

**CIHM  
Microfiche  
Series  
(Monographs)**

**ICMH  
Collection de  
microfiches  
(monographies)**



**Canadian Institute for Historical Microreproductions / Institut canadien de microreproductions historiques**

**© 1997**

## Technical and Bibliographic Notes / Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming are checked below.

- Coloured covers / Couverture de couleur
- Covers damaged / Couverture endommagée
- Covers restored and/or laminated / Couverture restaurée et/ou pelliculée
- Cover title missing / Le titre de couverture manque
- Coloured maps / Cartes géographiques en couleur
- Coloured ink (i.e. other than blue or black) / Encre de couleur (i.e. autre que bleue ou noire)
- Coloured plates and/or illustrations / Planches et/ou illustrations en couleur
- Bound with other material / Relié avec d'autres documents
- Only edition available / Seule édition disponible
- Tight binding may cause shadows or distortion along interior margin / La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure.
- Blank leaves added during restorations may appear within the text. Whenever possible, these have been omitted from filming / Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.
- Additional comments / Commentaires supplémentaires:

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

- Coloured pages / Pages de couleur
- Pages damaged / Pages endommagées
- Pages restored and/or laminated / Pages restaurées et/ou pelliculées
- Pages discoloured, stained or foxed / Pages décolorées, tachetées ou piquées
- Pages detached / Pages détachées
- Showthrough / Transparence
- Quality of print varies / Qualité inégale de l'impression
- Includes supplementary material / Comprend du matériel supplémentaire
- Pages wholly or partially obscured by errata slips, tissues, etc., have been refilmed to ensure the best possible image / Les pages totalement ou partiellement obscurcies par un feuillet d'errata, une pelure, etc., ont été filmées à nouveau de façon à obtenir la meilleure image possible.
- Opposing pages with varying colouration or discolorations are filmed twice to ensure the best possible image / Les pages s'opposant ayant des colorations variables ou des décolorations sont filmées deux fois afin d'obtenir la meilleure image possible.

This item is filmed at the reduction ratio checked below /  
Ce document est filmé au taux de réduction indiqué ci-dessous.

10x	14x	18x	22x	26x	30x
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12x	16x	20x	24x	28x	32x

The copy filmed here has been reproduced thanks to the generosity of:

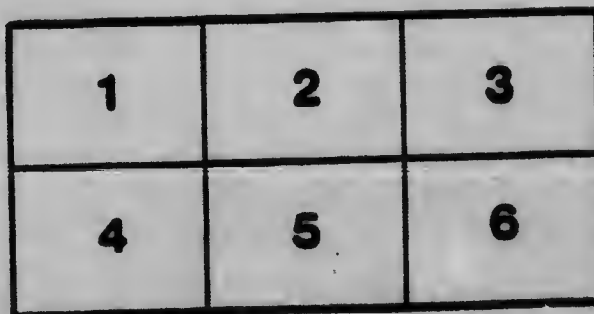
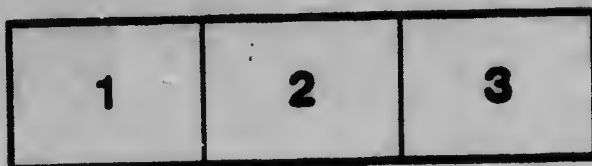
National Library of Canada

The images appearing here are the best quality possible considering the condition and legibility of the original copy and in keeping with the filming contract specifications.

Original copies in printed paper covers are filmed beginning with the front cover and ending on the last page with a printed or illustrated impression, or the back cover when appropriate. All other original copies are filmed beginning on the first page with a printed or illustrated impression, and ending on the last page with a printed or illustrated impression.

The last recorded frame on each microfiche shall contain the symbol  $\rightarrow$  (meaning "CONTINUED"), or the symbol  $\nabla$  (meaning "END"), whichever applies.

Maps, plates, charts, etc., may be filmed at different reduction ratios. Those too large to be entirely included in one exposure are filmed beginning in the upper left hand corner, left to right and top to bottom, as many frames as required. The following diagrams illustrate the method:



L'exemplaire filmé fut reproduit grâce à la générosité de:

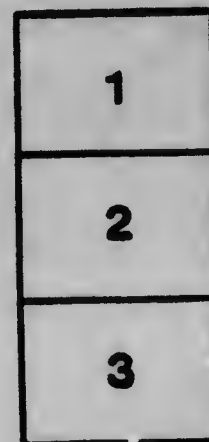
Bibliothèque nationale du Canada

Les images suivantes ont été reproduites avec le plus grand soin, compte tenu de la condition et de la netteté de l'exemplaire filmé, et en conformité avec les conditions du contrat de filmage.

