falls of less than 10 feet, the only dam existing being a rough stone wing-dam. This is an excellent site, and a fall of 20 feet could probably be rendered available, or 10 feet with a canal only 300 yards long. The place is about 6 miles from Lexington, which is the nearest railroad point. The drainage area above being about 2,200 square miles, the available power may be estimated for 20 feet fall, as in the table on page 121.

Three miles above this there was once, though not now, a mill. The next power is at Wise's ferry, known as Hyler's shoal. The total fall is not known, but a fall of 5 feet is utilized by a grist-mill near the head. Mills gives a fall near Wise's ferry of 17 feet, but whether there is a fall there now I cannot say.

Above that is a small shoal known as Kelly's, and then a shoal at Hiller's ferry, with a mill on each side of the river, using, however, falls of only a few feet. The available fall at this place I am unable to state. Mills mentions several shoals above Wise's ferry, in Lexington county, viz: Hunter's ferry (5½ feet), shoal (3½ feet), Snellgrove's island (9 feet), Manning's island, or Simon's ferry (15 feet, and a little above 15 feet additional), Domick's mill (15 feet); making in all, in Lexington county, a fall in the river of over 135 feet in a distance of perhaps 25 to 30 miles. For want of accurate data I have not tabulated these powers, but it is evident that the river offers a large amount of power in this distance. Above Hiller's ferry the next large fall is said to be at Calk's ferry, probably called Simon's ferry by Mills. There is a mill at this place using a fall of 5 feet, and, according to all that could be learned, the fall is one of the best on this part of the river.

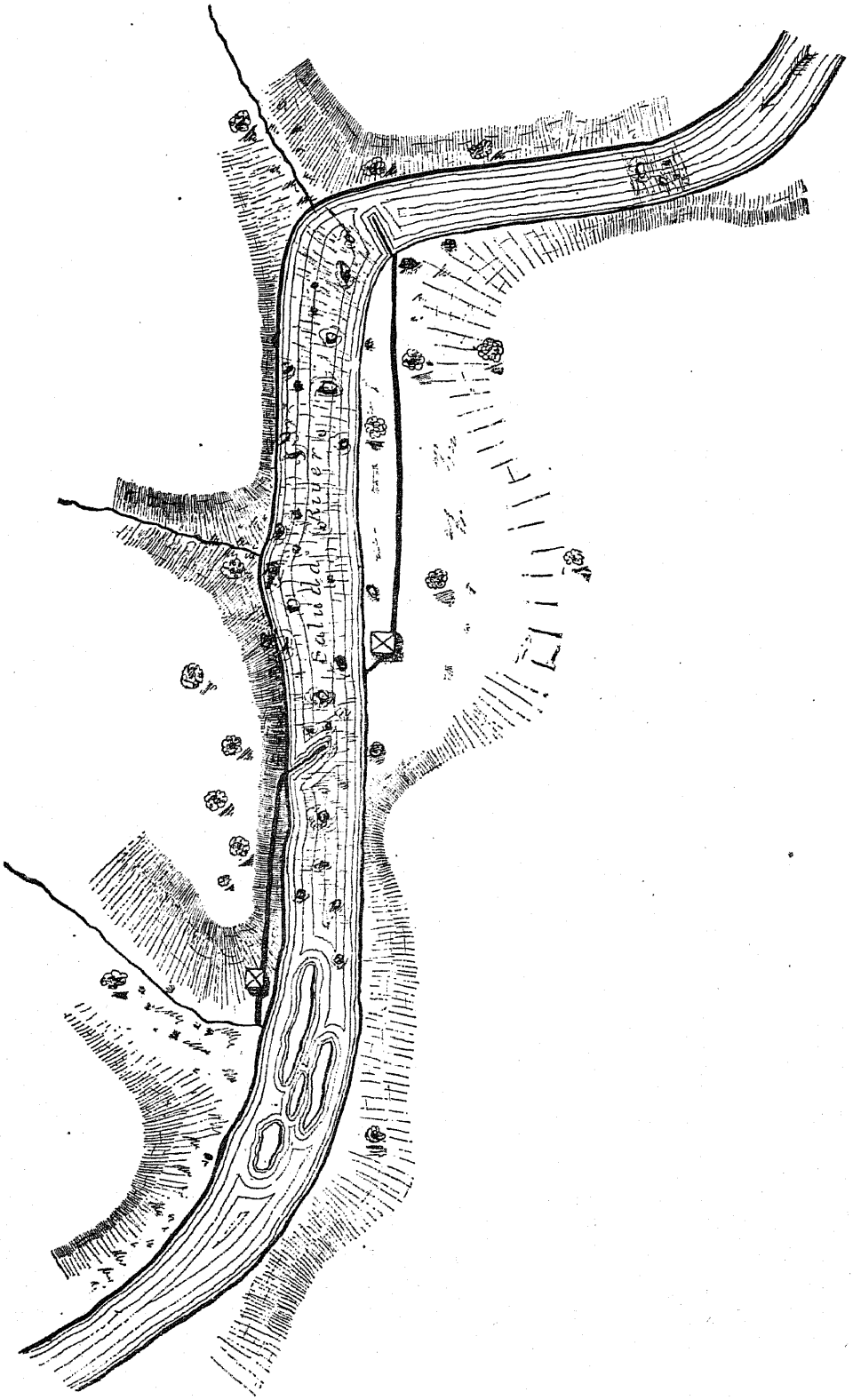
The next site is at McNary's ferry, where there is a mill using a fall of 11 feet, with a dam 4 feet high and a race 100 feet long. It is said to be a fine power, with only a small fraction utilized.

