No. 1,055.—"On Reclaiming Land from Seas and Estuaries."[1]
By JAMES OLDHAM, M. Inst. C.E.

THE practical operation to which the Author intends more especially to draw attention, and in which he was professionally engaged, is that of the reclamation of a portion of Sunk Island, on the River Humber. But before describing the details of the works, he will make some general observations on that river and its tributaries; and on the large amount of matter held in suspension, as well as the degradation going on, not only to the foreshores of the Humber, but also along the whole of the Holderness coast, from Bridlington to the Spurn. The Humber, from the confluence of the rivers Trent and Ouse to the sea, is 40 miles in length. For about the first 10 miles from the sea it has an average width of nearly 6 miles, the remaining portion being upwards of 2 miles in average width. The total area is equal to 80,000 acres. (Plate 18, Fig. 1.) With some trifling exceptions, the shores of the Humber consist of alluvial formation, and the neighbouring districts of rich agricultural land, generally speaking, tolerably well drained, having an average fall of tide, below the surface of the land, of about 17 feet. The foreshore, between high and low water marks, varies from ten chains to twenty chains in width, but in some localities, as for instance, between Sunk Island and the Spurn, it is considerably more. In some parts, extensive tracts of 'outstrays' exist beyond the banks, which are only submerged at average spring tides. These level tracts are covered with marine grasses, which are exceedingly valuable for young horses and sheep in the summer season. The 'outstrays' are called 'growths' in the locality, and also in many old legal documents. The surface level of the banks of the Humber is about 16 feet above the ordnance datum. The rise and fall of spring tides is 22 feet, and that of neap tides 10 feet to 12 feet. The rate of the stream during spring tides is from 4 knots to 5 knots per hour, and that of the stream during neap tides from $2\frac{1}{2}$ knots to 3 knots per hour. The channel at low-water spring tides increases in depth, from about 1 fathom at the confluence of the Trent and the Ouse, to 12 fathoms off the Spurn Point. The Humber is free from bars and other obstructions at its entrance, and the navigation is safe and good, even at low-water, for large ships as far as the port of Hull, and above that, for river vessels.

[1] The discussion on this Paper was taken in conjunction with the preceding and following ones on a similar subject, by Mr. Paton and Mr. Muller, respectively; and was continued over portions of three evenings, but an abstract of the whole is given consecutively.

At Brough, ten miles above Hull, on the Yorkshire coast of the Humber, the lias formation crops out; but dips beneath the bed of the estuary, and crosses into Lincolnshire. At Hessle the chalk is found, not only passing beneath the bed of the Humber, but also forming the Wold Hills of both counties, Yorkshire and Lincolnshire, rising in some parts of the East Riding to the height of 800 feet above the level of the sea. The chalk dips rapidly between Hessle and Hull, a distance of four miles, being above the level of the sea at Hessle, and 110 feet below the level of the sea at Hull. Although the surface of the chalk rises as it recedes from the Humber, yet at Sunk Island it is also 110 feet below the level of the sea.

From observations made by the Author, in directing the boring of Artesian wells on the banks of the Humber, he has found the strata above the chalk consist of clay, silt, peat, sand, and gravel. There is a compact bed of strong gravel from Hull to the sea coast at, or about, 60 feet below the level of high water, in which salt water is generally found. At 80 feet below the surface, nuts and leaves of trees have been discovered.

Considering the nature of the soil and the geological formation of the district (alluvium and diluvium), it is not surprising that the foreshores of the Humber, except where efficiently protected by artificial works, should be easily washed away, and that the water should then become loaded with earthy matter, which is again deposited in the less disturbed situations. In addition to the natural deposits which have taken place along the sides of the Humber, and which have assisted in the formation of islands, masses of floating mud are taken by artificial means on to low and worthless lands, by which their surface is raised, and rendered capable of the highest state of cultivation.

It may not be out of place to describe, briefly, the mode of 'warping,' or raising, the surface of low lands by tidal deposit, as practised on the banks of the Trent, the Ouse, and the Don. There are large tracts which were formerly swamp and peat bog land, and many thousands of acres have been, by this process, converted into rich agricultural districts. The usual mode is, to construct a sluice on the bank of a tidal river, and in connection with it a drain, or channel, for the flow of the tide into and over the land to be warped up. During spring tides, the tidal water is admitted to the full flow of high water; the inner door of the sluice is then let down, so that the water is retained until the river has fallen. The mud held in suspension is thus precipitated, and the water which entered heavily charged with alluvial matter becomes clear. The door of the sluice is then raised and the water allowed quietly to escape, leaving behind its load of rich deposit. The Author has known a district, of low and comparatively worthless land, receive, in the course of two and a half years, an average deposit of 3 feet, and thus to be rendered available for crops of grain, within three years from the commencement of the operation. The 'cloughs,' or sluices, are constructed in the ordinary manner, having self-acting tidal doors, and a sliding door which is raised and lowered by machinery. The surface level of districts raised by tidal deposit, is generally surrounded by other similar low lands, and in order to confine the tidal water within the required limits, a temporary bank is constructed by throwing up the earth in the immediate locality. Land warped up, in the mode described, is at once available for crops of grain, and is found to be of the most valuable description for potatoes and other roots; and districts of little value have been converted into rich estates, at an outlay varying from £5 per acre to £20 per acre. The difference of cost depends upon the nearness, or remoteness of the land to the river, and other circumstances.

