

REPORTS
RELATING TO THE
RIVER WELLAND
AND THE
DRAINAGE
OF DEEPING FEN.

Mr. J. Bonner
Spalding Oct 1852

THE

REPORTS

OF

CIVIL ENGINEERS

ON THE

IMPROVEMENT OF THE DRAINAGE

OF

DEEPING FEN,

AND OF THE

OUTFALL OF THE RIVER WELLAND:

PRINTED COLLECTIVELY, FOR THE USE OF THE DEEPING FEN
GENERAL DRAINAGE TRUSTEES.

London:

SHAW AND SONS, FETTER LANE.

1852.

LONDON: PRINTED BY SHAW AND SONS, FETTER LANE.

PREFATORY OBSERVATIONS.

THE great cost incurred in procuring the following Reports, the important information which they contain, the great local interests to which they relate, and the eminence of the civil engineers to whom such Reports are referable, appeared to "*The Deeping Fen General Drainage Trustees*" to render it desirable that they should be printed collectively, as the best means, not only of preserving them, but of rendering them generally useful.

The joint Report of Messrs. Maxwell and Hare (page 1), and the joint Report of Messrs. Jessop, Rennie, Maxwell, and Hare (page 6), are those on which the scheme for the drainage of Deeping fen, incorporated in the Act of Parliament of 1801, was based. Under this Act the commons were inclosed and subdivided amongst the parishes.

The Reports of Mr. Pear, in 1820 (page 11), and of Mr. Bevan, in 1823 (page 16), were those on the authority of which the Act for the drainage of Deeping fen by steam-power was obtained; and the Report of Mr. Mylne (page 19), has reference to that scheme.

The Reports of the late Mr. Rennie, in 1818 (page 22), and of Mr. (now Sir William) Cubitt, in 1842 (page 29), relate more particularly to the drainage by the Vernatt's drain.

The very valuable Reports of Mr. Bevan, in 1812 (page 31), of Mr. Pear, in 1815 (page 35), and of Mr. Warner, in 1835 and 1838 (pages 40, 48), have reference to the river Welland and its outfall, on which the permanent drainage and preservation of the fens and marsh districts, which drain by that river, entirely depend.

Following the foregoing Reports, will be found the report of Mr. Bevan, in 1810 (page 52), and of Sir William Cubitt, in 1837 (page 54); which Reports have reference to the navigation of the river Welland, both above and below the town of Spalding.

J. R. C.

SPALDING, September 6th, 1852.

REPORTS, &c.

The Report of Messrs. Maxwell and Hare, on the Drainage of Deeping, Langtoft, Baston, Crowland, Cowbit, Spalding, and Pinchbeck Commons, in the County of Lincoln.

WE, whose names are under-written, having been appointed by the proprietors of estates interested in the inclosure of several commons, comprised within the purview of an Act of Parliament, passed in the thirty-fourth year of the reign of his present Majesty, King George the Third, for "improving the outfall of the river Welland, in the county of Lincoln, and for the better drainage of the fen lands, low grounds, and marshes, discharging their waters through the same into the sea," to recommend the best means of effecting a drainage of the said commons: we have accordingly taken the same into consideration, and are fully of opinion that no effectual drainage or security can be had, without, in the first place, carrying the said Act into execution; but as we know, from experience, that money cannot be raised by the mode thereby prescribed, we recommend that clauses may be inserted in the Inclosure Act, for enabling all the proprietors whose lands are taxed under the Welland Act, to buy off their taxes, at the rate of years' purchase, on or before a certain time, to be expressed in the intended Inclosure Act; and in all cases where proprietors do not purchase their taxes, pursuant thereto, that the Commissioners appointed by the Welland Act shall be empowered to sell a sufficient quantity of land by auction, belonging to the defaulters, for purchasing the said tax at the rate aforesaid, and defraying the expenses of such sales. But it is necessary that some special provision should be made in respect to the commons, as the selling land from them in their present drowned state would, in fact, be giving to strangers that improvement to which the persons interested in those commons are entitled; to obviate which, we recommend a clause to be inserted in the Act, requiring the Commissioners under the Welland Act to ascertain the number of houses and tofts, and quantity or value of the land, entitled to common rights, with as much precision as the nature of the business will admit of, without waiting for a complete investigation, and also the value of the shares of the common to which the lords of manors and owners of