Les exemplaires originaux dont la couverture en papier est imprimée sont filmés en commençant par le premier plat et en terminant soit par la dernière page qui comporte une empreinte d'impression ou d'illustration, soit par le second plat, selon le cas. Tous les autres exemplaires originaux sont filmés en commençant par la première page qui comporte une empreinte d'impression ou d'illustration et en terminant par la dernière page qui comporte une telle empreinte.

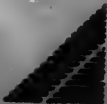
Un des symboles suivants apparaîtra sur la dernière image de chaque microfiche, selon le cas: le symbole  $\rightarrow$  signifie "A SUIVRE", le symbole  $\nabla$  signifie "FIN".

Les cartes, planches, tableaux, etc., peuvent être filmés à des taux de réduction différents. Lorsque le document est trop grand pour être reproduit en un seul cliché, il est filmé à partir de l'angle supérieur gauche, de gauche à droite, et de haut en bas, en prenant le nombre d'images nécessaire. Les diagrammes suivants illustrent la méthode.



MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



**APPLIED IMAGE Inc**

1853 East Main Street  
Rochester, New York 14609 USA  
(716) 482-0300 - Phone  
(716) 398-9959 - Fax

3/ **REPORT**

OF

**James P. Howley, Esq., on Town-  
ships' Survey in St. George's Bay**

together with

**Observations upon the Geological  
Structure underlying and in the  
immediate Vicinity of the Grav-  
ing Dock at River Head**