The waste of land on the banks of the Humber, and on the sea coast of Holderness, is very considerable. On the banks of the Humber the waste is greater above than below Hull. On the Lincolnshire coast, from South Ferriby westward, the loss is considerable. Within the recollection of the Author, in a length of from 3 miles to 4 miles not less than 200 acres of rich valuable land have disappeared. Close along the cliff, or margin of the land, there is a deep channel and an abrupt foreshore. The ravages in this locality threaten to outflank, in a few years, the sluices and lock constructed under the direction of Sir John Rennie, for the Commissioners of the Ancholme Navigation. Opposite the district named, an island of considerable extent, called Reed's Island, has been formed, on which there is extensive pasturage. The channel between the island and the mainland is from a quarter to a third of a mile in width. This island is still increasing in extent, and the area of the embanked portion may at any time be doubled.

The banks and foreshores, in many districts, are protected against the ravages of the tide and sea by piles, and chalk-stone facings; but where the current sets in deep channels, and undermines the land, such artificial means are of no avail. The only sure mode of protection would be to carry out some well-devised general scheme for extensive districts, which would not only save the existing land, but, in many instances, be the means of adding to it, and in some measure, if not altogether, would cover the cost of such protecting works. These works would also prove a great benefit to the navigable channels of the estuary.

The loss of land on the seaboard of Holderness is very great. By observations made over a considerable period of time along 40 miles of coast, the average waste amounts to about $2\frac{1}{4}$ yards per annum;—and such is the sure and onward progress of the advancing sea, that within a comparatively short interval of time, whole villages have disappeared. As bearing on this point, the following extract from a Paper presented to the British Association, in 1853, by Dr. Bell, entitled, "Observations on the Character and Measurements of Degradation of the Yorkshire Coast," should be quoted:—

"There cannot be a doubt that the process of waste and destruction of this remarkably fertile district had been going on long antecedent to any traditional or written history. We find, however, on record a lamentable catalogue of losses on this coast; one field after another has been swept away, and one township after another has disappeared. The village of Auburn has gone; the towns of Hartburn and Hyde, both at one period flourishing places, exist no longer. Owthorne has lately yielded to the same fate; the ancient church of Withernsea has long since disappeared, and its successor, built in 1434, is dilapidated and deserted. Further southward, Kilnsea church exists no longer; the last portion of the fabric (being part of the tower), according to the parish register, fell down the cliff into the sea, February 1, 1831; and the village itself is rapidly following. Camden mentions Pennismerk and Upsal, townships or hamlets in Holderness, neither of which remains at the present day. Nor have the encroachments of the deep been confined to the sea-coast of Holderness, for within the Humber we find that considerable tracts of land have been swept away; as, for instance, Redmare, Frismerk, Tharlesthorpe, Potterfleet, Ravenser, &c. The whole of the Yorkshire coast, south of Flamborough Head, is being continually wasted by the encroachments of the sea; and it is a startling consideration, that in the course of a few years, if the same process continue, other towns and villages, now flourishing and fertile, are doomed to follow. The rate of loss, however, throughout the line is not uniform; the physical features, and the geological composition of the cliffs, the set of the tide, and other minor causes influence the degradation to a greater or less degree."

"The line of coast to which my remarks apply extends about forty miles, and is now losing an amount of rich agricultural soil of 2¼ yards annually."

Although it has been ascertained that the average loss on the whole coast of Holderness is $2\frac{1}{4}$ yards per annum, yet the progress is far from uniform, for in some districts little or no change is perceptible for a length of time; but in other localities 10 yards or 15 yards will disappear in twelve months, or before a check is given nearly double that quantity in the course of a couple of years. Accurate measurements have been made from fixed points, at various parts of the coast, at different periods since 1786, and therefore the rate of waste may at any time be correctly found. Sufficient has been advanced to prove the loss of land both on the sea coast, as well as on the shores of the Humber; and an attempt will now be made to show what becomes of some portion of the débris under tidal influence, and the remarks of the Author, on this point, will be confined, chiefly, to the accretion and formation of Sunk Island and its immediate locality.

By reference to Plate 18, figs. 1 and 2, it will be seen, that

Sunk Island is situated on the north bank of the estuary, and that it has a coast line of about $6\frac{1}{2}$ miles. It contains about 7,000 acres of inclosed land under cultivation, the property of the crown, and separated by a narrow creek or drain. There are tracts of co-existent accretions, which have an area of 3,000 acres more, belonging to other parties, and forming additions to the mainland of Yorkshire—making altogether a total of 10,000 acres of rich alluvial soil, the greater part of which has accumulated during the last seventy or eighty years. At the time of Charles I., the island did not contain more than 9 acres of inclosed land, and lying nearly two miles from the coast of Yorkshire, it could scarcely be seen at high water of spring tides. At that time, and until about the close of the last century, a deep ship channel existed between the island and the Yorkshire coast. This was known as the North Channel, and the remainder of it still exists just within the Spurn, being at the point opposite the end of Trinity Sand; three quarters of a mile wide at low water of spring tides, and 12 feet deep towards the centre.