There was formerly a mill a mile or two below the mouth of the Little Saluda, but the next site of importance is 8 miles further up, at Perkins' ford. This shoal is said to be the best in Newberry and Edgefield counties, and is altogether unimproved. The banks are said to be favorable for building, and the fall was variously stated at from 5 to 10 feet in half a mile.

Bauknight's mill, one and a half miles above, is said to be the site of the third canal on the river, which had one lock, with a lift of 6 feet. The canal is on the north side, while the mill is on the other. Above this there are several small shoals and small mills. The river seems to be quite sluggish through this part of its course from Perkins' ford up, and the banks are said to be troublesome, and to wash out often at the dams. The next important power, and the most important on this part of the stream, is at Ware's mill, or the Great falls, above the mouth of Reedy river, and about 12 miles from Hodges, the nearest railroad point. It is shown in the following sketch:

*All statements regarding these canals are from Mills.

Sketch of the Saluda river at the Great falls, South Carolina.



The shoal is a mile long, and the fall is, in all, about 45 feet. At the head is a wing-dam on the left bank, and a race half a mile long gives a fall of 21 feet at Gaines' saw-mill. About 300 yards below the tail-race is a second wing-dam on the right bank, and a race 300 yards long gives a fall of 20 feet at Hart's grist- and saw-mill. The width of the river is about 400 feet opposite Hart's dam, and 200 feet below the shoals. The total fall could not be used at Hart's mill without a very expensive canal around bluffs. It could, however, be used on the left bank, this side being much more favorable. The most convenient location, however, is on the left bank, just below Gaines' mill, and by building a dam where Gaines' wing-dam is now, making it 10 feet high, or sufficient to back up

over a shoal about one-fourth of a mile above, a fall of 35 feet could be utilized with a race half a mile long. The bed of the stream is solid rock, and the facilities for the utilization of power are, in all respects, excellent. This is one of the best powers on the river. It is to be mentioned that a mile below the foot of the shoal is Robertson's shoal, with a fall of 3 or 4 feet, not of value for power.

Three or four miles above Ware's is Mattox's mill, 9 miles below Honea Path. It is not an important power, the fall being said to be only 4 or 5 feet. The next important power is Erwin's mill, a few miles from Honea Path, and at the lower border of Abbeville county. The river is divided by two islands, the total width being about 200 yards. Across one of the arms is a dam 300 feet long and 3 feet high, giving, with a race 150 feet long, a fall of 8 feet, capable of being increased to 10 feet, it is said, by going farther down.

Above Erwin's come several small shoals—Harper's, Kay's, and Gambrell's—not of much consequence, except Harper's, where it is said that a fall of 8 feet could be obtained. The next shoal is opposite Belton, used by Poore & Cox's mills, with a fall of about 8 feet, not capable of being increased, and not of importance for manufacturing. Some distance above is a ledge known as Hamilton Ford shoal, with a fall of 4 feet, which could be increased to 10 feet—a good location, and near the railroad.

Half a mile above is Holland's Ford shoal, with a fall of 7 feet in 300 yards, which is not improved. A canal 200 yards long would be necessary, and would not be expensive. It is one and a quarter miles from the railroad, and the amount of water is about the same as at Piedmont (see beyond). A dam could be built 8 feet high, giving a fall of 15 feet. Half a mile farther up is Blackburn Island shoal, not improved, with a fall of 6 feet in 100 yards, not capable of being increased to above 10 feet without backing over the shoals above. A canal would be difficult to build on account of a high rock bluff. Three-fourths of a mile above are the Tripp shoals, not improved, with a fall of 8 feet in 300 yards, capable of being increased to 16 feet without backing up to more than within 5 feet of the fall above. The shoal is of solid rock, and a canal would not be difficult. The place is a favorable one, situated one and a half miles from Williamston, on the railroad.

One mile above, at Wilson's ferry, the Pelzer Manufacturing Company is putting up a cotton factory. The dam is of granite, in cement, 250 feet long and 15 feet high, with a race of 200 feet, and a fall used of 21 feet at low water. The mill is building for 13,000 spindles, and is expected to be in operation by December 1, 1881. The site is a very favorable one, one and a half miles from Williamston, on the railroad, and half a mile from the nearest railroad point, from which a siding is to be run.

Six miles above is the factory of the Piedmont Manufacturing Company, but between this and the Pelzer mill is the Allen shoal, not used, with a natural fall of 14 feet in 250 yards, capable of being increased to 18 feet without interfering with the Piedmont factory. It is the most imposing fall on this part of the river, and is in all respects a very fine site. Bed and banks are favorable, and the place is located only a quarter of a mile from the railroad.