tithes will be entitled, subject, nevertheless, to be eventually settled by minute inquiry, survey, and valuation; and, further, directing the Commissioners under the Welland Act to apportion the money, at the rate aforesaid, of the taxes due from the commons, according to the mode agreed on for their division, with powers for enabling the Commissioners, in the first place, to require payment from the respective proprietors so appearing to be entitled, of a due portion of such purchase-money, and in case of default of payment, to borrow money on the credit of their respective estates; and if money cannot be borrowed on such mortgages, to have a further power of selling such part of the common as they shall deem sufficient for purchasing the taxes of such proprietors, and to deduct the part so sold out of the shares of such proprietors so making default as aforesaid.

By these means, the commons will be put on the same footing with the inclosed lands, as the persons interested in them will virtually have an option of buying off their taxes, or submitting to a sale of part of their allotments; by which, together with such aid as may be expected from loans on the credit of the tonnage and bare sands, a complete outfall may be obtained, by carrying the Welland Act into effect; but there are many other points which must be attended to for the drainage of the commons.

In the first place, the Vernatt's drain, which is in the best possible situation for conveying the waters from the commons, should be completed by the adventurers, in the manner directed by the Welland Act, page 67, viz., "of the clear width of thirty feet at the bottom, and to be deepened so as to be upon the same level with the sill of the present sluice, across the outfall of the said drain to the commencement thereof at Spalding Common;" and a new communication between the Vernatt's drain and the river Welland should be made, at or near Shotbolt's bridge.

The Commissioners under the Welland Act being enabled, at a certain time in the said Act mentioned, to cause the power to be abolished which was given to the Commissioners of Sewers by an Act of the fourteenth of the present King's reign, for shutting down the sluice doors at Podehole, and thereby stopping the waters of the commons out of the Vernatt's drain for twenty-eight days in every year—a power which is extremely prejudicial to the drainage of the commons and inclosed lands in Deeping Fen; we recommend that a clause be inserted in the intended Act, for requiring the adventurers of Deeping Fen to make and complete a drain for discharging the waters of the inclosed lands in Pinchbeck and Spalding into the outfall below the Vernatt's sluice, instead of part thereof being discharged, as they now are, into the Vernatt's drain at or near Podehole; such new drain to

be of such extent and dimensions, and in such situation and direction, and a tunnel laid under the Vernatt's drain, for draining the lands on the south side thereof, in such place, as shall be appointed by the Commissioners of the Welland Act; and immediately after the completion thereof, the aforesaid power now lodged in the Commissioners of Sewers for shutting Podehole doors, to be abolished.

It is here necessary to advert to a general and acknowledged principle, on which depends possibility as to drainage in all flat countries, as well as protection and security of their surrounding barrier banks, without which last all drainage is vain and futile, viz. the confinement of the upland waters to their proper channel, and leading them to their outfall by conveyances independent of the downfall waters. It appears to us, that the original undertakers proceeded upon this principle; but that more modern projectors departed from it, and instead thereof, instituted the present system of draining (if it may be so called) the inclosed lands, known by the name of "Deeping Fen," by means of engines, so placed as to drown the very lands for the drainage of which the proprietors of the commons had been originally induced to give up at least one half of their property. The maxim that ought to be understood by all concerned is, that the inclosed lands can never drain effectually without the commons being drained also, and so *vice versa*, and that both must stand or fall together. We mean not to reflect on the conduct of any man or body of men, but to state the fact exactly as it appears to us; and, indeed, the present owners of Deeping inclosed fen are not to be blamed, for most of them have purchased their estates since the introduction of the plan which we have reprobated; and if all parties will now concur in endeavouring to obtain that relief which every one knows to be necessary, it is still possible to hand to posterity, in a productive state, a large, rich, and fertile district of country, which has to this moment been held, so far as the inclosed lands are concerned, under circumstances of extreme hazard and manifest injustice, and, with respect to the commons, of absolute preclusion, not only from profit, but comfort and convenience.