The most ancient map showing Sunk Island, that the Author has been enabled to discover, is that by Captain Greenvill Collins, Hydrographer to his Majesty Charles II., and is to be found in his work entitled 'Great Britain's Coasting Pilot.' The original island only contained 9 acres in the time of Charles I. The Author is of opinion, that the whole of the deposit forming this island and the neighbouring accumulations, is from the sea face of the coast of Holderness; and his conclusions are based on the following considerations:—The deposit can only take place when the water is in a quiescent state, and the time when this occurs, is at high and at low water. Now, as the accretions cannot be produced at low water, except in some instances and to a small extent, it must follow, that they can only be formed at high water. Taking, therefore, the time of high water as that when the mud held in suspension by the tide is deposited, the question follows, from what direction has the tide last come at the time of high water? The deposit could not have come down the Humber, seeing that the current has been running up for the period of five hours, the time the tide occupies in rising; and, therefore, whatever might be floating in the water at flood tide would be conveyed up the estuary. Hence the matter, forming the accretions in question, must have come in with the tide, and have been deposited at high water. The following quotation, from the 'Geology of the Yorkshire Coast,' by Professor Phillips, supports this view. He says at page 30, speaking of Spurn Point:—"The materials which fall from the Wasting Cliffs between Bridlington and Kilnsea, are sorted by the tide, according to their weight and magnitude; the pebbles are strewed upon the shore, beneath the precipice from which they fell; the sand is driven along and accumulated in little bays and recesses; whilst the lighter particles of clay are transported away to the south, making muddy water, and finally enter the great estuary of the Humber, and enrich the level lands under the denomination of Warp."

The soil at the surface, and to a depth of 5 feet, or 6 feet, is found to be of an exceedingly fine alluvial description. Below this, sand and drift gravel are found, to the depth of about 30 feet, then 8 feet or 10 feet of strong clay; below which there are from 14 feet to 16 feet of silt, or sand and clay of a loose description; then follow 17 feet of loose chalk, clay, and stones; after that 30 feet of gravel and stones, resting upon a bed of clay of 5 feet thick; making a total depth of about 110 feet, before the chalk formation is arrived at. These particulars of the substrata of Sunk Island are taken, chiefly, from the description of a boring made by Messrs. Easton and Amos.

As to the nature, and the constituent properties of the Humber deposits, the Author would draw attention to the analyses by Mr. J. D. Sollitt, of Hull, who in 1853, presented to the British Association a Paper "On the Chemical Constitution of the Humber Deposits." He says—"By far the largest constituent part of the Humber mud is an exceedingly fine sand, the particles of which are so minute as almost to float in water, and being of such a quality as to render the whole perfectly unstable, and liable to be moved about by the slightest motion of the water; many of the particles of this sand, when examined by a powerful microscope, appear to have their corners worn down by the attrition of one particle against another, so as to be reduced to nearly a globular form, and great numbers of those particles are so small, as not to be more in diameter than a fourth part of that of a globule of human blood, or about $\frac{1}{12000}$th part of an inch: hence the sand which forms about 75 per cent. of the Humber deposits is, so far as relates to its particles, almost in the condition of a fluid, easily displaced and driven about by every tide, both when it rises and when it falls. In a gallon of water taken from the Humber, when the water was agitated by the tide, there were from 315 to 320 grains of this above-named fine deposit, and it was so exceedingly fine, as not all to have settled at the end of ten hours from the taking of the water from the river."

Six samples were taken from different parts of the Humber for analysis, and the following is the result of the analysis of one of the six, which was from water taken out of the Humber at Grimsby, nearly opposite Sunk Island:—

"Fine sand	76
Alumina	10
Carbonate of lime	2
Soluble salts	5
Oxide of iron	3
Organic matter	4
	100

"This sample contains no carbonate of magnesia."

The accretions in the Humber generally, and of Sunk Island in particular, are found to rise until the average surface level is coincident with the average surface rise of all tides, and when this elevation of the surface has been attained, the vegetable action commences, and marine plants make their appearance.

The first vegetable life, which presents itself on the soft mud surface, is the well-known marine plant rock samphire, or 'Crithmum maritimum.' This is followed by a variety of wiry rush-like grasses, of the sedge genus, and several descriptions of plants, having strong deep-shooting roots, and flat wide-spreading heads which rest on the surface of the ground. When the surface of the salt water accretion has become covered with vegetable life, and the ground is well consolidated, it is considered in a suitable state to be embanked. Sufficient proof exists, that where embankments of new accretions have been made, before the surface has become covered with vegetation, a long period must elapse before the land can be rendered productive, and that it remains, in a measure, waste and worthless. This, however, is not the case where the accretions are from fresh water deposits, or where but little salt exists in the water.

The mud of the Humber is rich in microscopic insect life, having a great number of species of infusoria, and especially that which is known as the 'diatomaceæ.' It becomes, therefore, a question, whether these and other animal existences, together with the vegetable action going on, are not the powers employed in converting the raw material of the deposits of the Humber into a state capable, when matured, of bearing grain and roots; and that until they have accomplished their work, the salt water accretions must remain comparatively barren, for a considerable length of time.

