

RIVER AVON has its rise near Tetbury on the borders of Wiltshire, and Gloucestershire, passes Malmesbury, Chippenham, and Bradford, where, besides other tributaries, it receives the Frome from the south; it flows by the north of Bath and Keynsham, receiving at the latter town the Chew from the south-west, and dividing the counties of Somerset and Gloucester, arrives at the city and port of Bristol. Here the river passes through an artificial cut south of its original bed, which was converted into a floating harbour; it resumes its old channel at the Hotwells, running between the steep cliff of St. Vincent's rock, and with one sharp bend near Shirehampton, joins the Severn $1\frac{1}{2}$ miles above Portishead, the total length from its source to Bristol being 74 miles. From the entrance of Cumberland dock to the mouth of the river the distance is $6\frac{1}{2}$ miles. The course was formerly round eastward of Dumball island, but that channel no longer exists, and the present outlet is now the shorter one westward of it, where between the points at high water it is less than a third of a mile in width, and at low-water the depth is from a quarter to half a fathom. From the entrance to Pill there is a channel depth at high-water ordinary springs of 40 feet, and at neaps 31 feet, decreasing to 33 feet at Cumberland basin entrance, and to Bathurst basin 22 feet; beyond which the Avon is navigable for barges to Noctham dam, $2\frac{1}{2}$ miles, the tide flowing to Hanham mills, 5 miles above the basin.

BRISTOL.—The city of Bristol, situated upon the right bank of the Avon, is bounded on either side by Gloucestershire and Somersetshire, and is of ancient date and importance. It stands on very irregular ground, Brandon hill elevated 259 feet; Clifton, a western suburb, above 300 feet. The river or New cut is crossed by one railway and three road bridges, including the suspension bridge across the St. Vincent rocks at Clifton, the span of which is 637 feet, and the roadway elevated 545 feet above high water; this remarkable structure was opened in 1864.

Harbour and Dock Accommodation.—As before mentioned the ancient bed of the river was converted into a floating harbour, which included also a portion of the Frome, which enters the city from the north-east; it is supplied by water from the river Avon by a canal or feeder above the dam at Noctham, and was opened for shipping in 1809. The New or compensating cut extends from Marsh bridge to the Rownham ferry, near the Hotwells, a distance of 2 miles, and where the river is 200 feet in width. The floating harbour is very circuitous, is crossed by several bridges, and about the centre is connected with the cut by the Bathurst basin. The public and private quay accommodation is very extensive, amounting to 9,000 feet of the first and 14,000 feet of the latter. There is in the harbour a patent slip for small vessels, five graving docks, and besides the Cumberland basin, a small floating dock at the north

side of the west end of the harbour. The principal dimensions are as follows :—

Name.	Year opened.	Length in Feet.	Breadth in Feet.	Area.	Depth in Feet.	Depth over Sill.	
						Springs.	Neaps.
Cumberland basin -	1809	635	300	A. R. P. 4 2 0	28	—	—
Junction lock -	1871	350	60	—	—	35	19
Sea locks -	—	266	54	—	—	32	16
	—	350	62	—	—	35	19
Floating harbour -	—	5,400	255	63 2 0	23 to 6 ft. in the feeder.	—	—
Bathurst basin -	—	430	210	2 0 0	18	—	—
Lock -	—	155	36½	—	—	23	7
Floating dock -	—	—	—	2 0 0	16	—	—
<i>Graving docks.</i>							
Albion -	—	375	43	—	—	14·6	—
Lime kiln -	—	145	34	—	—	13	—
Queen's dock -	—	300	45	—	—	14	—
Great Western -	—	300	48	—	—	12·6	—
Tucker's dock -	—	140	30	—	—	10·6	—

Avonmouth Docks.—The Avonmouth dock was opened in 1877, it is situated at the mouth of the river Avon, 1,000 yards from the safe and extensive anchorage of King road. The approach to the lock forms a tidal basin 350 yards in length, of an average width of 70 yards, with a depth of 40 feet at ordinary spring tides. The lock is 454 feet long and 70 feet wide, with a depth over the sills of 38 feet at ordinary spring tides, and of 26 feet at ordinary neap tides. The dock is 1,400 feet in length, with an uniform width of 500 feet, thus affording great facilities for swinging ships. There is an area of 16 acres, and the depth of water maintained will be 26 feet. The eastern quay is furnished with one travelling hydraulic and four hydraulic cranes, each capable of lifting 35 cwt.; on the western quay there is a 15-ton hydraulic crane for the purpose of lifting machinery and other heavy goods, also one 5-ton and two 3-ton portable cranes, all of them adapted for loading or discharging goods with the utmost dispatch, and there is direct communication with the whole of the railway systems of the kingdom. The Great Western and Anchor line steam vessels run between New York and this dock.*

The manufactories and commerce of Bristol are extensive. Of the former the most important are those of brass, copper, zinc, lead, soap, and shot. There are also iron foundries and sugar refineries. Coal is procured

* Vessels of 3,000 tons burthen have been docked and sent to sea, while others of half the size have been lying at anchor in King road waiting for water sufficient to take them to their port of destination.