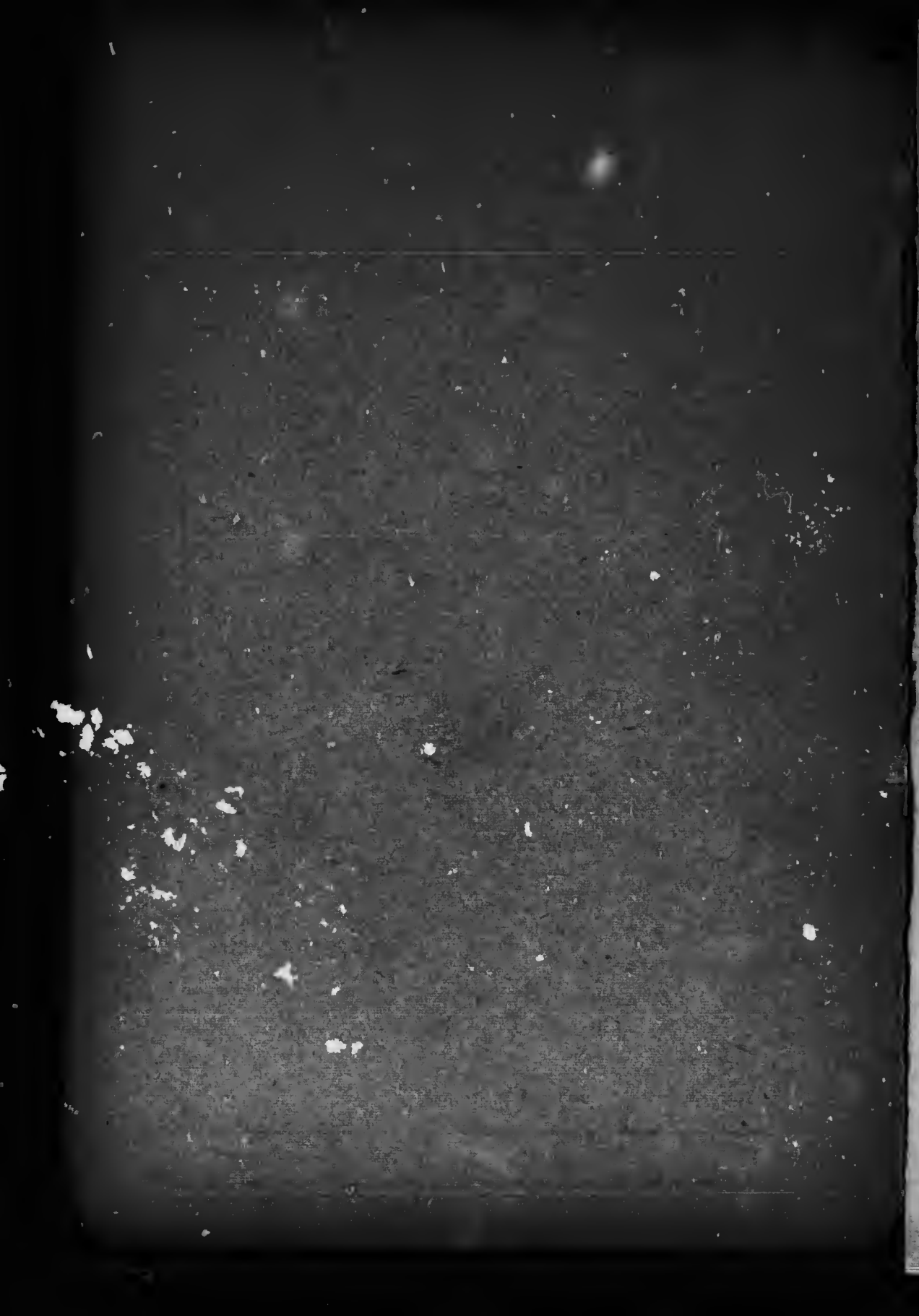
**1884.**



**ST. JOHN'S, N.F.**

**Robinson & Company, Limited, Print**

**1917**



*R. J. Saunders Esq.*

# REPORT

OF

James P. Howley, Esq., on Town-  
ships' Survey in St. George's Bay

together with

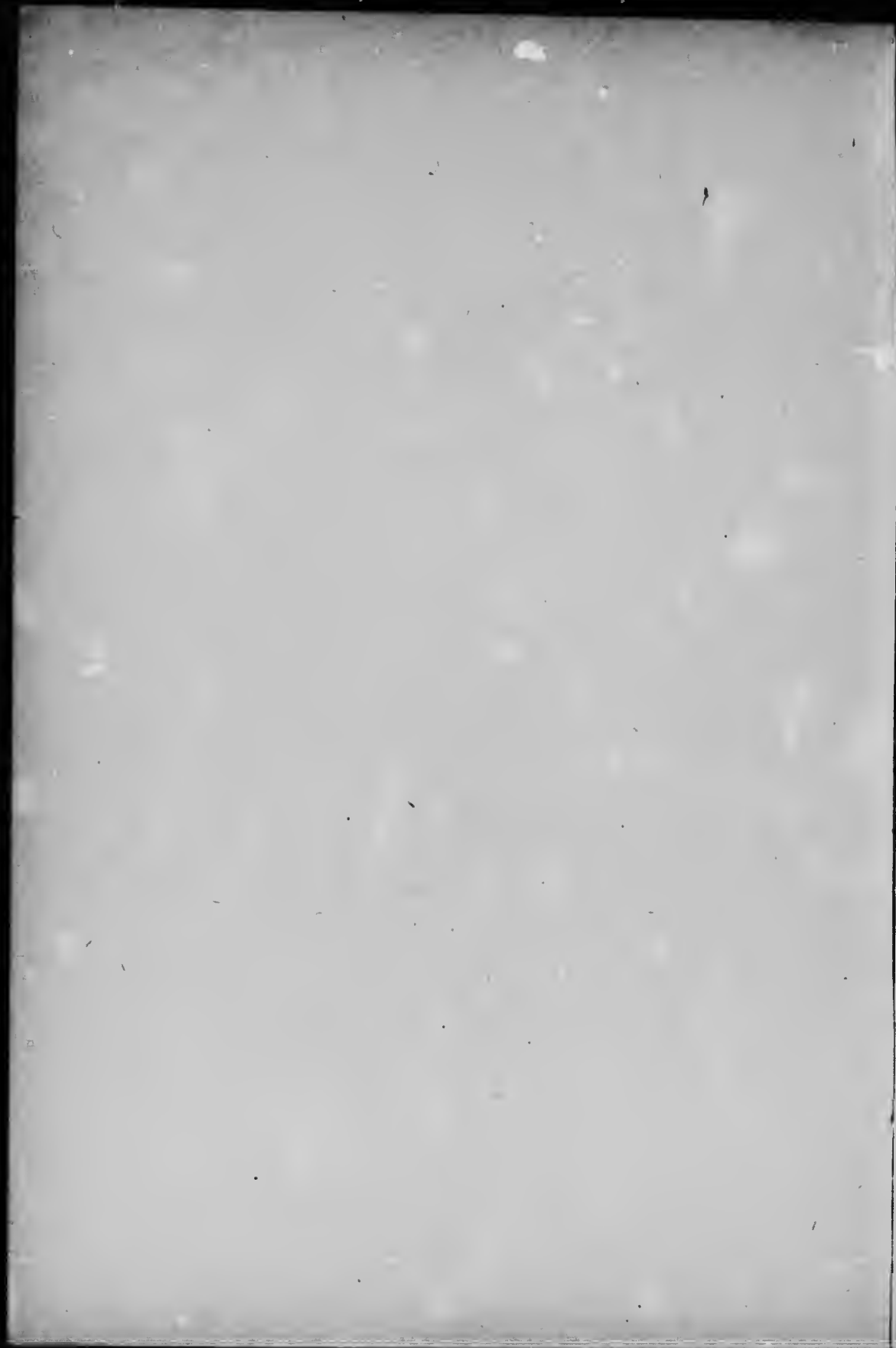
Observations upon the Geological  
Structure underlying and in the  
immediate Vicinity of the Grav-  
ing Dock at River Head

1884.