The Piedmont factory, one of the most important cotton-mills of the state, is 2 miles above the Allen shoal. The dam is of wood and stone, built in a curve on a solid rock foundation, and is 270 feet long and 7½ feet high. It was first built in 1873, and raised in 1879. A head-race 250 feet long, cut through stone, gives a fall of 16 feet at the wheel. The power used is stated at 500 horse-power, which it is said can be obtained during eleven months, and 400 during the remaining month. In addition to this, about 20 horse-power is used by a saw- and grist-mill, with a fall of 10 feet. The capacity of this factory is at present being increased, and it is intended to use 800 horse-power, which it is expected to obtain during eleven months, and 700 the other month; the fall is at the same time increased to 20 feet by raising the dam to a height of 11½ feet. No steam-power is used. It is to be remarked that here, as well as at all the other sites on this part of the Saluda, the conformation of the banks is such that large ponds are not formed, and the natural flow of the stream is all that can be utilized. When the mills are not running water flows over the dam.

The drainage area of the stream above Piedmont was measured from the map and found to be about 380 square miles. The rainfall is 56 inches. Reasoning by analogy, I would therefore estimate the power as follows:

State of flow (see pages 18 to 21).	Drainage area.	Fall.	Flow per second.	Horse-power available, gross.	
	Sq. miles.	*Feet.*	*Cubic feet.*	1 *foot fall.*	20 *feet fall.*
Minimum	380	20	70	8.0	160
Minimum low season			105	12.0	240
Maximum, with storage			425	48.3	970
Low season, dry years			125	14.2	284

I have made these estimates larger than those for Mountain shoal on the Enoree, and others in the neighborhood, because the Saluda extends farther into the mountains, and the rainfall is greater. I have even made them large in proportion to the other estimates for the Saluda, and the latter estimates may be, in fact, too small.*

*Since the above was written, I have observed that in the statistics of cotton-mills for the state of South Carolina, according to the present census, the power used at the Piedmont factory is stated at 320 horse-power.

According to the above table, in the low season of ordinary years about 350 horse-power could be depended upon, and probably 800 to 1,000 during nine months. The Piedmont factory has been nominally using over 400 horse-power at all times. I incline to think that the power actually used is hardly so large, but the result must once more show that the estimates of power given, although as accurate as I am able to make them with the data at hand, must be taken as approximations only.

Above Piedmont is a small shoal, where there was once a grist-mill; but the fall is only 4 or 5 feet, and it is of no importance.

The next is the Blasingame shoal, 5 miles from Greenville. It is said to have considerable fall, but to be hard to develop.

Harrison shoal, 6 miles from Greenville, which has never been used, is the next. It is said to have a small fall, and to be of no importance for manufacturing.

The last shoal on the main stream is at Farr's mills, also 6 miles from Greenville. It is utilized by a saw- and grist-mill, with a fall of 7 feet, using only 20 or 30 horse-power probably. The dam is of wood and stone, 300 feet long and 5 feet high, and the head-race is 200 feet long. It is said that the fall could be increased to some extent.

Summary of power on the Saluda river.