H.M.S. "Assistance," 1879 (draught of water 18 feet), disembarked cavalry and embarked infantry in the docks without difficulty. Large vessels should leave and enter on a rising tide if possible.—Captain C. E. BUCKLE, R.N.

in the vicinity, but it is not adapted for exportation. There is also some amount of shipbuilding carried on. The inland trade is chiefly by the Great Western, Midland, Bristol and Exeter, and South Wales Union railways. There are also short lines along the north side of the river to the pier at Avonmouth; and, branching off the Bristol and Exeter, along the south bank, to Pill and Portishead.

The chief foreign imports are cotton, hemp, sugar, tobacco, rum, and timber; and the exports, iron and general manufactures. The steam coasting trade is between Belfast, Cork, Dublin, Glasgow, Liverpool, Waterford, and Wexford, Padstow, Hayle, Bideford, Cardigan, and most of the ports in the Bristol Channel. The daily steam-vessels to Cardiff and Newport go from the river by Bathurst basin, the others from Cumberland basin. The Custom House returns for 1867 were as follows:—

No. of vessels belonging to the port 366=61,281 tons. In 1875, entered inwards, sailing vessels 5,397, of 229,131 tons; steam vessels 2,881, of 410,254 tons; outwards, sailing vessels 2,036, of 84,416 tons; steam vessels 2,154, of 347,333 tons.

There is a Sailor's home near the docks. The population of the municipal and parliamentary borough in 1871 was 182,524, which included Bedminster and Clifton.

Pill, or Crocker pill, is on the left bank of the Avon, across which there is a ferry to Shirehampton. The village is chiefly inhabited by pilots and seafaring men, and there is a small dock for building and repairing boats.

New Passage.—About 5 miles above Avonmouth the Severn contracts to $1\frac{1}{2}$ miles in width, across which since 1863 there has been steam communication in connexion with the Bristol and South Wales Union railway. From the east side, named the New Passage, the pier on piles projects 1,635 feet to beyond low water, and from Portskewet, on the opposite side, 708 feet, exclusive of stone buttresses. From both heads a *red* light is shown at night. The trains run down the piers, and goods are lowered to the pontoon stages by lifts. There is a depth of about 8 feet at the east pier head at springs; and of 16 at the west, and in the passage, which is buoyed, the least water is about 12 feet. The channel up from King road, named the Shoots, is very narrow, and contracts to $1\frac{1}{2}$ cables between the English stones on the east, and the Black Bedwins, Mixons, and Lady Bench on the west. Off Portskewet pier is Charstone rock, the top of which seldom covers, and upon it is a small tower from which at night a *red* light is shown which leads directly up the Shoots channel. The Dun sands, a large central danger, lie to the east of this rock. This rock is on the tail of the low water from the Wye river entrance, $1\frac{3}{4}$ miles above, on the right point of which is Chapel isle and ruin, and within, Beachley point. Between the latter and Aust head is the old passage, less than a mile,

across. At low water it is interrupted by rocks, such as the Ulverstone Upper and Lower Bench, and the Dod sand. Vessels occasionally anchor below Aust head, where there is from 4 to 7 fathoms, but the safest layorage is Mathern Oaze, a little above Portskewet.

River Wye and Chepstow.—The Wye rises on the southern side of Plinlimmon mountain in Montgomeryshire, about 2 miles from the source of the Severn, and flowing 19 miles south-eastward to Rhayadegwy, flows from thence by Builth to Hay, 36 miles, the boundary between Radnorshire and Brecknockshire. Twenty-eight miles beyond it reaches the city of Hereford, and, with a very circuitous channel of $26\frac{1}{2}$ and 19 miles, the towns of Ross and Monmouth. The river is here joined by the Monnow, having previously been swelled by numerous tributaries. Separating the counties of Monmouth and Gloucester, it flows by Redbrook, and under the Bigweir bridge of 160 feet span, on to Chepstow, 18 miles; passing the famed ruin of Tintern Abbey, and between abrupt cliffs and steep wooded falls. From Chepstow to the junction of the river with the Severn the distance is $2\frac{1}{2}$ miles, and the whole length from its source to the mouth, which is three-quarters of a mile wide, is 149 miles. The tide occasionally reaches as far as Redbrook, where barges discharge their cargoes, but boats navigate the river nearly to Hay in Brecknockshire.