As the land on the margin of the Humber approaches the state in which it is usually deemed to be of sufficient surface elevation and in such a condition as to be available for agricultural purposes, it is found, that many natural creeks and watercourses exist, and frequently, also, pools or low swampy places. These watercourses are in a great measure due to the existence of the pools, for after each tide overflows the land, the pools, or swamps, hold a considerable portion of water, which running out in the course of the ebb tide, has the effect of scouring out the various creeks. It is remarked, that so long as any of these reservoirs retain the tidal water, the creeks scarcely ever silt up, and should the land be embanked while in that state, the surface is found to be uneven and impaired in value. It is necessary, therefore, that for a year, or two years, before the operation of embanking is commenced, the surface of the ground should be drained by 'gripping,' so as to let off the whole of the standing pools. Immediately this is accomplished, all such depressions rapidly silt up, until one uniform plane is the result; with the exception, it may be, of some of the larger outfalls of the creeks; and even these will in a great measure disappear, when the drains are afterwards formed for subdividing the land, and the soil can then be carted from the excavations of the fence drains, into any of the old creeks which may remain. In some cases, however, the natural creeks become the fence drains and the divisions of the fields, and thus save expense in the cost of subdividing the land.

It is scarcely necessary to say, that prior to setting out the lines of the sea banks, a careful survey of the ground, and correct sections are indispensable. When the levels have been taken, the first point to be settled is the permanent drainage of the land about to be inclosed, so that a draining sluice may be immediately constructed to run off any accumulation of water in case of need. In fixing upon the site of the sluice, two considerations present themselves, first, the natural fall, or inclination of the surface of the land to one point, and secondly, the best site for the outfall, so as to effect a perfect system of drainage. The relative depth, or level of the cill of the sluice will be determined by collateral circumstances; such, for instance, as the rise and fall of the tide, and the condition, nature, and extent of the land to be drained.

In determining the sectional form and area of the bank, the Engineer must be guided by the height which will be necessary to prevent the possibility of an overflow, the situation in relation to the character of the waves rolling on to the works, and the nature of the materials to be used in the construction. Where the outer face is exposed to a heavy rolling sea, the slope or angle must be very gradual and extended, so as to prevent a heavy surge and disturbance of the face of the works; and should the soil used in the construction be of a light and sandy description, it becomes necessary to give an extensive base to the bank, and an easy and gradual inclination. In many situations, considerable allowance must be made for settlement and consolidation, otherwise the bank when completed may prove too low and have a distorted appearance. When the material to be used in the formation of sea banks is of a light loose character, it will be necessary to obtain clay, where it can be found, from the nearest locality, to form a strong puddled wall, to be carried up in the centre of the bank, so as to prevent the possibility of leakage through or under the works. If a slip takes place, in any part of tidal embankments, great care must be observed not to allow any fascines to be used, as there is always a danger and liability of fagots forming conductors for the water.

In order to preserve the outer, or sea face of the bank against the action of the water, it is desirable to face the slope with sods, bearing the marine grasses. These sods should be cut from 4 inches to 6 inches in thickness, and be well beaten into a regular form, in order to preserve a smooth surface. On the top and the land side of the bank, the fresh-water grasses will soon grow after the completion of the works, and, therefore, it is not necessary that those portions of the bank should be covered with turf in the first instance.

In illustration of the foregoing remarks, the Author will describe the works of the last embankment at Sunk Island, on the Humber, for inclosing about 700 acres of new accretion. In 1849 he presented plans and reports to the Commissioners of Her Majesty's Woods and Forests, of the nature and extent of the works to be performed, the foreshore, having been previously reported by him, to be in a fit state to be inclosed. The works were commenced in the spring of 1850 under his direction: their execution was contracted for, by Mr. G. C. Pauling. By the general plan of Sunk Island (Plate 18, fig. 2), it will be seen, that the portion of land under consideration is situated at the eastern extremity of the island, and that it has a narrow creek, called the Patrington Channel, on its north side. The line of bank extends from **A** to **B** and from **B** to **C**, and has a total length of 6,067 yards; **A** to **B** being 2,124 yards, and **B** to **C** 3,943 yards. The portion **B** to **C** having to encounter the rough storms of the Humber, and the surface level of the ground in the line of bank being lower than from **A** to **B**, necessitated a much stronger and higher embankment. At **B**, the sluice and outfall of the drainage were constructed, that point proving the most suitable for the purpose, and having the advantage of a short run into the Patrington Channel. The greatest height of the bank from **B** to **C** is 8 feet 10 inches; it is 4 feet wide at the top, and has a total width at its base of 61 feet. The outer or sea face was originally constructed with a slope of 5 to 1, and the inner face, with a slope of 1 to 1½. (Plate 18, fig. 4.) Along the inside of the bank, a drain was excavated, at a distance of 6 feet from the foot of the slope; its average width is 10 feet at the top, and its depth increases from 4 feet at **C**, to 6 feet 6 inches at **B**. The average height of this portion of the bank is 7 feet 6 inches, above the level of the land in the line of the works. The greatest height of the bank from **A** to **B** is 7 feet 6 inches. It is 3 feet wide at the top, and has a total width at its base of 32 feet. The outer face was constructed with a slope of 3 to 1, and the inner, with a slope of 1 to 1. (Plate 18, fig. 3.) Its average height is 6 feet 3 inches. On the inner side of this line of bank a carriage way was left, and a drain was excavated beyond it, of somewhat larger dimensions than the one from **B** to **C**, for the purpose of conducting a portion of the drainage of the old inclosure to the new sluice and outfall.