Locality.	Distance from mouth.	Drainage area.	Rainfall.					Total fall.		Horse-power available, gross.*				Utilized.		Percentage of minimum utilized.	Remarks.
			Spring.	Summer.	Autumn.	Winter.	Year.	Height.	Length.	Minimum.	Minimum low season.	Maximum, with storage.	Low season, dry years.	Horse-power, net.	Fall.		
	Miles.	*Sq. miles.*	*In.*	*In.*	*In.*	*In.*	*In.*	*Feet.*							*Feet.*		
Saluda factory	1.0	2,350	13	13	9	16	51	16	.....	1,000	1,275	3,800	1,500	150	16	20	Dam, 9 feet.
Mouth of Saluda	2.5	2,350	13	13	9	16	51	34	2.5 miles.	2,100	2,700	8,100	3,200	150	16	10	
Dreher's canal	10.0	2,200	14	13	10	16	53	20	1 mile...	1,150	1,500	4,400	1,750	50—	3-9	5—	
Hyler's shoal	14.0	2,200	14	14	10	16	54	17 (?)	.....	.....	.....	.....	.....	15	5	.....	
Kelly's shoal	.....	.....	...	...	...	...	...	5–6 (?)	.....	.....	.....	.....	.....	0	0	0	
Heller's ferry	.....	.....	...	...	...	...	...	9 (?)	.....	.....	.....	.....	.....	50—	.....	.....	
Calk's ferry	.....	.....	...	...	...	...	...	30 (?)	.....	.....	.....	.....	.....	30—	5	.....	
McNary's ferry	.....	.....	...	...	...	...	...	15 (?)	.....	.....	.....	.....	.....	.....	11	.....	
Summers' mill	.....	.....	...	...	...	...	...	.....	.....	.....	.....	.....	.....	0	0	0	
Perkins' ford	.....	.....	...	...	...	...	...	5–10 (?)	.....	.....	.....	.....	.....	0	0	0	
Bauknight's mill	.....	.....	...	...	...	...	...	6	.....	.....	.....	.....	.....	Small.	Small.	.....	
Great falls	65±	635	15	14	10	16	55	55	1.25 mile	800	1,000	4,000	1,200	50—	39	5	
Mattox's mill	69±	600	...	...	...	...	...	4–5	.....	60±	75±	300±	90±	.....	.....	.....	
Erwin's mill	.....	523	...	...	...	...	...	8–10	.....	120±	150±	600±	175±	.....	.....	.....	
Harper's shoal	.....	.....	...	...	...	...	...	8–10 (?)	.....	.....	.....	.....	.....	0	0	0	
Poore & Cox's mill	.....	.....	...	...	...	...	...	8	.....	.....	.....	.....	.....	.....	.....	.....	
Hamilton ford shoal	.....	.....	...	...	...	...	...	†4	.....	.....	.....	.....	.....	0	0	0	
Holland's ford shoal	.....	.....	...	...	...	...	...	†7	900 feet	.....	.....	.....	.....	0	0	0	
Blackburn's Island shoal	.....	.....	...	...	...	...	...	†6	300 feet	.....	.....	.....	.....	0	0	0	
Tripp shoal	.....	.....	...	...	...	...	...	†8	900 feet	.....	.....	.....	.....	0	0	0	
Pelzer Manufacturing Company.	.....	400	15	14	10	16	55	21	.....	.....	.....	.....	.....	(‡)	(‡)	(‡)	Dam, 15 feet.
Allen shoal	.....	400	...	...	...	...	...	†14	600 feet	.....	.....	.....	.....	0	0	0	
Piedmont Manufacturing Company.	.....	380	...	...	...	...	...	20	.....	160	240	970	284	(?)	20	(?)	Dam, 11.5 feet.
Small shoal	.....	.....	...	...	...	...	...	4–5	.....	.....	.....	.....	.....	0	0	0	
Blasingame shoal	.....	.....	...	...	...	...	...	.....	.....	.....	.....	.....	.....	0	0	0	
Harrison shoal	.....	.....	...	...	...	...	...	.....	.....	.....	.....	.....	.....	0		0	
Farr's mills	.....	275	...	...	...	...	...	.....	.....	.....	.....	.....	.....	20–30	7	.....	Dam, 5 feet.

*See pages 18 to 21. †Without dam. ‡Not yet running.

TRIBUTARIES OF THE SALUDA RIVER.

Twelve-Mile creek is the first stream worth mentioning in this connection. It enters the Saluda from the south a few miles above the Saluda factory, and drains an area of 93 square miles, entirely in Lexington county. It is to some extent a sand-hill stream, not very variable in flow, and it is utilized for a number of saw- and grist-mills, with falls of from 7 to 12 feet. The stream is said by those acquainted with it to afford near its mouth about 5 horse-power per foot most of the time. It flows by the town of Lexington, in the neighborhood of which there are two sites not utilized, said to be the only ones of any importance on the stream. Close by the town is a grist-mill, with a fall of 10 or 12 feet, and just below it is a fall of about 14 feet in half a mile. Just above the mill is the site of the old Laurel Fall factory, now used by a grist-mill, which, however, only utilizes a small part of the power. The first site referred to is a good one, and could be combined with the one occupied by the mill, giving a total fall of between 20 and 30 feet. The stream here is not over half as large as it is at its mouth.

Little Saluda creek, from the south, is the next tributary of note. It drains about 297 square miles, and joins the main stream at Wise's ferry. Its water-power, however, is not of much importance, and its flow is quite variable. There are a few small grist-mills on the stream and its tributaries, but it is not favorable for power.

Bush river, which rises in Laurens county, and enters the Saluda just below Perkins' ford, in Newberry county, drains an area of 105 square miles, and has considerable fall and some sites not used, but the powers are all small. The stream is quite variable in flow, and the mills have to stop in summer.

Little river, which rises in Laurens county and flows nearly parallel to Bush river, drains about 220 square miles, but is sluggish, and has no power of importance.

The only other tributary below the forks worth mentioning is Reedy river, which rises in Greenville county, flows southeast into Laurens, and enters the Saluda several miles below the Great falls, after draining an area of about 386 square miles. The length of the stream, measured in a straight line, is about 50 miles, and it receives one tributary worth mentioning, Reaburn's creek, which drains 105 square miles. The river flows through the town of Greenville, and offers a large amount of power, being shoaly for its entire length. The map shows the form and dimensions of the drainage-basin. The rainfall is about 53 inches on the entire basin: 15 in spring, 13 in summer, 9 in autumn, and 16 in winter. The fall of the stream is considerable, and much greater than that of the Saluda, its elevation at Greenville, at the crossing of the Air-line railroad, being 929 feet, while that of the Saluda is 809 feet, and that of the Enoree 842 feet, at the points where the same road crosses them. The bed of the stream is rocky, and the banks in some places high and rocky, and in others low and alluvial. It is said that the bottoms on the Reedy river are more extensive than on the Saluda above the junction of the two, but the fall of the stream is so rapid that they are not often overflowed. The stream is not very accessible in some parts, the nearest railroad points being Greenville and Laurens, as will be seen from the map.