Chepstow is upon the right bank of the Wye, and the magnificent ruins of its castle, occupying 3 acres of ground, are upon the summit of a cliff whose base is washed by the river. The town is connected to the Midland Counties, South Wales, and London, by the South Wales railway, which crosses the river by means of a bridge designed by Brunel, and opened in 1852, combining the principle of Telford's suspension and Stephenson's tubular bridges. The tube which spans the river is 300 feet in length and 9 feet in diameter, with a clear water-way of 51 feet above the highest tide at high water, and 94 feet above low water, while the bridge altogether is 600 feet in length. The river is also crossed at the town by an iron bridge opened in 1816; it is on piers of masonry, having a centre arch of 112 feet span, 2 arches of 70 feet, and 2 of 34 feet; the total length of the bridge is 372 feet.

Gloucester pilots act as pilots for Chepstow; vessels bound there generally weigh from King road at the first of the flood, when all the rocks show themselves. The leading marks for the dangerous passage of the shoals, through which the tide runs with great impetuosity, are well known to the pilots, but can be recognised by them only. Having arrived opposite Matherne upper pill, it is usual to keep half a cable off shore, a distance which will lead into the Wye. It is necessary in going up the river towards Chepstow to avoid Tideham stone, which has 6 feet over it when Fair-tide rock at Red cliff is covering; the stone lies abreast rock, upon the port hand, near an oak tree on Thornewell's farm.

Near the railway bridge vessels drawing 10 to 12 feet may lie afloat at all times, while there are several quays with 20 feet alongside them at high-water springs.

Tides.—It is high water, full and change, at Chepstow, at 7h. 30m. local, or 7h. 41m. Greenwich time; the mean spring rise is 38 feet, the neap 28½. The tide has, however, been known to rise as high as 56 feet.

Trade.—The river Wye is famed for its salmon fishery. There are iron-works for the manufacture of masts, boilers, and bridges, and within a short distance of the town several paper mills. There is, however, but little trade, and the exports are chiefly timber and bark. The Custom House returns in 1875 were as follows:—Number of sailing vessels, inwards, 772, of 22,983 tons; steam vessels 1, of 99 tons; outwards, 238, of 8,337 tons; steam-vessels 2, of 167 tons.

The population in 1878 was 3,500; in the sub-district census 1871 it was 6,770.

RIVER SEVERN and GLOUCESTER.—River Severn, second only to the Thames, takes its rise high up Plinlimmon, on the south-western borders of Montgomeryshire, 1,500 feet above the sea level; 11 miles from its source it reaches the town of Llanidloes; flowing from thence north-east by Welshpool for the great plain of Shropshire, and after making a wide circuit turns abruptly to the south-east for the town of Shrewsbury 72 miles, which it nearly surrounds. Upon the same course the river passes Coalbrookdale, and then, more southerly, Bewdly and Stourport, there joined by the Stour from the north, and several canals from the surrounding trading towns; 13 miles below, or 62½ from Shrewsbury, it passes the city of Worcester on the west, and enters the county of Gloucester at Tewkesbury, and in a south-west direction reaches the second cathedral city, distant 30 miles. From Gloucester to Sharpness the course of the Severn is very serpentine and irregular; 12 miles below the city, at Framilode it receives the Frome or Stroud from the east, and making a remarkable horse-shoe bend of 9 miles, it becomes a tidal estuary of varying breadth to its junction with the Bristol channel at King road, the total distance to which, from its source, is 220 miles. The river is navigable only to Sharpness for vessels of any size; beyond it to Gloucester it is dangerous and uncertain, and used only by small craft during springs. Above Gloucester, by means of artificial weirs and locks, it is navigated by vessels of from 80 tons to boats along different portions to as far as Pool quay, near Welshpool in Montgomeryshire, 31½ miles above Shrewsbury. The Stroud water canal from Framilode, connecting the Severn with the Thames, was completed in 1792 when the first vessel passed through.