ST. JOHN'S, N.F.

Robinson & Company, Limited, Print  
1917





# REPORT

OF

## James P. Howley, Esq., on Townships' Survey in St. George's Bay, 1884.

*To the Hon. Surveyor General:—*

SIR,—

Herewith I beg to submit the following report of my past season's work for the information of the Government.

On the 3rd June last I started in the S.S. "Curlew" for St. George's Bay, and arrived at Sandy Point on the 7th. My party consisted, on leaving, of an Assistant, Mr. A. White, two chainmen and five axemen, which was further augmented by the addition of seven axemen and a cook. My crew being thus completed we got fairly started with our work on the 10th June.

The object of the Survey was to lay off the large tract of land, situated on the South side of St. George's Bay, into townships of thirty-six square miles each, in accordance with the provisions of the new Act, passed last Session of the Legislature, and upon the lines of a plan previously approved of by the Executive.

Selecting Seal Rocks Point, on the South side of Flat Bay, as the best defined and most conveniently situated for the commencement of our survey a set of observations were here taken to establish a true meridian. . . A line was then started from the initial point, running S.  $46^{\circ} 10'$  E. true, or at right angles to the shore of the Bay, and continued for a distance of three miles and seventy-two chains, to the base of the Long Range Mountains, terminating in the vicinity of Cairn Mountain, a conspicuous peak of the Range, near the head of the Flat Bay Brook.

The principal base line, which is so situated as to lay parallel to the main South shore of the Bay and about midway between it and the Long Range, was turned off at right angles from the termination of the last line on a course S.  $43^{\circ} 50'$  W. true. This

base line was then pushed forward during the months of June, July and August, and part of September, and at every sixth mile, or township corner, side lines at right angles were run to the Coast, on the one hand, and towards the mountains on the other. At the sixth and twelfth corners, however, the character of the land on the inner side did not warrant carrying out the lines to their full extent of six miles.

The base line terminated at a distance of twenty-eight miles, having then reached the bare summit of the Anguille Range, not far from the head waters of the Codroy, and being sufficiently extended to take in all the available agricultural land on this side of the Bay. Having finished the base line, we next cut out to the shore from the twenty-fourth mile post, striking the Coast about one mile west of the mouth of Crabb's Brook. At the end of six miles the front line of the townships, which runs close along the seashore, and parallel to it and the principal base line, was then started on either side. This line extended westerly six miles, passing through the settlement known as the Highlands, and terminating at Ship Cove, near the foot of the Anguille Mountains. In its easterly extension, it crosses the estuaries of Crabb's, Little or Middle Barachois, and Robinson's River, inside of Robinson's Head, passing over the bank a mile beyond. For a distance of about five miles and a quarter it skirts along by the shore, at about ten chains distant from the bank. At the mouth of Berry-brook it again takes the land, and, passing somewhat over a mile inside of Bank Head, it finally runs out to the shore on the South side of Flat Bay, one and a half miles from its extreme head.

While occupied in running out this front line occasion was taken to lay off the lands claimed by the settlers along the shore, whose lots came within the township boundaries. At first much difficulty was experienced in getting the settlers to conform with the township lines laid down, but after explaining the necessity of having all boundary lines within township limits parallel to each other, and pointing out the advantage which would result from a uniform system, where no one individual's boundaries could conflict with his neighbors, &c., these difficulties were removed. After a while the great majority of the settlers expressed their approval of the plan adopted, which gave equal justice to all, and they even became most eager to have their lines at once defined and

marked out. In fact, the demand upon my time became so great that I was compelled to forego running out the back lines of the inside townships, which I had contemplated finishing this season.

The people of Crabbs, Little Barachois and Robinson's Rivers had hitherto no definite claims, they formed a sort of joint stock company and held all their lands in common; but the plan did not work well, some took advantage of others, and no one knew exactly what to call his own property. In order then to satisfy all parties here the entire frontage held in possession, and where no boundaries already existed, was divided and marked off into lots of equal areas, according to the number of families or individuals entitled to held land in each settlement. Only one or two individuals anxious to secure a lion's share, raised any objection to this plan.

A narrow fringe of land on the immediate coast line, and outside the township lines, has been used in common as a pasture for cattle during the past half century or more, and, as such, it was decided to allow it to remain, any attempt at sub-dividing proving utterly hopeless.