The shoals and mills on the streams are as follows, in their order ascending:

Washington's mill, grist and flour, with a small fall of 4½ feet or so. I would estimate the flow and power of the stream at its mouth as in the following table:

State of flow (see pages 18 to 21).	Drainage area.	Flow per second.	Horse-power, gross.
	Sq. miles.	*Cubic feet.*	*Per foot.*
Minimum	386	62	7.0
Minimum low season		82	9.4
Maximum, with storage		400	45.4
Low season, dry years		97	11.0

This mill, however, is probably above the mouth of Reaburn's creek, which enters Reedy river about 3 miles above its mouth, so that the stream is considerably smaller than at its mouth.

Next comes a grist-mill with 5½ feet fall; then a shoal not used, said to have a fall of about the same amount; then Boyd's shoal, used by a grist- and saw-mill with about 8 feet fall; then a long shoal, 2 or 3 miles long, not improved, said to be a good site, and once used by a small mill.

Then comes Tumbling shoal, about 16 miles from the mouth of the stream, 12 miles from Laurens, and 27 miles below Greenville. The shoal is short, and the fall amounts to 10 feet in 75. Here is a grist-mill using a fall of 10 feet and about 50 horse-power. The drainage area above the place is about 198 square miles, and I would estimate the gross power at about 34 horse-power (minimum), 45 horse-power (minimum low season), 53 horse-power (low season, dry years), and 60 to 70 horse-power during the low season of ordinary years. There is little storage during the night. The present mill uses all the power in dry seasons.

The next shoal is Cedar falls, though below it there used to be a tannery and grist-mill using a small fall. The fall at Cedar falls was stated at about 20 feet, of which 14 or 16 feet are used by a grist- and saw-mill and a cotton factory. The power used I do not know. There is no dam at all, and the mills are on both sides of the stream. The drainage area above this place is about 150 square miles.

One mile above it is Fork shoal, at the mouth of Reedy Fork creek, and about 16 miles from Greenville. There is a dam across both streams; that across the creek is 110 feet by 3, ponds over 10 acres, and at one end of it is situated the cotton-mill, using 20 feet fall and 40 horse-power, which can be obtained during about ten months, there being no waste in summer, except at night; that across the river is 125 feet by 2, and at one end of it is the grist-mill, with a fall of 7 feet, and using about 25 horse-power. The drainage area above this shoal is about 140 square miles.

It will be sufficient to mention simply the other shoals and mills, with one or two exceptions:

Harrison's grist-mill, about 10 feet fall.

Houff's mill (grist and saw), 10 feet fall.

Log shoal, 14 feet fall, with a 2-foot dam; used by a saw- and grist-mill.

Ashmore's grist-mill, 10 feet fall.

Linderman shoal, not used; small fall.

Reedy River Manufacturing Company, one and a half miles above. The dam is of wood, 225 by 5 feet, the fall 22 feet, and 125 horse-power is used during ten months and 100 horse-power the rest of the time. The drainage area is 87 square miles, and I would therefore estimate the power at about the same as on the Enoree at Pelham (see page 111).

Jones' paper-mill and saw-mill, 11½ feet fall; 50 horse-power during twelve months.

Parkins' grist-mill, 11 feet fall; said to be capable of increase by raising the dam.

Greene shoal, not used; very small—valueless.

Saw-mill shoal, not used; 8 or 9 feet fall.

Camperdown mills, at Greenville. The fall here is the most important on the stream, amounting to 64 feet in 500 yards, over a layer of gneiss-rock. The fall is used in two parts. The upper part is used on the left bank by Camperdown mill No. 2, and on the right bank by a machine-shop and box-factory, both using a fall of 32 feet. The dam is of timber bolted to the rock, 60 feet long and 3 feet high, making scarcely any pond; the race is 325 feet long, and the power used about 245 horse-power, which, however, can only be obtained for six months of the year. The factory uses 225 horse-power. The lower fall of 32 feet is used on the right bank by the Camperdown mill No. 1, with a triangular wooden frame dam 105 feet long and 14 feet high, bolted to the rock and planked over, and built in 1875 at a cost of $1,000. It ponds the water up to the tail-race of the upper factory, about 300 yards, and the head-race is 165 feet long. The power used is 160 horse-power, which can be obtained nine months of the year. This mill uses steam-power in dry seasons to the extent of 160 horse-power, while the upper mill uses up to 200 horse-power steam, the machine-shop using none.

Just above the upper mill is Cox & Markley's carriage factory, using about 12 horse-power, with a fall of 8 feet and a 4-foot dam, and utilizing all the water during the day-time in dry weather. The ponds are not large enough to store the water during the night, but just above the railroad crossing in Greenville there is said to be a good site for a storage-reservoir, where a 14-foot dam would flow 800 to 1,000 acres, allowing the power at the mills below to be increased to a considerable extent.