In constructing the banks, the contractor was required to use the soil excavated in forming the drains, and the remainder was to be taken from the ground lying outside the line of works, but under the restriction that the excavation was not to be made within 6 feet of the outer slope, and that it was not to exceed 4 feet 6 inches in depth. In order to prevent the danger of a slip, and damage to the works, the sides of the excavations nearest to the banks were not to have a less slope than 2 to 1, and the contractor was also to provide channels, for the purpose of discharging the water which might be accumulated in the pits after each tide. Within about three, or four years after the completion of the banks, the pits from which the soil was taken, were silted up to the general level of the land by tidal deposits.

In carrying out the works, gangs of men were set on at several places along the line, so as to raise the bank fully to the height of ordinary spring tides, but the principal natural creeks were left open for the escape of tidal water. The creeks were afterwards simultaneously filled up, and the whole embankment was brought to one level and to the full height required. The works were commenced in April; by the commencement of July, the tides were excluded from the land, and in the December following the whole was completed.

The contract price was 4*s.* 6*d.* per lineal yard for the portion from **A** to **B**, and 10*s.* 6*d.* per lineal yard from **B** to **C**; the former amounting to about $4\frac{1}{4}d.$ per cubic yard, and the latter to $5\frac{1}{4}d.$ per cubic yard on the average. The sluice was not executed under contract; the cost was £380. A stipulation was made with the contractor, that he should keep in proper order and condition, and bear the whole risk and responsibility of the works, for a period of twelve months after the date of their completion; and he was paid an extra sum for the drain from **A** to **B**.

The nature of the soil of Sunk Island is such, that it so consolidates and unites, as to be perfectly compact and impervious to the pressure of water, therefore no difficulty was experienced in that respect, and the entire lines of banks, formed by the material found in situ, proved from the first, perfectly watertight.

The total settlement from **B** to **C** amounted to 15 inches in the highest part of the bank, and it was partly due to the consolidation of the soil forming the bank, and partly to the subsidence of the ground on which the bank rested. There was very little settlement on the line from **A** to **B**, as the ground on that part of the inclosure proved much firmer.

The construction of the self-acting draining sluice is shown in Plate 18, figs. 5, 6, 7, 8. The tidal doors close by the pressure of the flood tide, and open when the water of the Humber has fallen below the surface level of the water in the drain. The foundation of the sluice consists of bearing piles, each about 12 feet, or 15 feet long, having cills bolted to the heads, on which a platform of red wood planks, 3 inches in thickness, is fitted and spiked. There are also four rows of sheeting piles 6 feet long and 11 inches by 3 inches in section. The superstructure consists of brickwork and stone copings. The hollow quoins of the gates, the framing of the gates, and the top cills and pointings, are of English oak; the bottom cills and pointings are of elm timber.

The fresh-water door is raised and lowered by machinery (Plate 18, figs. 9 and 10), and is used for the purpose of holding up fresh water in the drains, and for flushing and scouring the sluice and outfall, which is liable to be silted, in the summer, or when but little fresh water is running out. In very dry seasons, the sluice is used for taking in a quantity of tidal water, to fill or charge the fence ditches, and the cattle are thus prevented from straying; for the fields are generally only divided by ditches, and as the subsoil is of a sandy and porous nature, the water in them rapidly disappears.

Soon after the exclusion of the tidal water from the surface of newly-embanked land, the marine grasses and vegetation begin to die and decay, and in the course of a year, or two years, fresh-water grasses appear. After the lapse of about three years, a tolerably good surface of pasture is naturally formed, and it is capable of sustaining a considerable number of cattle. But that which is most surprising, is the spontaneous appearance, and the growth, on the inclosures of Sunk Island, of an entire covering of white clover, which presents itself within three years, or four years of the date of the exclusion of salt water.