Altogether one hundred claims were laid off along the coast, averaging about one hundred and thirteen and a half acres each, or a total area of 11,350 acres, about two-thirds of which is probably available for agricultural purposes.

On all the township lines due allowance was made for roads as specified on the Act, viz., one chain at every mile on the base and front lines, and at every alternate mile on the side lines, giving the townships each a total breadth of 486 chains and depth of 484 chains. A stout post was driven at every mile or section corner, upon one side of which the number of the section, in Roman characters from I. to VI., was legibly cut, those on the base line having the reverse side also marked onward from I. to XXVIII. The townships on the outer or seaside of the base line have their four sides completed, and are all ready for sub-division into sections. One of those on the inner side has three of its four sides cut out, and two others two sides each. Altogether ninety-seven miles of line were measured during the season.

The work was of a very laborious character, owing to the fact that all provisions, camp equipage, &c., had to be continu-

ously backed along the lines, little or no opportunity of availing of water carriage by boats or flats presenting itself. Frequently during the summer, when obliged to renew our stock of provisions, portages of fifteen and twenty miles had to be made at one time.

By reference to the large map which I have constructed since my return home, on a scale of two and a half inches to one mile, it will be seen that the whole of the available land of the South side of St. George's Bay is included within nine townships, which are numbered in red on the plan. Only six of these, however, contain their full complement of land, or nearly so. The three remaining townships are incomplete, owing to the irregularity of the coast line in one instance, and the projection of spurs from the Anguille and Long Range Mountains, in the case of the other two. No I. contains thirty square miles, being deficient by six; No. V., twenty-seven square miles, deficient by nine; and No. VI., twenty-four square miles, wanting twelve of its full complement, or a total deficiency of twenty-seven square miles. This is, however, counter-balanced by about an equal amount of available land inside the rear lines of Nos. VII. and VIII. townships. The projecting part of the shore at Bank Head, outside townships No. II., equals an area of six square miles more, giving a total area for the whole tract of 330 square miles, or 211,200 square acres. Probably one-third of this great area would have to be deducted as unfit for settlement, owing to the prevalence of barren and marshy land, which would still leave 220 square miles, or 140,800 square acres available. The character of the soil spread over so extensive a surface is, of course, very diversified; fully half of Nos. I., II., III. and IX. townships is occupied by extensive barrens and great bogs, of little value except as runs for sheep and cattle. In the remaining townships the good land preponderates, and the soil in many places is of superior richness, especially in the vicinity of the large rivers, where much interval land appears. The prevailing character is a deep red or yellowish sandy loam; but the alluvial interval deposits partake more of the character of a rich, dark sometimes nearly black, mould. The fertility of these latter soils is well attested in the size and quality of the timber they support. Yellow birch, (wych hazel), white birch, balsam poplar, maple, large spruce, and fir are the prevailing varieties; but considerable tracts are frequently covered with a

dense growth of large alders, intermixed with elder and white-wood, certain indication of a rich, moist, alluvial soil. It is worthy of note that these characteristics are well known and recognized in the other provinces, especially in New Brunswick, Nova Scotia and Cape Breton Island. Mr. Edward Jack, of New Brunswick, a high authority on the land and timber of that province, who recently paid a visit to this country, confirms the above statement, and has authorized me to use his name in connection with this subject. To use Mr. Jack's own words "The soil which covers the lower carboniferous formation in New Brunswick is almost invariably good, the same holds true of Nova Scotia and Cape Breton. It is, in fact, a very marked characteristic, and must strike the attention of even the casual observer. When I have been exploring the forests of New Brunswick, wherever I saw the characteristic red of the sandstones and conglomerates of this formation, I at once assumed that I was in a country whose soil would be well adapted to the purposes of agriculture. The growth of wood on this soil is of a better quality and frequently of a larger size than on any other rock formation that I know of, with perhaps the exception of the friable calcareous slates of the upper silurian, which disintergrate readily and leave behind them a soil free from stone."

The cause of the fertility of such soils is readily accounted for in this way,—nine-tenths of the superficial deposits spread over any tract of country are composed of the debris of the rock formations immediately underlying them. When, as in the case of the lower carboniferous, the bulk of the formation is composed of soft sandstones, shales, clays, marls, limestones and gypsum; an intermixture of these various ingredients must naturally result in superior character of soil. On the contrary where the underlying rocks are chiefly crystalline, siliceous, or feldspathic, containing little or no lime, the resulting soils are usually poor and hungry, requiring a constant supply of fertilizing agents to render them at all productive. The question then of the superiority, or otherwise, of the soil, over any tract of country, can at all times be determined upon Geological grounds, when the rock structure of the country is known.