The drainage area of the stream above Greenville is only 44 square miles, and there are no falls above. It is evident that for such a small stream the Reedy river offers a large amount of power, which is well utilized. There are shoals on some of its tributaries, but the powers are small. Laurel creek, which comes in above Ashmore's, has a shoal not used; and Reaburn's creek, a large stream, has one good shoal about nine miles from Laurens, with a fall of 26 feet over a solid rock ledge, used by Goodgion's grist- and saw-mills. Less than a mile above, on the same stream, is the old Fuller factory-site, now used by a saw- and grist-mill, with a fall of 14 feet.

It remains to say a few words about the three forks of the Saluda.

The North fork drains an area of about 56 square miles, and is a mountain stream, like the north fork of the Pacolett, with a rapid fall, but small volume of water. It has at one place a perpendicular fall, over a gneiss ledge, of between 200 and 300 feet, and at another place a similar fall not quite so high. The stream unites with the Middle fork, which drains 66 square miles, and below the junction, about 13 miles from Greenville, there is one grist-mill, with a fall of 9 feet over a rock shoal. A mile below is a shoal not used, with 12 feet fall; and there are doubtless numerous other places where power could be obtained. On the Middle fork itself there is one grist-mill, 16 miles from Greenville, with a fall of 18 feet, which could probably be increased by raising the dam. It is said to be an excellent small power. The dam is 5 feet high, 200 feet long, and the head-race is of the same length. The mill is not in use at present, and the dam is out of repair. This site is situated about a mile above the junction of the two forks.

The South fork has a very rapid fall, and numerous shoals which might be utilized, but with small volume of water and inaccessible locations. All the headwaters abound in cataracts and precipitous falls, many of several hundred feet almost vertical. The drainage area of this fork is 78 square miles or thereabout.

Finally, the large amount of space which it has been necessary to devote to the Santee river and its tributaries shows that the drainage-basin abounds in the finest kind of water-powers. It would be difficult to select another stream of equal drainage area which can offer so large a number of excellent powers, from the smallest to the largest. From the great falls of the Catawba, with a fall of 173 feet, to the numberless fine small powers on the smaller streams in western South Carolina, the range is large, and offers powers of all scales of magnitude; and as the manufacturing interest in the South develops, there is no doubt that many of the fine powers now lying idle will be turned to account. Hand in hand with this development will go the construction of railroads, until the southern streams become, like many of the northern ones, a succession of mill-ponds, with all kinds of manufactures on their banks, and the country becomes threaded with a network of railroads and studded with factory villages.

Table of utilized power on the Santee river and tributaries.

Name of stream.	Tributary to what.	State.	County.	Kind of mill.	Number of mills.	Total fall used.	Total horse-power used, net.
						Feet.	
Santee	Atlantic	South Carolina			0	0.0	0
Tributaries below forks	Santee	do			0	0.0	0
Wateree (Catawba)	do	do	Kershaw	Flour and grist	1	7.0	20
Do	do	do	Chester	do	1	18.0	25
Do	do	do	Lancaster	do	1	4.0	20
Do	do	do	York	do	4	30.0	86
Do	do	North Carolina	Mecklenburg	do	3	11.0	55
Do	do	do	Gaston	do	2	19.0	30
Do	do	do	do	Saw	1	9.0	13
Do	do	do	do	Cotton factory	1	22.0	195
Do	do	do	Iredell	Flour and grist	1	15.0	15
Do	do	do	do	Saw	2	32.0	40
Do	do	do	Catawba	Flour and grist	1	6.0	16
Do	do	do	do	Cotton factory	2	12.5	80
Do	do	do	Alexander	Flour and grist	1	3.0	6
Do	do	do	Caldwell	do	1	9.0	20
Do	do	do	do	Saw	2	21.0	30
Do	do	do	do	Carriage and wagon factory	1	9.0	10
Do	do	do	Burke	Saw	3	39.0	56
Do	do	do	McDowell	Flour and grist	2	23.0	32
Tributaries to	Wateree	South Carolina	Sumter	do	8	45+	74
Do	do	do	do	Saw	2	13.0	25
Do	do	do	Kershaw	Flour and grist	12	89+	170
Do	do	do	do	Saw	3	29.0	70
Do	do	do	Fairfield	Flour and grist	2	33.0	16
Do	Catawba	do	Chester	do	9	116+	172
Do	do	do	do	Saw	1	18.0	7
Do	do	do	do	Cotton factory	2	39.5	.....
Do	do	do	Lancaster	Flour and grist	5	46+	85
Do	do	do	York	do	14	189.5	304
Do	do	do	do	Saw	6	66.0	180
Do	do	do	do	Cotton-gin	1	16.0	12
Do	do	North Carolina	Mecklenburg	Flour and grist	14	194.0	206
Do	do	do	do	Saw	8	114.0	78
South fork Catawba	do	do	Gaston	Cotton factory	5	64.0	425
Do	do	do	do	Flour and grist	5	61.0	64
Do	do	do	do	Saw	2	17.0	20
Do	do	do	Lincoln	Paper	2	21.0	270
Do	do	do	do	Chair factory	1	8.0	50
Do	do	do	do	Flour and grist	2	10.0	60
Do	do	do	do	Cotton factory	1	6.5	50
Do	do	do	Catawba	Flour and grist	3	52.0	37
Do	do	do	do	Saw	3	30.0	34
Tributaries to	South fork Catawba	do	Gaston	Flour and grist	8	128.0	122
Do	do	do	do	Saw	4	68.0	100
Do	do	do	Lincoln	Flour and grist	8	131.5	113
Do	do	do	do	Saw	3	32.0	35
Do	do	do	do	Cotton-gin	5	48.0	44
Do	do	do	do	Leather works	3	52.0	28
Do	do	do	do	Millwrighting	1	18.0	15
Do	do	do	Catawba	Flour and grist	4	60.0	47
Do	do	do	do	Woolen	1	8.0	8
Do	do	do	do	Iron casting, etc.	1	10.0	20
Do	do	do	do	Blomaries and forges	1	.....	30
Do	Catawba	do	Gaston	Cotton factory	1	8.0	50
Do	do	do	do	Flour and grist	3	40.0	34
Do	do	do	do	Saw	2	28.0	19
Do	do	do	do	Cotton-gin	1	20.0	10
Do	do	do	Lincoln	Flour and grist	6	71.5	60
Do	do	do	do	Saw	4	36.0	33
Do	do	do	do	Blomaries and forges	1	13.0	40
Do	do	do	do	Woolen	1	.....	12
Do	do	do	Catawba	Flour and grist	7	125.0	110
Do	do	do	do	Saw	3	34.0	30
Do	do	do	do	Blomaries and forges	1	12.0	20
Do	do	do	do	Miscellaneous	3	45.0	23