Under these impressions, we beg leave to state, first as to the river Welland, there are obstructions which, in our opinion, have greatly contributed to the late unfortunate breach in the bank next the commons. The most considerable of these obstructions, are the locks at the bottom of Cowbit Wash; which, however, must remain until the works provided for by the Welland Outfall Act are carried into execution, as it is necessary that the tides should be stemmed, to prevent an accumulation of silt in the river, above the locks; but, in the meantime, all other obstructions to the free passage of the Welland waters through the town of Spalding, and from thence to their discharge at or

near the reservoir, should be removed; and as soon as the outfall is completed, the bed of the river should be deepened, and the present locks entirely taken away.

Next, the river Glenn should be scoured out, from Cate's bridge to its outfall at the reservoir; and if this was effectually done, the waters thereof would be conveyed, in a great measure, below soil, with this additional good effect, that all the highland waters from King-street dike, which is an ancient catch-water drain, running between Stow and Greatford on one side, and King-street road on the other, would be discharged down the Glenn, instead of occasionally running across King-street road at Stow, and from thence into the fens; all the earth which is to be taken out of the river should be laid on its banks, which we recommend to be trenched on the river side thereof, which trench should be filled with the heaviest part of the earth, and made water-tight. By these means, the waters of the river Glenn may be kept, in general, out of the Counter Wash; but as that must, in case of breaches, receive the highland waters, and at all times receive such part of the waters from Thurlby common, Bourn South fen and pastures, and Thurlby fen pastures, as cannot be discharged down the river Glenn, or Bourn Eau, we also recommend a trench to be cut in the south bank of the Counter drain, which drain should be cleansed out, and the trench filled and made water-tight with the heaviest part of the earth. Thus, the waters of the Counter Wash would be kept from oozing through the bank and expanding over the whole of the fens, and be eventually discharged through Vernatt's drain, at such times as they would not interfere with the fen waters.

It is necessary to be more particular in respect of Bourn South fen and pastures, and Thurlby fen and pastures, the waters of which, including those of Thurlby common, are discharged into the Counter Wash, by means of a tunnel under the river Glenn; and here we must observe, that the same neglect prevails of leading the waters from the high lands into Bourn Eau and the river Glenn; in consequence of which, those highland waters are discharged, first into Thurlby common and pastures, and Bourn South fen and pastures, and thence through the said tunnel into the Counter drain, to the great annoyance and prejudice, as well of that common and the pasture and fen, as of those lands the drainage of which is more immediately the subject of our attention. Bourn Eau ought also to be scoured, and its banks made secure and water-tight, in the same manner as above recommended in respect of the Glenn. And Carr dike, which is the ancient catch-water drain for that district, should also be sufficiently cleansed for leading the highland water into Bourn Eau, or the Glenn, independent of the downfall water of those fens and pastures, which of

itself would not be materially prejudicial to the drainage under contemplation, and, especially, if a great part of that downfall water could be discharged through the Glenn; which it possibly might, after the river was deepened, instead of passing under it to the Counter Wash.

To revert to Deeping inclosed fen, it cannot be denied that in common justice the mills that the adventurers have deemed necessary for its drainage, ought to throw their waters into drains within their own lands, and not into the commons, as they now do; but it would be attended with a very heavy expense to alter the present plan, and, instead thereof, we recommend that all the drains used by the adventurers should be embanked and the banks made water-tight, in the manner above stated, the adventurers paying for the land cut and covered; and the waters from Crowland common, and from the Kesteven part of the other commons, should be conveyed by new drains through the two droves called North drove and South drove, without communicating with the drains from Deeping inclosed fen.

We are of opinion that the works recommended will, if properly executed, be found very ample for all the purposes required, combining such particular works as may be constructed under such general powers as are usually authorized by Acts of inclosure and drainage; by means of which the Commissioners may be enabled to make all such interior drains and other interior works as can be wanted for discharging the waters from the commons into the Vernatt's drain and the Welland river, in conjunction with the waters from Deeping inclosed fen.