St. George's Bay can scarcely be said to have any roads, as yet. and without these indispensable necessities to agricultural develop-

ment, no settlement can possibly take place inside the immediate coast line. Wherever the land can be reached and utilized, it is now occupied, and, were access given to the lands in the rear, I believe many of the people would avail of them. During the past season a good deal of work has been performed by the coast settlers in opening up a main line of road from the Highlands towards the head of Flat Bay, and much energy and skill has been displayed by the people in their mode of construction, as yet, however, there are only a few sections of this road finished, with long intervals, where the track only has been marked out. There are many difficulties to contend with, especially at the crossing of various rivers where heavy bridging is required before this line of road can be completed. In a few instances a little better engineering skill might be used to advantage in improving the present location. Nevertheless, I consider that a very good return has been given for the expenditure so far. The people of the Highlands petitioned the Legislature last session for a small grant to open up a line of road some three miles in extent, leading from their settlement back from the shore to a patch of very fine interval land on Highland river, where they had already proved the superiority of the soil by several small clearings previously made. Their petition was answered by a grant of \$200, for which they were very grateful. The road was commenced shortly before my arrival there, and such was the eagerness displayed to reach the land in question, that they actually completed three-quarters of a mile in one day. Several of our township lines are well adapted for line of road, but especially the twenty-fourth side line, which presents throughout its entire length of twelve miles, a very gentle upward grade from the sea shore, it passes through a dense forest all the way, does not cross any large stream, the land on either side is good, and the line itself most centrally and conveniently situated. Many of the sub-division lines, when cut, will also be admirably suited for road lines.

The construction of a main line of road through this valuable tract of country, connecting it with the Codroy Valley and Port-aux-Basques, is of paramount importance to the future advancement of the West Coast. The subject has been frequently urged before, but the past season's experience impressed me more than ever with the absolute necessity of such an undertaking, ere any

permanent settlement on a large scale can take place inside the Coast line. Two routes present themselves as feasible for such an undertaking. The first, by following up the Codroy Valley and passing inside the Anguille range, where a narrow gorge separates the Anguille from the Long Range mountains. I had an opportunity while in the vicinity during the past fall of inspecting this route, and from all I could observe, there is no practical difficulty in the way of constructing a good road. The valley, though narrow, is tolerably level, well sheltered, and appears as if placed by nature for the purpose of connecting the two districts. Once through this pass, several courses are then open to choose from, for the further extension of the road to Flat Bay. A line running close along by the foot hills of the Long Range and terminating at Seal Rocks, would be perhaps the most direct; but, I imagine, a more feasible, and certainly more central line, would strike obliquely across the country in a straight line for the extreme head of Flat Bay, where so much work has already been accomplished. There of the two settlements of Codroy and St. George's Bay only, were the chief points aimed at, it appears quite possible that a road might be located along the shore on the western slope of the Anguille Range, from Codroy Village to the Highlands. Here it would meet the present main line along the shore of St. George's Bay, where so much work has already been accomplished. There are many difficulties to contend with on this route, and several deep gorges in the side of the Anguilles would have to be crossed. A considerable amount of engineering ingenuity would be required to be exercised in carrying out its construction, but with the aid of trestle-work bridging, I believe the gulches might be easily spanned, and that no other insuperable difficulty exists. The necessary timber required for bridging is abundant on the slope of the hills. The comparative lengths of either route differ but slightly, and may be set down at about ninety miles from Point-aux-Basques to Flat Bay. About fifty miles of the latter line is already partly finished, and about forty of the former.

The outcrop of the Coal seams on Robinson's and Little Barachois Rivers being within two miles of the point where our base line crossed the rivers, the opportunity was availed of to make a further examination of these deposits. The seam on the former Brook, discovered by myself in 1873, being situated low down in

the bed of the stream, was completely hidden from view, and all traces of our former work obliterated. This was caused by the freshets and ice carried down the stream in Spring, having moved the loose gravel and stones, filling up the opening then made and even removing every fragment of coal left upon the bank. It was only after a very diligent search and much labor in removing boulders that the seam was re-discovered. The outcrop was then uncovered for several yards towards the bank, when a good section was procured. The seam, including under and upper clays, measures on the outcrop six feet across, but the angle of inclination which it makes with the horizon reduces the actual vertical thickness to about five feet. At least four feet of this thickness is good coal. It is rather harder than ordinary Sydney, very bituminous, eaking coal, emitting much gas while under combustion, and burns freely when once fairly ignited. The dip of this bed is down stream or towards the Northwest, and it appears to lie in a narrow synclinal trough, in which case it should come again to the surface from a mile to a mile and a half further West with an opposite inclination. Where, however, the latter outcrops might be expected, the rocks are totally concealed by debris for some distance. The Jukes seam, on the Little Barachois River, named after Mr. J. B. Jukes, F.G.S., who discovered it in 1840, was also visited. It is just two miles distant, up stream from our base line, while the side line separating townships VII. and VIII. crosses the river thirty chains below, and passes on the South Side within sixteen chains of the outcrop. In 1873 Mr. Murray carefully examined and measured this seam, the result of which is given in the Report for that year, as follows: "Coal, 1 foot 3 inches; coal in thin layers, alternating with thin layers of argillaceous and carbonaceous shale, 2 feet 3 inches. Juke's seam, 3 feet 6 inches."