Table of utilized power on the Santee river and tributaries—Continued.

Name of stream.	Tributary to what.	State.	County.	Kind of mill.	Number of mills.	Total fall used.	Total horse-power used, net.
						Feet.	
Tributaries to	Catawba	North Carolina	Alexander	Flour and grist	10	115.0	153
Do	do	do	do	Saw	4	58.0	62
Do	do	do	do	Cotton factory	1	12.0	20
Do	do	do	Caldwell	Flour and grist	13	250.0	157
Do	do	do	do	Saw	7	104.0	155
Do	do	do	do	Woolen	1	6.0	.....
Do	do	do	Burke	Flour and grist	13	213+	255
Do	do	do	do	Saw	4	60+	55
Do	do	do	do	Woolen	2	16 0	28
Do	do	do	McDowell	Flour and grist	9	133.0	92
Do	do	do	do	Woolen	2	16+	20
Congaree	Santee	South Carolina	Richland	Flour and grist	2	21.0	70
Do	do	do	do	Water-works	1	12.0	40
Tributaries of	Congaree	do	do	Flour and grist	8	77.0	77
Do	do	do	do	Saw	3	32 0	35
Do	do	do	Lexington	Flour and grist	5	41.0	57
Do	do	do	do	Saw	6	52.0	55
Do	do	do	do	Cotton-gin	1	4.0	10
Do	do	do	do	Cotton factory	1	12.0	40
Broad river	do	do	do	Flour and grist	3	23.0	70
Do	do	do	do	Saw	1	10.0	10
Do	do	do	Fairfield	Flour and grist	1	15.0	30
Do	do	do	Chester	do	1	8.0	15
Do	do	do	Union	do	2	25.0	40
Do	do	North Carolina	Cleaveland	do	2	16.0	22
Do	do	do	Rutherford	do	2	38.0	24
Do	do	do	do	Saw	1	20.0	15
Enoree river	Broad	South Carolina	Newberry	Flour and grist	1	4.5	15
Do	do	do	Union	do	1	3.0	8
Do	do	do	Spartanburgh	do	3	40.0	42
Do	do	do	Laurens	do	6	78.0	123
Do	do	do	do	Saw	2	25.0	30
Do	do	do	Greenville	Cotton-gin	2	21.0	11
Do	do	do	do	Saw	1	20.0	20
Do	do	do	do	Flour and grist	5	79.0	67
Do	do	do	do	Cotton factory	1	18.0	60
Do	do	do	do	Woolen	1	15.0	8
Tributaries of	Enoree	do	Newberry	Flour and grist	1	9.0	16
Do	do	do	Laurens	do	4	63.0	56
Do	do	do	Greenville	do	7	122,0	70
Do	do	do	do	Cotton-gin	7	106.0	50
Do	do	do	do	Cotton factory	1	48.0	48
Tiger river	Broad	do	Spartanburgh	Flour and grist	5	80.0	73
Do	do	do	do	Saw	1	9.0	18
Do	do	do	do	Cotton-gin	4	60.0	32
Tributaries of	Tiger	do	do	do	4	70.0	38
Do	do	do	do	Flour and grist	16	294.0	198
Do	do	do	do	Saw	7	105.0	74
Do	do	do	do	Cotton factory	1	17.0	35
Do	do	do	Union	Flour and grist	3	58.0	24
Do	do	do	do	Saw	1	6.0	8
Do	do	do	Greenville	Flour and grist	1	25.0	18
Do	do	do	do	do	6	95.0	80
Pacolett river	Broad	do	Union	Flour and grist	3	16.0	28
Do	do	do	do	Saw	1	4.0	10
Do	do	do	Spartanburgh	Flour and grist	1	10.0	15
Do	do	do	do	Saw	2	18,0	44
Do	do	do	do	Cotton factory*	1	.....	.....
Do	do	do	do	Woolen	1	11.0	4
Tributaries of	Pacolett	do	do	Flour and grist	9	136.0	165
Do	do	do	do	Saw	10	133.0	145
Do	do	do	do	Cotton-gin	5	75.0	60
Do	do	do	do	Leather	1	18.0	10
Do	do	do	do	Cotton factory	3	.....	280
Do	do	do	do	Woolen	2	20+	20
Do	do	do	Greenville	Flour and grist	2	33.0	28