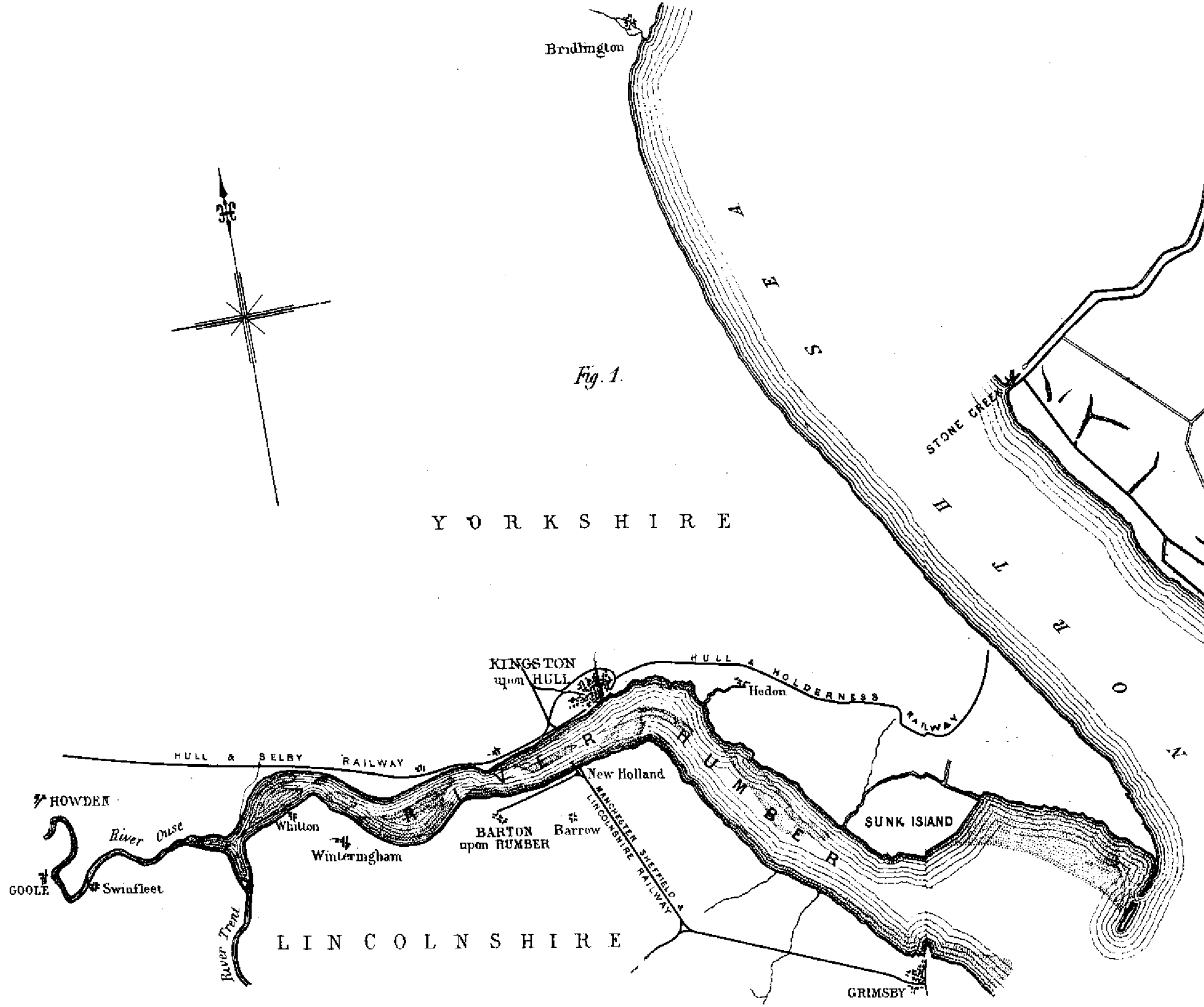
Hitherto, the Author has only noticed the availability of embanked accretions, as grazing or pasture land, but a few remarks will not prove uninteresting as to their value for tillage. After the completion of the embankment, and the subdivision of the land, a selection is made as to what portion shall remain as pasture, and what shall be worked by tillage. Some trifling labour devolves on the farmer, in levelling irregular places on the surface; he then ploughs and prepares for a crop, and

PLATE 18 VOL. XXI.

RECLAIMING LAND

RIVER HUMBER

Fig. 1.