A second seam, one foot five inches in thickness, occurs in the same section about 120 feet higher up. It was the opinion of Mr. Murray, at the time, that the two latter seams were a continuation of the Robinson's Brook seam, on the opposite side of the trough; being here split in two by a wedge of sandstone, &c., as is frequently the case in other coal fields. The past season's observations, however, seem to point to a different conclusion, and I have reason to believe they are entirely distinct seams, that on Robinson's Brook, being at a lower horizon, in which case it might



be expected to cross the little Barachois Brook, a half a mile or so down the stream from the outcrop of Juke's seam. Should such prove to be the case, there would then be an aggregate thickness of not less than eight feet of coal in the three seams. The value or otherwise of those deposits will entirely depend upon the superficial area they occupy, and this can only be satisfactorily determined by the application of the boring rod. The probability of these being the only coal deposits of value in the Island, is, I think, sufficient warrant to urge the advisability of determining their extent without delay. We already possess the necessary apparatus, and the carrying out of the work need not be very expensive, if proper means be adopted. The boring rod judiciously applied to this region, would effect the double purpose of determining the extent of the coal seams already known to exist, and be perhaps the means of revealing others whose surface outcrops might never be discovered. As an instance of the importance of this coal area to the future of Newfoundland, the following estimate will give some idea:—A seam of coal one foot thick would yield per square acre 1,500 tons, per square mile 960,000 tons, we have only to multiply this amount by eight (the aggregate thickness here), when the result per square mile would give 7,680,000 tons. Should the seams be persistent in thickness, and the boring prove them to occupy an area of, say five square miles, we may then confidently rely upon no less than 38,400,000 tons of available coal in this district. As a further illustration of its importance, I may here state that the above estimate equals the whole annual output from all the Cape Breton Mines, taking the average between the years 1858 and 1870 for a period of 111 years to come.

The immense gypsum deposits so frequently met with throughout this region cannot fail to become of considerable economic importance in the future, especially as much of it partakes of the character known as alabaster. Its value as a fertilizer, should the country become settled with an agricultural population, can scarcely be over-estimated. Many substances of minor importance, such as building stones, lime stones, brick clays, grindstones, whetstones, &c., occur in abundance.

The Laurentian hills in the rear give promise of considerable deposits of iron ore, boulders and fragments of which are found plentifully distributed along the beds of the principal streams.

These and other less known resources, combined with the greatly superior quality of the soil, must in time render the District of St. George's Bay one of the most flourishing and prosperous in the Island of Newfoundland.

I have the honor to be, Sir,

Your obedient Servant,

(Signed), JAMES P. HOWLEY.

**Observations upon the Geological Structure underlying  
and in the immediate vicinity of the Graving Dock  
at River Head, 1884**

St. John's, 26th December, 1884.

SIR,—

I have been requested to offer a few observations upon the Geological Structure underlying and in the immediate vicinity of the Graving Dock at River Head, for incorporation in your Report. The importance of a correct knowledge of the foundation upon which the Dock rests, and of the improbability of its being affected either by springs or quicksands, such as so frequently render structures of the kind unsound and expensive to maintain, can hardly be over-estimated. I beg, therefore, to submit the following notes, trusting they may be sufficiently explicit to establish the foregoing position.

The Harbor of St. John's for the greater part lies along the strike of a set of bluish grey slates, known locally as the St. John's slates. In their Eastern and Western extension they trend down the valley of the River-head stream, partly underlie the town and strike into the land again in the vicinity of the Railway wharf; thence onwards towards Quidi Vidi Lake. Flanking these slates on the South side is a hard greenish grey siliceous sandstone, in massive beds, known as the Signal-hill sandstone; while they are underlaid on the North side by highly indurated and variegated slates and flagstones. These latter occupy the greater portion of the country in rear of the town, being frequently repeated by folds and flexures of the stratification.

Though the St. John's slates are of a hard and tough nature, they are, nevertheless the least durable of all the rocks comprising the great Huronian series, to which the whole of these strata are referable. The angles of inclination at which the various bands dip from the horizon are of course subject to the intensity or otherwise of the movements which have effected the whole series. In the vicinity of the harbor, however, the dip becomes more regular, though maintaining a high angle, with an inclination towards the South Side hill.