*Being built.

Table of utilized power on the Santee river and tributaries—Continued.

Name of stream.	Tributary to what.	State.	County.	Kind of mill.	Number of mills.	Total fall used.	Total horse-power used, net.
						Feet.	
Other tributaries of	Broad	South Carolina	Lexington	Flour and grist	2	12+	25
Do	do	do	Newberry	do	1	18.0	11
Do	do	do	Union	do	5	60.0	79
Do	do	do	Fairfield	do	2	19.0	16
Do	do	do	do	Saw	1	11.0	25
Do	do	do	Chester	Flour and grist	3	79.0	75
Do	do	do	York	do	14	207.0	204
Do	do	do	do	Saw	3	.....	49
Tributaries of	do	North Carolina	Cleaveland	Flour and grist	16	240.0	220
Do	do	do	do	Saw	10	179.0	147
Do	do	do	do	Cotton-gin	1	.....	.....
Do	do	do	do	Paper	1	16.0	75
Do	do	do	do	Cotton factory	2	23.0	70
Do	do	do	Polk	Flour and grist	1	23.0	35
Do	do	do	do	Saw	1	22.0	34
Do	do	do	Rutherford	Flour and grist	18	254.0	277
Do	do	do	do	Saw	4	.....	45
Do	do	do	do	Woolen	1	12.0	4
Do	do	do	do	Leather	1	50.0	40
Do	do	do	do	Cotton-gin	1	12.0	20
Do	do	do	McDowell	Flour and grist	4	51.0	51
Saluda	Congaree	South Carolina	Lexington	do	5	21.0	62
Do	do	do	do	Cotton factory	1	16.0	150
Do	do	do	Greenville	Flour and grist	4	48.0	62
Do	do	do	do	Cotton factory	1	20.0	800?
Do	do	do	Edgefield	Flour and grist	3	7+	34
Do	do	do	Abbeville	do	5	42.0	160
Do	do	do	do	Saw	1	.....	10
Do	do	do	Anderson	Flour and grist	2	.....	42
Do	do	do	do	Saw	1	9.0	8
Do	do	do	Pickens	Flour and grist	1	8.0	18
Do	do	do	do	Cotton-gin	1	6.0	10
Reedy river	Saluda	do	Laurens	Flour and grist	7	79.0	136
Do	do	do	do	Saw	2	18.0	35
Do	do	do	Greenville	Cotton factory	3	86.0	510
Do	do	do	do	Wagon factory	1	6.5	8
Do	do	do	do	Box factory	1	32.0	20
Do	do	do	do	Blacksmithing	1	6.0	6
Do	do	do	do	Paper	1	11.5	.....
Reedy and tributaries	do	do	do	Flour and grist	20	359.0	249
Do	do	do	do	Cotton factory	1	20.0	40
Do	do	do	do	Woolen	1	26.0	.....
Do	do	do	do	Saw	4	61.0	58
Do	do	do	do	Cotton-gin	3	56.0	75
Do	do	do	do	Leather	1	14.0	6
Do	do	do	do	Saw	8	214.0	111
Do	do	do	do	Cotton-gin	5	60.0	31
Tributaries of	Reedy	do	Laurens	Flour and grist	3	57.0	18
Do	do	do	do	Saw	2	34.0	19
Do	do	do	do	Woolen	1	26.0	8
Do	Saluda	do	Lexington	Flour and grist	6	39.0	51
Do	do	do	do	Saw	4	30.0	70
Do	do	do	do	Brick and tile	1	8.0	8
Do	do	do	Newberry	Flour and grist	8	81.0	77
Do	do	do	do	Saw	1	8.0	15
Do	do	do	do	Cotton-gin	4	25.0	24
Do	do	do	Laurens	Flour and grist	3	30.0	45
Do	do	do	Greenville	do	6	.....	60
Do	do	do	Edgefield	do	5	25+	80
Do	do	do	Abbeville	do	2	44.0	20
Do	do	do	Anderson	do	4	55.0	58
Do	do	do	do	Saw	2	27.0	18
Do	do	do	Pickens	Flour and grist	11	200.0	62
Do	do	do	do	Saw	5	75.0	72
Do	do	do	do	Cotton-gin	10	190.0	100
Do	do	do	do	Woolen	2	26.0	26