GLOUCESTER stands on a gentle eminence on the left bank of the Severn, where it is divided into two channels by the isle of Alney, and crossed by one road and two railway bridges, the width of the river being

105 feet; it has been an inland port for centuries, but only since the opening of the Gloucester and Berkley canal, in 1827, has it become of commercial importance, and since which the river quays of 200 yards in length have become practically neglected.

Canal and Docks.—The canal, which in some places runs alongside the banks of the river, and is upon a dead level, is $16\frac{1}{2}$ miles in length to Sharpness point, and of an average width of 86 feet, with a navigable depth of 15 feet, admitting vessels of 700 tons to dock through. The docks at Gloucester occupy about 13 acres, affording upwards of 3,000 yards of quay room, the whole of which is connected with the narrow, and a portion with the broad gauge lines of railways, on to which vessels can either discharge direct or into the warehouses behind. The docks are connected with the river by a small lock for the passage of river craft only. There are three graving docks, the largest 165 feet long and 35 feet 6 inches in width at the water line, with 12 feet over the sill; the second is 113 feet by 29 feet 6 inches, and $10\frac{3}{4}$ feet over the sill; and the third suitable for river craft only.

The railway lines in immediate connection with the city are the Gloucester and Cheltenham, and the Great Western round from Bristol to South Wales.

Trade.—The manufactures of Gloucester are chiefly iron-founding, rope, sail-making, boat and some ship-building. The exports, a considerable quantity of salt, some coal and culm. The foreign trade is principally with America, Russia, the Black Sea, and the Baltic; and the Custom-house returns in 1878 were as follows:—

The number of vessels belonging to the port, sailing 230=9,605 tons, steam vessels 12=338 tons. The number of coasters entered inwards, 1,901=83,383 tons, outwards, 2,359=215,829 tons. Foreign, inwards, with cargo, 576=209,909 tons; ditto, in ballast, 4=244 tons; ditto, outwards, with cargo, 217=47,206 tons, and in ballast, 169=94,646 tons.

Supplies and ship stores of all descriptions can be obtained, and there is a Sailor's home near the docks. The population of the borough in 1871 was 31,804.

Sharpness, the entrance from the Severn of the Gloucester and Berkley canal, is upon the left bank of the river, by which it is 27 miles below the city, $17\frac{1}{2}$ above King road, and 10 above Aust head; the width of the river is here half a mile, increasing below to a little within the Old Passage, to 2 miles, but at low water, with the exception of a narrow, winding, and shifting channel, it is filled up with the Oldbury sands off the east shore, the Shepherdine, Lydney, and Sanagar sands on the west, and the Prinn abreast the canal entrance.*

* The passage from King road to Sharpness, and vice versa, should only be made by night, leaving King road at 2 hours, and Sharpness at half an hour before high-water.

Basins and Docks.*—The canal is entered through a basin of $2\frac{1}{2}$ acres, the sea gates being $37\frac{1}{2}$ feet in width; between the basin and the canal there are two locks abreast; the largest, adapted for shipping, is 159 feet long and 35 in breadth, with a depth of 18 feet over the upper sill into the canal.

The depth over the sill of the sea gates is very irregular and uncertain, an average spring affording 27 feet 9 inches, and a neap 15 feet 6 inches. *See tides.* From the pier flag-staff, a red flag is shown by day, and a lamp by night when the gates are open. Supplies for daily use can be had at Sharpness, and good water from the canal, with which it and the docks are supplied.

About three-quarters of a mile below Sharpness is the new basin and junction canal. The entrance, in a western direction, is 60 feet wide, fronted by open timber piers, the upper one curving to the north to facilitate the passage of vessels; the tidal basin is 600 feet in length by 300 in width, with an area of about 4 acres. From this a lock of 320 feet long and 60 feet wide leads to a floating dock 2,200 feet in length and from 450 to 200 feet in width, with a depth of 24 feet; a short branch at the northern end forms a junction with the canal about 500 yards within the locks. The depth of water over the entrance sill will be about the same as at Sharpness, but the velocity of tide not quite as great, and the access much easier. Within the floating dock is a graving dock 350 feet in length by 50 feet in width. A railway bridge across the Severn half a mile above the docks connects them with the South Wales and Forest of Dean coal fields.

Lydney, a post town and seaport, upon the right bank of the Severn, is by land 20 miles south-west of Gloucester, and $1\frac{1}{2}$ miles N.N.W. from the river. A canal, navigable for vessels of light draft, connects the latter nearly with the town, and from thence a tramroad running through the forest of Dean, unites with the Wye at Lydbrook, where there are ironworks.