We are aware that some of the works above stated should be done by the Commissioners of the Black Sluice Drainage, others by the adventurers of Deeping fen, others in certain reaches by the proprietors of estates bordering on parts of the river Glenn, and that others are under the direction of Commissioners of Sewers; but as all descriptions are materially interested in the improvement of the several rivers and drains referred to in this Report, we trust that nothing is wanting to call them into action but a public avowal on the part of the adventurers of Deeping fen, of a disposition to unite and concur in the means which we have recommended, for the attainment of general benefit and security.

GEO. MAXWELL.
EDWD. HARE.

February 24th, 1800.

*The Report of Messrs. Jessop, Rennie, Maxwell, and Hare,
&c. &c.*

WE, the undersigned, having viewed the grounds in Deeping inclosed fen, and the commons adjoining thereto, with the several drains, sluices, and other works, connected therewith; and also the rivers Welland and Glenn, and the banks thereof, and the line of the proposed Welland Cut, from Shepherd's Hole to Fosdike; and having also caused such levels to be taken as the time would allow of, and perused the several Acts of Parliament, and other papers and documents, relative to the said fen and commons; submit our opinions to the adventurers, and to the owners of free lands and commons, as follow:—

First, As a temporary improvement of the outfall, until means may be found for raising money to effect the whole, that part of the new cut, provided for by the Welland Act, be executed, viz., from Shepherd's Hole, through the salt marshes of Surfleet and Algarkirke, to near Fosdike Inn, there to have a temporary communication with the river Welland, the water to be turned into the cut by a dam across the present channel, as directed by the said Act.

Secondly, That Vernatt's drain be widened, from Shotbolt's bridge to Podehole, to a thirty feet bottom, and deepened, having the same foreland and slopes as directed by the Welland Act, from Vernatt's sluice to Shotbolt's bridge; and that Great Graft and Mill Green bridges be re-built, with openings of thirty feet at the least.

Thirdly, That Blue Gote drain, from its sluice to the turnpike road, be widened to a ten feet bottom, with slopes of one and an half to one, and deepened to the level of the sill of Vernatt's sluice, having a sluice at its junction with the Glenn of ten feet water way; and that from thence it be continued, diminishing gradually to a six feet bottom at the upper end, near the Dozen's bank: And also, that a branch to the said drain be made, from the lands lying between Vernatt's drain and the Westlode, passing by a tunnel equal to three feet in diameter, to be made under Vernatt's drain, the said branch to be six feet wide at the bottom, and on a level with the bottom of Vernatt's drain. The said drain and branch last described to be appropriated to the drainage of the lands of Pinchbeck and Spalding, which now drain into Vernatt's drain; and when the said drain and branch, with the sluice and tunnel, shall be completed, the right of draining into the Vernatt's drain to cease.

Fourthly, That a new drain be made from Podehole, to join the Rampart drain; and that the Rampart drain be enlarged, to the east end of the South Drove, and a new drain be continued from thence, along the middle of the Drove and to a cross drain hereafter described, with a communication to the middle of Crowland common; the said drain to be five feet in depth and twenty-four feet in width, at the bottom, from Podehole to the east end of the Drove, from thence to diminish gradually to the width of eighteen feet, at its junction with the said cross drain; the slopes of the said drain to batter at one and an half to one, or more where it may be necessary.

The earth from the said drain to be formed into regular embankments, with forelands of ten feet in width.

Fifthly, That from Podehole to the east end of the North Drove, the drain called The Eighteen Feet Drain, be widened to a twenty-four feet bottom, at the depth of five feet; and that a drain, of the same dimensions as that through the South Drove, be continued through the middle of the North Drove to the cross drain.

Sixthly, That the counter drain, from Podehole to the tunnel under the Glenn, be properly cleansed and enlarged, sufficiently to afford earth for embanking both sides thereof.

Seventhly, That a new drain across the commons, in the parts of Kesteven, from the Welland bank to the Counter bank, near the Glenn, be made, of eighteen feet in width, at bottom, and five feet in depth; at which drain those passing through the droves, as before described, should terminate, its slopes, banks, and foreland, to be similar to those of the said drains.