RIVER HUMBER AND COAST LINE OF HOLDERNESS

Scale for Fig 1

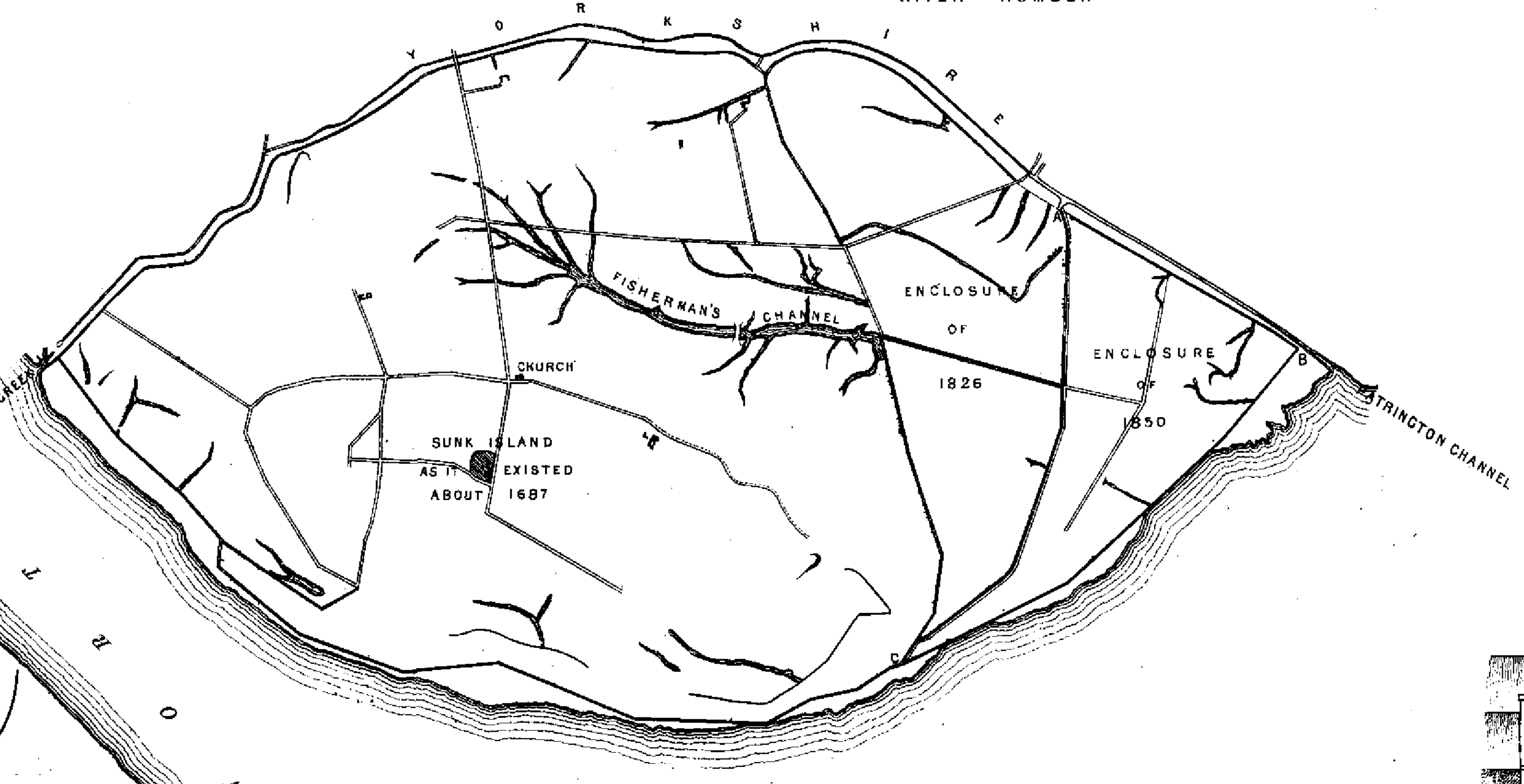
Scale for Fig 2

Scale for Figs 3 & 4

Scale for Figs 5, 6, 7 & 8

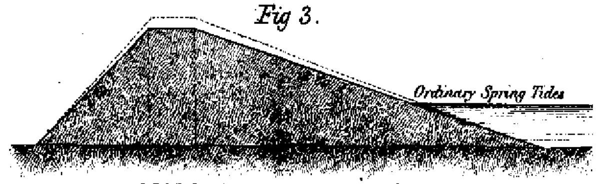
Scale for Figs 9 & 10

Fig. 2.



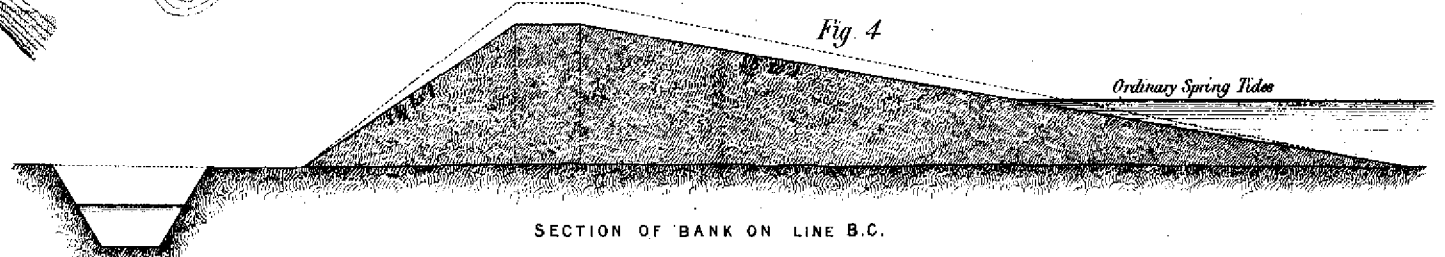
MAP OF SUNK ISLAND

Fig 3.



SECTION OF BANK ON LINE A.B.

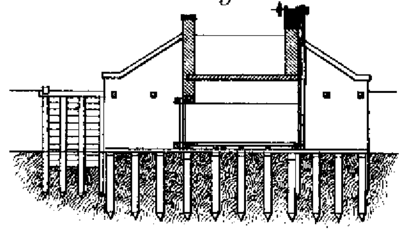
Fig 4



SECTION OF BANK ON LINE B.C.

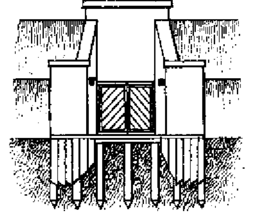
CLOUGH OR SLUICE FOR THE NEW LAND

Fig. 5



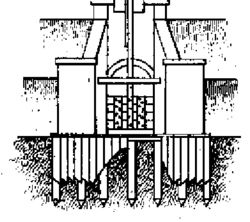
LONGITUDINAL SECTION.

Fig. 6.



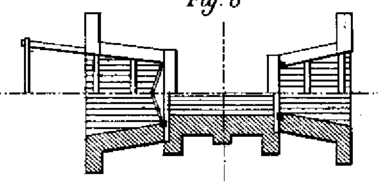
DOWN STREAM ELEVATION

Fig. 7.