Over the entire surface of the country, wherever depressions in the rock crust admit of it, a superficial deposit consisting of sand, gravel and clay is everywhere met with, the debris of the disintegrated and denuded rocks themselves. Apart from the ordinary atmospheric action other agencies, but especially ice in the form of glaciers, has added its influence in remodeling the contour of the whole country. The enormous abrading power which the latter exerted is made apparent, not only in the character of these superficial deposits, but more clearly in the rounded, grooved and polished surfaces presented by the rocks wherever exposed to view. The effect produced by the movement of the ice-sheet in its downward tendency from the higher levels towards the sea, was to dislodge from their parent beds all projecting fragments of rock, grind down the surfaces over which it passed, push before it, or carry upon its sides, vast piles of rubbish, which it finally deposited or left after it in the deeper hollows, in the form of unstratified drift or till. The harder sandstones and argillites resisting to a certain extent the onward movement, diverted its course, and directed the full force of the great ice-plough to seek the line of least resistance, viz., along the strike of the softer St. John's slate band. In the course of time the result was the deeply grooved valley and basin of the harbor as it now exists. The finely pulverized slate, with a certain proportion of oxide of iron and lime derived from mineral veins intersecting the adjacent rocks, combined with the fragments of the rocks themselves, all firmly cemented together, forms the till in question. In fact, it is a natural concrete of a very durable description. Upon reaching it in the course of excavating the Dock Basin, it was found so extremely tough that much labor was expended in removing a thin layer from its surface. Such then is the material upon

which the Graving Dock rests. It would be difficult to conceive a substance more admirably adapted for a foundation, not even the rock surface itself could afford a more desirable or more substantial bedding.

The deposits overlying this moraine drift at the head of the harbor consist of sand, mud and clay, subsequently brought down by the drainage of the country, and greatly augmented since the occupation of St. John's, by refuse and sewage from the upper part of the town. The glacial drift, however, undoubtedly forms the lowest superficial deposit, as is the case everywhere around, and has nothing intervening between it and the naked upturned edges of the slates upon which it rests. The impossibility of any river silt underlying this drift, rests upon the fact, that no river existed prior to the scooping out of the valley by the action of the glacier.

I regret that my absence from home during the greater part of the time the excavations were being conducted, deprived me of the opportunity of measuring a vertical section of these superficial deposits. Through the kindness of Mr. Shuster, Superintendent of Construction, I have been enabled to obtain an approximate, sufficiently accurate in detail. I learn from the same gentleman that before reaching the required depth of thirty-one feet below high water mark, the whole of the more recent alluvial and sewage deposits were removed down to the till and some eighteen inches of the latter also. It was indeed a most fortunate circumstance that so suitable a material should be met with almost exactly where needed.

The impervious nature of this deposit to the influence of waters is, perhaps, one of its highest recommendations. Had the required depth been reached, before striking it, there might be some danger to anticipate from the influx of water, or from springs, especially where there was any considerable thickness of silt beneath the flooring of the Dock. In order to make this clear, it would be perhaps well to enter somewhat into the theory of springs: Sir Charles Lyell says, "their origin is chiefly atmospheric," or in other words their source arises in great measure from the rain and snow falls which percolate through the more porous sub-soils, till stopped by coming in contact with some im-

permeable stratum. A subterranean drainage then takes place, but when impeded by projecting points or ridges of rock, or where inequalities in the stratum occur, reservoirs are formed, which on being tapped produce springs. When, however, there are no such impediments, and the surface of the substratum presents a comparatively smooth inclined plane, no quantity of water can lodge upon it "Water must find its level" underground, as on the surface.

Speaking of the causes of failure to obtain water in boring for wells, the same high authority quoted above, says: "Where natural lines of drainage exist there remains but a small quantity to escape by artificial issues." He also adds "that the dip of the strata may be such as to carry off the water from the adjacent highlands to some trough in an opposite direction, as when the borings are made at the foot of an escarpment where the strata incline inwards, or in a direction opposite to the face of the cliffs."

This is exactly what occurs here. The widest part of the harbor basin forms a deep trough, towards which all water finding its way through the more porous subsoils, must drain off. The Dock, situated as it is at the upper end of the harbor, stands on a much higher level, from which is a regular downward slope towards the deeper basin. It is also close to the escarpment of the South Side hill range, where the strata "do incline inward, or in a direction opposite the face of the hills." In view of the foregoing facts, I think there need be little apprehension of the structure ever being troubled, either by shifting quicksands or springs from beneath.

I remain,

Your obedient Servant,

(Signed),            JAMES P. HOWLEY, F.G.S.