Eighthly, That King-street dike be deepened two feet, on an average; so far as the same extends by the side of Greatford parish, and from thence to Stow, it be made of the same depth and dimensions with the other part, when so deepened; the earth to be formed into a bank, where necessary, on the east side.

This drain to serve as a catch-water drain, for intercepting the water of the high lands to the west of it, and conveying it to the river Glenn, at Kate's bridge.

Ninth, That a catch-water drain be made at or near the western boundary of the Kesteven commons, in such direction as may best avoid injury to the lands lying between the same and King's-street dike.

Tenth, That the bed of the river Welland be deepened, and the soil, so taken out, applied to the strengthening of the banks; and that all projections and obstructions, from Spalding locks downwards, be removed; but the locks themselves will be necessary, for stemming the

tides—at least until the whole of the works are completed, as provided for by the Welland Act.

Eleventh, As the river Glenn is much obstructed, and its banks very narrow and imperfect, it is necessary, to the safety of the lands in Deeping fen and to the lands on the north side of the Glenn, that the said river should be effectually cleansed and deepened; and we are of opinion, that the most effectual mode of doing this will be to make a drain on the south side of, and parallel to, the river Glenn, from Baston Hedge to Pinchbeck Bars, leaving a foreland of fifteen feet on each side of the said drain, the dam to be made wide and deep enough to afford earth for making a bank on the south side thereof of nine feet in height, with slopes of two feet horizontal to one foot perpendicular, to serve in lieu of the present Counter bank.

The effect of this drain will be to take off the water of the river Glenn, so as to lay its bottom dry, and give an opportunity of deepening the same and effectually strengthening and securing its banks; to aid and relieve the river in times of flood; to take, alternately with the river, the whole water, when the river or the drain may hereafter want cleansing, or the banks repairing; and to receive the waters of the last-mentioned catch-water drain.

Twelfth, Previous to the execution of the last described drain, the river Glenn, from Pinchbeck Bars to its outfall into the Welland, should be cleansed and deepened; and, on the completion of the said drain, the remainder should be cleansed and deepened, up to Kate's bridge, and its banks be effectually repaired.

Thirteenth, As it will very much accommodate all the owners of land in the fens to have the drains navigable, the bridges should be so constructed as to admit the passage of boats or lighters; and a communication between the drains and the river Welland should be made, through Hill's drain; but no horse or other quadruped should be used in haling.

Fourteenth, A clause should be inserted in the Act, to regulate the height of the water wheels of the wind engines, in proportion to the respective heights of the land to be drained and its distance from the outfall—due regard being had to the shrinking of the commons, upon their being brought into cultivation.

Fifteenth, As the natural fall of the country is too little to effect a complete drainage, without the use of engines, unless (at a very great expense) the Vernatt's drain were to be extended to the river Witham, we think it necessary that proper engines be erected at Podehole, for discharging water from the internal main drains into the Vernatt's

drain, in order to keep the water, at all times, low enough to enable the private engines to work into the common drains.

N.B.—In arranging the position of the main drains, we have advised them to pass through the middle of the droves, on the presumption, that the commoners must sell a sufficient quantity of land, to enable them to advance their proportion towards the general works; and that the owners of estates, bordering on the droves, will purchase to the extent of their frontage respectively. If this should not be the case, it will then be necessary that the said owners of estates should embank the present drains, on the borders of the droves, and that the commoners should drain separately by the middle drains.

As the adventurers have a power to get earth, for repairing the banks, within the distance of one hundred and twenty feet, when earth cannot be obtained from the Wash lands, it is advisable that they should purchase from the commons such one hundred and twenty feet in breadth, or upwards, with the herbage of the banks, subject to such communications with the river as may be necessary; and that there should be the usual or general power of purchasing earth, on emergencies.

With regard to the expense of the several works, we advise as follow:—

I. That such parts of the works provided for by the Welland Act, as we have recommended to be executed, be done out of the taxes to be raised under that Act.

II. That the several works next undermentioned be done at the sole expense of the adventurers:—

1. Vernatt's drain and bridges.
2. Blue Gote drain, with its culvert, sluice, and extensions.
3. The scouring and deepening of the river Welland, and removing obstructions therein.