UP STREAM ELEVATION

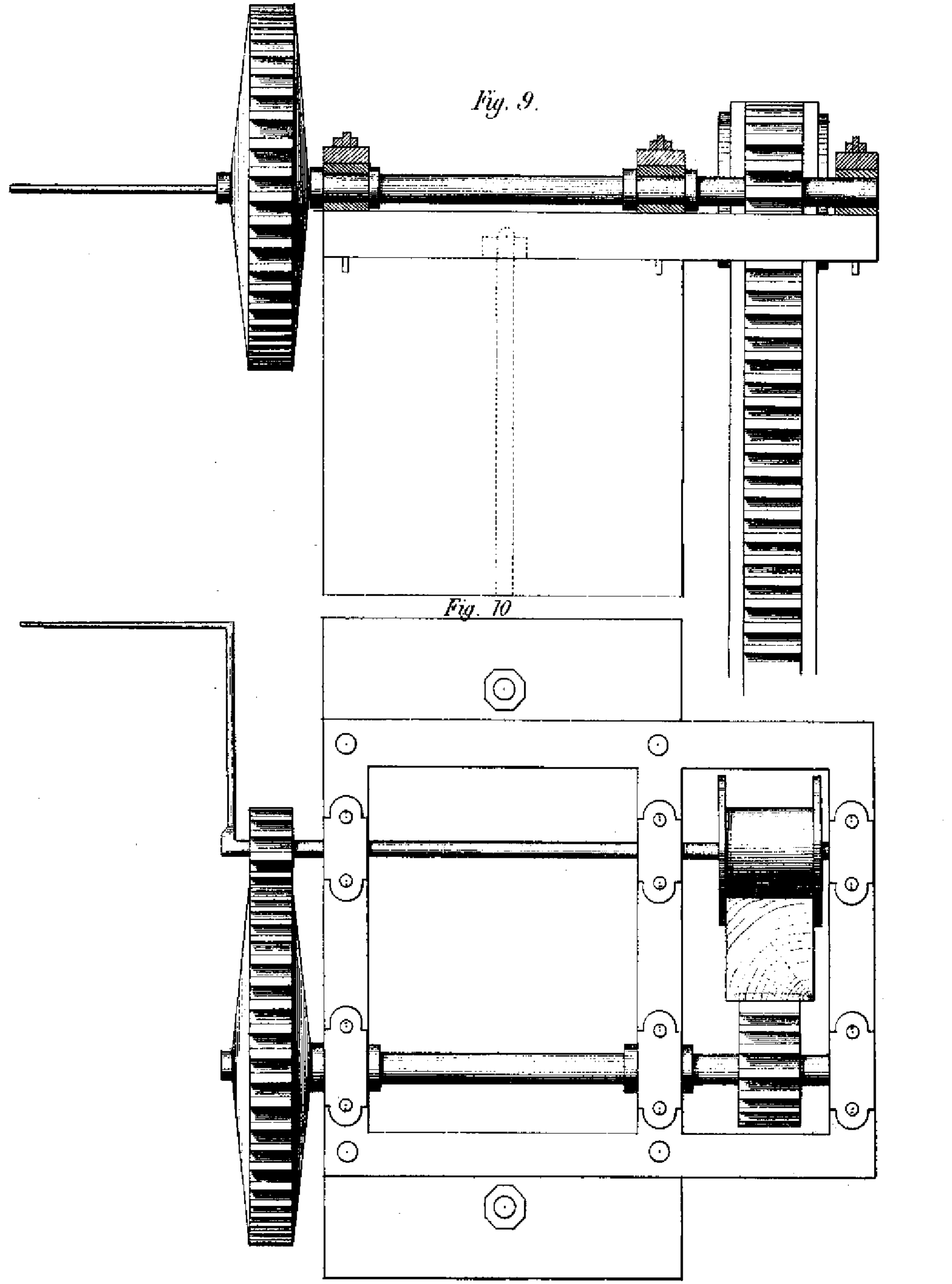
Fig. 8



PLAN

Fig. 9.

Fig. 10



SIDE ELEVATION AND PLAN OF LIFTING GEAR

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generally the first on the land is rape. This is sown about the third year or fourth year after the inclosure, and the produce is usually of extraordinary quantity and vigour. The following season oats, or beans may be sown, and then wheat, and perhaps, of all the districts of England, the largest and best crops may be found on Sunk Island, for the tenants admit that the land produces upwards of six imperial quarters of wheat per acre. Flax also is produced of a fine and valuable quality, and in large quantities. The producing power of this description of land is not limited to the growth of cereals, or fibrous products, but the finest roots, such as potatoes, turnips, mangold wurzel, &c., are successfully cultivated. The climate is generally mild through the winter, with trifling exceptions, but it is hot in the summer. The rain-fall amounts to about 18 inches, on an average, per annum. The harvest, is frequently from one week to two weeks earlier than in the surrounding neighbourhood.

Patrington Channel is a narrow muddy creek, along which river vessels of 50 tons burthen may pass at spring tides; but for want of back water for flushing, or scouring, it is difficult to maintain a navigation. It is therefore to be feared that it will soon cease to be navigable up to Patrington Haven. This channel defines the limits of Sunk Island to the eastward, and as the accretion is rapidly forming in that quarter, a few years will prepare a large increase to the available surface of the island, which, whenever it reaches its limits in that direction, will add about 3,000 acres to the present tenantable holdings, and make a total in Sunk Island alone, of about 10,000 acres.

In 1854, the Author made surveys of the district between Sunk Island and the Spurn, with a view of embanking about 10,000 acres; but certain circumstances arising, further proceedings were, for the time, abandoned. The project, however, is not lost sight of, and it is probable that at a not very distant period, a rich tract of land will be obtained, and by such a result a more permanent security be given to the Spurn itself, which is far from being in a safe, or satisfactory state, owing to the onward ravages of the sea, as already described, along the Holderness coast. There is no doubt, but that the loss of the promontory, would occasion an incalculable injury to the safe navigation of the Humber, and one which perhaps could never again be remedied.

This Paper is illustrated by a series of diagrams, from which Plate 18 (figs. 1 to 10) has been compiled.