The Lydney basin is 220 feet long by 80 broad, having a depth when level with the canal of 23 feet, to which it is connected by a lock 100 feet in length by 25 in width, with a depth of 14 feet over the upper sill; the sea gates are 26 feet in width, with 24 feet of water over the sill at ordinary springs. It is approached between two piers, the north one 300 feet in length; upon this pier-head a black ball is hoisted when light vessels are to anchor until loaded ones have passed out, and a light at night when the gates are open; a warping buoy is moored above the pier to assist vessels to the anchorage out of the current.

* If entering Sharpness basin (without a pilot) it is necessary to wait outside the piers till the tide slackens, which it does for about 10 minutes and then comes in with a rush.—Remarks by Lieutenant A. G. Fullerton, R.N., E.M. Gunboat *Fervent*, 1878.

The main channel of the river is on the opposite side, the sands off the port drying at 4 hours ebb. The rapidity of the current is very great, forming an eddy counter to the ordinary direction of the stream.

Temporary lights.—See foot note.*

The trade is chiefly carried on in trows or river vessels, but occasionally there are some of from 160 to 220 tons from Ireland. The exports are the produce of the forest of Dean, consisting of coal, iron, tin-plate, timber, and bark.

Lydney is a creek of Gloucester, and the custom-house returns in 1878 were :—Coasters inwards, with cargoes, 167 = 6,943 tons ; in ballast, 1,642 = 85,835 tons ; outwards, with cargoes, 1,803 = 89,423 tons ; ditto, in ballast, 4 = 405 tons.

The population in 1861 was 2,285, and of the sub-district in 1871, 6,377.

Tides of the Severn.—It is high water, full and change, at Sharpness about three-quarters of an hour after King road, a high spring rise is about 31 feet, or 13 feet less than at King road ; an ordinary rise, 27 feet ; a high neap, 17 feet ; and a low one, 13 feet 6 inches ; the duration of a low spring flood and of a high neap is $3\frac{1}{2}$ hours ; of a high spring, $2\frac{1}{4}$ hours ; and of a high neap, $3\frac{1}{2}$ hours.

The flood at Aust head runs 5 knots, the ebb $5\frac{1}{2}$, above which it is of uncertain and unequal velocity. The Hygre, or Bore, rushes up the river with considerable noise, and a front of 4 and 5 feet ; it is experienced in the several channels from about 2 miles above Sharpness, but not in a continuous wave from shore to shore, until past Longney, 9 miles below Gloucester, and where the river is 260 feet broad. It is observed to be highest about the fifth flood from full and change, and occasioned by the contractions of the stream below.

At Gloucester, the high water is 1h. 47m. later than at Sharpness, and a high spring rise is 7 feet 6 inches, or 23 feet 6 inches less than at Sharpness, and the duration of the flood 45 minutes ; a low spring is about 3 feet 6 inches, and the duration is then 2h. 45m. The flood is only experienced for about 4 days before and after the springs, the stream continuing to set up the river 20 minutes after the water has commenced falling at Gloucester. Before the weirs were constructed the tide occasionally reached Worcester ; now and at springs only, to the weir at Tewkesbury, at times flowing over it.

* Two fixed white lights are shown from sunset to sunrise on each side—one at each upper and one at each lower end—of the staging during the construction of the new bridge on the Severn, about half a mile above Sharpness.

Vessels passing up and down the river at night will understand that the navigable channel lies between these lights, and that it is dangerous to pass through any other opening.

Pilots and Steam-tugs.—The pilot boats are both cutter and yawl rigged, with the letter G upon their sails; they cruise down as far as Lundy island. There are steam-tugs, and vessels usually tow up and down, the time required being about three hours to Sharpness from King road; and through the canal to Gloucester, a working day.

Directions.—Vessels bound up the Severn for Lydney or Sharpness, usually weigh from King road at 2½ hours flood. Those drawing 22 feet of water can reach and enter the canal on springs, and others of 10 and 12 feet draft at neaps. The most critical portion of the navigation is about the Barnacle channel and Lydney grounds, on account of the rapidity of the tides and the variable nature of the sands.

Note.—A tunnel across the Severn in the neighbourhood of the New Passage is in progress and may be completed in 1880.

Near the railway bridge vessels drawing 10 to 12 feet may lie afloat at all times, while there are several quays with 20 feet alongside them at high-water springs.

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