The adventurers to scour out the Glenn, in conjunction with such other bodies, or private persons, as are at present bound to repair the different districts of its respective banks; and such cross drains as will be necessary for communications between the present mill drains and the main drains through the two droves, in case the same shall be substituted for the present drains on each side thereof, to be made and embanked at the expense of the respective owners of the several mills, but otherwise, the said owners to embank their present drains, and drain their lands by the sides of the said droves, separately from the commons.

The drains next undermentioned are proposed to be declared main drains, by Act of Parliament, for the mutual benefit of the commoners and owners, as well of adventurers' lands as of free lands, in Deeping fen, and to be made and enlarged respectively, and for ever afterwards maintained at the joint expense of the said commoners, including those interested in Crowland common, and of the said owners of adventurers' lands and free lands, according to the number of acres belonging to each, between the banks of the rivers Glenn and Welland, *viz.*

The drain from Podehole to the Rampart drain.

The enlargement of the Rampart drain.

The enlargement of the Eighteen Feet drain.

The drains through the middle parts of the two Drovers.

The drains from the west end of the two Drovers, to join the drain next mentioned.

The drain across the Kesteven commons.

The enlargement and extension of King-street dike.

The catch-water drain for the waters of the lands lying between King-street dike and the commons.

The drain parallel with the Glenn, for receiving the waters of the last-mentioned drain, and discharging them into the Glenn, at Pinchbeck Bars.

The present drain of the Counter Wash, with both banks thereof.

Also all necessary bridges, over the said drains, and proper mills at Podehole for throwing the waters into the Vernatt's, to be built at the same joint expense, and in the same proportions, as before stated.

The herbage of the internal banks, and forelands of the drains, to be vested in trustees, for the sole benefit of the commoners.

W. JESSOP.
JOHN RENNIE.
GEO. MAXWELL.
EDWD. HARE.

Spalding, August 11th, 1800.

As we are of opinion, that engines will be absolutely necessary, at Podehole, for relieving the internal main drains, which may otherwise be frequently overcharged; if wind engines are used, they may be made on a much better construction than any hitherto used in the fens; but as in calm weather they will frequently be useless, when they may be much wanted, we have no hesitation in saying, that the only certain

way, without extending Vernatt's drain as before mentioned, of securing a complete drainage, will be to make use of a steam-engine.

A small one may be sufficient to relieve the drains, and enable the private mills at all times to work, when they have wind, but a large one might be erected, equal to the power of all the present mills.

W. JESSOP.
JOHN RENNIE.

The Report of Mr. Thomas Pear, on the Improvement of the Drainage of Deeping Fen and adjoining Commons, by Steam Power.

To the General Trustees for the Drainage of Deeping Fen and adjoining Commons.

GENTLEMEN,

Pursuant to your desire that I should report to you on the expediency of erecting steam engines for rendering effectual the works of drainage made under the authority of the Act of the 41st Geo. 3, for the drainage of Deeping fen and adjoining commons; I beg to submit the following observations and estimate to your consideration.

The works of drainage executed under the authority, and, in fact, pointed out and directed by the above-mentioned Act, consist of one main drain, called the South Drove drain, commencing at Podehole and extending from thence to the east end of a certain part of the said commons, called the South drove, and from thence along the middle of the same drove to its junction with the Cross drain, near the north bank of the river Welland. One other main drain, also commencing at Podehole, extending from thence to the east end of a certain drove, called the North drove, and from thence along the middle thereof until its junction with the said Cross drain, at or near to the bank of the river Glen. Also one other drain, called the Cross drain, being cut across the several commons in Kesteven, and commencing at or near the river Welland, and extending from thence to or near the south bank of the Counter drain, the Cross drain communicating with the two last described main drains. Besides the drains

above described, there is another main drain, called the Counter drain, extending from Podehole almost in a straight line to a certain place called Baston Hedges, where it joins the Gravel drain.

The extreme length of the South Drove drain is $8\frac{1}{2}$ miles, and the fall from the surface of the land, at its commencement at Cross drain to the sill of Podehole sluice, is 6 feet 2 inches. By this drain the waters of James Deeping common, part of Market Deeping common, Crowland common, Cowbit common, certain part of Spalding common comprised within the first district, and all the lands in Deeping old inclosed fen, between Horsgate Roft, otherwise the Littleworth turnpike road, and the Welland bank, are conveyed to the Vernatt's drain, at Podehole.

The extreme length of the North Drove drain is $5\frac{1}{2}$ miles and 13 chains, and the fall from the surface of the land, at its commencement at Cross drain to the sill of Podehole sluice, is 5 feet 2 inches. By this drain the waters of part of Market Deeping common, Langtoft common, and Baston common, part of Spalding common called Jordans, and of all the lands lying in Deeping old inclosed fen, between the said Littleworth turnpike road and the Counter drain, are conveyed to the said Vernatt's drain.

The extreme length of the Counter drain is $6\frac{1}{2}$ miles, and the fall from the surface of the land at its commencement to the sill of Podehole sluice is about 8 feet. By this drain the waters of Bourn and Thurlby South Fen pastures and of the Counter Wash, and of all the lands draining by Gravel drain, are conveyed to the said Vernatt's drain at Podehole.

The water thus brought down by the South Drove drain, the North Drove drain, and the Counter drain to Podehole, is conveyed from thence by the said Vernatt's drain to the river Welland. The length of the Vernatt's drain is $6\frac{1}{2}$ miles and 14 chains, *and is cut on a dead level.*

There is a sluice at the termination of the South and North Drove drains, at Podehole, and also another sluice at the termination of the Counter drain at the same place. There is also an outfall sluice at the junction of the Vernatt's drain with the river Welland at the reservoir.

From what has been premised it might be inferred, that the falls which have been stated would have afforded an imperfect natural drainage; and if the sill of the Vernatt's outfall sluice had been always clear of water, such would have been the result. But the discharge of the fen waters at the outfall sluice of this drain, notwithstanding the water in the main drains is raised to a much greater height than

its natural level, is prevented for several weeks together, in wet seasons, by the head of water in the Welland.

It is proposed, therefore, to adopt steam engines, for the purpose of elevating the Vernatt's drain to a height that would be equal to force its discharge at the outfall sluice. To ascertain the practicability of this scheme, we must first ascertain the greatest height of water in the Welland on the sill of the Vernatt's outfall sluice. From long observation and experience, I can state that the greatest height of water in the river Welland in times of flood on the sill of the Vernatt's outfall sluice, is 6 feet; but as this is merely for a few days, it will be proper to state the mean height of ordinary floods in the Welland which occasion a head of water on the sill of the said sluice for many weeks, owing to which the discharge of the fen waters is prevented. The extreme height in such cases I can safely assert does not exceed 5 feet. The water in the Vernatt's drain would, therefore, require to be raised 5 feet, to become on a level with the flood waters in the Welland; and it must be raised a still greater height in order to its being discharged.

By means of levels which I have taken, I have ascertained that the lowest land is situate in the North Drove, the surface of which is only about four feet above the horizontal level of the sill of Podehole sluice. The level of the lands in general in Deeping fen and the adjoining commons, is about 6 feet above the level of that sluice. It would be desirable to reduce the water below the surface of the lowest lands about 1 foot; the depth of water, therefore, to remain on the sill of Podehole sluice will be 3 feet, and the surplus quantity of water must be cast by means of engines into the Vernatt's drain.

Estimating the quantity of land to be drained at 43 square miles, or 27,520 acres, it will be necessary to ascertain the probable quantity of water to which it is subjected by downfall and soakage.

I will assume, therefore, that the quantity of downfall water that will require to be drained from the land in the course of the year, will average 4 inches in depth upon the plain surface which I have estimated at 43 square miles, or 27,520 acres, and this would give 399,590,400 cubic feet of water; and to this we must add the probable quantity of water arising from the soakage of the higher lands, which I will assume as equal to half the quantity arising from actual downfall. Two engines, therefore, one of 50 and the other of 40 horse power, would discharge the whole of the water in 69 days, being after the rate of 6000 cubic feet per minute, and the main drains would be completely emptied in the course of every 24 hours.